Job No. 188268

March 30, 2022

Windsor Ridge Homes
4164 Austin Bluffs Parkway, #361
Colorado Springs, CO 80918

Re: Addendum to Soils and Geology Study – Proposed Zone Change
Tract B, Windermere, Filing No. 1
El Paso County, Colorado

Dear Mr. Stevens:

RMG – Rocky Mountain Group has previously completed a *Soils and Geology Study* (and attached *Response to CGS Comments*, with both the report and the response documents being last revised January 18, 2021, Job No. 162062) for the Windermere subdivision, Filing No. 1 for Windsor Ridge Homes. Subsequent to approval of this site for single-family residential construction, the southernmost portion of the site (south of Mardale Lane) has been proposed for revision/rezoning from single-family residential lots to a multi-family area. The original *Soils and Geology Study* is attached and included in Appendix A.

To date, RMG has not been provided with a site plan showing the layout or configuration of the proposed multi-family structures. However, the proposed multi-family area (now identified as Tract B) generally encompasses the area previously identified as El Paso County Assessor parcel number 5329400016. This portion of the site was included in the previously approved *Soils and Geology Study* report, but it is our understanding that the El Paso County Planning Department (EPCPD) will require a re-review to determine the suitability of the proposed zoning change described above.

The purpose of this addendum is to review the geologic conditions present within the southern portion of the site (designated as Tract B on the updated plat drawings for Windermere Filing No. 1 by Drexel, Barrell & Co. last dated March 25, 2022, Job No. 21187-01) and provide an opinion regarding the negative impacts (if any) that the identified geologic conditions will have on the proposed zoning change. The figures originally presented in the *Soils and Geology Study* noted above have been revised to identify the area that is to be rezoned, and are attached and included as Figures 1-6 of this report. Figure 7 of this report depicts the currently proposed configuration of the site, with Tract B identified.

Project Description

As originally platted, the development was to be grouped into two phases, Phase I consisting of 163 single-family lots and Phase II consisting of 40 single-family lots. As rezoned, the original Windermere subdivision would retain 163 single-family lots (north of Mardale Lane), and the 40 single-family lots south of Mardale Lane would be rezoned for multi-family construction. The rezoned Tract B is also anticipated to contain a detention facility. It is our understanding the proposed zoning is to be changed to RM30, *Residential Multi-Dwelling.*

Previous Studies and Field Investigation

In addition to the previous *Soils and Geology Study* referenced above (and the prior investigations referenced therein), RMG has more recently completed the following reports within the single-family portion of the site:

1. *Subsurface Soil Investigation, Lots 63-73, 74-100, 122-139, and 149-163, Windermere, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 186474, dated February 18, 2022.
2. *Subsurface Soil Investigation, Lots 4-66, 101-121, and 140-148, Windermere, El Paso County*, Colorado, prepared by RMG – Rocky Mountain Group, Job No. 183672dated March 14, 2022.

Existing Site Conditions

The site is undeveloped and has been graded. It is anticipated additional overlot grading will need to be completed. The site does not contain vegetation or trees. The overall slope of the site is down to the south, southwest.

All previous recommendations and conclusions included in the Soils and Geology Study referenced above and not specifically addressed herein remain valid.

We hope this provides the information you have requested. Should you have questions, please feel free to contact our office.

Cordially,

RMG – Rocky Mountain Group

Kelli Zigler

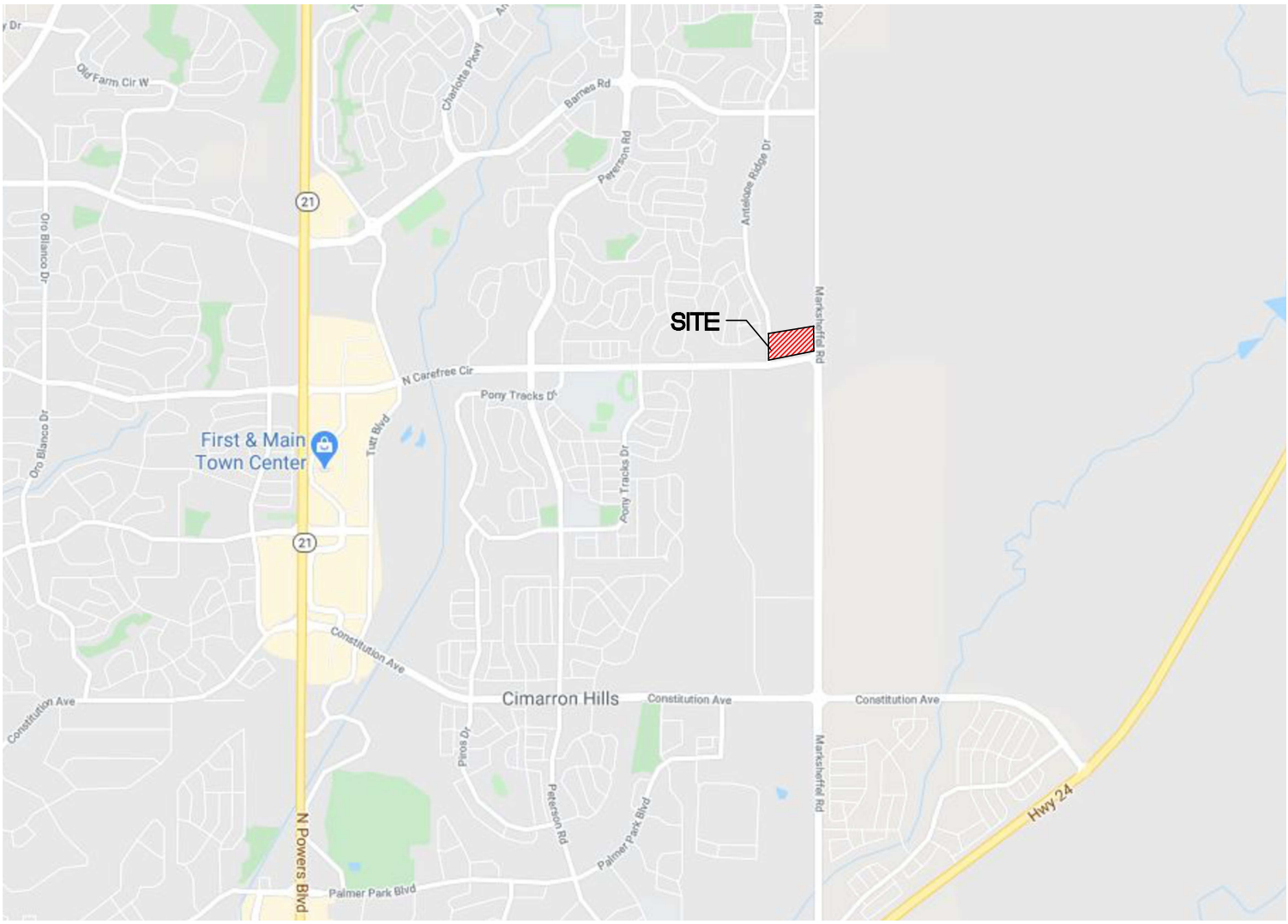
Kelli Zigler
Project Geologist

Reviewed by,

RMG – Rocky Mountain Group

COLORADO REGISTERED
ANTHONY P. MUNGER
4/1/22
39818
PROFESSIONAL ENGINEER

Tony Munger, P.E.
Geotechnical Project Manager



NOT TO SCALE

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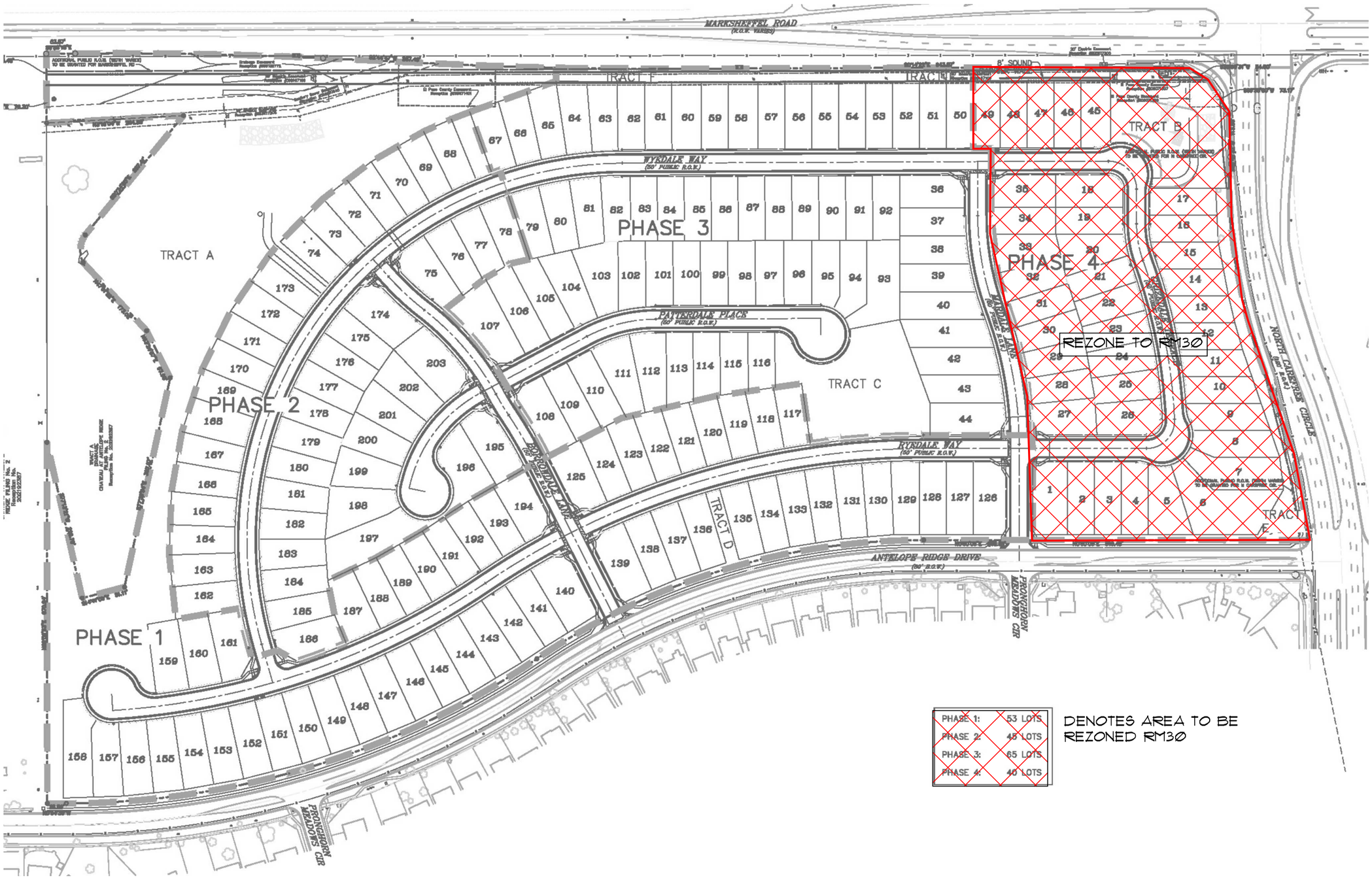
SITE VICINITY MAP

WINDERMERE
N. MARKSHEFFEL RD
EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

JOB No. 162062

FIG No. 1

DATE 10-26-2020
REV 3-30-22



JOB No. 162062

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Pueblo / Canon City:
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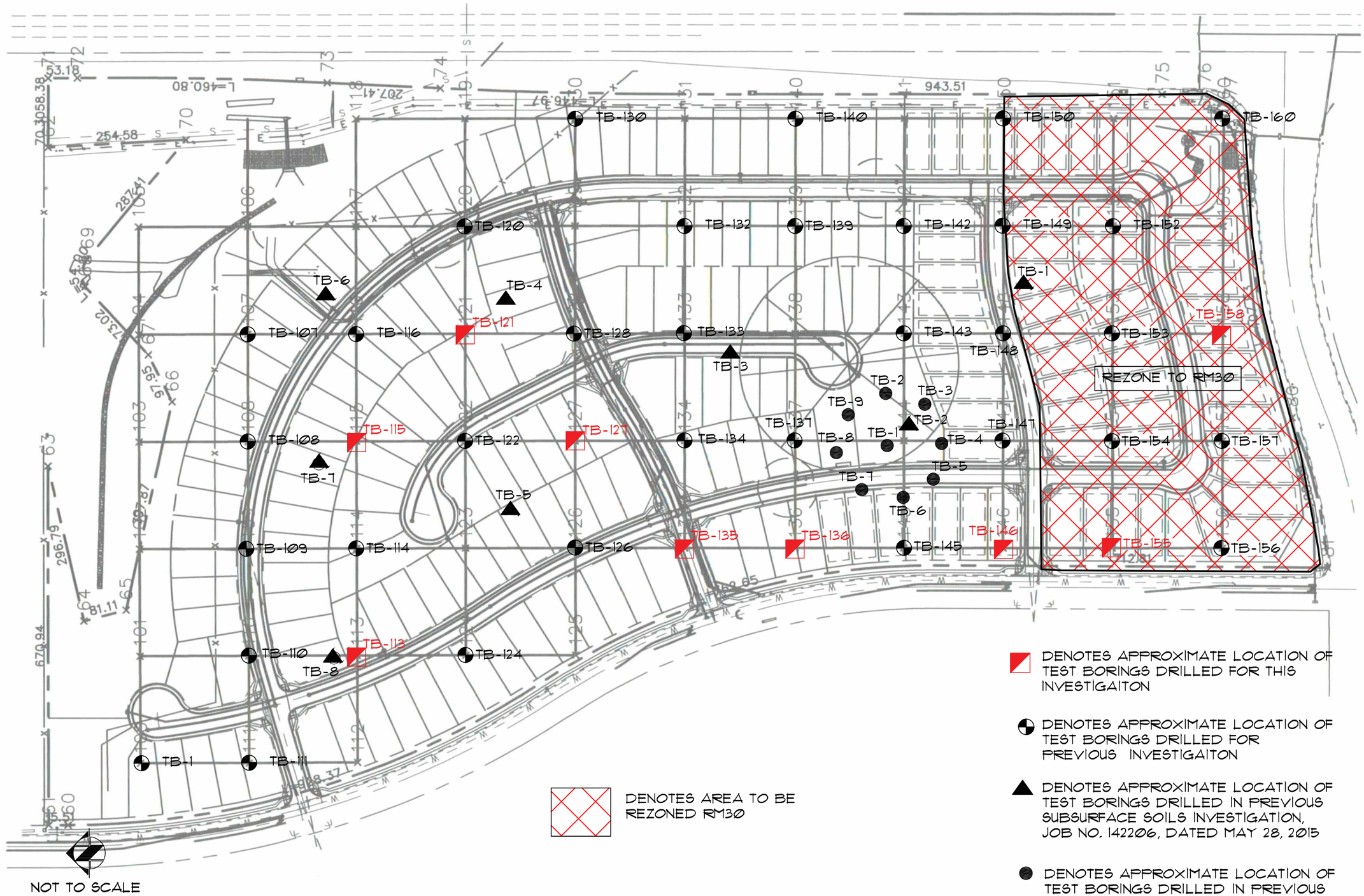
WINDERMERE
N. MARKSHEFFEL RD
EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

ENGINEER:	TPM
DRAWN BY:	KZ
CHECKED BY:	TPM
ISSUED:	10-26-2020
REVISION: DENOTE REZONE AREA	3-30-22

SITE PLAN

SHEET No.
FIG-2



DENOTES AREA TO BE REZONED RM30

DENOTES APPROXIMATE LOCATION OF TEST BORINGS DRILLED FOR THIS INVESTIGAITON

DENOTES APPROXIMATE LOCATION OF TEST BORINGS DRILLED FOR PREVIOUS INVESTIGAITON

DENOTES APPROXIMATE LOCATION OF TEST BORINGS DRILLED IN PREVIOUS SUBSURFACE SOILS INVESTIGATION, JOB NO. 142206, DATED MAY 28, 2015

DENOTES APPROXIMATE LOCATION OF TEST BORINGS DRILLED IN PREVIOUS SUBSURFACE SOILS INVESTIGATION, JOB NO. 142206, DATED MARCH 5, 2014

JOB No. 162062

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Pueblo / Canon City:
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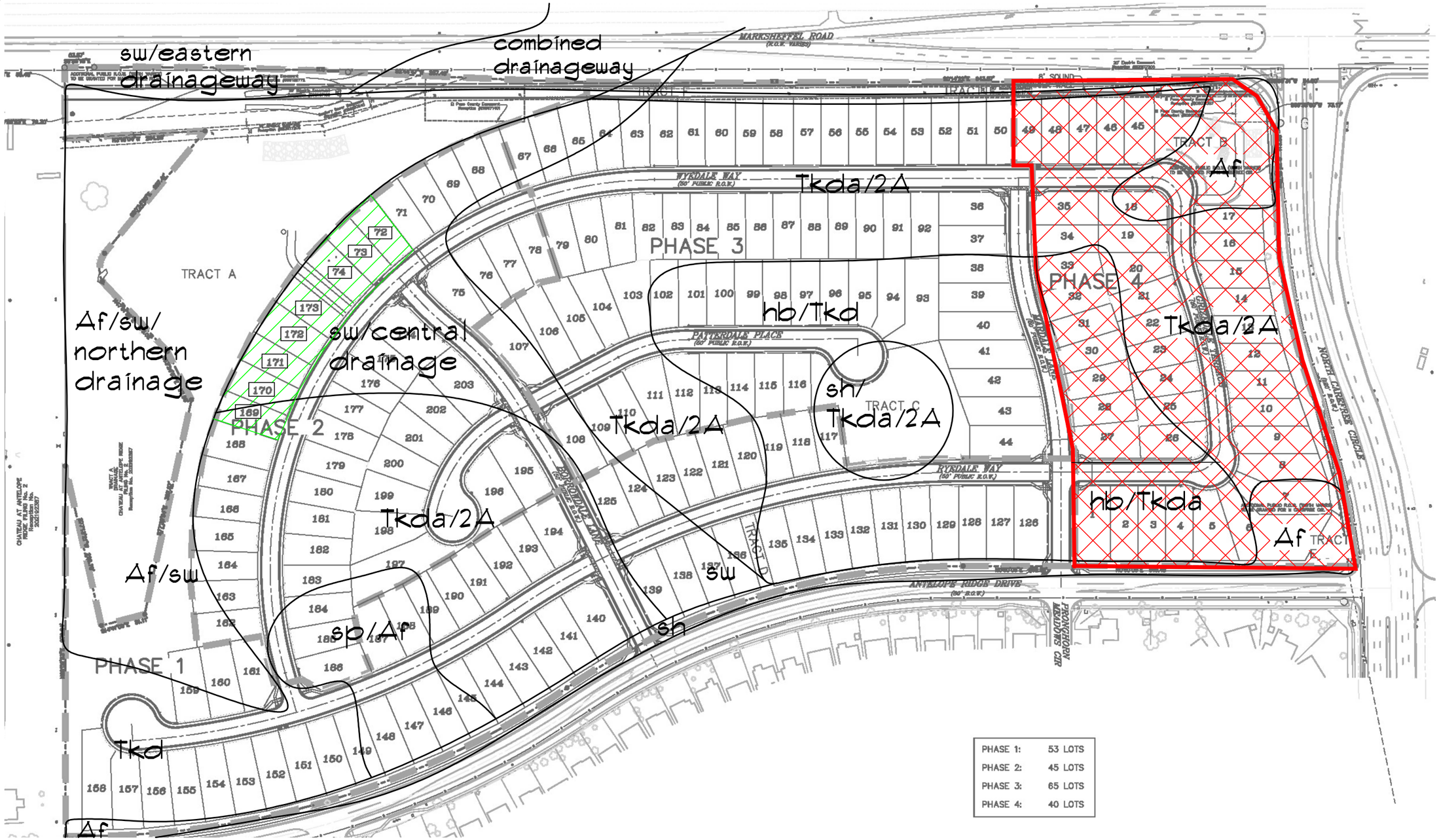
WINDERMERE SUBDIVISION
COLORADO SPRINGS, CO
WINDSOR RIDGE HOMES

ENGINEER:	TM
DRAWN BY:	BG
CHECKED BY:	TM
ISSUED:	4-17-18
REVISION: DENOTE REZONE AREA	3-30-22

TEST BORING LOCATION PLAN

SHEET No.
FIG-3



PHASE 1:	53 LOTS
PHASE 2:	45 LOTS
PHASE 3:	65 LOTS
PHASE 4:	40 LOTS

Geologic

- *Tkda - Dawson Arkose Formation (Eocene)* - Dawson Sandstone consists of silty sandstone with interbedded layers of claystone/siltstone.
- *Af - Artificial fill* - areas of visible known fill to include: the existing detention pond banks, berms along the western and southern property lines, stockpile
- *sw - seasonally wet* areas where near-surface moisture conditions may seasonally occur, includes areas where shallow groundwater was encountered in the test borings
- *sh* - sandstone "hill"
- *hb* - hard to very hard sandstone bedrock encountered at the surface
- *sp* - stockpile

Engineering

2A - stable alluvium, colluvium and bedrock on gentle to moderate slopes

With the indication of seasonally shallow groundwater near the existing detention pond, full-depth basements are not recommended on Lots 72-74, and 169-173.

Area to be rezoned RM30

NOT TO SCALE

BASE MAP PROVIDED BY: GOOGLE AND DREXEL, BARREL & CO.

JOB No. 162062

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Pueblo / Canon City:
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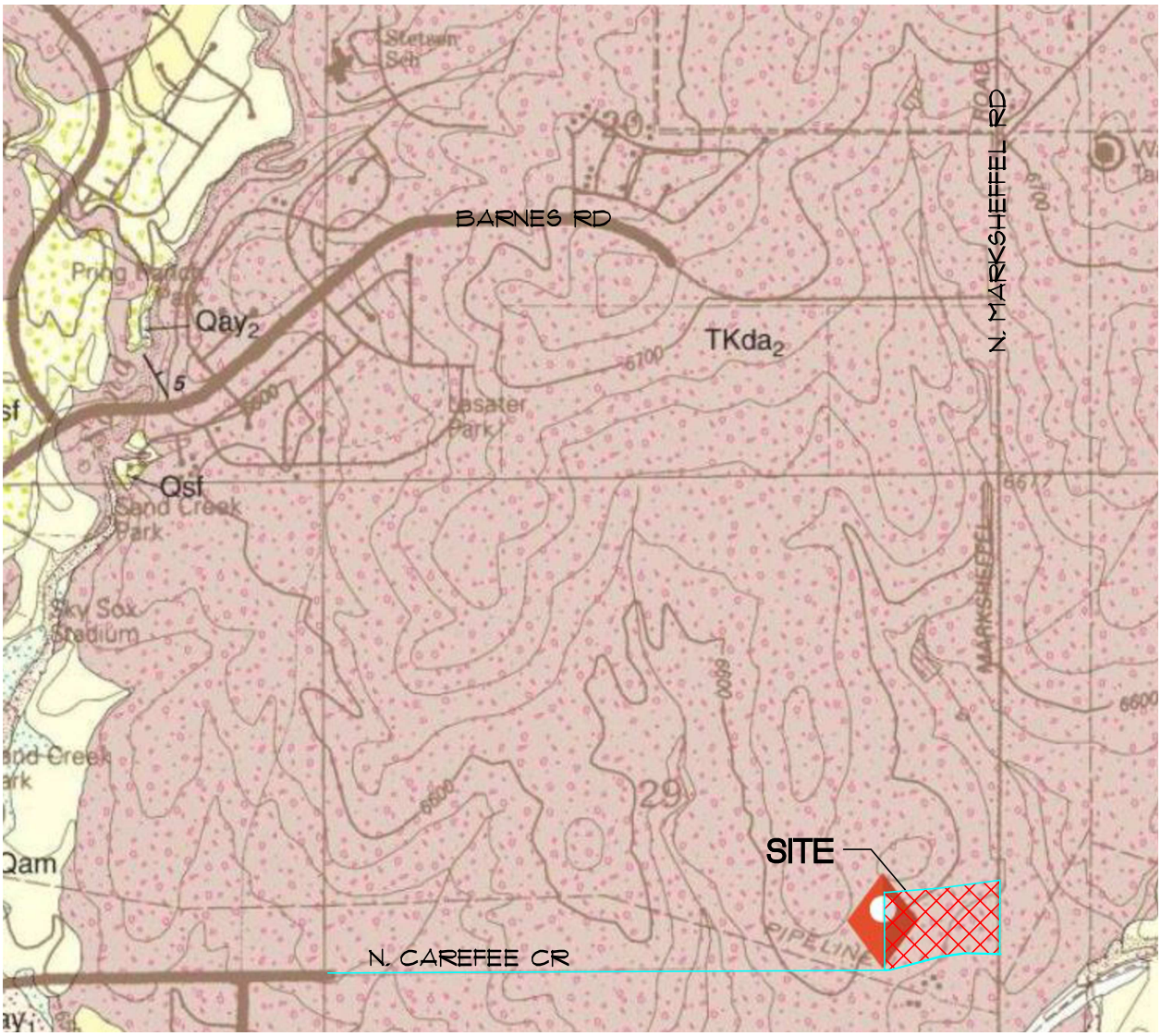
WINDERMERE
N. MARKSHEFFEL RD
EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

ENGINEER:	TPM
DRAWN BY:	KZ
CHECKED BY:	TPM
ISSUED:	10-26-2020
REVISED:	1-18-21
REVISED: DENOTE REZONE AREA	3-30-22

ENGINEERING AND GEOLOGY MAP

SHEET No.
FIG-4



NOT TO SCALE
BASE MAP PROVIDED BY: CGS

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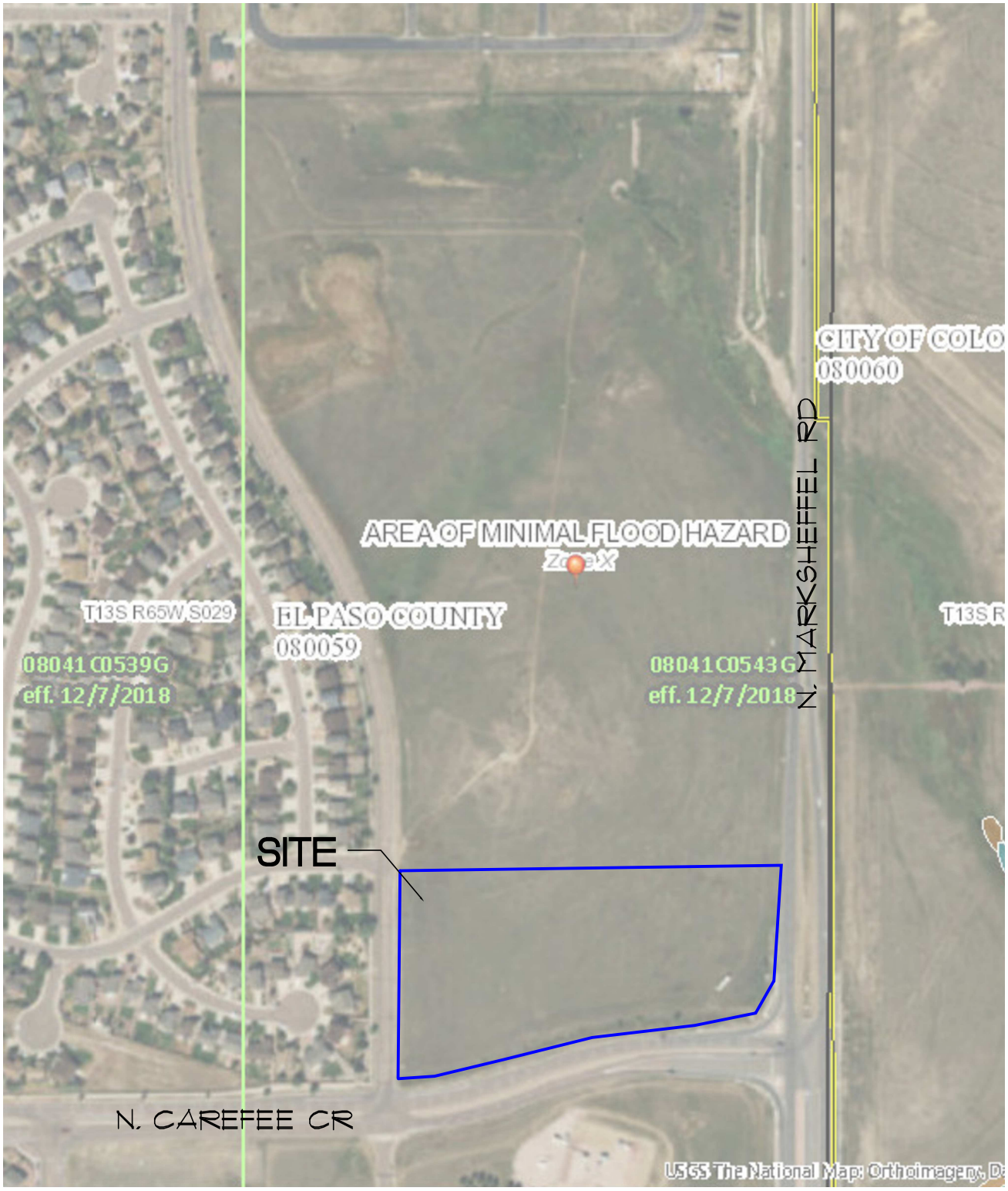
FALCON NW QUADRANGLE

WINDERMERE
N. MARKSHEFFEL RD
EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

JOB No. 162062

FIG No. 5

DATE 10-26-2020
REV 3-30-22



NOT TO SCALE
BASE MAP PROVIDED BY: FEMA

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ROCKY MOUNTAIN GROUP

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(970) 330-1071

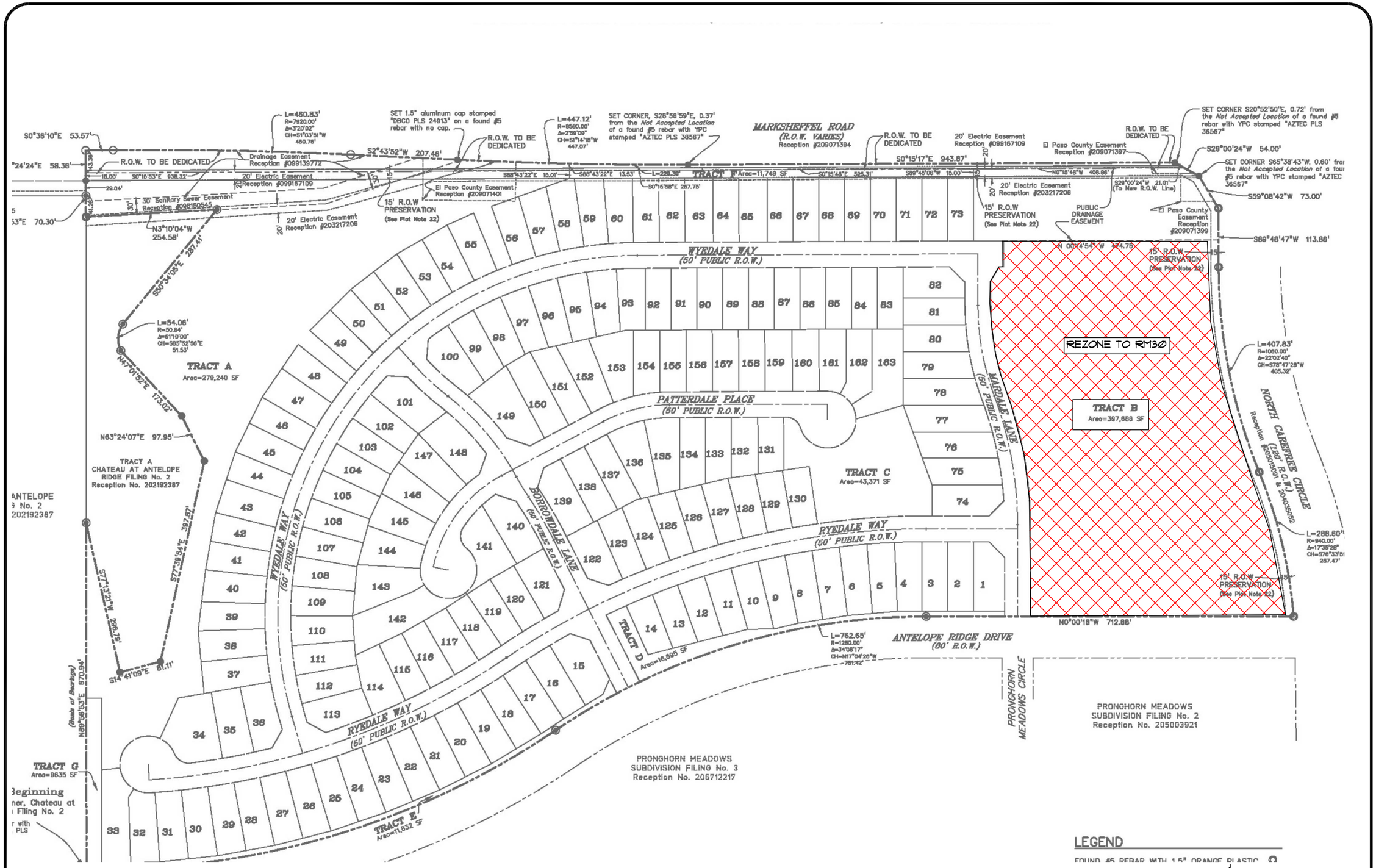
FEMA MAP

WINDERMERE
N. MARKSHEFFEL RD
EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

JOB No. 162062

FIG No. 6

DATE 10-26-2020
REV 3-30-22



Area to be rezoned RM30

NOT TO SCALE

BASE MAP PROVIDED BY: DREXEL, BARREL & CO.

JOB No. 162062

ARCHITECTS RMG ENGINEERS

ROCKY MOUNTAIN GROUP

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(719) 544-7750

WINDERMERE
N. MARKSHEFFEL RD
EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

ENGINEER:	TPM
DRAWN BY:	KZ
CHECKED BY:	TPM
ISSUED:	3-30-2022

PROPOSED REZONE

SHEET No.
FIG-7

APPENDIX A

Soils and Geology Study
Windermere Subdivision
El Paso County, Colorado
Prepared by RMG – Rocky Mountain Group
Job No. 162062
Last dated January 18, 2021

Job No. 162062

January 18, 2021

Windsor Ridge Homes
4164 Austin Bluffs Parkway, #361
Colorado Springs, CO 80918

Re: Response to CGS Comments
Windermere Subdivision
N Carefree Cr
El Paso County, Colorado

Dear Mr. Stephens:

RMG – Rocky Mountain Group (RMG) prepared the Soils and Geology Report (RMG Job No. 162062, last dated October 26, 2020) for the proposed development, consisting of 203 single-family residences. The report was reviewed by personnel of the Colorado Geological Survey (CGS), and comments were posted on the El Paso County website, EDARP, and forwarded to RMG by personnel of Drexel Barrell & Co. on December 2, 2020.

This letter provides RMG's response to CGS' comments. For clarity and ease of review we have "snipped" the relevant comments and pasted them below, each followed by our response to that comment.

CGS Comment:
Persistent shallow groundwater occurs at this site and within this region. This is reflected in part where RMG has mapped areas as “seasonally wet” (sw). Within this area they state, “basement construction should be avoided on the proposed lots 72-74 and lots 169-173.” This is not all the lots within the “seasonally wet” map unit. No technical basis has been provided why some lots within this mapped designation should avoid basement construction and not others.

RMG Response:
As noted in our report, "*Additionally, areas of seasonal and potentially seasonal shallow groundwater were observed on the site. In these areas, the potential for periodically high subsurface moisture conditions may be encountered. These areas currently lie within the low-lying areas in the northeastern corner of the site and the existing detention area. Water has been observed in these areas during seasonally high moisture periods.*" Where the proposed lots encroach within these low-lying areas in the northeastern corner of the site, personnel of RMG have reviewed the available groundwater data available to date (compiled from nearly 60 test borings, only 5 of which contained any groundwater at all) and the conditions observed in our site reconnaissance visits to determine which lots are anticipated to encounter groundwater conditions

shallow enough to impact basement construction. We recommended that basement construction be avoided on these lots.

Regarding the remaining areas identified as "seasonally wet" (sw) in our report, these lots are in an area we designated the "central drainageway". As noted in section 6.5 of our report, "*It is our understanding that the central drainageway is to be infilled as part of the overlot grading process. Based on our investigation, the central drainageway does not appear to be related to a shallow groundwater condition. Rather, it is a relatively low-lying pathway for surface runoff. Provided that the site drainage and grading plan provides for adequate surface runoff in this area, it is our opinion that no further mitigation measures are required. Site grading should be configured to avoid ponding of water around the structures.*"

For clarification, the "seasonally wet" designation in our report does not necessarily indicate the presence of a subsurface water condition. Intermittent (or "seasonally wet") drainages such as those identified on the site are typically incised by surficial runoff during periods of high precipitation or snowmelt, not by subsurface groundwater conditions (whether a permanent water table, or a localized "perched" water condition). The pathway that these surface water conditions follow (and thus, the drainage channels that they incise) are based on surface topography, not on groundwater conditions occurring below the ground surface. Surficial drainage channels, such as the ones identified on this site, can and do occur in areas with no subsurface groundwater conditions. Likewise, areas containing high groundwater conditions (either permanent or "perched") can and do occur in areas with no incised drainages on the ground surface. The two conditions, while both relating to the presence or movement of water, can and do occur independently of each other and the presence of one is not a reliable indication of the presence of the other. There are no indications of a persistent subsurface groundwater condition within the central drainageway and thus, it is our opinion that there is insufficient justification to prohibit basement construction in this area.

CGS Comment:

Seasonal groundwater monitoring has not been conducted at this site as recommended by the Engineering Criteria Manual (ECM) and extent of seasonal fluctuation is unknown. Without monitoring, potential impacts from groundwater are indeterminate. RMG states, p. 8, "If shallow groundwater conditions are found to exist on additional lots at the time of site-specific subsurface soil investigations, the feasibility of basement construction and/or any recommended mitigation measures are to be addressed at that time."

RMG Response:

Seasonal groundwater monitoring is recommended by the El Paso County Engineering Criteria Manual (ECM) in cases where groundwater has been encountered within 5 feet of the original ground surface (as part of a Subsurface Water Investigation Report). Groundwater was not encountered within 5 feet of the original ground surface in any of the test borings performed at this site by RMG. Furthermore, the stated purpose of this report is to "*ensure mitigation of high groundwater effects upon public improvements within the right-of-way.*" The ECM does not indicate any correlation between the Subsurface Water Investigation Report (or the associated groundwater monitoring) and a determination of basement feasibility. Nor does the ECM require seasonal groundwater monitoring as part of the geologic hazard evaluation. At most, the ECM lists "monitoring programs" as one of many available site evaluation techniques. However, it also

states that "*The most appropriate site evaluation techniques shall be determined by the geologist/geotechnical engineer based on site conditions and the activities being proposed for the site.*" Based on the locations and depths of groundwater encountered in our investigation, a review of the proposed development, and a review of the ECM requirements regarding groundwater, it is our opinion that a seasonal groundwater monitoring program is not required at this site.

CGS Comment:
ECM is clear that discussion of seasonal variations in groundwater levels based on groundwater monitoring are the responsibility of the applicant at the time of initial planning.

RMG Response:
As noted above, the ECM states that it is up to the geologist/geotechnical engineer to determine which investigation methods are appropriate for the site. The ECM does designate one specific condition when groundwater monitoring would be required but that condition does not relate to basement feasibility (or any other construction within the proposed lots), and this site does not meet that criteria.

CGS Comment:
This subdivision includes areas of both shallow groundwater and potentially shallow groundwater. CGS recommends the applicant follow ECM recommendations and perform a groundwater monitoring program to determine groundwater depths and extent of seasonal fluctuation. In the absence of such a program and prior to approval of the development plan we recommend it be demonstrated where mitigation of persistent groundwater is taking place from:

- Raising site grades;
- Garden-level basement construction; and/or,
- An underdrain system.

RMG Response:
RMG has identified one area on the site where shallow groundwater is anticipated to exist within the proposed lots. We have recommended that basement construction be avoided on these lots. It is our opinion that further investigation or mitigation is not required at this time.

CGS Comment:
It is the applicant's responsibility to demonstrate that groundwater levels will be maintained 3 to 5 feet below base of foundation year-round and how this is achieved should be clearly shown and stated on the plans. Areas where basements are not feasible, areas where specific mitigation allows basements, and areas of high ground above any seasonal groundwater levels should be clearly depicted on the plans and individual lot numbers listed for each area. All areas where basements are considered feasible should clearly state how it was determined that groundwater levels will be maintained 3 to 5 feet below base of foundation.

RMG Response:
The ECM has no such requirement. The ECM does not stipulate a minimum separation between groundwater and the base of the proposed foundations. Nor does it provide any specific criteria for determining basement feasibility with respect to groundwater, or for determination of mitigation measures necessary to promote basement feasibility. These determinations are the responsibility of the geologist/geotechnical engineer preparing the report. We have made these determinations, and provided our recommendations accordingly.

It is our opinion that the report referenced above (and the recommendations provided therein) are in compliance with the ECM, and that no additional investigations or revisions to the referenced report are required at this time.

I hope this provides the information you have requested. Should you have questions, please feel free to contact our office.

Cordially,

RMG – Rocky Mountain Group

Kelli Zigler

Kelli Zigler
Project Geologist

Tony Munger, P.E.
Geotechnical Project Manager

Architecture
Structural
Geotechnical

ROCKY MOUNTAIN GROUP
EMPLOYEE OWNED

Materials Testing
Forensic
Civil/Planning

SOILS AND GEOLOGY STUDY

Windermere Subdivision
El Paso County, Colorado

PREPARED FOR:

Windsor Ridge Homes
4164 Austin Bluffs Parkway, #361
Colorado Springs, CO 80918

JOB NO. 162062

October 26, 2020
Revised January 18, 2021

Respectfully Submitted,
RMG – Rocky Mountain Group

Kelli Zigler
Project Geologist

Reviewed by,
RMG – Rocky Mountain Group

COLORADO REGISTERED
ANTHONY P. MUNGER
1/19/21
39818
PROFESSIONAL ENGINEER

Tony Munger, P.E.
Geotechnical Project Manager

TABLE OF CONTENTS

FIGURES

APPENDIX A

Additional Referenced Documents

APPENDIX B

Test Boring Logs and Summary of Laboratory Test Results from: *N. Carefree Circle and Marksheffel Road*, El Paso County, Colorado, prepared by RMG – Rocky Mountain Group, Job No. 162062, last dated February 5, 2019

APPENDIX C

Test Boring Logs and Summary of Laboratory Test Results from: *Addendum to Subsurface Soil Investigation, Windermere Subdivision, North Carefree Circle and Marksheffel Road*, El Paso County, Colorado, prepared by RMG – Rocky Mountain Group, Job No. 162062, last dated July 20, 2018

APPENDIX D

Test Boring Logs and Summary of Laboratory Test Results from: *Subsurface Soil Investigation, Windermere Subdivision, El Paso County, Colorado,* prepared by RMG – Rocky Mountain Group, last dated May 28, 2015

APPENDIX E

Test Boring Logs and Summary of Laboratory Test Results from: *Preliminary Soils and Geology Report, Hilltop Subdivision, North Carefree Circle and Marksheffel Road, El Paso County, Colorado,* prepared by RMG Engineers, last dated May 5, 2014

1.0 SUMMARY

1.1 Project Location

The project lies in the E ½ of Section 29, Township 13 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located at the northwest intersection of Marksheffel Road and N. Carefree Circle. The approximate location of the site is shown on the Site Vicinity Map, Figure 1.

1.2 Project Description

We understand the development is to be grouped into two phases, with Phase I consisting of 163 lots in and Phase II consisting of 40 lots. The proposed development also includes Tract areas and two detention ponds.

The total calculated area of the site, as recorded on the *Windermere Preliminary Plan*, prepared by Drexel, Barrell & Co. last dated June 18, 2020, Project No. 21187-01CSCV, is 55.58 acres. The proposed development is to consist of 203 single family residential lots with an average lot size of 6,978 square feet. The parcels included in this study are:

- EPC Schedule No. 5329400013, currently labeled as Antelope Ridge Drive and is zoned RS-5000 CAD O, *Residential Suburban, Commercial Airport District.*
- EPC Schedule No. 5329111002, currently labeled as Antelope Ridge Drive and is zoned RS-5000 CAD O, *Residential Suburban, Commercial Airport District.*

It is our understanding water and wastewater are to be provided by the Cherokee Metro district. Therefore, an on-site wastewater treatment system evaluation is not anticipated to be required.

The purpose of this report is to provide a Soils and Geology Study that meets the current requirements outlined in the *El Paso County Land Development Code* (LDC), the *El Paso County Engineering Criteria Manual* (ECM). This report also addresses the Panning and Community Development Engineering review comments, dated March 21, 2019, in regards to the previous *Preliminary Soils and Geology Report* (2014), referenced below. The original *Soils and Geology Report* was also reviewed by the Colorado Geological Survey (CGS). The comments from CGS were posted on the El Paso County Electronic Development Application Review Program (EDARP) on July 28, 2020, and their comments have also been considered in preparation of this updated report. The general boundary of our investigation in presented in Figure 2.

1.3 Scope of Report

The scope of this study included a physical reconnaissance of the site and a review of pertinent, publically available documents including (but not limited to) previous geologic and geotechnical reports, overhead and remote sensing imagery, published geology and/or hazard maps, design documents, etc. Our services exclude the evaluation of the environmental and/or human, health-related work products or recommendations previously prepared, by others, for this project.

The objectives of our study are to:

- Identify geologic conditions that are present on this site,
- Analyze the potential negative impacts of these conditions on the proposed site development,
- Analyze the potential negative impacts to the surrounding properties and/or public services resulting from the proposed site development as it relates to existing geologic hazards,

- Provide our opinion of suitable techniques that may be utilized to mitigate the potential negative impacts identified herein.

This report presents the findings of the study performed by RMG relating to the geologic conditions of the above-referenced site. Revisions and modifications to this report may be issued subsequently by RMG, based upon:

- Additional observations made during grading and construction which may indicate conditions that require re-evaluation of some of the criteria presented in this report,
- Review of pertinent documents (development plans, plat maps, drainage reports/plans, etc.) not available at the time of this study,
- Comments received from the governing jurisdiction and/or their consultants subsequent to submission of this document.

1.4 Site Evaluation Techniques

The information included in this report has been compiled from:

- Field reconnaissance
- Geologic and topographic maps
- Review of selected publicly available, pertinent engineering reports
- Available aerial photographs
- Exploratory soil test borings by RMG
- Laboratory testing of representative site soil and rock samples by RMG
- Geologic research and analysis
- Site development plans prepared by others

Geophysical investigations were not considered necessary for characterization of the site geology. Monitoring programs, which typically include instrumentation and/or observations for changes in groundwater, surface water flows, slope stability, subsidence, and similar conditions, are not known to exist and were not considered applicable for the scope of this report.

1.5 Land Use and Engineering Geology

Overall, the site was found to be suitable for the proposed development. Several geologic conditions were encountered in areas that will impose some constraints on development and land use. These geologic conditions include artificial fill, expansive soils and bedrock, seasonal and potentially seasonal shallow groundwater. Based on the review of the *Preliminary Plan* referenced above, as well as the *Preliminary Erosion Control Plan* prepared by Drexel, Barrell & Co. last dated June 18, 2020, Project No. 21187-01ECCV these areas will have some impact on the development. These conditions are discussed in greater detail in this report.

1.6 Previous Studies and Field Investigation

Reports of previous geotechnical engineering/geologic investigations for this site were available for our review and are listed below:

1. *Preliminary Subsurface Soil Investigation, N. Carefree Circle and Marksheffel Road, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 162062, last dated February 5, 2019.
2. *Addendum to Subsurface Soil Investigation, Windermere Subdivision, North Carefree Circle and Marksheffel Road, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 162062, last dated February 5, 2019.
3. *Addendum to Subsurface Soil Investigation, Windermere Subdivision, N. Carefree Circle and Marksheffel Road*, El Paso County, Colorado, prepared by RMG – Rocky Mountain Group, Job No. 162062, last dated July 20, 2018.
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6. *Addendum to Preliminary Soils and Geology Report, Windermere, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 142206, last dated November 14, 2014.
7. *Preliminary Soils and Geology Report, Hilltop Subdivision, North Carefree Circle and Marksheffel Road, El Paso County, Colorado*, prepared by RMG Engineers, Job No. 142206, last dated March 5, 2014.

2.0 GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION

2.1 Existing Site Conditions

The site is mostly undeveloped other than a detention pond located along the northern property line. A stockpile of imported soil resides near the northwest corner of the property. An unnamed drainageway enters the property near the center of the eastern property line and continues to flow into the detention pond.

2.2 Topography

A hill with sandstone outcroppings exists near the western boundary in the southern third of the property. The hill is the highest portion of the property, with slopes down to the roads to the west, south, and east and northward down to a southwest/northeast drainage crossing the site. The northern portion of the site slopes down to Marksheffel Road on the east and to the same southwest/northeast drainage.

2.3 Vegetation

The majority of the site consists of low lying native grasses and weeds. Few deciduous trees are present on the site.

2.4 Aerial photographs and remote-sensing imagery

Personnel of RMG reviewed aerial photos available through Google Earth Pro dating back to 1999, CGS surficial geologic mapping, and historical photos by historicaerials.com dating back to 1947. The site has remained generally undisturbed prior to 1999. Prior to 1947, a dam was constructed in the location of the existing detention pond. The dam remained in place until prior to 1999 when improvements were made in

conjunction with the development to the north. Since 1999, the detention area has remained seasonal wet and has retained little free standing water.

3.0 SCOPE OF REPORT

The purpose of this investigation is to characterize the general geotechnical and geologic site conditions, and present our opinions of the potential effect of these conditions on the proposed development of single-family residences within the referenced site. As such, our services exclude evaluation of the environmental and/or human, health-related work products or recommendations previously prepared, by others, for this project.

Revisions to the conclusions presented in this report may be issued based upon submission of the Development Plan. This study has been prepared in accordance with the requirements outlined in the El LDC specifically Chapter 8 last updated August 27, 2019 applicable sections include 8.4.8 and 8.4.9. and ECM, specifically Appendix C last updated July 9, 2019.

This report presents the findings of the study performed by RMG relating to the geologic conditions of the above-referenced site. Revisions and modifications to the conclusions and recommendations presented in this report may be issued subsequently by RMG based upon additional observations made during grading and construction which may indicate conditions that require re-evaluation of some of the criteria presented in this report.

4.0 FIELD INVESTIGATION

4.1 Drilling

The subsurface conditions within the property were previously explored multiple times by RMG, by drilling a total of sixty (60) exploratory borings between March 2014 and March 2018. The test borings extended to depths of approximately 10 to 47 feet below the existing ground surface. The approximate locations of the test boring locations are presented on the Test Boring Location Plan, Figure 3.

The test borings were drilled with a power-driven, continuous-flight auger drill rig. Samples were obtained during drilling of the test boring in general accordance with ASTM D-1586 and D-3550, utilizing a 2-inch O.D. Split Barrel Sampler and a 2½-inch O.D. California sampler, respectively. An Explanation of Test Boring Logs and the Test Boring Logs from each previous investigation are presented in Appendices B through E.

4.2 Laboratory Testing

Soil laboratory testing was performed as part of each previous investigation. The laboratory tests included moisture content, dry density, grain-size analyses, Atterberg Limits and Swell/Consolidation tests. A Summary of Laboratory Test Results from each previous investigation is presented in Appendices B through E.

4.3 Groundwater

The presence of creeks, streams, holding ponds, or other waterways (particularly those that only intermittently contain water) is not necessarily indicative of a shallow groundwater condition. Such waterways can be fed solely from "upstream" precipitation, irrigation, and other surface sources. Shallow groundwater was encountered in 5 of the previous test borings at depths ranging from 6 to 42 feet. Below is a table summarizing the groundwater depths within the previous reports, referenced above.

Job No./ Date of Report	Test Boring (TB) No.	Depth of Groundwater (Ft)	Date of Groundwater Measurement
142206 / 5/28/15	TB-2	42.0	2/20/14
142206 / 5/28/15	TB-6	6.0	2/20/14
142206 / 5/28/15	TB-7	21.5	2/20/14
162062 / 5/5/19	107	14.0	3/18/18
162062 / 5/5/19	130	16.0	3/18/18

Groundwater was not encountered in the remaining test borings. Areas of seasonal and potentially shallow groundwater are indicated on the Engineering and Geology Map, Figure 4 and is discussed in the following section.

Fluctuations in groundwater and subsurface moisture conditions may occur due to variations in rainfall and other factors not readily apparent at this time. Development of the property and adjacent properties may also affect groundwater levels.

As a result of the groundwater conditions encountered in TB-6 performed for Job No. 142206, it is our opinion that **basement construction should be avoided on the proposed Lots 72-74 and lots 169-173.** Based on our knowledge of the area and engineering design and construction techniques employed in the El Paso County area, it is our opinion that there is insufficient reason to preclude full-depth basements on the remaining lots at this time. If shallow groundwater conditions are found to exist on additional lots at the time of the site-specific subsurface soil investigations, the feasibility of basement construction and/or any recommended mitigation measures are to be addressed at that time.

5.0 SOIL, GEOLOGY, ENGINEERING GEOLOGY

5.1 General Geology

Physiographically, the site lies near the center of the Denver Basin, an asymmetrical, oval-shaped, geological structural depression. This structural basin lies directly east of the Front Range and covers a large part of eastern Colorado. The formation of the Denver Basin began during the Ancestral Rockies uplift, approximately 300 million years ago. The Rampart Range fault is about 12 miles west of the site.

Bedrock in the area tends to be very gently dipping in a northerly direction. The bedrock in the area of the site are sedimentary in nature and are typically Paleocene and Upper Cretaceous. The bedrock underlying the site consists of the Dawson Arkose Formation. Overlying this formation are unconsolidated deposits of residual soils, man-made, sheetwash deposits, and alluvial soils. The alluvial soils were deposited by water in the drainages on the site. Man-made soils exist as earthen dams, berms and stockpiles.

5.2 Soil Conservation Survey

The U.S. Soil Conservation Service along with USDA has identified the soils on the property as:

- 97 – Truckton, sandy loam, 3 to 9 percent slopes. The Truckton, sandy loam was mapped by the USDA to encompass the entire property. Properties of the Truckton, sandy loam include, well-drained soil, depth of the water table is anticipated to be greater than 80 inches, runoff is anticipated to be low, frequency of flooding and ponding is none, and landforms are hills. The Truckton, sandy loam is anticipated in the areas of all the new residences.

5.3 Site Stratigraphy

Based on our field observations and review of relevant geologic maps, a geologic map was prepared which identifies the geologic conditions affecting the development. The geologic units present of the site are presented in the Engineering and Geology Map, Figure 4.

The site generally consists of fine-coarse grained sand with some clay content overlying the Dawson Formation. The sandstone is generally permeable, well drained, and has good foundation characteristics. Six geologic units and one engineering unit were mapped at the site as:

Geologic Units

- *Tkda – Dawson Arkose Formation (Eocene)* – as mapped on the Falcon NW Quadrangle, The Dawson Sandstone which consists of silty sandstone with interbedded layers of claystone/siltstone. The Dawson formation is thick-bedded to massive, generally light colored arkose, pebbly, and pebble conglomerate. The sandstone is generally poorly sorted with high clay content. The sandstone is generally permeable, well drained, and has good foundation characteristics. The claystone/siltstone is generally well sorted with high sand content. The claystone/siltstone generally is less permeable than the sandstone and is generally not suitable for direct bearing of shallow foundations.
- *Af – Artificial fill* – areas of visible known fill to include: the existing detention pond banks, berms along the western and southern property lines, stockpile
- *sw – seasonally wet* areas where near-surface moisture conditions may seasonally occur, includes areas where shallow groundwater was encountered in the test borings
- *sh* – sandstone "hill"
- *hb* – hard to very hard sandstone bedrock encountered at the surface
- *sp* - stockpile

Engineering Unit

- 2A – Stable alluvium, colluvium and bedrock on gentle to moderate slops (5% to 12%)

5.4 Soil Conditions

The soils encountered in the test borings can be grouped into five general soil and rock types. The soils were classified using the Unified Soil Classification System (USCS). Below is a brief description of each soil and bedrock type encountered on the property.

<u>Artificial Fill (CL and SC/SM)</u>
Fill was encountered in three of the test borings. The fill extended to depths of approximately 6 to 30 feet

below the existing surface. The fill materials were described as stiff and medium dense consistencies. Minimal testing was performed on the fill due to the locations (located within areas where overlot grading cuts are anticipated to remove the majority of the fill).

Native Silty to Clayey Sand (SM and SC/SM)
The silty to clayey sand material is residual soil derived from the Dawson Arkose Formation. The silty sand (SM) and the silty to clayey sand (SC/SM) were encountered throughout the site, extending to depths ranging from 1 to 10 feet. These materials were described as loose to dense consistencies. This material is considered to have nil to low swell potential.

Native Sandy Clay (CL)
The sandy clay material is also considered residual soil derived from the Dawson Arkose Formation. The sandy clay (CL) was encountered near the surface intermittently across the site. The sandy clay extended to depths ranging between 6 to 8 feet and was described as stiff to very stiff consistencies. This material is considered to have low to moderate swell potential.

Dawson Arkose Formation - Sandstone
The sandstone was encountered in the majority of the test borings. The sandstone was generally described as hard to very hard consistencies. The sandstone with low clay content is considered to have low swell potential. The swell potential is anticipated to increase with increasing clay content.

Dawson Arkose Formation – Claystone/Siltstone
The claystone/siltstone was encountered intermittently across the site at various depths below the ground surface. The claystone/siltstone was generally described as hard to very hard consistencies. The claystone/siltstone is considered to have low to moderate potential.

6.0 ENGINEERING GEOLOGY – IDENTIFICATION OF GEOLOGIC HAZARDS

6.1 Relevance of Geologic Conditions to Land Use Planning

The El Paso County Engineering Criteria Manual recognizes and delineates the difference between hazards and constraints. A geologic hazard is one of several types of adverse geologic conditions capable of causing significant damage or loss of property and life. Geologic hazards are defined in Section C.2.2 Sub-section E.1 of the ECM. A geologic constraint is one of several types of adverse geologic conditions capable of limiting or restricting construction on a particular site. Geologic constraints are defined in Section C.2.2 Sub-section E.2 of the ECM (1.15 Definitions of Specific Terms and Phrases). The following geologic hazard and constraints were considered in the preparation of this report, and are not anticipated to pose a significant risk to the proposed development:

- Avalanches
- Debris Flow-Fans/Mudslides
- Floodplains
- Ground Subsidence
- Landslides
- Steep Slopes
- Rockfall

- Ponding water
- Steeply Dipping Bedrock
- Unstable or Potentially Unstable Slopes
- Scour, Erosion, accelerated erosion along creek banks and drainageways
- Springs and High Groundwater

The following sections present geologic constraints that have been identified on the property:

6.2 Expansive Soils and Bedrock

Based on the test boring logs and laboratory testing performed on the site, the silty to clayey sand and sandstone generally possess nil to low swell potential. The clay and claystone/siltstone generally possess low to moderate swell potential.

Mitigation
Foundation design and construction are typically adjusted for expansive soils. Expansive soils and bedrock are anticipated to be encountered on the site. If expansive soils or bedrock are encountered in the excavations, mitigation of expansive soils can be accomplished by overexcavation and replacement with structural fill or subexcavation and replacement with on-site moisture-conditioned soils. The overexcavated soils should be observed and tested to verify adequate compaction. Overexcavation and replacement has been successful in minimizing slab movement. If slab movement cannot be tolerated, the use of structural floors should be considered for basement construction on lowly to moderately expansive clays and claystone/siltstone. Drilled piers are generally not advised due to the presence of very hard bedrock. Final foundation recommendations should be determined after additional investigation is completed for each building site.

Additional test borings (site-specific soil investigations) will be necessary prior to the foundation excavation, and open excavation observations will be necessary prior to the placement of any foundation components.

6.3 Compressible Soils

Based on the test boring logs, the silty to clayey sand generally possesses low to moderate compressibility potential. The clay, sandstone, and claystone/siltstone are generally anticipated to possess low compressibility potential.

Mitigation
Foundation design and construction are typically adjusted for compressible soils. Compressible soils are anticipated to be encountered on the site. If compressible soils are encountered, mitigation of compressible soils can generally be accomplished by overexcavation and recompaction.

Additional test borings (site-specific soil investigations) will be necessary prior to the foundation excavation, and open excavation observations will be necessary prior to the placement of any foundation components.

6.4 Hard Bedrock

Hard to very hard bedrock was encountered in the test borings throughout the site. A sandstone “hill” exists on the property and outcroppings of the sandstone are visible. The elevation of the sandstone “hill” is approximately 20 feet higher than the surrounding area.

The sandstone “hill” and the area immediately surrounding the “hill” encountered hard cemented sandstone at the surface. This sandstone “hill” and area are mapped and presented in the Engineering and Geology Map, Figure 4. According to the *Cut/Fill Map*, referenced in Appendix A, the sandstone hill is to be reshaped to a limited degree. Relatively shallow cuts are proposed along the top of the "hill", but cuts along the sides may reach depths of approximately 15 to 16 feet in some areas.

Mitigation

Development within this area is anticipated to be difficult. The bedrock may require the use of specialized heavy-duty equipment and/or blasting to facilitate rock break-up and removal. In areas where the very hard sandstone bedrock is anticipated to be encountered, the builder is considering the use of stiffened slab-on-grade or crawlspace foundations to minimize the depth of excavations within the sandstone.

6.5 Floodplain and Drainage Areas

Based on our review of the Federal Emergency Management Agency (FEMA) Community Panel No. 08041C0539G and 08041C0543G effective December 7, 2018 and the online ArcGIS El Paso County Risk Map, the entire property lies outside of any designated 100-year and 500-year floodplains. The FEMA Map is presented in Figure 6.

Although the property does not lay within a designated floodway, it does include defined drainage features that should be taken into consideration. One such feature is a drainageway entering the property near the middle of the northern property line (hereafter referred to as the "northern drainageway"). This northern drainageway discharges into the existing detention pond along the northern property line. A second feature is a drainageway entering the site near the northeastern corner of the property (hereafter referred to as the "eastern drainageway"). This eastern drainageway is predominantly confined to an existing swale along Marksheffel Road. The third feature is a drainageway crossing the middle of the site in a southwest-to-northeast direction (hereafter referred to as the "central drainageway"). The northern and central drainageways converge near the northeast corner of the site, then extend southeasterly towards Marksheffel Road where the eastern drainageway also converges. This combined drainageway then proceeds to cross Marksheffel road to the east.

Additionally, areas of seasonal and potentially seasonal shallow groundwater were observed on the site. In these areas, the potential for periodically high subsurface moisture conditions may be encountered. These areas currently lie within the low-lying areas in the northeastern corner of the site and the existing detention area. Water has been observed in these areas during seasonally high moisture periods. It is our opinion that these areas can be avoided or properly mitigated during development. The potential exists for higher groundwater levels during high moisture periods and should the structures encroach on these areas, the following precautions should be followed.

Mitigation

It is our understanding that some reshaping of the existing detention pond is proposed. Likewise, it is our understanding that some reshaping of the eastern drainage way/swale paralleling Marksheffel Road is also proposed. All detention area improvements shall be completed as recommended in **Section 10.0**

Detention Storage Criteria of this report and (as applicable) the approved drainage report for this development. RMG has not verified the adequacy of the northern drainageway, eastern drainageway, or the detention pond to support the anticipated flows, as specific drainage studies are beyond the scope of this study. Refer to the approved drainage report for the site for this evaluation.

It is our understanding that the central drainageway is to be infilled as part of the overlot grading process. Based on our investigation, the central drainageway does not appear to be related to a shallow groundwater condition. Rather, it is a relatively low-lying pathway for surface runoff. Provided that the site drainage and grading plan provides for adequate surface runoff in this area, it is our opinion that no further mitigation measures are required. Site grading should be configured to avoid ponding of water around the structures.

6.6 Corrosive Minerals

Sandstone bedrock underlies the entire site. Sandstone bedrock is generally considered to contain corrosive minerals.

Mitigation

To help mitigate potential corrosion, buried ferrous metal piping, conduit, and similar construction materials should be coated, wrapped or otherwise protected to avoid or reduce contact with the on-site soils. For environments corrosive to concrete, sulfate-resistant cement and additives should be used.

6.7 Fill Soils

Fill soils were encountered in seven of the test borings, primarily along the southern and western banks of the detention pond, in the identified stockpile, and near the berms paralleling the western and southern property boundaries. Fill depths up to 32 feet were encountered in the stockpile near the northwestern portion of the detention pond, and up to depths of 5 to 6 feet near the berms.

To date, no documentation has been provided to RMG indicating that these fill soils were observed and tested during placement. Unless such documentation is received, these fills should be considered unsuitable for support of the proposed structures. Furthermore, any new fill placed atop this existing fill should also be considered unsuitable for support of the proposed structures.

Mitigation

The existing (undocumented) fill soils, where encountered below proposed foundations, will require removal and replacement with compacted structural fill. Prior to overlot grading operations and placing any new overlot grading fill, it is recommended test pits be performed and observed by RMG in the areas identified as containing fill soils, to verify the depth of the existing fill for removal prior to placing any new fill.

6.8 Proposed Grading, Erosion Control, Cuts and Masses of Fill

A grading plan has been prepared for the proposed new lots. Overlot grading and masses of fill are proposed. Based on the test borings performed previously by RMG for this property, the excavations will encounter a range of materials to include, silty to clayey sand (fill and native), sandy clay (fill and native), sandstone, and siltstone/claystone.

The on-site soils are mildly susceptible to wind and water erosion. Minor wind erosion and dust may be an issue for a short time during and immediately after construction. Should the problem be considered severe during construction, watering of the cut areas may be required. Once construction is complete, vegetation should be re-established.

Prior to placement of any overlot grading fill or removal and recompaction of the existing materials, topsoil, low-density native soil, fill and organic matter should be removed from the fill area. The subgrade should be scarified, moisture conditioned to within 2% of the optimum moisture content, and recompacted to the same degree as the overlying fill to be placed. The placement and compaction of fill should be periodically observed and tested by a representative of RMG during construction.

Mitigation

We anticipate that the deepest excavation cuts for basement level construction will be approximately 6 to 8 feet below the existing ground surface. We believe the surficial sand soils will classify as Type C materials and the clay soils will classify as Type B as defined by OSHA in 29CFR Part 1926, date January 2, 1990. OSHA requires temporary slopes made in Type C materials be laid back at ratios no steeper than 1.5:1 (horizontal to vertical) and slopes made in Type B materials be laid back at ratios no steeper than 1:1 (horizontal to vertical) unless the excavation is shored or braced. Flatter slopes will likely be necessary should groundwater conditions occur. It is recommended that fill slopes be no steeper than 3:1 (horizontal to vertical).

6.9 Radon

*"**Radon Act 51** passed by Congress set the natural outdoor level of radon gas (0.4 pCi/L) as the target radon level for indoor radon levels.*

Northern El Paso, CO and the 80931 zip code located in El Paso County, has an EPA assigned Radon Zone of 1. A radon zone of 1 predicts an average indoor radon screening level greater than 4 pCi/L, which is above the recommended levels assigned by the EPA. Black Forest is located in a high risk area of the country. *The EPA recommends you take corrective measures to reduce your exposure to radon gas.*

Most of Colorado is generally considered to have the potential of high levels of radon gas, based on the information provided at: http://county-radon.info/CO/El_Paso.html. There is not believed to be unusually hazardous levels of radon from naturally occurring sources at this site.

Mitigation

Radon hazards are best mitigated at the building design and construction phases. Providing increased ventilation of basements, crawlspaces, creating slightly positive pressures within structures, and sealing of joints and cracks in the foundations and below-grade walls can help mitigate radon hazards.

7.0 RELEVANCE OF GEOLOGIC CONDITIONS TO LAND USE PLANNING

It is our opinion the existing geologic and engineering geologic conditions will likely impose some limitations on the proposed development and construction. The most significant conditions affecting development will be the hard sandstone bedrock and potentially shallow groundwater. However, it is our opinion that all of the identified conditions can be mitigated with avoidance or proper engineering design and construction practices.

The upper silty to clayey sand and sandy clay materials were encountered at loose to medium dense and stiff to stiff consistency, respectively. Areas of loose soils and/or artificial fill soils may be encountered but are anticipated to be reworked and regraded with the overlot development. Prior to placing any new overlot grading fill, it is recommended test pits be performed and observed by RMG in the areas identified as containing fill, to verify the depth of the existing fill for removal. Expansive clay, claystone/siltstone and clayey sandstone are anticipated to be encountered at varying depths across the site.

The existing (undocumented) fill soils, where encountered below proposed foundations, will require removal and replacement with compacted structural fill. Prior to overlot grading operations and placing any new overlot grading fill, it is recommended test pits be performed and observed by RMG in the areas identified as containing fill soils, to verify the depth of the existing fill for removal prior to placing any new fill.

Foundation types are anticipated to include stiffened slab-on-grade, crawlspace, and basement construction. The areas where foundation excavations penetrate the overlot grading fill may encounter expansive clay and claystone/siltstone, which will require mitigation. However, these soils will not prohibit development.

The sandstone "hill" and the area immediately surrounding the "hill" encountered hard cemented sandstone at the surface. This sandstone "hill" and area are mapped and presented in the Engineering and Geology Map, Figure 4. According to the *Cut/Fill Map*, referenced in Appendix A, the sandstone hill is to be reshaped to a limited degree. Relatively shallow cuts are proposed along the top of the "hill", but cuts along the sides may reach depths of approximately 15 to 16 feet in some areas. Development within this area is anticipated to be difficult. The bedrock may require the use of specialized heavy-duty equipment and/or blasting to facilitate rock break-up and removal. In areas where the very hard sandstone bedrock is anticipated to be encountered, the builder is considering the use of stiffened slab-on-grade or crawlspace foundations to minimize the depth of excavations within the sandstone.

Areas of seasonally shallow groundwater and potentially seasonal shallow groundwater were encountered on the site. As a result of the groundwater conditions encountered in TB-6 performed for Job No. 142206 and the seasonally wet areas, it is our opinion that **basement construction should be avoided on Lots 72-74 and 169-173.** Based on our knowledge of the area and engineering design and construction techniques employed in the El Paso County area, it is our opinion that there is insufficient reason to preclude full-depth basements on the remaining lots at this time. If shallow groundwater conditions are found to exist on additional lots at the time of the site-specific subsurface soil investigations, the feasibility of basement construction and/or any recommended mitigation measures are to be addressed at that time.

Foundations are required to have a minimum 30-inch depth for frost protection. In areas where potentially high subsurface moisture conditions are anticipated, subsurface drains are recommended to help minimize the intrusion of water into areas below grade. Typical drain details are presented in Figures 7 and 8.

8.0 ECONOMIC MINERAL RESOURCES

Under the provision of House Bill 1529, it was made a policy by the State of Colorado to preserve for extraction commercial mineral resources located in a populous county. Review of the *El Paso Aggregate Resource Evaluation Map, Master Plan for Mineral Extraction, Map 1* indicates the site is identified as upland deposits comprised of sand, gravel, silt and clay remnants of older stream deposits on topographic

highs or beach like features. Extraction of the sand and gravel resources are not considered to be economical compared to materials available elsewhere within the county.

According to the *Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands*, the site is mapped within the Denver Basin Coal Region. However, the area of the site has been mapped "Poor" for coal resources, no active or inactive mines have been mapped in the area of the site. No metallic mineral resources have been mapped on the site. The sedimentary rocks in the areas may lack the geologic structure for trapping oil or gas: therefore, it may not be considered a significant resource in this area.

9.0 EROSION CONTROL

The soils encountered on the site are mildly susceptible to wind erosion and water erosion. During construction disturbance of the site most likely will occur around the building sites and more than likely will require regrading and revegetation. With regard to water erosion, loosely compacted soils will be most susceptible to water erosion, residually weathered soils and weathered bedrock materials become increasingly less susceptible to water erosion.

Minor wind erosion and dust problems may arise during and immediately after construction. If the problem becomes severe during this time, watering of the cut areas may be required to control dust. Installation of erosion protection or vegetation after completion of the structures is anticipated to mitigate the majority of the erosion and dust problems.

10.0 DETENTION STORAGE CRITERIA

This section has been prepared in accordance with the requirements outlined in the El Paso County Land Development Code (LDC), the Engineering Criteria Manual (ECM) Section 2.2.6 and Appendix C.3.2.B, and the El Paso County (EPC) Drainage Criteria Manual, Volume 1 Section 11.3.3.

10.1 Soil and Rock Design Parameters

TB-6 (Job No. 142206, dated May 28, 2015) and TB-107 (Job No. 162062, last dated February 5, 2019) were located in the general vicinity of the proposed Full Spectrum Detention Basin, Tract A. TB-160 (Job No. 162062, last dated February 5, 2019 was located in the general vicinity of the proposed Private Full Spectrum Extended Detention Basin, Tract B. RMG has performed laboratory tests of soil from across the proposed development. Based upon field and laboratory testing, the following soil and rock parameters are typical for the soils likely to be encountered, and are recommended for use in detention pond embankment design.

Soil Description	Unit Weight (lb/ft^3)	Friction Angle (degree)	Active Earth Pressure, K_a	Passive Earth Pressure, K_p	At Rest Earth Pressure, K_o
Silty to Clayey Sand (SC/SM)	105	30	0.33	3.0	0.50
Silty Sandstone	110	30	0.33	3.0	0.50

Sandy Claystone/Siltstone	100	20	0.49	2.0	0.66

10.2 Embankment Recommendations

Based on a review of the *Erosion Control Plan* for Windermere, the proposed detention pond in Tract B is to be excavated approximately 40 plus feet below the surrounding ground surface on the western portion and approximately 11 feet above the surrounding ground surface. Above-grade embankments are to be constructed with 4:1 slopes. Embankments should be constructed in accordance with applicable sections of the El Paso County Engineering Criteria Manual, the El Paso County Drainage Criteria Manual, and the El Paso County Land Development Manual. The following recommendations are in accordance with the El Paso county DCM Volume 2, Extended Detention Basin (EDB), Design Procedure and Criteria, paragraph 8.

The ground area to receive embankments should be cleared and grubbed to a minimum depth of two-feet to remove grass, shrubs, trees, roots, stumps, and other organic material. The exposed soil should be moisture-conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 95 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557). The prepared surface should present a firm and stable condition.

Embankment should be constructed as structural fill on a prepared stable base. On-site native soil, when screened of all deleterious material and cobbles greater than 6-inches in any dimension, is anticipated to be suitable for embankment construction. Structural fill should be placed in 10-inch loose lifts, moisture-conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content), and compacted to a minimum of 95 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557).

Structural fill placed on slopes should be benched into the slope. Maximum bench heights should not exceed 4 feet, and bench widths should be wide enough to accommodate compaction equipment. Structural fill should not be placed on frozen subgrade or allowed to freeze during moisture conditioning and placement. To verify the condition of the compacted soils, density tests should be performed during placement. The first density tests should be conducted when 24 inches of fill have been placed.

11.0 ADDITIONAL STUDIES

The findings, conclusions and recommendations presented in this report were provided to evaluate the suitability of the site development. Unless indicated otherwise, the test borings, laboratory test results, conclusions and recommendations presented in this report are only intended for the use of the minor subdivision and are *not intended* for use for design and construction of the proposed single family residences or for any future proposed structures. We recommend that a *lot-specific* **subsurface soil investigation** be performed for each proposed new structures. The extent of any fill soils encountered during the lot-specific investigation(s) should be evaluated for suitability to support the proposed structures prior to construction.

Future lot-specific subsurface soil investigations should consider the proposed structure type, anticipated foundation loading conditions, location within the property, and local construction methods. Recommendations resulting from the investigations should be used for design and confirmed by on-site observation and testing during development and construction.

12.0 CONCLUSIONS

Based upon our evaluation of the geologic conditions, it is our opinion that the proposed development is feasible. The geologic conditions identified are expansive soils/bedrock, compressible soils, hard bedrock, seasonally and potentially seasonal shallow groundwater, corrosive minerals, and radon which are not considered usual for the Front Range region of Colorado. Mitigation of geologic conditions is most effectively accomplished by avoidance. However, where avoidance is not a practical or acceptable alternative, geologic conditions should be mitigated by implementing appropriate planning, engineering, and local construction practices.

In addition to the previously identified mitigation alternatives, surface and subsurface drainage systems should be implemented. Exterior, perimeter foundation drains should be installed around below-grade habitable or storage spaces. Surface water should be efficiently removed from the building area to prevent ponding and infiltration into the subsurface soil.

The foundation and floor slabs of the structure should be designed using the recommendations provided in the lot-specific subsurface soil investigation performed for each lot. In addition, appropriate surface drainage should be established during construction and maintained by the homeowner.

We believe the surficial sand soils will classify as Type C materials and the clay soils will classify as Type B as defined by OSHA in 29CFR Part 1926, date January 2, 1990. OSHA requires temporary slopes made in Type C materials be laid back at ratios no steeper than 1.5:1 (horizontal to vertical) and slopes made in Type B materials be laid back at ratios no steeper than 1:1 (horizontal to vertical) unless the excavation is shored or braced. Flatter slopes will likely be necessary should groundwater conditions occur.

Long term cut slopes in the upper soil should be limited to no steeper than 3:1 (horizontal to vertical). Flatter slopes will likely be necessary should groundwater conditions occur. It is recommended that long term fill slopes be no steeper than 3:1 (horizontal to vertical).

Revisions and modifications to the conclusions and recommendations presented in this report may be issued subsequently by RMG based upon additional observations made during grading and construction which may indicate conditions that require re-evaluation of some of the criteria presented in this report.

It is important for the Owner(s) of these properties read and understand this report, as well as the previous reports referenced above, and to carefully to familiarize themselves with the geologic hazards associated with construction in this area. This report only addresses the geologic constraints contained within the boundaries of the site referenced above.

13.0 CLOSING

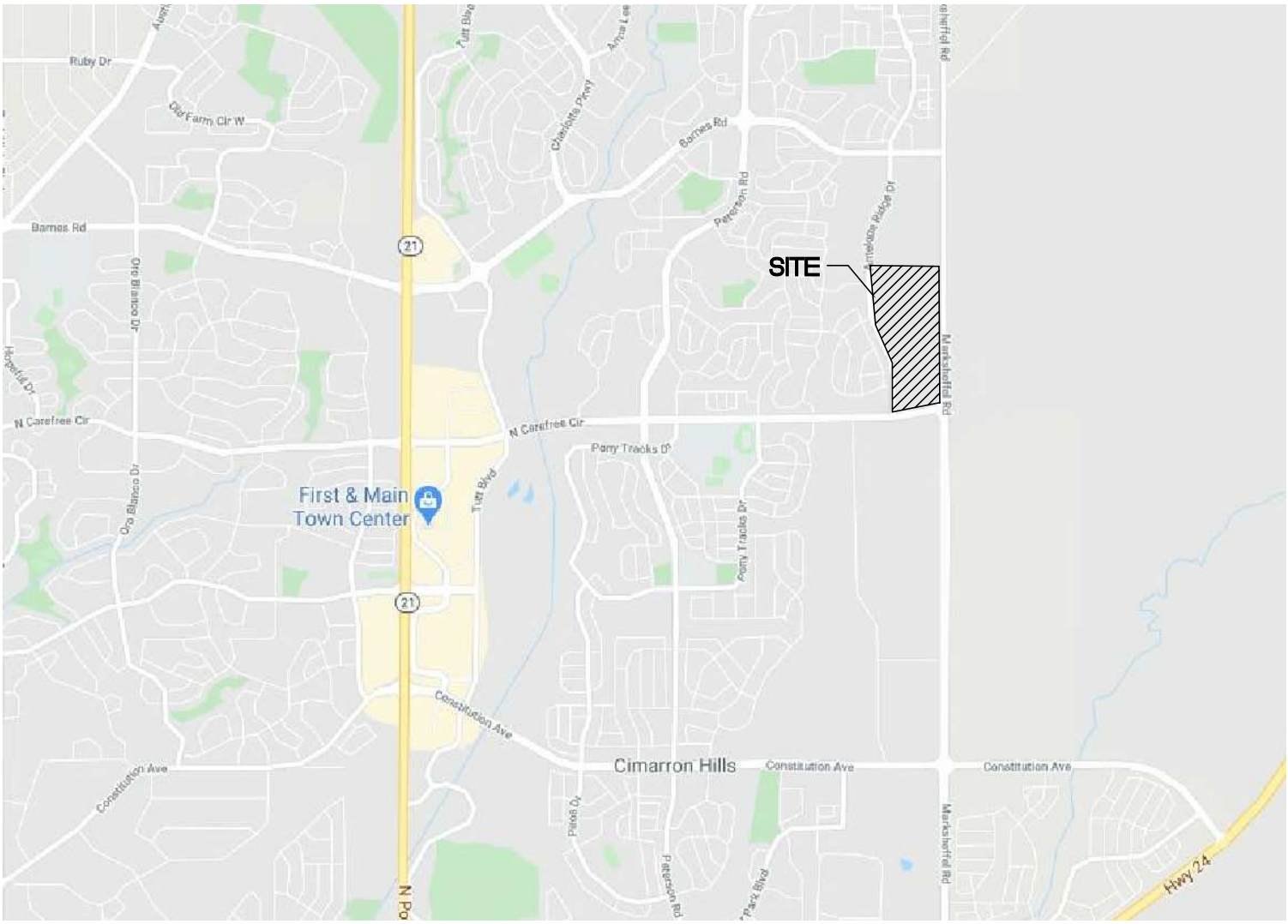
This report is for the exclusive purpose of providing geologic hazards information and preliminary geotechnical engineering recommendations. The scope of services did not include, either specifically or by implication, evaluation of wild fire hazards, environmental assessment of the site, or identification of contaminated or hazardous materials or conditions. Development of recommendations for the mitigation of environmentally related conditions, including but not limited to, biological or toxicological issues, are beyond the scope of this report. If the owner is concerned about the potential for such contamination or conditions, other studies should be undertaken.

This report has been prepared for **Windsor Ridge Homes** in accordance with generally accepted geotechnical engineering and engineering geology practices. The conclusions and recommendations in this report are based in part upon data obtained from review of available topographic and geologic maps, review of available reports of previous studies conducted in the site vicinity, a site reconnaissance, and research of available published information, soil test borings, soil laboratory testing, and engineering analyses. The nature and extent of variations may not become evident until construction activities begin. If variations then become evident, RMG should be retained to re-evaluate the recommendations of this report, if necessary.

Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by geotechnical engineers and engineering geologists practicing in this or similar localities. RMG does not warrant the work of regulatory agencies or other third parties supplying information which may have been used during the preparation of this report. No warranty, express or implied, is made by the preparation of this report. Third parties reviewing this report should draw their own conclusions regarding site conditions and specific construction techniques to be used on this project.

If we can be of further assistance in discussing the contents of this report or analysis of the proposed development, from a geotechnical engineering point-of-view, please feel free to contact us

FIGURES



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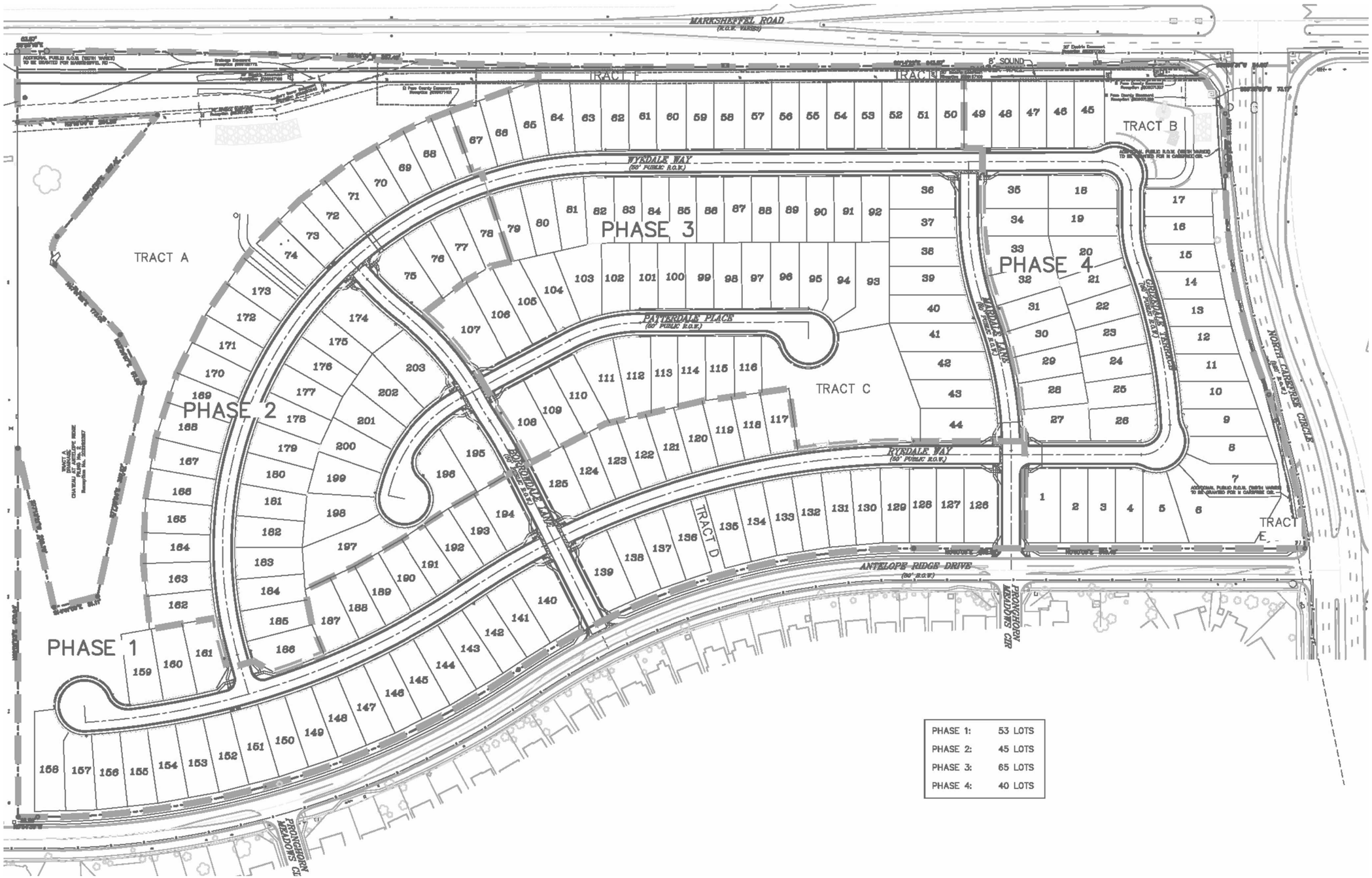
SITE VICINITY MAP

WINDERMERE
N. MARKSHEFFEL RD
EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

JOB No. 162062

FIG No. 1

DATE 10-26-2020



PHASE 1:	53 LOTS
PHASE 2:	45 LOTS
PHASE 3:	65 LOTS
PHASE 4:	40 LOTS

NOT TO SCALE

JOB No. 162062

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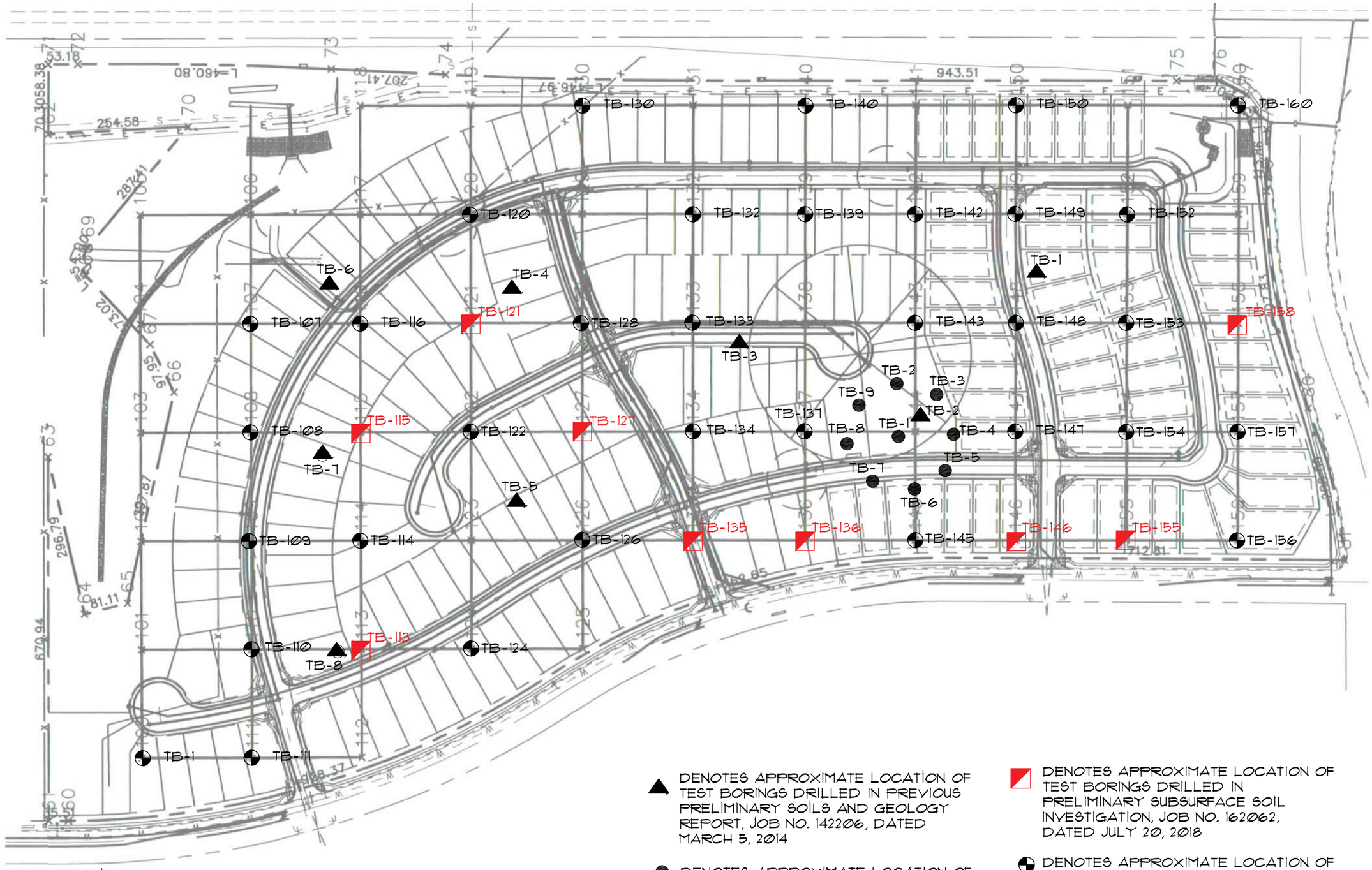
(719) 544-7750

WINDERMERE
N. MARKSHEFFEL RD
EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

ENGINEER:	TPM
DRAWN BY:	KZ
CHECKED BY:	TPM
ISSUED:	10-26-2020
REVISION:	DATE:
	JOB #:

SITE PLAN

SHEET No.
FIG-2



▲ DENOTES APPROXIMATE LOCATION OF TEST BORINGS DRILLED IN PREVIOUS PRELIMINARY SOILS AND GEOLOGY REPORT, JOB NO. 142206, DATED MARCH 5, 2014

● DENOTES APPROXIMATE LOCATION OF TEST BORINGS DRILLED IN PREVIOUS SUBSURFACE SOIL INVESTIGATION, JOB NO. 142206, DATED MAY 28, 2015

■ DENOTES APPROXIMATE LOCATION OF TEST BORINGS DRILLED IN PRELIMINARY SUBSURFACE SOIL INVESTIGATION, JOB NO. 162062, DATED JULY 20, 2018

◐ DENOTES APPROXIMATE LOCATION OF TEST BORINGS DRILLED FOR PRELIMINARY SUBSURFACE SOIL INVESTIGATION, JOB NO. 162062, DATED APRIL 17, 2018

JOB No. 162062

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WINDERMERE SUBDIVISION
EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

ENGINEER:	TM
DRAWN BY:	KZ
CHECKED BY:	TM
ISSUED:	10-20-20
REVISION:	DATE: JOB #:

TEST BORING LOCATION PLAN

SHEET No.
FIG-3

Geologic

- *Tkda - Dawson Arkose Formation (Eocene)* - Dawson Sandstone consists of silty sandstone with interbedded layers of claystone/siltstone.
- *Af - Artificial fill* - areas of visible known fill to include: the existing detention pond banks, berms along the western and southern property lines, stockpile
- *sw - seasonally wet* areas where near-surface moisture conditions may seasonally occur, includes areas where shallow groundwater was encountered in the test borings
- *sh* - sandstone "hill"
- *hb* - hard to very hard sandstone bedrock encountered at the surface
- *sp* - stockpile

Engineering

2A - stable alluvium, colluvium and bedrock on gentle to moderate slopes

With the indication of seasonally shallow groundwater near the existing detention pond, full-depth basements are not recommended on Lots 72-74, and 169-173.

NOT TO SCALE

BASE MAP PROVIDED BY: GOOGLE AND DREXEL, BARREL & CO.

JOB No. 162062

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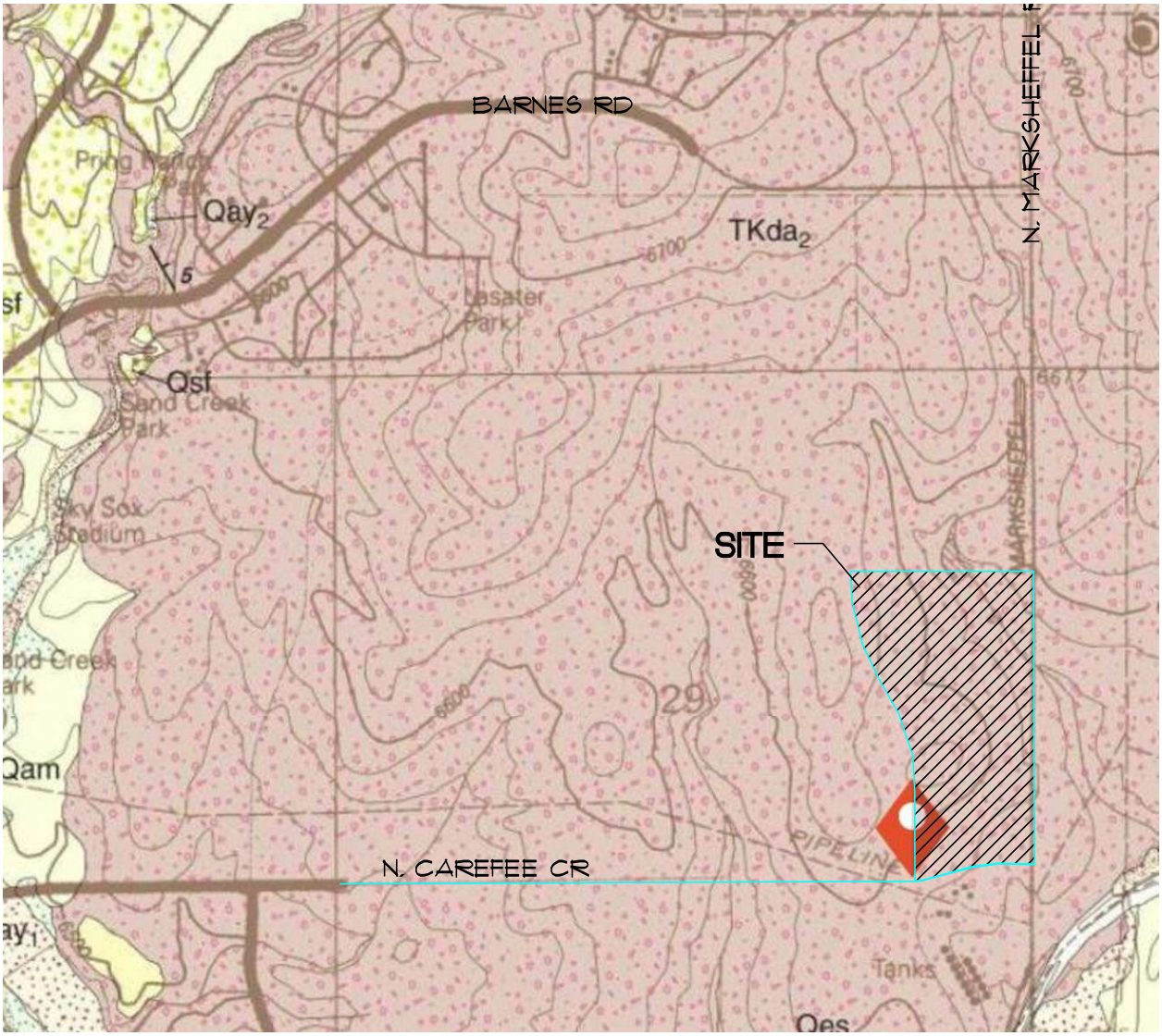
DRAWN BY:	KZ
CHECKED BY:	TPM
ISSUED:	10-26-2020
REVISION:	DATE: JOB #:
REVISED: 1-18-21	

ENGINEERING AND GEOLOGY MAP

SHEET No.
FIG-4



NOT TO SCALE
BASE MAP PROVIDED BY: CGS

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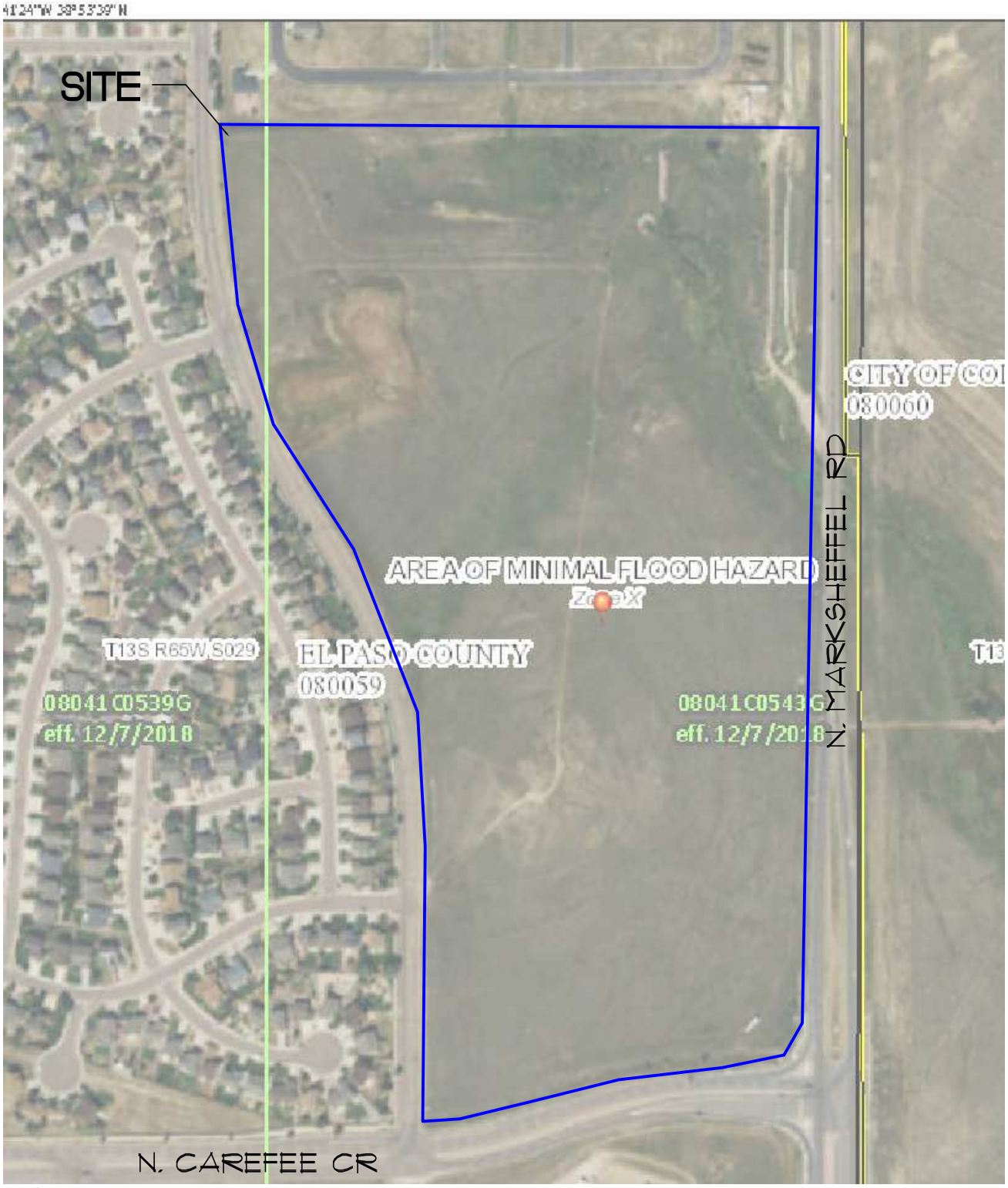
FALCON NW QUADRANGLE

WINDERMERE
N. MARKSHEFFEL RD
EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

JOB No. 162062

FIG No. 5

DATE 10-26-2020



NOT TO SCALE
BASE MAP PROVIDED BY: FEMA

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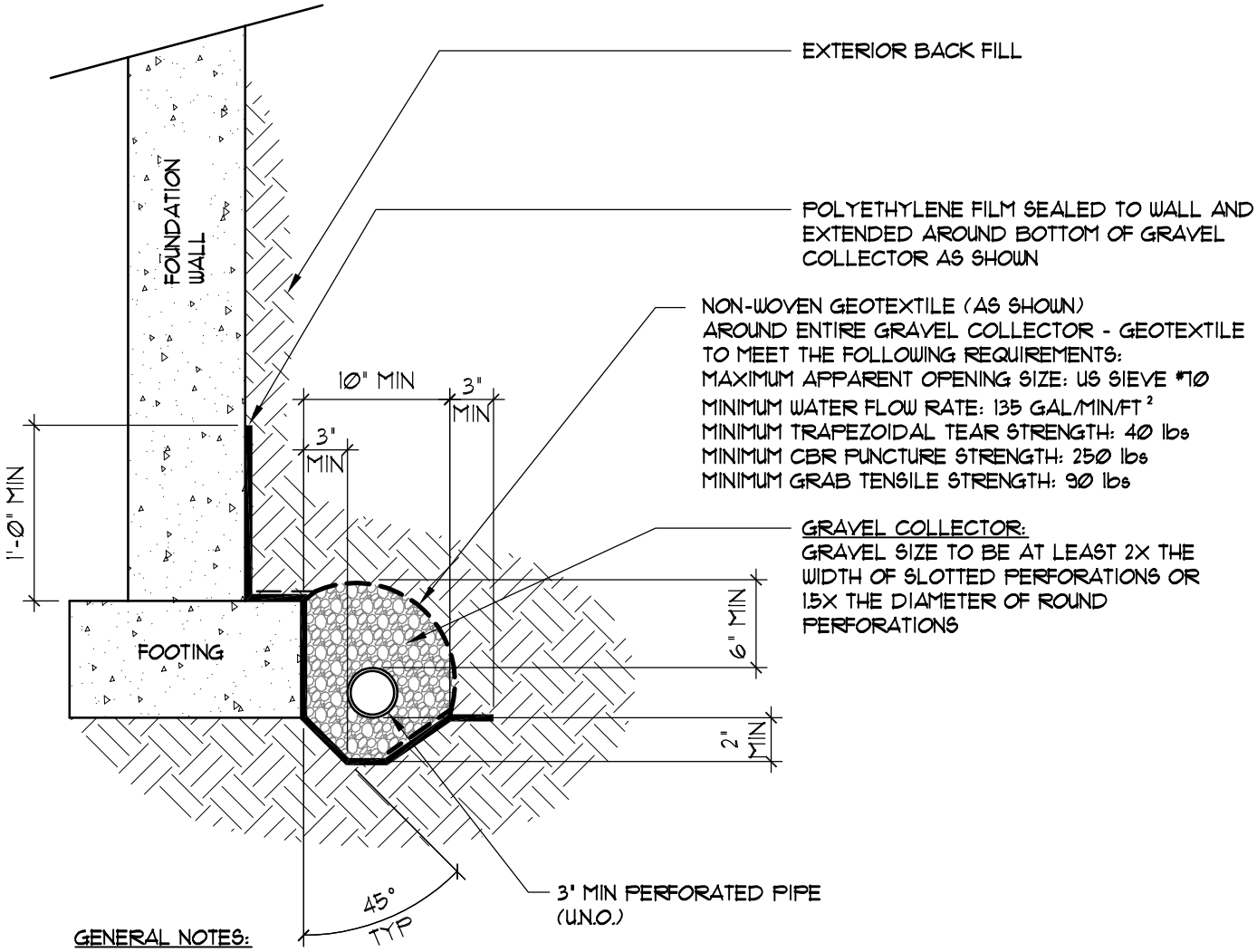
FEMA MAP

WINDERMERE
N. MARKSHEFFEL RD
EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

JOB No. 162062

FIG No. 6

DATE 10-26-2020



GENERAL NOTES:

1. BOTTOM OF DRAIN PIPE SHALL BE AT OR BELOW BOTTOM OF FOOTING AT ALL LOCATIONS
2. ALL DRAIN PIPE SHALL BE PERFORATED PLASTIC, WITH THE EXCEPTION OF THE DISCHARGE PORTION WHICH SHALL BE SOLID, NON-PERFORATED PIPE.
3. DRAIN PIPE SHALL HAVE POSITIVE FALL THROUGHOUT.
4. DRAIN PIPE SHALL BE PROVIDED WITH A FREE GRAVITY OUTFALL, IF POSSIBLE. IF A GRAVITY OUTFALL CANNOT BE ACHIEVED, THEN A SUMP PIT AND PUMP SHALL BE USED. THE OUTFALL SHOULD EXTEND PAST BACKFILL ZONES AND DISCHARGE TO A LOCATION THAT IS GRADED TO DIRECT WATER OFF-SITE.
5. ALL DRAIN COMPONENTS SHALL BE RATED/APPROVED BY THE MANUFACTURER FOR THE INSTALLED DEPTH AND APPLICATION
6. DRAIN SYSTEM, INCLUDING THE OUTFALL OF THE DRAIN, SHALL BE OBSERVED BY QUALIFIED PERSONNEL PRIOR TO BACKFILLING TO VERIFY INSTALLATION.
7. A VERTICAL SEGMENT OF PERFORATED DRAIN PIPE, CAPPED AT THE TOP, SHALL EXTEND TO FINISH GRADE WITHIN ALL WINDOW WELLS.

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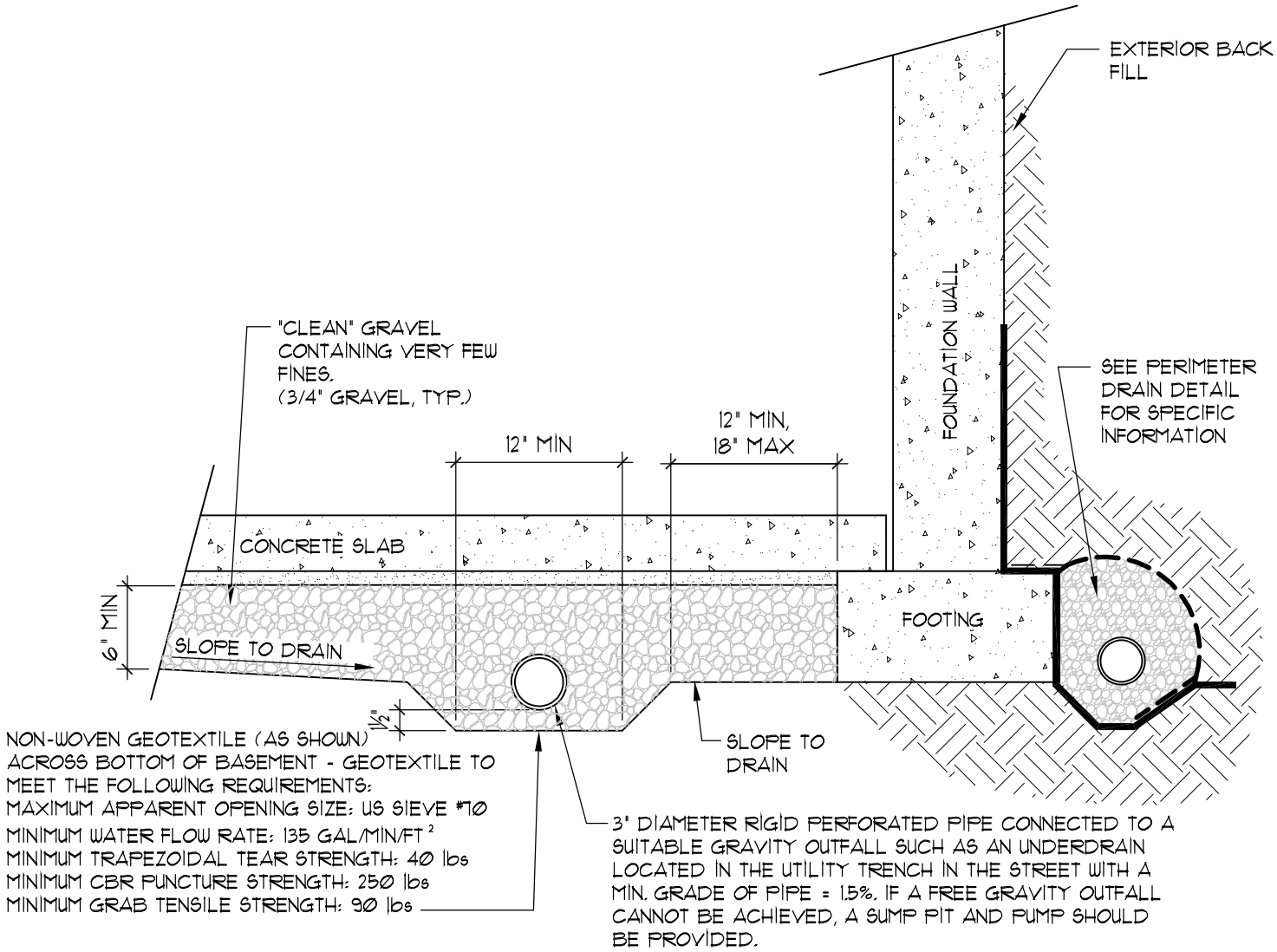
PERIMETER DRAIN

FIG No. 7



GENERAL NOTES:

1. ALL DRAIN PIPE SHALL BE PERFORATED PLASTIC, WITH THE EXCEPTION OF THE DISCHARGE PORTION WHICH SHALL BE SOLID, NON-PERFORATED PIPE.

2. DRAIN PIPE SHALL HAVE POSITIVE FALL THROUGHOUT.

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4. ALL DRAIN COMPONENTS SHALL BE RATED/APPROVED BY THE MANUFACTURER FOR THE INSTALLED DEPTH AND APPLICATION

5. DRAIN SYSTEM, INCLUDING THE OUTFALL OF THE DRAIN, SHALL BE OBSERVED BY QUALIFIED PERSONNEL PRIOR TO BACKFILLING TO VERIFY INSTALLATION.

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UNDERSLAB DRAIN

FIG No. 8

APPENDIX A
Additional Reference Documents

1. *Overall Site Phase Plan, Windermere, Preliminary Plan, N. Marksheffel Road, El Paso County, Colorado,* prepared by Drexel, Barrel &. Co. File Nate 21187-01SP1, last dated June 18, 2020.
2. *Cut/Fill Map, Windermere, Preliminary Plan, N. Marksheffel Road, El Paso County, Colorado,* prepared by Drexel, Barrel &. Co. File Nate 21187-01 CUT FILL, last dated June 18, 2020.
3. *Preliminary Erosion Control Plan, Windermere, Preliminary Plan, N. Marksheffel Road, El Paso County, Colorado,* prepared by Drexel, Barrel &. Co. File Nate 21187-011, last dated February 21, 2019.
4. *Flood Insurance Rate Map, El Paso County, Colorado and Unincorporated Areas, Community Panel No.* 08041C0539G and 08041C0543G, Federal Emergency Management Agency (FEMA), effective December 7, 2018.
5. *Geologic Map of the Falcon NW 7.5 Minute Quadrangle, El Paso County, Colorado,* Colorado Geological Survey, compiled by Madole, R.F, Open-File report OF03-08, 2003.
6. *Falcon NW Quadrangle Geologic Map, El Paso County, Colorado,* Matthew L. Morgan and Peter E. Barkman, Colorado Geological Survey, Denver, CO. 2012.
7. *Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands Administered y the Colorado State Land Board,* Colorado Geological Survey. Compiled by Keller, John W.; TerBest, Harry and Garrison, Rachel E. Open-File Report 03-07. 2003
8. *Falcon NW, Quadrangle, Environmental and Engineering Geologic Map for Land Use,* compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
9. *Falcon NW Quadrangle, Map of Potential Geologic Hazards and Surficial Deposits*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
10. *Pikes Peak Regional Building Department:* https://www.pprbd.org/. https://property.spatialest.com/co/elpaso/#/property/5329400013 Schedule No.: 5329400013 and https://property.spatialest.com/co/elpaso/#/property/5329111002 Schedule No.: 5329111002.
11. *Colorado Geological Survey, USGS Geologic Map Viewer*: https://ngmdb.usgs.gov/mapview/
12. *Historical Aerials:* https://www.historicaerials.com/viewer, Images dated 1947, 1955, 1960, 1969, 1999, 2005, 2009, 2011, 2013, 2015, 2017.
13. *USGS Historical Topographic Map Explorer:* http://historicalmaps.arcgis.com/usgs/ Colorado Springs Quadrangles dated 1893, 1909, 1961, 1975, and 1989.
14. *Google Earth Pro*, Imagery dated 1999, 2003, 2004, 2005, 2006, 2011, 2015, 2017, and 2019.

APPENDIX B

Test Boring Logs and Summary of Laboratory Test Results from: *N. Carefree Circle and Marksheffel Road*, El Paso County, Colorado, prepared by RMG – Rocky Mountain Group, Job No. 162062, last dated February 5, 2019

TEST BORING: **100**
DATE DRILLED:
3/8/18
ELEVATION (FT): 6625.22
NO GROUNDWATER ON
3/8/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SANDSTONE, SILTY TO CLAYEY, tan and brown to light gray, very hard, moist				
5		■	50/6"	15.5
10		■	50/3"	11.9
15		■	50/7"	19.7
CLAYSTONE, SANDY, tan to brown with rust staining, medium hard, moist				
20		■	31	31.0
25				
SANDSTONE, SILTY, blue, very hard, moist				
30		■	50/3"	18.1

TEST BORING: **107**
DATE DRILLED:
3/15/18
ELEVATION (FT): 6580.95
GROUNDWATER @ 14.0 '
3/15/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, SILTY, brown, medium dense, moist				
5		■	13	9.5
10		■	17	13.6
SANDSTONE, SILTY TO CLAYEY, brown, medium hard, moist to wet				
15		◢	50/10"	20.8
CLAYSTONE, SANDY, brown, hard, moist to wet				
20		■	50/8"	25.6

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TEST BORING LOGS

JOB No. 162062

FIGURE No. 4

DATE 4/17/18

TEST BORING: **108**
DATE DRILLED:
3/8/18
ELEVATION (FT): 6592.91
NO GROUNDWATER ON
3/8/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SAND, SILTY TO CLAYEY, tan to brown, loose, moist			
5		■	6	16.1
10		◢	9	7.6
	SANDSTONE, SILTY TO CLAYEY, tan to gray, hard to very hard, moist			
15		■	50/11"	12.4
20				
25		■	50/7"	20.1

TEST BORING: **109**
DATE DRILLED:
3/8/18
ELEVATION (FT): 6600.96
NO GROUNDWATER ON
3/8/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SAND, SILTY TO CLAYEY, with sandy clay seams, tan to brown, medium dense, moist			
5		■	10	14.5
10		■	13	10.7
15		■	25	24.4
	SANDSTONE, SILTY TO CLAYEY, tan to brown, very hard, moist			
20		■	50/3"	13.5
25	SANDSTONE, SILTY, blue, very hard, moist			
30		■	50/3"	16.1

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TEST BORING LOGS

JOB No. 162062

FIGURE No. 5

DATE 4/17/18

TEST BORING: **110**
DATE DRILLED:
3/8/18
ELEVATION (FT): 6625.54
NO GROUNDWATER ON
3/8/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, with interbedded clayey sand, tan and dark brown to dark gray, stiff, moist				
5			15	19.5
10				
15			16	18.4
20				
25			11	19.6
30				
CLAYSTONE, SANDY, dark brown to dark gray, hard, moist				
35			50/8"	14.3
40				
SANDSTONE, SILTY, blue, moist				
45				
AUGER REFUSAL AT 47' DUE TO HARD BEDROCK				

TEST BORING: **111**
DATE DRILLED:
3/8/18
ELEVATION (FT): 6628.33
NO GROUNDWATER ON
3/8/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SANDSTONE, SILTY TO CLAYEY, tan and brown to gray, hard to very hard, moist				
5			50/9"	12.7
10			50/6"	16.0
15			50/5"	16.0
CLAYSTONE, SANDY, blue to gray, very hard, moist				
20				
25			50/6"	23.6
SANDSTONE, SILTY, blue, very hard, moist				
30			50/6"	20.7

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TEST BORING LOGS

JOB No. 162062

FIGURE No. 6

DATE 4/17/18

TEST BORING: **114**
DATE DRILLED:
3/15/18
ELEVATION (FT): 6603.50
NO GROUNDWATER ON
3/15/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	CLAY, SANDY, dark brown, stiff, moist			
5		■	13	15.8
	SAND, SILTY TO CLAYEY, brown, loose to medium dense, moist			
10		■	7	15.4
15		■	15	30.4
	SANDSTONE, SILTY, brown, very hard, moist			
20		■	50/3"	14.5

TEST BORING: **116**
DATE DRILLED:
3/8/18
ELEVATION (FT): 6584.34
NO GROUNDWATER ON
3/8/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SANDSTONE, SILTY, tan to brown, very hard, moist			
5		■	50/4"	12.1
10		■	50/3"	13.1
15		■	50/2"	15.6
	SANDSTONE, SILTY, blue, very hard, moist			
20		■	50/1"	10.9

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TEST BORING LOGS

JOB No. 162062

FIGURE No. 7

DATE 4/17/18

TEST BORING: **120**
DATE DRILLED:
3/15/18
ELEVATION (FT): 6580.85
NO GROUNDWATER ON
3/15/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown, stiff, moist				
5			12	10.3
SAND, SILTY, brown, loose, moist				
10			10	12.6
SANDSTONE, SILTY, brown, hard, moist				
15			50/6"	12.3
CLAYSTONE, SANDY, brown with rust staining, hard, moist				
20			50	23.5

TEST BORING: **122**
DATE DRILLED:
3/15/18
ELEVATION (FT): 6593.85
NO GROUNDWATER ON
3/15/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, SILTY TO CLAYEY, brown, medium dense, moist				
5			10	11.5
SAND, SILTY, brown, medium dense, moist				
10			19	8.7
SANDSTONE, SILTY, brown, very hard, moist				
15			50/4"	11.2
20			50/4"	13.9

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TEST BORING LOGS

JOB No. 162062

FIGURE No. 8

DATE 4/17/18

TEST BORING: **124**
DATE DRILLED:
3/15/18
ELEVATION (FT): 6615.03
NO GROUNDWATER ON
3/15/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SAND, SILTY, light brown, loose to medium dense, moist			
5		■	6	11.5
10		■	8	9.7
15		■	11	6.7
	CLAYSTONE, SANDY, brown, hard, moist			
20		■	50/11"	21.3

TEST BORING: **126**
DATE DRILLED:
3/15/18
ELEVATION (FT): 6600.14
NO GROUNDWATER ON
3/15/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SAND, SILTY TO CLAYEY, brown to dark brown, loose to medium dense, moist			
5		◢	11	15.7
10		■	5	15.3
15	SANDSTONE, SILTY TO CLAYEY, brown, very hard, moist	■	50/6"	17.4
20				
	SANDSTONE, SILTY, blue, very hard, moist			
25		■	50/3"	--

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TEST BORING LOGS

JOB No. 162062

FIGURE No. 9

DATE 4/17/18

TEST BORING: **128**
DATE DRILLED:
3/15/18
ELEVATION (FT): 6596.82
NO GROUNDWATER ON
3/15/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SAND, SILTY, light brown, loose, moist			
5			5	9.4
	SANDSTONE, SILTY TO CLAYEY, brown, very hard, moist			
10			50/4"	12.0
15			50/3"	12.2
	SANDSTONE, SILTY, blue, very hard, moist			
20			10/0"	13.5

TEST BORING: **130**
DATE DRILLED:
3/15/18
ELEVATION (FT): 6577.11
GROUNDWATER @ 16.0 '
3/15/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SAND, SILTY TO CLAYEY, brown, loose, moist			
5			8	9.5
10			8	13.7
	SANDSTONE, SILTY, brown, very hard, moist to wet			
15			50/7"	12.9
20	CLAYSTONE, SANDY, brown, hard, moist to wet		50/10"	22.0

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TEST BORING LOGS

JOB No. 162062

FIGURE No. 10

DATE 4/17/18

TEST BORING: **132**
DATE DRILLED:
2/8/18
ELEVATION (FT): 6594.64
NO GROUNDWATER ON
2/8/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SAND, SILTY TO CLAYEY, tan to gray, medium dense, moist			
5			13	7.7
	CLAYSTONE, SANDY, brown to olive and gray with rust staning, very hard, moist			
10			50/3"	23.0
15			50/2"	19.8
20			50/1"	7.8
	SANDSTONE, SILTY TO CLAYEY, brown to gray, very hard, moist			
25			50/2"	2.4
	AUGER REFUSAL AT 25' DUE TO HARD BEDROCK			

TEST BORING: **133**
DATE DRILLED:
2/8/18
ELEVATION (FT): 6605.14
NO GROUNDWATER ON
2/8/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SANDSTONE, SILTY TO CLAYEY, with sandy claystone seams, brown to gray, very hard, moist			
5			50/6"	11.1
10			50/2"	14.8
15			50/2"	17.7
20			50/2"	14.2
25				
30			50/1.5"	9.9

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TEST BORING LOGS

JOB No. 162062

FIGURE No. 11

DATE 4/17/18

TEST BORING: **134**
DATE DRILLED:
2/8/18
ELEVATION (FT): 6607.17
NO GROUNDWATER ON
2/8/18

SANDSTONE, SILTY TO CLAYEY, with sandy claystone seams, brown to gray, very hard, moist

AUGER REFUSAL AT 30' DUE TO HARD BEDROCK

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
5		■	50/3"	13.7
10		■	50/3"	11.3
15		■	50/6"	10.4
20		■	50/4"	10.0
25				
30		■	50/3"	7.8

TEST BORING: **137**
DATE DRILLED:
2/8/18
ELEVATION (FT): 6617.72
NO GROUNDWATER ON
2/8/18

CLAYSTONE, SANDY, tan to olive and gray, very hard, moist

SANDSTONE, SILTY, blue, very hard, moist

AUGER REFUSAL AT 25' DUE TO HARD BEDROCK

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
5		■	50/3"	22.7
10		■	50/3"	18.7
15		■	50/3"	12.6
20		■	50/3"	11.2
25		■	50/2"	18.1

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TEST BORING LOGS

JOB No. 162062

FIGURE No. 12

DATE 4/17/18

TEST BORING: **139**
DATE DRILLED:
2/8/18
ELEVATION (FT): 6600.05
NO GROUNDWATER ON
2/8/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SAND, SILTY TO CLAYEY, with sandy clay seams, tan to gray, medium dense, moist			
5		■	21	10.8
10		■	21	10.2
	BORING TERMINATED AT 10' DUE TO DRILL RIG MALFUNCTION			

TEST BORING: **140**
DATE DRILLED:
3/15/18
ELEVATION (FT): 6584.20
NO GROUNDWATER ON
3/15/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	CLAY, SANDY, brown, stiff, moist			
5		■	9	13.9
	SAND, SILTY TO CLAYEY, brown, medium dense, moist			
10		■	12	11.5
15		■	14	10.1
	SANDSTONE, SILTY, brown, very hard, moist			
20		■	50/3"	11.4

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TEST BORING LOGS

JOB No. 162062

FIGURE No. 13

DATE 4/17/18

TEST BORING: **142**
DATE DRILLED:
2/7/18
ELEVATION (FT): 6601.70
NO GROUNDWATER ON
2/7/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SAND, SILTY TO CLAYEY, tan to brown, medium dense, moist			
5		■	25	11.3
10		■	22	9.9
	SANDSTONE, SILTY TO CLAYEY, with sandy claystone seams, brown, very hard, moist			
15		■	50/6'	24.8
20		■	50/5"	18.7
	SANDSTONE, SILTY, blue and dark gray, very hard, moist			
25				
30		■	50/1"	16.9

TEST BORING: **143**
DATE DRILLED:
2/7/18
ELEVATION (FT): 6618.87
NO GROUNDWATER ON
2/7/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SANDSTONE, SILTY TO CLAYEY, with sandy claystone seams, tan and brown to dark brown, very hard, moist			
5		■	50/6"	21.1
10		■	50/5"	28.3
15		◢	50/4"	27.0
20				
	SANDSTONE, SILTY TO CLAYEY, blue, very hard, moist			
25		■	50/1"	--
30		■	50/3"	--
	AUGER REFUSAL AT 30' DUE TO HARD BEDROCK			

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TEST BORING LOGS

JOB No. 162062

FIGURE No. 14

DATE 4/17/18

TEST BORING: **145**
DATE DRILLED:
3/15/18
ELEVATION (FT): 6617.13
NO GROUNDWATER ON
3/15/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAYSTONE, SANDY, brown, hard, moist				
5			50/8"	17.2
10			50/8"	20.4
SANDSTONE, SILTY, blue, very hard, moist				
15			10/0"	15.3

TEST BORING: **147**
DATE DRILLED:
2/8/18
ELEVATION (FT): 6615.28
NO GROUNDWATER ON
2/8/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SANDSTONE, SILTY TO CLAYEY, tan to gray, very hard, moist				
5			50/3"	16.7
CLAYSTONE, SANDY, brown to gray, very hard, moist				
10			50/3"	14.6
15			50/4"	18.0
SANDSTONE, SILTY TO CLAYEY, olive to gray, very hard, moist				
20			50/5"	30.3
CLAYSTONE, SANDY, blue to gray, moist				
25				
SANDSTONE, SILTY, blue, very hard, moist				
30			50/2"	64.8
35				
40			50/1.5"	12.4

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TEST BORING LOGS

JOB No. 162062

FIGURE No. 15

DATE 4/17/18

TEST BORING: **148**
DATE DRILLED:
2/8/18
ELEVATION (FT): 6607.75
NO GROUNDWATER ON
2/8/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SANDSTONE, SILTY TO CLAYEY, tan to gray, hard to very hard, moist			
5			50/8"	--
10			50/3"	--
	CLAYSTONE, SANDY, olive to gray with rust staning, hard to very hard, moist			
15			50/8"	--
20			50/2"	--
25				
	SANDSTONE, SILTY TO CLAYEY, blue, very hard, moist			
30			50/3"	--
35				
40			50/2"	--

TEST BORING: **149**
DATE DRILLED:
2/7/18
ELEVATION (FT): 6594.95
NO GROUNDWATER ON
2/7/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SAND, SILTY TO CLAYEY, tan to brown, medium dense, moist			
5			18	15.2
	SANDSTONE, SILTY TO CLAYEY, tan to brown, medium hard to very hard, moist			
10			49	17.4
15			50/1"	33.0
20			50/1"	29.0
25				
30			50/1"	13.8

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TEST BORING LOGS

JOB No. 162062

FIGURE No. 16

DATE 4/17/18

TEST BORING: **150**
DATE DRILLED:
3/15/18
ELEVATION (FT): 6584.33
NO GROUNDWATER ON
3/15/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SAND, SILTY TO CLAYEY, brown, very loose to medium dense, moist			
5		■	3	17.6
10		■	12	11.4
	SANDSTONE, SILTY, brown, very hard, moist			
15		■	50/3"	10.2
	CLAYSTONE, SANDY, brown, hard, moist			
20		■	50/8"	19.0

TEST BORING: **152**
DATE DRILLED:
2/7/18
ELEVATION (FT): 6582.74
NO GROUNDWATER ON
2/7/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	FILL: SAND, SILTY TO CLAYEY, brown to dark brown, medium dense, moist			
5		■	11	12.7
	CLAYSTONE, SANDY, tan to olive, very hard, moist			
10		■	50/3"	20.5
15		■	50/3"	26.9
	SANDSTONE, CLAYEY, with sandy claystone seams, brown and tan, very hard, moist			
20		■	50/1"	18.6

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TEST BORING LOGS

JOB No. 162062

FIGURE No. 17

DATE 4/17/18

TEST BORING: **153**
DATE DRILLED:
2/7/18
ELEVATION (FT): 6592.81
NO GROUNDWATER ON
2/7/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SAND, SILTY TO CLAYEY, tan to brown, medium dense, moist			
5		■	24	11.8
	SANDSTONE, SILTY TO CLAYEY, tan to brown, very hard, moist			
10		■	50/1"	10.1
15		■	50/2"	11.8
20		■	47	23.7

TEST BORING: **154**
DATE DRILLED:
2/7/18
ELEVATION (FT): 6604.54
NO GROUNDWATER ON
2/7/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SANDSTONE, SILTY TO CLAYEY, with sandy claystone seams, tan and brown to dark brown, hard to very hard, moist			
5		■	50	9.0
10				
15		◢	50/7"	19.6
20		■	50/1"	11.1
25				
	SANDSTONE, SILTY, blue and dark gray, moist			
30		■	40	--

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TEST BORING LOGS

JOB No. 162062

FIGURE No. 18

DATE 4/17/18

TEST BORING: **156**
DATE DRILLED:
2/7/18
ELEVATION (FT): 6602.4
NO GROUNDWATER ON
2/7/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	FILL: SAND, SILTY TO CLAYEY, tan to brown, loose, moist			
5			9	8.7
	SANDSTONE, SILTY TO CLAYEY, with sandy claystone seams, brown, hard to very hard, moist			
10			50/9"	13.3
15			50/1"	12.0
20			50/1"	12.4
25				
	SANDSTONE, SILTY, blue, moist			
30				

TEST BORING: **157**
DATE DRILLED:
2/7/18
ELEVATION (FT): 6595.20
NO GROUNDWATER ON
2/7/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SAND, SILTY TO CLAYEY, dark brown, moist			
	SANDSTONE, SILTY TO CLAYEY, tan to brown, very hard, moist			
5			50/8"	6.9
10			50/1"	9.2
15			50/2"	11.5
20			50/4"	11.5

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TEST BORING LOGS

JOB No. 162062

FIGURE No. 19

DATE 4/17/18

TEST BORING: **160**
DATE DRILLED:
3/15/18
ELEVATION (FT): NOT SURVEYED
NO GROUNDWATER ON
3/15/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SAND, SILTY, light brown, loose, moist			
5			17	15.4
	CLAYSTONE, SANDY, brown, very hard moist			
10			50/6"	14.6
15			50/5"	14.7

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TEST BORING LOGS

JOB No. 162062

FIGURE No. 20

DATE 4/17/18

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	FHA Expansion Pressure (psf)	% Swell/ Collapse	USCS Classification
100	4.0	15.5								
100	9.0	11.9								
100	14.0	19.7								
100	19.0	31.0								
100	29.0	18.1								
107	4.0	9.5								
107	9.0	13.6								
107	14.0	20.8								
107	19.0	25.6								
108	4.0	16.1								
108	9.0	7.6								
108	14.0	12.4								
108	24.0	20.1								
109	4.0	14.5								
109	9.0	10.7								
109	14.0	24.4								
109	19.0	13.5								
109	29.0	16.1								
110	4.0	19.5								
110	14.0	18.4								
110	24.0	19.6								
110	34.0	14.3								
111	4.0	12.7		NP	NP	0.0	29.1			SM
111	9.0	16.0		NP	NP	1.8	25.1			SM
111	14.0	16.0		NP	NP	0.0	25.9			SM
111	24.0	23.6								
111	29.0	20.7								
114	4.0	15.8								
114	9.0	15.4								
114	14.0	30.4								
114	19.0	14.5								
116	4.0	12.1		NP	NP	0.0	35.0			SM
116	9.0	13.1		NP	NP	1.0	37.6			SM
116	14.0	15.6								

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SUMMARY OF LABORATORY TEST RESULTS

JOB No. 162062
FIGURE No. 21
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Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	FHA Expansion Pressure (psf)	% Swell/ Collapse	USCS Classification
116	19.0	10.9								
120	4.0	10.3								
120	9.0	12.6								
120	14.0	12.3								
120	19.0	23.5								
122	4.0	11.5								
122	9.0	8.7		NP	NP	5.6	23.9			SM
122	14.0	11.2		NP	NP	1.2	28.3			SM
122	19.0	13.9								
124	4.0	11.5								
124	9.0	9.7		NP	NP	0.4	21.6			SM
124	14.0	6.7		NP	NP	2.2	26.3			SM
124	19.0	21.3								
126	4.0	15.7								
126	9.0	15.3								
126	14.0	17.4								
126	19.0	14.4								
128	4.0	9.4								
128	9.0	12.0								
128	14.0	12.2								
128	19.0	13.5								
130	4.0	9.5								
130	9.0	13.7								
130	14.0	12.9								
130	19.0	22.0		48	27	0.0	44.4			SC
132	4.0	7.7								
132	9.0	23.0								
132	14.0	19.8								
132	19.0	7.8								
132	24.0	2.4								
133	4.0	11.1								
133	9.0	14.8								
133	14.0	17.7								
133	19.0	14.2								

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SUMMARY OF LABORATORY TEST RESULTS

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Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	FHA Expansion Pressure (psf)	% Swell/ Collapse	USCS Classification
133	29.0	9.9								
134	4.0	13.7								
134	9.0	11.3								
134	14.0	10.4		32	14	1.8	41.6			SC
134	19.0	10.0								
134	29.0	7.8								
137	4.0	22.7								
137	9.0	18.7		66	41	0.0	81.6			CH
137	14.0	12.6								
137	19.0	11.2								
137	24.0	18.1								
139	4.0	10.8								
139	9.0	10.2								
140	4.0	13.9								
140	9.0	11.5								
140	14.0	10.1								
140	19.0	11.4								
142	4.0	11.3		36	16	2.6	30.5			SC
142	9.0	9.9				0.4	36.2			
142	14.0	24.8								
142	19.0	18.7				0.0	83.2			
142	29.0	16.9								
143	4.0	21.1								
143	9.0	28.3								
143	14.0	27.0								
143	34.0	27.5								
145	4.0	17.2								
145	9.0	20.4		45	22	0.5	45.1			SC
145	14.0	15.3								
147	4.0	16.7								
147	9.0	14.6				0.0	73.1			
147	14.0	18.0		37	19	0.0	56.8			CL
147	19.0	30.3								
147	29.0	64.8								

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Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	FHA Expansion Pressure (psf)	% Swell/ Collapse	USCS Classification
147	39.0	12.4								
149	4.0	15.2								
149	9.0	17.4								
149	14.0	33.0								
149	19.0	29.0								
149	29.0	13.8								
149	39.0	18.8								
150	4.0	17.6								
150	9.0	11.4								
150	14.0	10.2								
150	19.0	19.0								
152	4.0	12.7		33	12	0.9	49.1			SC
152	9.0	20.5		58	33	0.0	64.5			CH
152	14.0	26.9								
152	19.0	18.6								
153	4.0	11.8								
153	9.0	10.1								
153	14.0	11.8								
153	19.0	23.7								
154	4.0	9.0								
154	9.0	16.5								
154	14.0	19.6								
154	19.0	11.1								
154	24.0	15.2								
156	4.0	8.7								
156	9.0	13.3								
156	14.0	12.0								
156	19.0	12.4								
157	4.0	6.9								
157	9.0	9.2		NP	NP	0.1	39.7			SM
157	14.0	11.5								
157	19.0	11.5								
160	4.0	15.4								
160	9.0	14.6								

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SUMMARY OF LABORATORY TEST RESULTS

JOB No. 162062
FIGURE No. 21
PAGE 4 OF 5
DATE 4/17/18

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	FHA Expansion Pressure (psf)	% Swell/ Collapse	USCS Classification
160	14.0	14.7								

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SUMMARY OF LABORATORY TEST RESULTS

JOB No. 162062
FIGURE No. 21
PAGE 5 OF 5
DATE 4/17/18

APPENDIX C

Test Boring Logs and Summary of Laboratory Test Results from: *Addendum to Subsurface Soil Investigation, Windermere Subdivision, North Carefree Circle and Marksheffel Road*, El Paso County, Colorado, prepared by RMG – Rocky Mountain Group, Job No. 162062, last dated July 20, 2018

TEST BORING: **113**
DATE DRILLED:
6/5/18
ELEVATION (FT): 6621.18
NO GROUNDWATER ON
6/5/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: SAND, SILTY TO CLAYEY, brown to gray with rust staining, medium dense, moist				
5			15	17.0
10			12	12.0
SAND, SILTY TO CLAYEY, tan to brown, loose, moist				
15			9	8.7
SANDSTONE, SILTY TO CLAYEY, tan to brown, very hard, moist				
20			50/6"	11.9
25			50/5"	15.2
30			50/7"	23.3
CLAYSTONE, SANDY, dark brown, moist				
SANDSTONE, SILTY, blue, very hard, moist				
35			50/5"	21.3

TEST BORING: **115**
DATE DRILLED:
6/5/18
ELEVATION (FT): 6593.73
NO GROUNDWATER ON
6/5/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, SILTY TO CLAYEY, brown, loose to medium dense, moist				
5			8	12.5
10			12	11.6
SANDSTONE, SILTY TO CLAYEY, brown, very hard, moist				
15			50/6"	8.1
20				10.5

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TEST BORING LOG

JOB No. 162062

FIGURE No. 4

DATE 7/20/18

TEST BORING: **121**
DATE DRILLED:
6/5/18
ELEVATION (FT): 6588.90
NO GROUNDWATER ON
6/5/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SAND, SILTY TO CLAYEY, brown, loose, moist			
5			6	9.2
	SANDSTONE, SILTY TO CLAYEY, brown, very hard, moist			
10			50/3"	12.8
15				12.6

TEST BORING: **127**
DATE DRILLED:
6/4/18
ELEVATION (FT): 6597.33
NO GROUNDWATER ON
6/4/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	CLAY, SANDY, light brown, medium stiff, moist			
5			8	18.6
	SANDSTONE, SILTY, light brown, dense, moist			
10			50/4"	13.9
15			50/2"	10.1

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TEST BORING LOG

JOB No. 162062

FIGURE No. 5

DATE 7/20/18

TEST BORING: **135**
DATE DRILLED:
6/4/18
ELEVATION (FT): 6602.71
NO GROUNDWATER ON
6/4/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SAND, SILTY, brown, mediume dense, moist			
5		■	10	22.3
	SANDSTONE, SILTY, light brown, dense, moist			
10		■	50/3"	14.6
15		■	50/3"	15.0

TEST BORING: **136**
DATE DRILLED:
6/4/18
ELEVATION (FT): 6610.43
NO GROUNDWATER ON
6/4/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	CLAY, SANDY, brown, stiif, moist			
5		■	11	16.7
	SANDSTONE, SILTY, light brown, dense, moist			
10		■	50/3"	11.6
15		■	50/2"	13.6

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TEST BORING LOG

JOB No. 162062

FIGURE No. 6

DATE 7/20/18

TEST BORING: **146**
DATE DRILLED:
6/4/18
ELEVATION (FT): 6614.75
NO GROUNDWATER ON
6/4/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SANDSTONE, SILTY, light brown, dense, moist				
5			50/8"	12.2
CLAYSTONE, SANDY, brown, hard, moist				
10			50/8"	19.1
15			50/9"	24.3
SANDSTONE, SILTY, light brown, dense, moist				
20			50/6"	19.0
CLAYSTONE, SANDY, olive and browm, hard, moist				
25			32	25.3

TEST BORING: **155**
DATE DRILLED:
6/4/18
ELEVATION (FT): 6608.44
NO GROUNDWATER ON
6/4/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SANDSTONE, SILTY, light brown, dense, moist				
5			50/6"	12.4
CLAYSTONE, SANDY, brown, hard, moist				
10			40	28.1
15			50/8"	24.4
SANDSTONE, SILTY, light brown, dense, moist				
20			50/4"	15.1

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TEST BORING LOG

JOB No. 162062

FIGURE No. 7

DATE 7/20/18

TEST BORING: **158**
DATE DRILLED:
6/4/18
ELEVATION (FT): 6584.40
NO GROUNDWATER ON
6/4/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, SILTY, brown, medimu dense, moist				
5			15	9.9
SANDSTONE, SILTY, brown, dense, moist				
10			50/3"	9.4
CLAYSTONE, SANDY, olive and brown, hard, moist				
15				21.3
20			50/9"	23.9
CLAYSTONE, SANDY, blue and gray, hard, moist				
25			50/4"	20.0

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TEST BORING LOG

JOB No. 162062

FIGURE No. 8

DATE 7/20/18

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	% Swell/ Collapse	FHA Expansion Pressure (psf)	RMG Soil Type
113	4.0	17.0		42	16		30.4			
113	9.0	12.0								
113	14.0	8.7								
113	19.0	11.9								
113	24.0	15.2								
113	29.0	23.3								
113	34.0	21.3								
115	4.0	12.5								
115	9.0	11.6		34	11		36.5			
115	14.0	8.1								
115	19.0	10.5								
121	4.0	9.2								
121	9.0	12.8		40	14	0.8	38.6	- 0.2		
121	14.0	12.6								
127	4.0	18.6		NP	NP		57.7			
127	9.0	13.9								
127	14.0	10.1								
135	4.0	22.3								
135	9.0	14.6		NP	NP		19.9			
135	14.0	15.0								
136	4.0	16.7		NP	NP		59.6			
136	9.0	11.6								
136	14.0	13.6								
146	4.0	12.2								
146	9.0	19.1		47	18		52.7	1.2		
146	14.0	24.3								
146	19.0	19.0								
146	24.0	25.3								
155	4.0	12.4								
155	9.0	28.1								
155	14.0	24.4		64	26		56.7	0.7		
155	19.0	15.1								
158	4.0	9.9								
158	9.0	9.4								

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SUMMARY OF LABORATORY TEST RESULTS

JOB No. 162062
FIGURE No. 9
PAGE 1 OF 2
DATE 7/20/18

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	% Swell/ Collapse	FHA Expansion Pressure (psf)	RMG Soil Type
158	14.0	21.3								
158	19.0	23.9		58	21		60.3	0.7		
158	24.0	20.0								

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SUMMARY OF LABORATORY TEST RESULTS

JOB No. 162062
FIGURE No. 9
PAGE 2 OF 2
DATE 7/20/18

APPENDIX D

Test Boring Logs and Summary of Laboratory Test Results from: *Subsurface Soil Investigation, Windermere Subdivision, El Paso County, Colorado,* prepared by RMG – Rocky Mountain Group, last dated May 28, 2015

TEST BORING: **1**
DATE DRILLED:
4/2/15
REMARKS:
NO GROUNDWATER ON
4/2/15

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SANDSTONE, SILTY, brown, moist			
	CLAYSTONE, SANDY, brown with rust staining, moist			
5			45	21.0
10			46	21.8
15			35	24.4
	SANDSTONE, SILTY, blue to grey, very hard, moist			
20			50/0"	--

TEST BORING: **2**
DATE DRILLED:
4/2/15
REMARKS:
NO GROUNDWATER ON
4/2/15

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SAND, SILTY, brown, medium dense, moist			
5			13	11.5
	SANDSTONE, SILTY, brown to blue and grey, very hard, moist			
10			50/5"	13.4
15			50/0"	14.6
20			50/0"	14.1

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TEST BORING LOGS

JOB No. 142206

FIGURE No. 4

DATE 5/28/15

TEST BORING: **3**
DATE DRILLED:
4/2/15
REMARKS:
NO GROUNDWATER ON
4/2/15

SAND, SILTY TO CLAYEY, brown, medium dense, moist

CLAYSTONE, SANDY, brown, medium hard to hard, moist

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
5			15	13.8
10			31	21.4
15			50/7"	18.0
20			50/10"	23.4

TEST BORING: **4**
DATE DRILLED:
4/2/15
REMARKS:
NO GROUNDWATER ON
4/2/15

CLAY, SANDY, brown, medium stiff, moist

CLAYSTONE, SANDY, brown with rust staining, firm to hard, moist

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
5			7	21.7
10			50/8"	21.5
15			21	34.4
20			50/11"	28.3

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TEST BORING LOGS

JOB No. 142206

FIGURE No. 5

DATE 5/28/15

TEST BORING: **5**
DATE DRILLED:
4/2/15
REMARKS:
NO GROUNDWATER ON
4/2/15

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SAND, SILTY, brown, moist			
	CLAYSTONE, SANDY, brown, moist			
5	SANDSTONE, SILTY, brown with rust staining, hard, moist		50/10"	15.7
	CLAYSTONE/SILTSTONE, SANDY, brown with rust staining, medium hard to hard, moist			
10			50/9"	25.3
15			33	27.0
20			34	21.6

TEST BORING: **6**
DATE DRILLED:
4/2/15
REMARKS:
NO GROUNDWATER ON
4/2/15

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SAND, SILTY, brown, moist			
	SANDSTONE, SILTY TO CLAYEY, brown, hard, moist			
5			50/9"	15.6
	CLAYSTONE, SANDY, brown with rust staining, hard, moist			
10			50/9"	24.8
	SANDSTONE, SILTY, blue to grey, very hard, moist			
15			50/6"	18.4
20			50/4"	13.3

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TEST BORING LOGS

JOB No. 142206

FIGURE No. 6

DATE 5/28/15

TEST BORING: **7**
DATE DRILLED:
4/2/15
REMARKS:
NO GROUNDWATER ON
4/2/15

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SAND, SILTY, brown, moist			
	CLAYSTONE, SANDY, brown with rust staining, medium hard to hard, moist			
5			50/9"	21.8
10			41	25.9
15			41	28.3
	SANDSTONE, SILTY, blue to grey, very hard, moist			
20			50/3"	14.3

TEST BORING: **8**
DATE DRILLED:
4/2/15
REMARKS:
NO GROUNDWATER ON
4/2/15

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	SAND, SILTY TO CLAYEY, tan to brown, loose to medium dense, moist			
5			4	8.9
10			16	8.4
	SANDSTONE/CLAYSTONE, SANDY, brown with rust staining, hard, moist			
15			50/9"	22.1
	SANDSTONE, SILTY, blue to grey, very hard, moist			
20			50/0"	13.6

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TEST BORING LOGS

JOB No. 142206

FIGURE No. 7

DATE 5/28/15

TEST BORING: **9**
DATE DRILLED:
4/2/15
REMARKS:
NO GROUNDWATER ON
4/2/15

	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, SILTY, brown, moist					
SANDSTONE/CLAYSTONE, SILTY TO CLAYEY, tan to brown, medium hard to hard, moist	5			38	19.8
	10			50/9"	19.1
SANDSTONE, SILTY TO CLAYEY, blue to grey, very hard, moist	15			50/0"	12.0
	20			50/0"	12.4

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TEST BORING LOGS

JOB No. 142206

FIGURE No. 8

DATE 5/28/15

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	% Swell/ Collapse	FHA Expansion Pressure (psf)
1	4.0	21.0							
1	9.0	21.8	102.3	38	17		65.1	2.7	
1	14.0	24.4							
2	4.0	11.5		NP	NP		41.8		
2	9.0	13.4							
2	14.0	14.6							
2	19.0	14.1							
3	4.0	13.8	90.6	40	19		46.8	- 3.7	
3	9.0	21.4							
3	14.0	18.0							
3	19.0	23.4							
4	4.0	21.7		55	25		65.4		
4	9.0	21.5	91.3					0.3	
4	14.0	34.4							
4	19.0	28.3							
5	4.0	15.7							
5	9.0	25.3							
5	14.0	27.0		57	27		53.5		
5	19.0	21.6							
6	4.0	15.6		43	17		40.0		
6	9.0	24.8	95.5					0.8	
6	14.0	18.4		45	18		39.3		
6	19.0	13.3							
7	4.0	21.8	95.4					0.9	
7	9.0	25.9							
7	14.0	28.3							
7	19.0	14.3		NP	NP		22.8		
8	4.0	8.9							
8	9.0	8.4		NP	NP		26.7		
8	14.0	22.1		50	28		48.5		
8	19.0	13.6							
9	4.0	19.8							
9	9.0	19.1		48	23		52.3		
9	14.0	12.0							

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SUMMARY OF LABORATORY TEST RESULTS

JOB No. 142206
FIGURE No. 10
PAGE 1 OF 2
DATE 5/28/15

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	% Swell/ Collapse	FHA Expansion Pressure (psf)
9	19.0	12.4		34	13		38.3		

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SUMMARY OF LABORATORY TEST RESULTS

JOB No. 142206
FIGURE No. 10
PAGE 2 OF 2
DATE 5/28/15

APPENDIX E

Test Boring Logs and Summary of Laboratory Test Results from: *Preliminary Soils and Geology Report, Hilltop Subdivision, North Carefree Circle and Marksheffel Road, El Paso County, Colorado,* prepared by RMG Engineers, last dated May 5, 2014

TEST BORING: 1
DATE DRILLED: 2/19/14
REMARKS: NO GROUNDWATER ON 2/20/14

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
			7	8.4	1
5			10	9.1	1
10			13	12.0	1
15			58	17.9	2
20			50/2"	14.1	3
			50/0"	–	3
25					

SAND, SILTY TO CLAYEY, light brown, loose to medium dense, moist

CLAYSTONE/SILTSTONE, SANDY, tan to brown, hard, moist

SANDSTONE, SILTY, with silstone, tan to brown and blue, hard to very hard, moist

SAMPLER REFUSAL AT 24 FEET DUE TO VERY HARD BEDROCK

TEST BORING: 2
DATE DRILLED: 2/19/14
REMARKS: GROUNDWATER @ 42.0 ' 2/20/14

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
			50/3"	14.4	3
5			50/6"	16.8	3
10			50/6"	21.4	2
15			50/6"	28.6	2
				–	3
20			50/8"	28.8	2
25			50/3"	–	3
30			50/3"	17.1	3
35					
40			50/3"	25.1	2
45					
			50/0"	–	3
50					

SANDSTONE, SILTY, brown, very hard, moist

CLAYSTONE/SILTSTONE, SANDY, olive to brown, very hard, moist

SANDSTONE, SILTY, blue to grey, very hard, moist

CLAYSTONE/SILTSTONE, SANDY, olive to brown, hard, moist

SANDSTONE, SILTY, blue to grey, very hard, moist

CLAYSTONE/SILTSTONE, SANDY, blue to gray, very hard, moist to wet

SANDSTONE, SILTY, blue to grey, very hard, moist to wet

SAMPLER REFUSAL AT 49 FEET DUE TO VERY HARD BEDROCK

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TEST BORING LOGS

JOB No. 142206

FIGURE No. 6

DATE 3/5/14

TEST BORING: 3
DATE DRILLED: 2/19/14
REMARKS: NO GROUNDWATER ON 2/20/14

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
				--	1
			50/9"	27.7	2
5			50/6"	20.2	2
10			50/0"	12.4	3
15			50/0"	12.1	3
20			50/0"	–	3

SAND, SILTY, light brown, moist

CLAYSTONE/SILTSTONE, SANDY, olive to brown, very hard, moist

SANDSTONE, SILTY, brown to blue and grey, very hard, moist

BULK SAMPLES DUE TO VERY HARD BEDROCK

TEST BORING: 4
DATE DRILLED: 2/19/14
REMARKS: NO GROUNDWATER ON 2/20/14

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
			7	11.9	1
5			70	14.0	3
10			50/4"	7.7	3
15			50/1"	11.0	3
20				--	3

SAND, SILTY TO CLAYEY, light brown, loose, moist

SANDSTONE, SILTY, light brown to gray and blue, hard to very hard, moist

BULK SAMPLES DUE TO VERY HARD BEDROCK

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TEST BORING LOGS

JOB No. 142206

FIGURE No. 7

DATE 3/5/14

TEST BORING: 5
DATE DRILLED:
2/19/14
REMARKS:
NO GROUNDWATER ON
2/20/14

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
			8	10.5	1
5			10	10.5	1
10			34	18.3	1/3
15			52	27.2	2
20			50/4"	26.8	2
			50/0"	–	3
25					

SAND, SILTY TO CLAYEY, light brown, loose to medium dense, moist

CLAYSTONE/SILTSTONE, SANDY, olive to brown, medium hard to very hard, moist

SANDSTONE, SILTY, blue to grey, very hard, moist

SAMPLER REFUSAL AT 24 FEET DUE TO VERY HARD BEDROCK

TEST BORING: 6
DATE DRILLED.
2/19/14
REMARKS:
GROUNDWATER @ 6.0 '
2/20/14

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
			8	14.8	1
5			8	23.7	1
10			30	21.1	3
15			50/11"	30.0	2
20			50/8"	23.5	2

SAND, SILTY TO CLAYEY, dark brown to brown, loose, moist

SANDSTONE, SILTY, brown, medium hard, moist to wet

CLAYSTONE/SILTSTONE, SANDY, brown to gray, hard, moist to wet

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TEST BORING LOGS

JOB No. 142206

FIGURE No. 8

DATE 3/5/14

TEST BORING: 7
DATE DRILLED:
2/19/14
REMARKS:
GROUNDWATER @ 21.5 '
2/20/14

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
	SAND, SILTY TO CLAYEY, light brown, loose to medium dense, moist				
			12	14.7	1
5			15	11.2	1
10			11	11.2	1
	SANDSTONE, SILTY, brown, very hard, moist to wet				
15			50/4"	12.9	3
20			50/1"	12.9	3
			10/0"	–	3
25	SAMPLER REFUSAL AT 24 FEET DUE TO VERY HARD BEDROCK				

TEST BORING. 8
DATE DRILLED:
2/19/14
REMARKS:
NO GROUNDWATER ON
2/20/14

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
	SAND, SILTY TO CLAYEY, dark brown, loose, moist				
			8	15.2	1
5			10	11.7	1
10	SANDSTONE, SILTY, light grey to blue, hard, moist		52	5.1	3
	CLAYSTONE/SILTSTONE, SANDY, brown to grey, medium hard, moist				
15			60	31.7	2
	SANDSTONE, CLAYEY, brown, very hard, moist				
20			50/5"	19.8	3

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TEST BORING LOGS

JOB No. 142206

FIGURE No. 9

DATE 3/5/14

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	FHA Expansion Pressure (psf)	% Swell/ Collapse	RMG Soil Type
1	2.0	8.4								1
1	4.0	9.1		34	14	0.0	30.7			1
1	9.0	12.0								1
1	14.0	17.9	102.6	50	24		70.0		2.3	2
1	19.0	14.1								3
1	24.0	11.5								
2	2.0	14.4								3
2	4.0	16.8								3
2	9.0	21.4	101.1	49	24		84.9		0.4	2
2	14.0	28.6								2
2	19.0	28.8								2
2	29.0	17.1		41	15		64.0			3
2	39.0	25.1								2
3	2.0	27.7	95.3	52	20		59.8		1.1	2
3	4.0	20.2								2
3	9.0	12.4		NP	NP		41.4			3
3	14.0	12.1								3
3	19.0	12.4								
4	2.0	11.9		33	12	0.2	30.6			1
4	4.0	14.0								3
4	9.0	7.7								3
4	14.0	11.0								3
4	19.0	12.0								
5	2.0	10.5								1
5	4.0	10.5								1
5	9.0	18.3		49	21		54.8			1/3
5	14.0	27.2								2
5	19.0	26.8	96.4						1.5	2
5	24.0	12.9								
6	2.0	14.8	106.5	40	17		41.5		- 0.8	1
6	4.0	23.7								1
6	9.0	21.1								3
6	14.0	30.0	88.5	54	21		74.8		0.2	2
6	19.0	23.5								2

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SUMMARY OF LABORATORY TEST RESULTS

JOB No. 142206
FIGURE No. 10
PAGE 1 OF 2
DATE 3/5/14

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	FHA Expansion Pressure (psf)	% Swell/ Collapse	RMG Soil Type
7	2.0	14.7	100.1	40	17		51.6		0.4	1
7	4.0	11.2								1
7	9.0	11.2								1
7	14.0	12.9								3
7	19.0	12.9								3
8	2.0	15.2								1
8	4.0	11.7	110.2	38	13		37.2		- 4.0	1
8	9.0	5.1								3
8	14.0	31.7	89.1	64	28		82.0		0.7	2
8	19.0	19.8								3

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SUMMARY OF LABORATORY TEST RESULTS

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