EPC STORMWATER REVIEW COMMENTS
IN ORANGE BOXES WITH BLACK TEXT

Final Drainage Report

Windermere Filing No. 2
El Paso County, Colorado

PCD File No.: PPR2442

Prepared for:
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Project #: 196160000

Prepared: November 2024

Kimley»Horn

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Please remove Appendix F which contains multiple copies of an older study. The updated Soils report submitted as a separate document, will be sufficient.

An older version of this preliminary drainage report was attached. Include the final version of the report in which all engineering comments were addressed from SP223. This version is the latest PDR submitted in EDARP under SP223.

CERTIFICATION

ENGINEERS STATEMENT

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

SIGNATURE (Affix Seal): ____
Noah M. Brehmer, P.E. Date
Colorado P.E. License No. 63226

DEVELOPER'S STATEMENT

I, the developer, have read and will comply with all of the requirements specified in this drainage report and plan.

____
Business Name

____
By:

____
Title:

____
Address:

EL PASO COUNTY

Filed in accordance with the requirements of the Drainage Criteria Manual, Volumes 1 and 2, El Paso County Engineering Criteria Manual and Land Development Code, as amended.

____ ______________________
Joshua Palmer, P.E. Date
County Engineer/ECM Administrator

Conditions:

104 single family attached per LOI and SDP.

GENERAL LOCATION AND DESCRIPTION

PURPOSE AND SCOPE OF STUDY

The purpose of this Final Drainage Report (FDR) is to provide the hydrologic and hydraulic calculations and to document and finalize the drainage design methodology in support of the approximately 200 multi-family unit development, known as Windermere Filing No. 2 subdivision (“the Project”) for Colo Windermere #2, LLC (“the Client”). The Project is located within the jurisdictional limits of El Paso County (“the County”) and Sand Creek Drainage Basin. Thus, the guidelines for the hydrologic and hydraulic design components were based on the criteria outlined by the County.

The site was studied as part of the approved Preliminary Drainage Report for Windermere & Final Drainage Report for Windermere Filing No. 1, by Classic Consulting (October 2014) and the more recently approved Final Drainage Report for Windermere Filing No. 1, by Drexel, Barrel & Co. (April 2022).

LOCATION

The Project is located at 7653 Mardale Ln. at the northwest corner of the North Marksheffel Road and North Carefree Circle intersection in El Paso County, Colorado. More specifically, the East ½ of Section 29, Township 13 South, Range 65 West of the 6th P.M., Tract B, Windermere Filing No. 1 (parcel number 53294-16-011). The site is bounded by Windermere Filing No. 1 subdivision (Mardale Lane) to the North, North Marksheffel Road to the east, North Carefree Circle to the south, and Antelope Ridge Drive to the west. A vicinity map has been provided in the **Appendix** of this report.

DESCRIPTION OF PROPERTY

The Project is located on approximately ±9.22 acres of partially developed over lot graded land with limited vegetation and grass cover. The site currently provides stormwater quality and detention with a full spectrum extended detention basin and there are no known major drainage ways or irrigation facilities on site. The site generally drains from west to east with slopes ranging from 2% to 25%. There is an existing private on-site Full Spectrum Extended Detention Basin at the east end of the Site that accepts flows from most of the Property. The Project is not adjacent to any major drainageways and does not outfall directly to any major drainageways.

Highlight is inconsistent with other documents.

PROJECT CHARACTERISTICS

The Project is a proposed townhome subdivision development that will include approximately 200 units platted as individual lots. The project will include the construction of private streets, driveways, hardscape/landscape, and associated utility and storm infrastructure required to serve each lot. Water quaility and detention is required for the site improvements and will be accomplished with the exisitng onsite private full spectrum extended detentionbBasin located at the east end of the site. As part of the utility infrastructure improvements, a proposed storm sewer system will be constructed to collect runoff. Stormwater will be conveyed via overland flow across the lots, and within curb and gutter before being captured in proposed storm inlets. The storm sewer system will then convey runoff into the full spectrum extended detention basin before being discharged at the southeast corner of the site.

SOILS DATA

NRCS soil data is available for the Site (See **Appendix**) and the onsite soils are 100% USCS Hydrologic Soil Group A or Truckton sandy loam. Group A soils have higher infiltration rates compared to other soil groups and are generally made up of well drained, cohesive sands or gravelly sands. Additionally, a subsurface soil investigation performed by Entech Engineering on January 25, 2022, can be found in the **Appendix**.

EXISTING VEGETATION

The existing site is currently partially developed. Ground cover consists of limited native grasses, shrubs, and various stormwater pond infrastructure to include some concrete and stone riprap. Based on visual inspection the site currently is 50% vegetated.

DRAINAGE DESIGN CRITERIA

DEVELOPMENT CRITERIA REFERENCE

The existing storm facilities follow the El Paso County Drainage Criteria Manual (the "CRITERIA"), El Paso Engineering Criteria Manual (the "ECM"), and the Mile High Flood District Urban Storm Drainage Criteria Manual (the "MANUAL"). Site drainage is not significantly impacted by such constraints as utilities or existing development. Further detail regarding onsite drainage patterns is provided in the Proposed Drainage Conditions Section.

HYDROLOGIC CRITERIA

The 5-year and 100-year design storm events were used in determining rainfall and runoff for the existing drainage system per chapter 6 of the CRITERIA. Table 6-2 of the CRITERIA is the source for rainfall data for the 5-year and 100-year design storm events. Design runoff was calculated using the Rational Method for developed conditions as established in the CRITERIA and MANUAL. Runoff coefficients for the proposed development were determined using Table 6-6 of the CRITERIA by calculating weighted impervious values for each specific site basin. The detention storage requirement was calculated using Full Spectrum Detention methods as specified in the CRITERIA and MANUAL. The Full Spectrum Extended Detention Basin's outlet structure was designed to release the Water Quality Capture Volume (WQCV) in 40 hours. Based upon this approach, the drainage design provided for the Site is in keeping with the historic drainage patterns for the Site.

HYDRAULIC CRITERIA

The proposed drainage facilities are designed in accordance with the CRITERIA and MANUAL. Floodplain identification was determined using FIRM panels by FEMA and information provided in the CRITERIA. Hydraulic calculations were computed using Storm CAD using the Standard Method. Results of the hydraulic calculations are summarized in the **Appendix**.

VARIANCES FROM CRITERIA

There are no proposed variances from the El Paso County Drainage Criteria.

FLOODPLAIN STATEMENT

The Site is located outside the 100-year floodplain and within Zone X (an area of minimal flood hazard) as noted on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel #08041C0543G dated December 7, 2018 (See **Appendix**).

MAJOR DRAINAGE BASIN – HISTORIC HYDROLOGY

The previously approved *Preliminary Drainage Report for Windermere & Final Drainage Report for Windermere Filing No. 1 by Classic Consulting (October 2014)* will be reference for the existing off-site basins that have not changed from the time of the Classic Consulting report.

EXISTING DRAINAGE CONDITIONS

Verify existing drainage conditions are consistent with the latest preliminary drainage report. Additional comments may be added to the next submittal.

The existing Site was over lot graded [illegible] *development* and studied as part of the previously approved *Final Drainage Report for Windermere Filing No. 1, by Drexel, Barrell & Co. (April 2022)*. A private on-site Full Spectrum Extended Detention Basin was designed as part of *Windermere Filing No. 1*. The design basis for the pond was to mitigate the potential for future grading within the stormwater pond facility area. Therefore, it was assumed that the final proposed build-out watershed imperviousness would be 68% for the Site.

The following basin descriptions reference the Windermere Filing No. 2 Preliminary Drainage Report prepared by Drexel, Barrell & Co., dated August 2024. The proposed conditions map will be utilized as the Existing Conditions for this Final Drainage Report. Please reference the existing conditions drainage map, historic conditions drainage map, and Preliminary Drainage Report in the ***Appendix***.

ON-SITE

Sub-Basin A1

Sub-basin A1 is 6.79 acres and consists of central majority of the Site. This basin consists of a partially developed over lot graded area and is partially vegetated with a soil stockpile. The runoff developed within this sub-basin sheet flows generally from northwest to southeast overland before being discharged into the existing detention facility. Slopes in this sub-basin range from approximately 2-5%. The weighted imperviousness of this sub-basin is 65%. The developed direct runoff from sub-basin A1 is 12.6 cfs for the 5-year event and 27.9 cfs for the 100-year event.

Sub-Basin A2

Sub-basin A2 is 0.92 acres and consists of the south end of the Site. This basin consists of a vegetated drainage ditch. The runoff developed within this sub-basin sheet flows generally from west to east overland before entering an existing area inlet at the southeast end of the site. Flows then enter the existing stormwater network. Slopes in this sub-basin range from approximately 2-5% with steeper slopes along the pond embankment and drainage swale slopes. The weighted imperviousness of this sub-basin is 4%. The developed direct runoff from sub-basin A2 is 0.7 cfs for the 5-year event and 3.4 cfs for the 100-year event.

Include basin D16 flows.

Sub-Basin P1

Sub-basin P1 is 1.00 acre and consists of the existing full spectrum extended detention basin for the site. The runoff developed within this sub-basin is treated and stored in place, and then discharged to the southeast into existing stormwater infrastructure. The pond side slopes are generally at a 3:1 grade. The weighted imperviousness of this sub-basin is 0%. The developed direct runoff from sub-basin P1 is 0.5 cfs for the 5-year event and 2.7 cfs for the 100-year event.

Sub-Basin C3

Sub-basin C3 is 0.63 acres and consists of the east end of the site. This sub-basin consists of a vegetated existing drainage swale. The runoff developed within this sub-basin sheets flows overland at slopes of approximately 2-5% with steeper slops along the pond embankment and travels south into an existing area inlet at the southeast corner of the site. Flows then enter the existing public stormwater network. The weighted imperviousness of this sub-basin is 0%. The developed direct runoff from sub-basin C3 is 0.5 cfs for the 5-year event and 2.5 cfs for the 100-year event.

OFF-SITE

Sub-Basin B1

Sub-basin B1 is 3.33 acres and consists of an off-site area north of the proposed development. This basin consists of fully developed residential lots and roads. The runoff developed within this sub-basin sheet flows generally from northwest to southeast at slopes of approximately 2-15% where it flows into existing curb and gutter and subsequently into an existing curb inlet. Flows are then conveyed through an existing 24” stormwater pipe that eventually discharges into the north end of the existing detention basin. The weighted imperviousness of this sub-basin is 65%. The developed direct runoff from sub-basin B1 is 7.2 cfs for the 5-year event and 16.0 cfs for the 100-year event.

Sub-Basin B2

Sub-basin B2 is 0.49 acres and consists of an off-site area northeast of the proposed development. This basin consists of fully developed residential lots and roads. The runoff developed within this sub-basin sheet flows generally from north to south at slopes of approximately 2-5% where it flows into existing curb and gutter and subsequently into an existing curb inlet. Flows are then conveyed through an existing 24” stormwater pipe that eventually discharges into the north end of the existing detention basin. The weighted imperviousness of this sub-basin is 65%. The developed direct runoff from sub-basin B2 is 1.0 cfs for the 5-year event and 2.3 cfs for the 100-year event.

Sub-Basin B4

Sub-basin B4 is 0.16 acres and consists of an offsite area northeast of the site. This sub-basin consists of the rear yards of the lots within sub-basin B2. The runoff developed within this sub-basin sheet flows from the northwest to the southeast overland at slopes of approximately 2-15%. Flows then enter an existing area inlet and are conveyed through an existing 24” storm pipe that discharges into the north end of the existing detention facility. The weighted imperviousness of this sub-basin is 65%. The developed direct runoff from sub-basin B4 is 0.4 cfs for the 5-year event and 0.8 cfs for the 100-year event.

Sub-Basin D16

Sub-basin D16 is 2.73 acres and consists of an offsite area west of the site. This sub-basin consists of the Pronghorn Meadows Subdivision Filing No. 2 which is residential lots, roads, and a portion of North Carefree Circle. The runoff developed within this sub-basin sheet flows from the northwest to the southeast at slopes of approximately 2-5%. Flows travel into existing curb and gutter which conveys flows to an existing curb inlet and through an existing 24” culvert under Antelope Ridge Dr. Flows then enter the site from the existing culvert and travel overland through an existing drainage ditch to an existing area inlet where flows then enter the existing stormwater network. The weighted imperviousness of this sub-basin is 65%. The developed direct runoff from sub-basin D16 is 4.9 cfs for the 5-year event and 10.7 cfs for the 100-year event.

Sub-Basin NC2

Sub-basin NC2 is 1.61 acres and consists of an offsite area generally west and south of the site. This sub-basin consists of Mardale Ln., Antelope Ridge Dr., and North Carefree Circle. The runoff developed within this sub-basin sheet flows from the crown of the existing roads and into existing curb and gutter and eventually into an existing curb inlet at the southeast end of the site at slopes of approximately 2-5%. Flows travel into existing storm pipes on North Carefree Circle. In the event the curb inlet is clogged, flows would bypass into the existing on-site area inlet at the southeast corner of the site. The weighted imperviousness of this sub-basin is 83%. The developed direct runoff from sub-basin NC2 is 6.3 cfs for the 5-year event and 12.1 cfs for the 100-year event.

Sub-Basin NC1

Sub-basin NC1 is 0.43 acres and consists of North Carefree Circle. This sub-basin consists of paved asphalt road. The runoff developed within this sub-basin sheet flows at slopes of approximately 2-5% into existing curb and gutter and into the existing curb inlets within North Carefree Circle right-of-way. Flows then enter the existing public stormwater network at the southeast corner of the site. In the event the curb inlets become clogged some of the flows would enter the existing area inlet at the southeast corner of the site. The weighted imperviousness of this sub-basin is 93%. The developed direct runoff from sub-basin NC1 is 1.9 cfs for the 5-year event and 3.4 cfs for the 100-year event.

Sub-Basin EXR

Sub-basin EXR is 0.53 acres and consists of an offsite area northeast of the site. This sub-basin consists of Marksheffel Rd and associated median. The runoff developed within this sub-basin sheet flows at slopes of approximately 2-5% into existing curb and gutter ultimately into an existing curb inlet and travels through an existing 24” storm pipe that travels east and then south within the Marksheffel Rd. right-of -way. The weighted imperviousness of this sub-basin is 100%. The developed direct runoff from sub-basin EXR is 2.4 cfs for the 5-year event and 4.4 cfs for the 100-year event.

PROPOSED DRAINAGE CONDITIONS

The proposed project site is approximately ±9.22 acres in size and involves the construction of approximately 200 townhomes, site access, pedestrian ramps, curb and gutter, private roads, retaining walls, parking, wet and dry utilities, and stormwater infrastructure. Flows generated from the drainage area's proposed conditions are captured and conveyed via proposed stormwater infrastructure to an existing private above ground full spectrum extended detention basin. Flows are released from this pond from an existing outlet structure, existing orifice plate, and existing pipe with restrictor plate into an existing public stormwater infrastructure network. Flows generated from the proposed conditions with generally follow historic patterns. Under proposed conditions the entire drainage area associated with this project is approximately ±12.04 acres with a 51% on-site weighted imperviousness and 22% off-site weighted imperviousness. The proposed on-site flows for the 5 and 100-yr storm event are 18.25 cfs and 41.95 cfs respectively while off-site is 5.00 cfs and 11.02 cfs respectively. The existing detention facility sizing, inlet capacity, and pipe sizing calculations can be found in the ***Appendix*****.**

ON-SITE

Please revise narratives according to comments on map.

Sub-Basin P1

Sub-basin P1 is approximately 0.92 acres and consists of proposed townhomes, landscape, and private drives along the northwest property line adjacent to the intersection of Mardale Lane and Antelope Ridge Drive. Flows developed in this sub-basin generally travel southeast at grades of 2-9%. Flows are conveyed via curb and gutter to a proposed private 5' CDOT Type-R curb inlet at DP D1. Flows are then conveyed through proposed storm infrastructure to the existing private above ground full spectrum extended detention basin. Developed runoff during the 5-year and 100-year events are 2.00 cfs and 4.46 cfs respectively. The weighted imperviousness of sub-basin P1 is 60%

Sub-Basin P2

See map. Not all P2 flows are collected at DP D2.

Sub-basin P2 is approximately 1.04 acres and consists of proposed townhomes, landscape, and private drives in the northeast corner of the property adjacent to Mardale Lane, and the existing detention basin. Flows developed in this sub-basin generally travel southeast at grades of 2-5%. Flows are conveyed via curb and gutter to a proposed private 5' CDOT Type-R curb inlet at DP D2. Flows are then conveyed through proposed storm infrastructure to the existing private above ground full spectrum extended detention basin. Developed runoff during the 5-year and 100-year events are 2.71 cfs and 5.86 cfs respectively. The weighted imperviousness of sub-basin P2 is 65%.

Sub-Basin P3

Sub-basin P3 is approximately 1.11 acres and consists of proposed townhomes, landscape, and private drives along the west property line adjacent to Antelope Ridge Drive. Flows developed in this sub-basin generally travel southeast at grades of 2-7%. Flows are conveyed via curb and gutter to a proposed private 5' CDOT Type-R curb inlet at DP D3. Flows are then conveyed through proposed storm infrastructure to the existing private above ground full spectrum extended detention basin. Developed runoff during the 5-year and 100-year events are 3.41 cfs and 6.79 cfs respectively. The weighted imperviousness of sub-basin P3 is 80%.

Sub-Basin P4

Sub-basin P4 is approximately 1.02 acres and consists of proposed townhomes, landscape, and private drives within the western half of the site. Flows developed in this sub-basin generally travel southwest at grades of 2-5%. Flows are conveyed via curb and gutter to a proposed private 5’ CDOT Type-R curb inlet at DP D4. Flows are then conveyed through proposed storm infrastructure to the existing private above ground full spectrum extended detention basin. Developed runoff during the 5-year and 100-year events are 3.56 cfs and 6.77 cfs respectively. The weighted imperviousness of sub-basin P4 is 89%.

Sub-Basin P5

Sub-basin P5 is approximately 0.37 acres and consists of proposed landscape, and private drives within the central portion of the site. Flows developed in this sub-basin generally travel south at grades of 2-5%. Flows travel overland through a proposed drainage swale to a proposed private CDOT Type C area inlet at DP D5. Flows are then conveyed through proposed storm infrastructure to the existing private above ground full spectrum extended detention basin. Developed runoff during the 5-year and 100-year events are 0.21 cfs and 1.08 cfs respectively. The weighted imperviousness of sub-basin P5 is 14%.

Sub-Basin P6

Sub-basin P6 is approximately 1.76 acres and consists of proposed townhomes, landscape, and private drives in the central portion of the property. Flows developed in this sub-basin generally travel southeast at grades of 2-5%. Flows are conveyed via curb and gutter to a proposed private 5’ CDOT Type-R curb inlet at DP D6. Flows are then conveyed through proposed storm infrastructure to the existing private above ground full spectrum extended detention basin. Developed runoff during the 5-year and 100-year events are 5.81 cfs and 11.41 cfs respectively. The weighted imperviousness of sub-basin P6 is 83%.

Sub-Basin P7

Sub-basin P7 is approximately 0.29 acres and consists of proposed landscape, and sidewalk located within the central eastern half of the property. Flows developed in this sub-basin generally travel south at grades of 2-25%. Flows travel overland through a proposed drainage swale to a proposed private CDOT Type C area inlet at DP D7. Flows are then conveyed through proposed storm infrastructure to the existing private above ground full spectrum extended detention basin. Developed runoff during the 5-year and 100-year events are 0.29 cfs and 1.06 cfs respectively. The weighted imperviousness of sub-basin P7 is 24%.

west

Sub-Basin P8

Sub-basin P8 is approximately 1.70 acres and consists of existing and proposed landscape, sidewalk, and detention basin embankment along the west, south, and east property line northwest property line. Flows developed in this sub-basin generally travel south and east at grades of approximately 2-25%. Flows are conveyed via existing drainage swales to an existing public CDOT Type C area inlet at DP D8. Flows are then conveyed through existing public storm infrastructure off-site. Developed runoff during the 5-year and 100-year events are 0.32 cfs and 2.92 cfs respectively. The weighted imperviousness of sub-basin P8 is 6%.

Per El Paso County Engineering Criteria Manual I.7.1.C.1.a, the impervious area in this sub basin is excluded from the Water Quality Capture Volume given it is not practicable to capture this runoff as it does not drain toward the existing control measure.

This exclusion is applicable for 20% of the site, not to exceed 1 acre. P8 is 1.7ac. Consider using runoff reduction RPAs and/or self treating SPAs to reduce the untreatable area to less than 1ac.

Include flows from off site basin D16 and please address the change in flows leaving the site, developed vs. historic.

Sub-Basin P9

P9 needs to include all of the storm system flows entering the pond.

Sub-basin P9 is approximately 1.01 acres and consists of the existing private above ground full spectrum extended detention basin located on the east side of the property. Flows developed in this sub-basin generally travel south at 3:1 detention basin side slope. Flows are conveyed via existing concrete trickle channel to an existing private outlet control structure at DP D9. Flows are then conveyed through an existing outlet storm pipe into existing public storm infrastructure. In the event of a storm event exceeding the 100-year design, flows will be conveyed over the existing riprap emergency spillway and into the existing public CDOT Type C area inlet. Developed runoff during the 5-year and 100-year events are 0.09 cfs and 1.89 cfs respectively. The weighted imperviousness of sub-basin P9 is 1%.

OFF-SITE

The proposed project site will continue to receive some existing off-site flows as stated in the existing conditions in the Preliminary Drainage Report. These flows and design points are described in further detail below. Furthermore, these flows were already accounted for in the overall master design of the full spectrum extended detention basin.

Sub-Basin OP1

Sub-basin OP1 is the off-site portion of proposed sub-basin P9 and is the existing sub-basin C3 as described in the existing conditions of the preliminary drainage report. This sub-basin is approximately 0.06 acres and consists of existing landscape located on the northeast corner of the property. Flows developed in this sub-basin generally travel southwest at grades of approximately 2-5%. Flows are conveyed via an existing drainage swale that flows to the property line at DP OD1 through proposed sub-basin P9 and ultimately into the existing public CDOT Type C area inlet at DP D9. It is understood that these flows are not anticipated to discharge directly into the existing detention basin which is consistent with the existing design and runoff conditions. Developed runoff during the 5-year and 100-year events are less than 0.01 cfs and 0.13 cfs respectively. The weighted imperviousness of sub-basin OP1 is 0%.

Sub-Basin OP2

Sub-basin OP2 is the off-site portion of proposed sub-basin P2 and existing sub-basins B1 and B2 as described in the existing conditions of the preliminary drainage report. This sub-basin is approximately 0.03 acres and consists of existing landscape, asphalt road and sidewalk located the northeast corner of the site as part of the existing access to the site. Flows developed in this sub-basin that bypass the existing curb inlets generally travel south at grades of approximately 2-5%. Flows are conveyed via proposed curb and gutter to the property line at DP OD2 through existing sub-basin P2 and ultimately into the proposed private 5’ CDOT Type-R curb inlet at DP D2. The other off-site flows are captured in the existing curb inlets which convey and discharge into the existing private full spectrum extended detention basin. Developed runoff during the 5-year and 100-year events are 0.09 cfs and 0.19 cfs respectively. The weighted imperviousness of sub-basin OP1 is 67%.

Design Point OD3

Design Point OD3 accounts for the off-site flows that travel on-site from existing sub-basin D16 as described in the existing conditions and in the preliminary drainage report. It is understood that these flows are generated from the existing Pronghorn Meadows Subdivision (Filing No. 2). The existing flows travel via curb and gutter to an existing Public 8’ CDOT Type-R curb inlet and are then conveyed through an existing 24” culvert passing under Antelope Ridge Drive. Flows then enter the proposed site at DP OD3. Next, these flows are conveyed through the existing vegetated drainage swale which ultimately outfalls into the existing public CDOT Type C area inlet. These flows do not directly discharge into the existing full spectrum extended detention basin but rather are conveyed off-site through existing public stormwater infrastructure. Existing runoff conveyed to DP OD3 during the 5-year and 100-year events are 4.90 cfs and 10.70 cfs respectively.

DRAINAGE FACILITY DESIGN

DETENTION AND WATER QUALITY

The WQCV and 100-year detention is required for this Project. This is accomplished through the existing private Full Spectrum Extended Detention Basin on the east end of the Site. The existing private above ground Full Spectrum Extended Detention Basin was sized to provide WQ and detention for the Windermere Filing No. 2 sub-basin's tributary to the EDB (Existing Sub-Basins from the Preliminary Drainage Report and proposed Sub-Basins P1-P10, OP2) per UDFCD criteria. The water quality and detention calculations are provided in the Preliminary Drainage Report in the Appendix of this report. The existing EDB outfalls into existing public off-site stormwater infrastructure.

Four-Step Process

The four-step process per the MANUAL provides guidance and requirements for the selection of siting of structural Construction Control Measures (CCMs) for new development and significant redevelopment.

Step 1: Employ Runoff Reduction Practices
Currently the site is vacant over lot graded, seeded and mulched land with surrounding existing residential development. Development of the site will increase current runoff conditions due to increased imperviousness values. However, the detention basin was sized accordingly with an assumed future imperviousness of 68%. Furthermore, implementation the of landscaping throughout the site, the proposed storm sewer infrastructure, and the existing Full Spectrum Extended Detention Basin will help slow runoff and encourage infiltration.

Step 2: Provide Water Quality Capture Volume (WQCV)
The water quality capture volume is detained using the existing Full Spectrum Extended Detention Basin in the northwest corner of the Site. The outfall pipe together with the water quality outlet structure control the release of stormwater to less than historic rates.

Step 3: Stabilize Drainageways
There are no current drainageways conveyed through this property. No improvements to stabilize drainageways are a part of this Project.

Step 4: Consider need for Industrial and Commercial BMPs
Erosion control features for the final stages of the Project will be designed to reduce contamination. Source control BMPs will include the use of, inlet protection, silt fences, concrete washout areas, stockpile management, and stabilized staging areas. The Grading and Erosion Control Plans will be submitted as a separate construction document set.

Detention and Water Quality Design

The existing private on-site Full Spectrum Extended Detention Basin was designed with an outlet structure that is fitted with an interim orifice plat and restrictor plate to release the WQCV in a 40-hour time period per the MANUAL.

Calculations included in the Appendix provide details regarding the private water quality and detention basins design. The calculations include determination of the storage volumes required for full spectrum detention for the WQCV and 100 year detention and allowable release rates.

Per the Windermere Filing No. 2 South Pond Final Design Developed Condition Calculations. Overall, 0.235 acre-feet of WQCV is required, and 0.458 acre-feet of detention volume was required for the existing Extended Detention Basin. The total anticipated area contributing to the Extended Detention Basin consisted of 12.79 acres (54.9% imperviousness). The outlet structure and orifice releases approximately 0.3 cfs in the 5-year event and 10.6 cfs in the 100-year event. This is less than the historic flows in the 5-year and 100-year event.

Include historic flows here.

Outlet Requirements

The water quality standards established by the CRITERIA are met by the existing private on-site Full Spectrum Extended Detention Basin. The water quality outlet structure was designed per the specifications in the CRITERIA. The outlet structure for the Extended Detention Basin meets the micro-pool requirement that it be integrated into the design of the structure with an additional initial surcharge volume. The orifice plates of the structures were designed based on the CRITERIA. The orifice plates will allow the WQCV to be drained from the structure in 40 hours for the Extended Detention Basin. The calculations for the design of the outlet structure is presented in the **Appendix**.

Channel Design and Soil Erodibility

Please discuss for whole site, not just EDB.

An existing concrete lined trickle channel within the basin was designed per the MANUAL. A forebay structure is located at the upstream entrances to the Extended Detention Base. The forebay structure was designed per the MANUAL. Pond as-builts are included in the **Appendix**.

Emergency Spillway Path

The emergency overflow from the existing private on-site Full Spectrum Extended Detention Basin was designed to follow historic drainage patterns and spill over the southeast side of the Extended Detention Basin to the existing public CDOT Type C area inlet into existing public stormwater infrastructure.

COST OF PROPOSED DRAINAGE INFRASTRUCTURE

An Engineers Opinion of Probable Construction Cost (EOPCC) is provided in this submittal package. There are no public drainage facilities. All improvements with this Project will be private. The improvements are detailed in the Financial Assurance Estimate Form.

DRAINAGE AND BRIDGE FEES

The Site is located in the Sand Creek Drainage Basin. The total acreage of the parcel (PID: 5329416011) is approximately ±9.22 acres. The proposed site imperviousness is 51%. The total drainage fees due for the Site is outlined below.

	2024 Fees ($ / Impervious acre)	Total Site Area (Acre)	X	Site Imperviousness	=	Impervious Area (Acre)	Amount Due ($)
Drainage Fee	$25,632	9.22		0.51		4.70	$120,526.79
				Total amount due:			**$120,526.79**

Please include bridge fees.

GRADING AND EROSION CONTROL

The GEC plans will be submitted to El Paso County Planning and Community Development Department for review and approval prior to construction. The GEC plans are consistent with this drainage report.

MAINTENANCE AND OPERATIONS

Twice per year inspections (spring and fall) of the stormwater detention and water quality structures are recommended. The owner/operator will be responsible for maintenance. A copy of this report will be provided to the owner/operator. This satisfies the EDB Operation and Maintenance (O&M) Manual.

OTHER GOVERNMENT AGENCY REQUIREMENTS

Approval from other agencies such as the FEMA, the Army Corps of Engineers, Colorado State Engineer, Colorado Water Conservation Board, and others are not needed with this Project.

SUMMARY

Ultimate outflow from the site occurs at the southeastern corner of the existing private on-site full spectrum extended detention basin. Existing and proposed flows enter the detention basin and are released at less than historic rates from the existing pond control structure through the existing 18" outfall pipe which connects to the existing public area inlet at the southeast corner of the site. Flows then enter the existing off-site stormwater network.

Per the preliminary drainage report, the existing detention basin design was based on a final build-out watershed imperviousness of 68%. The existing outlet structure has a release rate of 0.3 cfs and 10.6 cfs for the 5-year and 100-year storm events respectively. Under historic conditions, the sub-basin EX-A released at rates of 11.3 cfs and 28.2 cfs for the 5-year and 100-year storm events respectively. The proposed flows for the on-site sub basins is 18.25 cfs and 41.95 cfs for the 5-year and 100-year storm events respectively. These proposed flows are accounted for the in the design of the existing detention basin.

Doesn't match proposed drainage map.

Flows from pond outlet should compare to flows at DP6 not drainage basin EX-A.

COMPLIANCE WITH STANDARDS

The existing drainage design presented within this report conforms to the El Paso County Drainage Criteria Manual and the Mile High Flood District Urban Storm Drainage Criteria Manual. Additionally, the Site runoff and storm drain facilities will not adversely affect the downstream and surrounding developments. The proposed developed flows entering the Extended Detention Basin and are greater than the existing ultimate outfall of the site due to the greater imperviousness of the site, however the EDB design accounted for future development with associated higher imperviousness and implementation of the drainage basins will disperse the flow over an extended period of time therefore releasing at equal to or less than the historic rate.

REFERENCES

1. City of Colorado Springs Drainage Criteria Manual, May 2014.

2. El Paso County Drainage Criteria Manual, Vol. 1 and 2, October 1994.

3. Mile High Flood District Drainage Criteria Manual (MHFDCM), Vol. 1, prepared by Wright-McLaughlin Engineers, June 2001, with latest revisions.

4. Flood Insurance Rate Map, El Paso County, Colorado and Incorporated Areas, Map Number 08041C0543G, Effective Date December 7, 2018, prepared by the Federal Emergency Management Agency (FEMA).

APPENDIX

APPENDIX A - SOILS MAP AND FEMA FIRM PANEL

United States
Department of
Agriculture

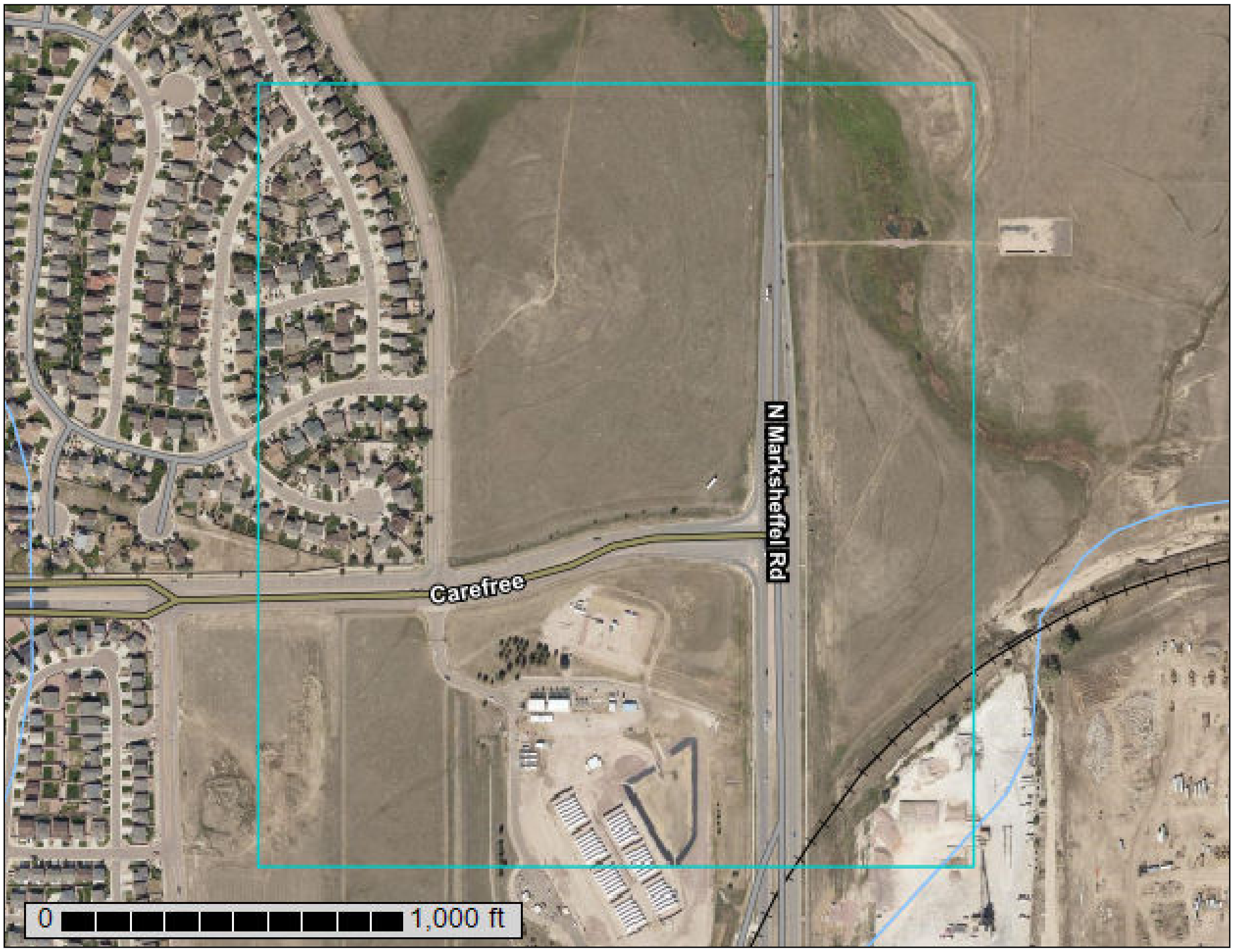
NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for

El Paso County Area, Colorado



August 23, 2024

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

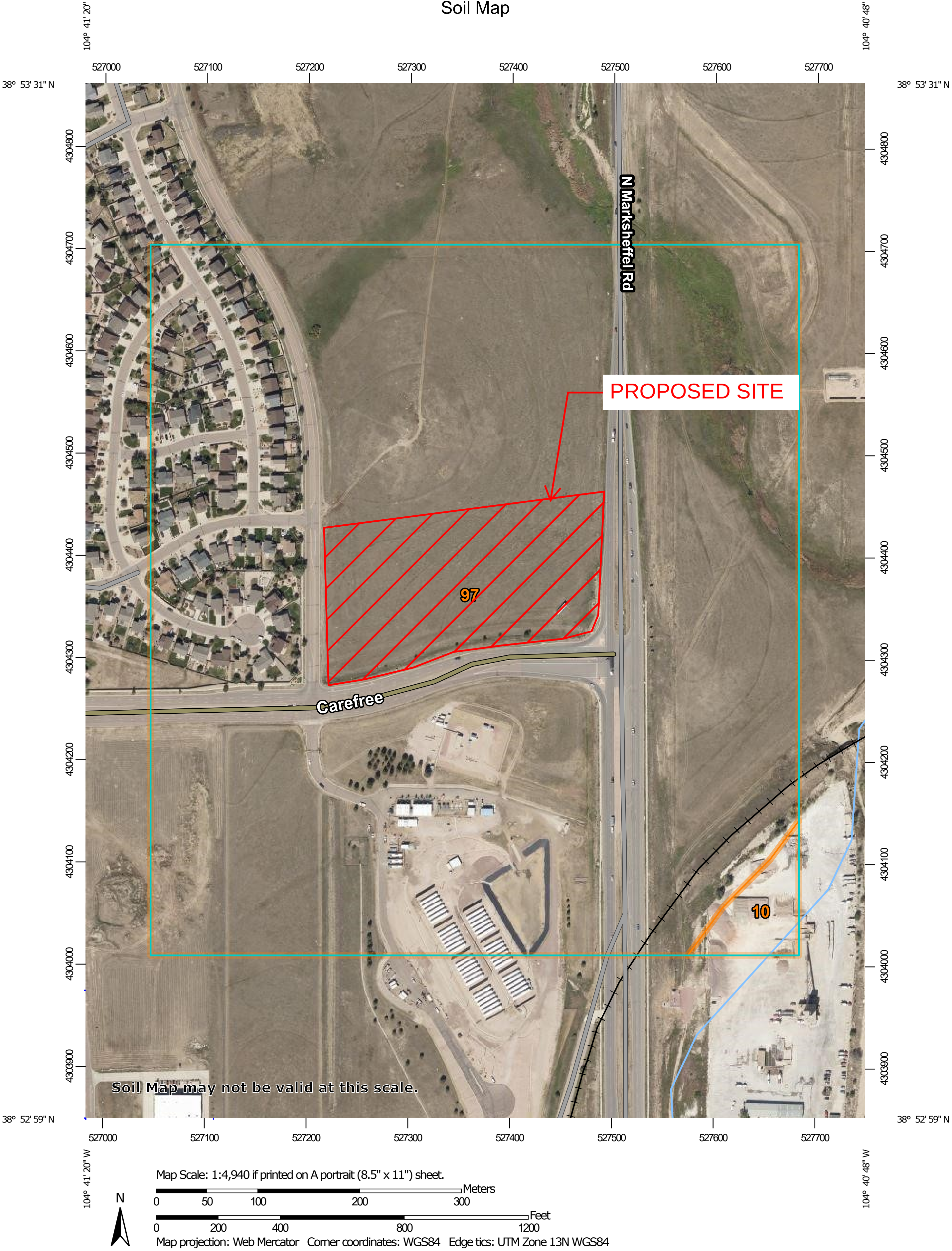
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map



Map Scale: 1:4,940 if printed on A portrait (8.5" x 11") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 21, Aug 24, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 19, 2018—Sep 23, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
10	Blendon sandy loam, 0 to 3 percent slopes	1.8	1.6%
97	Truckton sandy loam, 3 to 9 percent slopes	108.1	98.4%
Totals for Area of Interest		**109.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

El Paso County Area, Colorado

10—Blendon sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 3671
Elevation: 6,000 to 6,800 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Blendon and similar soils: 98 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blendon

Setting

Landform: Terraces, alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from arkose

Typical profile

A - 0 to 10 inches: sandy loam
Bw - 10 to 36 inches: sandy loam
C - 36 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Available water supply, 0 to 60 inches: Moderate (about 6.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

97—Truckton sandy loam, 3 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2x0j2
Elevation: 5,300 to 6,850 feet
Mean annual precipitation: 14 to 19 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 85 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Truckton and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Truckton

Setting

Landform: Interfluves, hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Re-worked alluvium derived from arkose

Typical profile

A - 0 to 4 inches: sandy loam
Bt1 - 4 to 12 inches: sandy loam
Bt2 - 12 to 19 inches: sandy loam
C - 19 to 80 inches: sandy loam

Properties and qualities

Slope: 3 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Maximum salinity: Nonsaline (0.1 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.6 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Blakeland

Percent of map unit: 8 percent
Landform: Interfluves, hillslopes
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Bresser

Percent of map unit: 7 percent
Landform: Interfluves, low hills
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

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NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

This map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

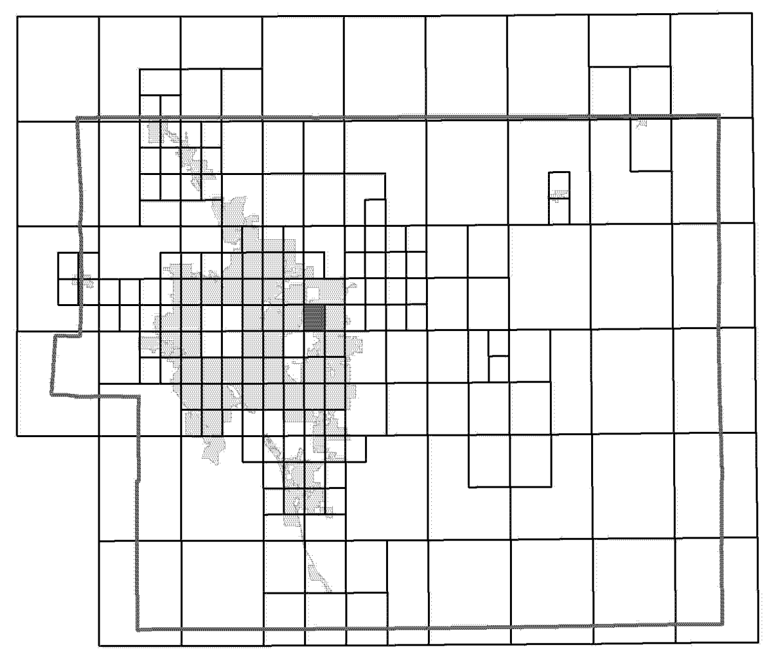
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

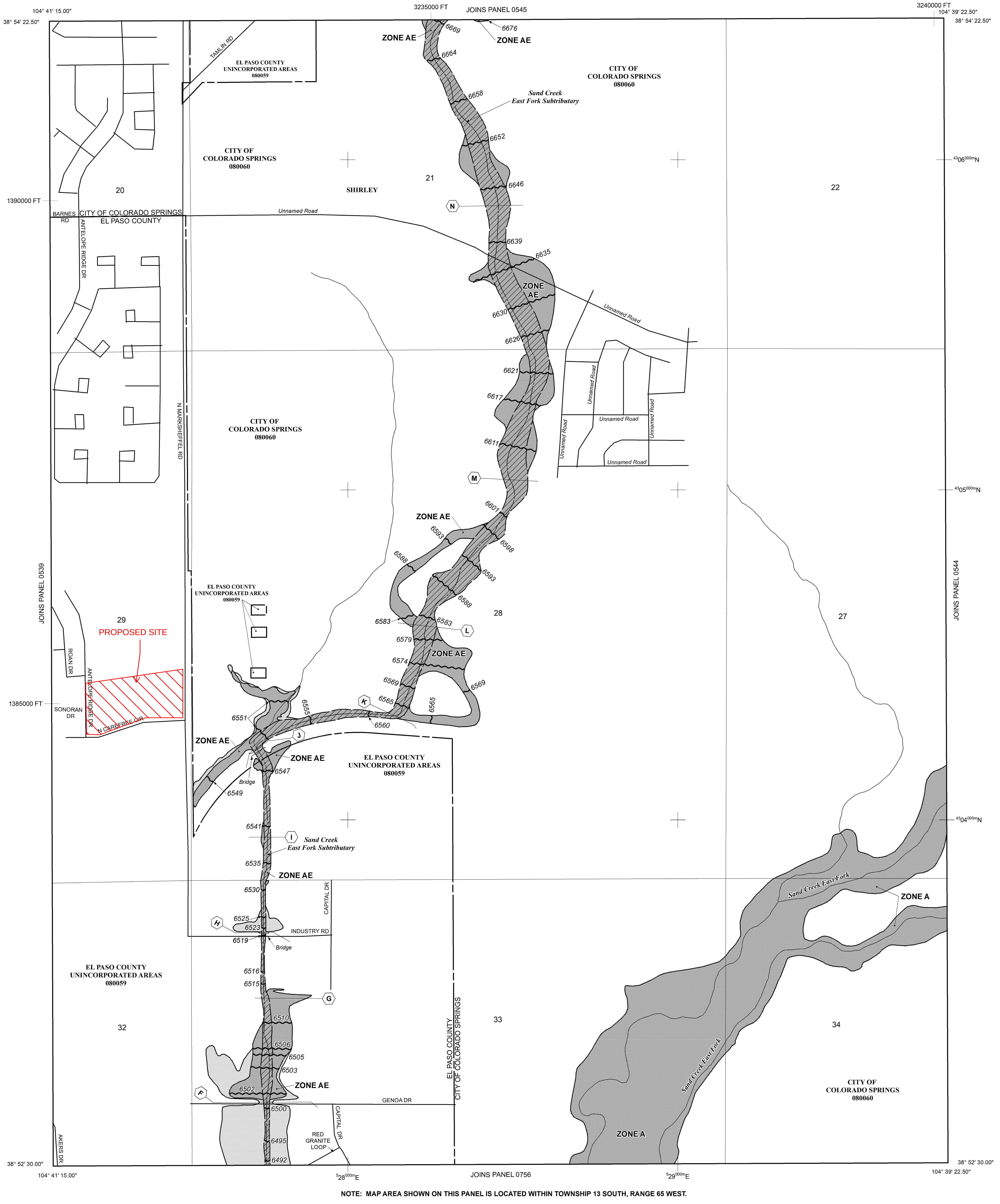
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 13 SOUTH, RANGE 65 WEST.

LEGEND

▨ SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

▨ FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

▨ OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

☐ OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

▨ COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

▨ OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

———————	Floodplain boundary
—— —— —	Floodway boundary
——— ———	Zone D Boundary
●●●●●●●●●●●●	CBRS and OPA boundary
▨ ←	Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
~~ 513 ~~	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

(A)———(A)	Cross section line
(23)--------(23)	Transect line
97° 07' 30.00" 32° 22' 30.00"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000mN	1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT	5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
● M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0543G

FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 543 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0543	G
EL PASO COUNTY	080059	0543	G

Notice: This map was reissued on 05/15/2020 to make a correction.This version replaces any previous versions. See the Notice-to-User Letter that accompanied this correction for details.

Notice to User: The **Map Number** shown below should be used when placing map orders: the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0543G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

APPENDIX B - HYDROLOGIC CALCULATIONS

EXISTING HYDROLOGIC CALCS FROM PDR USED FOR FDR

PROJECT INFORMATION

PROJECT: Windermere 2
PROJECT NO: 21187-03
DESIGN BY: KGV
REV. BY: TDM
AGENCY: El Paso County
REPORT TYPE: Preliminary
DATE: 6/5/2024

Update to the final version of the PDR that was submitted with all comments addressed.

ell & Co.

Soil Type: A

	C2*	C5*	C10*	C100*	% IMPERV
Landscape/Lawn		0.15		0.50	0
Residential (<1/8 acre)		0.45		0.59	65
Asphalt/Sidewalk		0.90		0.96	100

PROPOSED

SUB-BASIN	SURFACE DESIGNATION	AREA	COMPOSITE RUNOFF COEFFICIENTS				% IMPERV
		ACRE	C2	C5	C10	C100	
A1	Landscape/Lawn	0.06		0.15		0.50	0
	Residential (<1/8 acre)	6.69		0.45		0.59	65
	Asphalt/Sidewalk	0.04		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL A1		6.79					
A2	Landscape/Lawn	0.88		0.15		0.50	0
	Residential (<1/8 acre)	0.00		0.45		0.59	65
	Asphalt/Sidewalk	0.03		0.90		0.96	100
	WEIGHTED AVERAGE			0.18		0.52	4%
TOTAL A2		0.92					
			POND				
P1	Landscape/Lawn	1.00		0.15		0.50	0
	Residential (<1/8 acre)	0.00		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.15		0.50	0%
TOTAL P1		1.00					
			OFFSITE				
B1	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	3.33		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL B1		3.33					
B2	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	0.49		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL B2		0.49					
B4	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	0.16		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL B4		0.16					

Tributary to Pond		**12.70**					**55.0%**
D16	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	2.73		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL D16		2.73					
NC2	Landscape/Lawn	0.27		0.15		0.50	0
	Residential (<1/8 acre)	0.00		0.45		0.59	65
	Asphalt/Sidewalk	1.34		0.90		0.96	100
	WEIGHTED AVERAGE			0.77		0.88	83%
TOTAL NC2		1.61					
EXR	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	0.00		0.45		0.59	65
	Asphalt/Sidewalk	0.53		0.90		0.96	100
	WEIGHTED AVERAGE			0.90		0.96	100%
TOTAL EXR		0.53					
C3	Landscape/Lawn	0.63		0.15		0.50	0
	Residential (<1/8 acre)	0.00		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.15		0.50	0%
TOTAL C3		0.63					
NC1	Landscape/Lawn	0.03		0.15		0.50	0
	Residential (<1/8 acre)	0.00		0.45		0.59	65
	Asphalt/Sidewalk	0.40		0.90		0.96	100
	WEIGHTED AVERAGE			0.85		0.93	93%
TOTAL NC1		0.43					

PROJECT INFORMATION

PROJECT: Windermere 2
PROJECT NO: 21187-03
DESIGN BY: KGV
REV. BY: TDM
AGENCY: El Paso County
REPORT TYPE: Preliminary
DATE: 6/5/2024

Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

PROPOSED **TIME OF CONCENTRATION STANDARD FORM SF-2**

SUB-BASIN DATA					INITIAL/OVERLAND TIME (t_i)				TRAVEL TIME (t_t)					PIPE TRAVEL TIME (t_p)				TIME OF CONC. t_c		FINAL t_c
BASIN	DESIGN PT:	C_5	C_{100}	AREA	LENGTH	HT	SLOPE	t_i	LENGTH	HT	SLOPE	VEL.	t_t	LENGTH	SLOPE	VEL.	t_t	COMP.	MINIMUM	
				Ac	Ft	FT	%	Min	Ft	FT	%	FPS	Min	Ft	%	FPS	Min	t_c	t_c	**Min**
A1	1	0.45	0.59	6.79	100	2	3.0	8.4	855	21	3.7	10.1	1.4					9.8	5	**9.8**
B1		0.45	0.59	3.33	35	1	3.5	4.7	885	30	3.4	10.8	1.4					6.1	5	**6.1**
B2		0.45	0.59	0.49	50	2	4.0	5.4	725	20	2.8	9.8	1.2					6.6	5	**6.6**
B1+B2	2	0.45	0.59	3.82	From Basin B1			6.1						212	0.5	5.1	0.7	6.8	5	**6.8**
B4		0.45	0.59	0.16	50	17	33.3	2.7	185	3	1.5	4.0	0.8					3.4	5	**5.0**
P1		0.15	0.50	1.00	100	1	1.0	17.8	205	10	4.8	12.8	0.3					18.0	5	**18.0**
DP1+DP2+B4+P1	3	0.42	0.58	11.78	From Design Point 1			9.8	250	2.5	1.0	4.0	1.0					10.9	5	**10.9**
D16	4	0.45	0.59	2.73	200	10	5.0	10.1	350	12	3.5	6.5	0.9					11.0	5	**11.0**
A2		0.18	0.52	0.92	50	10	5.9	6.7	992	25	3.3	8.5	1.9					8.7	5	**8.7**
NC2	19	0.77	0.88	1.61	50	2	4.0	2.7	1340	35	2.6	9.4	2.4					5.1	5	**5.1**
EXR		0.90	0.96	0.53	20	2	10.0	0.8	320	6	2.0	4.9	1.1					1.9	5	**5.0**
C3		0.15	0.50	0.63	60	12	20.0	5.1	455	15	3.3	5.6	1.4					6.4	5	**6.4**
EXR+C3+DP6+A2	S	0.41	0.61	4.81	From Design Point 6			11.0						850	3.0	11.8	1.2	12.2	5	**12.2**
DP19+DPS	J1	0.50	0.67	6.42	From Design Point S			12.2						100	1.0	5.9	0.3	12.4	5	**12.4**
NC1		0.85	0.93	0.43	45	1	2.2	2.4	185	4	2.2	8.7	0.4					2.8	5	**5.0**
DPJ1+NC1	20	0.52	0.69	6.85	From Design Point J1			12.4						50	1.0	8.4	0.1	12.5	5	**12.5**

PROJECT INFORMATION

Drexel, Barrell & Co.

PROJECT:	Windermere 2
PROJECT NO:	21187-03
DESIGN BY:	KGV
REV. BY:	TDM
AGENCY:	El Paso County
REPORT TYPE:	Preliminary
DATE:	6/5/2024

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

PROPOSED **RUNOFF** **5 YR STORM** **P1=** **1.50**

			DIRECT RUNOFF				
BASIN (S)	**DESIGN POINT**	**AREA (AC)**	**RUNOFF COEFF**	**t_c (MIN)**	**C * A**	**I (IN/HR)**	**Q (CFS)**
A1	1	6.79	0.45	9.8	3.06	4.13	**12.6**
B1		3.33	0.45	6.1	1.50	4.84	**7.2**
B2		0.49	0.45	6.6	0.22	4.72	**1.0**
B1+B2	2	3.82	0.45	6.8	1.72	4.68	**8.1**
B4		0.16	0.45	5.0	0.07	5.10	**0.4**
P1		1.00	0.15	18.0	0.15	3.17	**0.5**
DP1+DP2+B4+P1	3	11.78	0.42	10.9	5.00	3.97	**19.8**
D16	4	2.73	0.45	11.0	1.23	3.96	**4.9**
A2		0.92	0.18	8.7	0.16	4.32	**0.7**
NC2	19	1.61	0.77	5.1	1.25	5.08	**6.3**
EXR		0.53	0.90	5.0	0.48	5.10	**2.4**
C3		0.63	0.15	6.4	0.09	4.76	**0.5**
Pond Release	P						**0.3**
EXR+C3+DP5+POND RELEASE	S	4.81	0.41	12.2	1.96	3.80	**7.8**
DP19+DPS	J1	6.42	0.50	12.4	3.21	3.76	**12.4**
NC1		0.43	0.85	5.0	0.36	5.10	**1.9**
DPJ1+NC1	20	6.85	0.52	12.5	3.57	3.75	**13.7**

PROJECT INFORMATION

PROJECT:	Windermere 2
PROJECT NO:	21187-03
DESIGN BY:	KGV
REV. BY:	TDM
AGENCY:	El Paso County
REPORT TYPE:	Preliminary
DATE:	6/5/2024

Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

PROPOSED **RUNOFF** **100 YR STORM** **P1=** 2.52

			DIRECT RUNOFF				
BASIN (S)	**DESIGN POINT**	**AREA (AC)**	**RUNOFF COEFF**	**t_c (MIN)**	**C * A**	**I (IN/HR)**	**Q (CFS)**
A1	1	6.79	0.59	9.8	4.02	6.93	**27.9**
B1		3.33	0.59	6.1	1.96	8.12	**16.0**
B2		0.49	0.59	6.6	0.29	7.92	**2.3**
B1+B2	2	3.82	0.59	6.8	2.25	7.87	**17.7**
B4		0.16	0.59	5.0	0.09	8.58	**0.8**
P1		1.00	0.50	18.0	0.50	5.33	**2.7**
DP1+DP2+B4+P1	3	11.78	0.58	10.9	6.87	6.67	**45.8**
D16	4	2.73	0.59	11.0	1.61	6.65	**10.7**
A2		0.92	0.52	8.7	0.48	7.26	**3.4**
NC2	19	1.61	0.88	5.1	1.42	8.54	**12.1**
EXR		0.53	0.96	5.0	0.51	8.58	**4.4**
C3		0.63	0.50	6.4	0.32	8.00	**2.5**
Pond Release	P						**10.6**
EXR+C3+DP5+POND RELEASE	S	4.81	0.61	12.2	2.91	6.38	**29.2**
DP19+DPS	J1	6.42	0.67	12.4	4.33	6.32	**38.0**
NC1		0.43	0.93	5.0	0.40	8.58	**3.4**
DPJ1+NC1	20	6.85	0.69	12.5	4.73	6.29	**40.4**

Kimley»Horn

STANDARD FORM SF-1
PROPOSED RUNOFF COEFFICIENTS - IMPERVIOUS CALCULATION

PROJECT NAME: Windermere Filing No. 2
DATE: 8/22/2024
PROJECT NUMBER: 196160000
CALCULATED BY: DPM
CHECKED BY: NMB

SOIL: Type A

LAND USE:	PAVEMENT AREA	ROOF AREA	LANDSCAPE AREA	TYPE AREA
2-YEAR COEFF.	0.89	0.71	0.02	
5-YEAR COEFF.	0.90	0.73	0.08	
10-YEAR COEFF.	0.92	0.75	0.15	
100-YEAR COEFF.	0.96	0.81	0.35	
IMPERVIOUS %	100%	90%	0%	

DESIGN BASIN	DESIGN POINT	PAVEMENT AREA (AC)	ROOF AREA (AC)	LANDSCAPE AREA (AC)	TYPE AREA (AC)	TOTAL AREA (AC)	C(2)	C(5)	C(10)	C(100)	Imp %
On-Site Basins											
P1	D1	0.41	0.16	0.35		**0.92**	0.53	0.56	0.60	0.70	60%
P2	D2	0.46	0.24	0.34		**1.04**	0.56	0.59	0.63	0.73	65%
P3	D3	0.43	0.51	0.17		**1.11**	0.67	0.70	0.72	0.80	80%
P4	D4	0.47	0.49	0.06		**1.02**	0.75	0.77	0.79	0.85	89%
P5	D5	0.05	0.00	0.32		**0.37**	0.14	0.19	0.25	0.43	14%
P6	D6	0.67	0.87	0.22		**1.76**	0.69	0.71	0.74	0.81	83%
P7	D7	0.07	0.00	0.22		**0.29**	0.23	0.28	0.34	0.50	24%
P8	D8	0.10	0.00	1.60		**1.70**	0.07	0.13	0.20	0.39	6%
P9	D9	0.01	0.00	1.00		**1.01**	0.03	0.09	0.16	0.36	1%
BASIN SUBTOTAL		**2.67**	**2.27**	**4.28**	**0.00**	**9.22**	**0.44**	**0.48**	**0.52**	**0.64**	**51%**
		29%	**25%**	**46%**	**0%**	**100%**					
Off-Site Basins											
OP1	OD1	0.00	0.00	0.06		**0.06**	0.02	0.08	2.19	0.35	0%
OP2	OD2	0.02	0.00	0.01		**0.03**	0.60	0.63	0.01	0.76	67%
BASIN SUBTOTAL		**0.02**	**0.00**	**0.07**	**0.00**	**0.09**	**0.21**	**0.26**	**0.24**	**0.49**	**22%**
		22%	**0%**	**78%**	**0%**	**100%**					

Kimley»Horn

STANDARD FORM SF-2
Proposed Time of Concentration

PROJECT NAME: **Windermere Filing No. 2**
PROJECT NUMBER: **196160000**
CALCULATED BY: **DPM**
CHECKED BY: **NMB**

DATE: 8/22/2024

SUB-BASIN DATA			INITIAL TIME (T_i)			TRAVEL TIME (T_t)					Tc CHECK (URBANIZED BASINS)					FINAL Tc
DESIGN BASIN (1)	AREA Ac (2)	C5 (3)	LENGTH Ft (4)	SLOPE % (5)	T_i Min. (6)	LENGTH Ft. (7)	SLOPE % (8)	C_v (9)	VEL fps (11)	T_t Min. (12)	COMP. tc (13)	TOTAL LENGTH (14)	TOTAL SLOPE (15)	TOTAL IMP. (16)	Tc Min. (17)	Min.
On-Site Basins																
P1	0.920	0.558	100	1.5%	8.7	175	2.2%	20.0	3.0	1.0	9.7	275	1.9%	60%	17.6	9.7
P2	1.040	0.593	79	2.4%	6.2	132	1.9%	20.0	2.8	0.8	7.0	211	2.1%	65%	16.3	7.0
P3	1.110	0.696	73	1.3%	5.8	232	1.8%	20.0	2.7	1.4	7.2	305	1.7%	80%	14.3	7.2
P4	1.020	0.770	87	1.2%	5.3	254	1.8%	20.0	2.7	1.6	6.9	341	1.6%	89%	12.9	6.9
P5	0.370	0.191	31	2.5%	6.8	171	1.5%	7.0	0.9	3.3	10.2	202	1.7%	14%	26.1	10.2
P6	1.760	0.713	66	2.0%	4.6	439	4.5%	20.0	4.2	1.7	6.3	505	4.2%	83%	14.0	6.3
P7	0.290	0.278	58	15.0%	4.7	145	1.0%	7.0	0.7	3.5	8.1	203	5.0%	24%	23.1	8.1
P8	1.700	0.128	100	2.3%	13.5	1,117	6.0%	7.0	1.7	10.9	24.4	1217	5.7%	6%	33.7	24.4
P9	1.010	0.088	100	2.5%	13.7	286	2.7%	7.0	1.2	4.1	17.8	386	2.6%	1%	30.2	17.8
Off-Site Basins																
OP1	0.06	0.08	100	3.0%	13.0	3	2.5%	7.0	1.1	0.0	13.0	103	3.0%		27.1	13.0
OP2	0.03	0.63	35	2.5%	3.8	46	2.0%	20.0	2.8	0.3	4.1	81	2.2%	67%	15.2	5.0

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_o^{0.33}}$$

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$

$$t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

Kimley»Horn

STANDARD FORM SF-3
PROPOSED STORM DRAINAGE DESIGN - RATIONAL METHOD 5 YEAR EVENT

PROJECT NAME: Windermere Filing No. 2
PROJECT NUMBER: 1.96E+08
CALCULATED BY: DPM
CHECKED BY: NMB

P_1 (1-Hour Rainfall) = 1.5

DATE: 8/22/2024

		DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
STORM LINE	DESIGN POINT	DESIGN BASIN	AREA (AC)	RUNOFF COEFF	tc (min)	C*A(ac)	I (in/hr)	Q (cfs)	tc(max)	S(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCIT Y	tt (min)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
On-Site Basins																					
	D1	P1	0.92	0.53	9.66	0.49	4.11	2.00													
	D2	P2	1.04	0.56	6.97	0.59	4.62	2.71													
	D3	P3	1.11	0.67	7.24	0.75	4.56	3.41													
	D4	P4	1.02	0.75	6.89	0.77	4.64	3.56													
	D5	P5	0.37	0.14	10.16	0.05	4.03	0.21													
	D6	P6	1.76	0.69	6.29	1.22	4.77	5.81													
	D7	P7	0.29	0.23	8.11	0.07	4.39	0.29													
	D8	P8	1.70	0.07	24.35	0.12	2.65	0.32													
	D9	P9	1.01	0.03	17.81	0.03	3.13	0.09													
Off-Site Basins																					
	OD1	OP1	0.06	0.02	13.01	0.00	3.63	0.00													
	OD2	OP2	0.03	0.60	5.00	0.02	5.09	0.09													

Kimley»Horn

STANDARD FORM SF-3
PROPOSED STORM DRAINAGE DESIGN - RATIONAL METHOD 100 YEAR EVENT

PROJECT NAME: Windermere Filing No. 2
DATE: 8/22/2024
PROJECT NUMBER: 1.96E+08
P_1 (1-Hour Rainfall) = 2.52
CALCULATED BY: DPM
CHECKED BY: NMB

STORM LINE		DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
			DESIGN BASIN	AREA (AC)	RUNOFF COEFF	tc (min)	C*A(ac)	I (in/hr)	Q (cfs)	tc(max)	S(C*A) (ac)	I (in/hr)	Q (cfs)	SLOPE (%)	STREET FLOW(cfs	DESIGN FLOW(cfs)	SLOPE (%)	PIPE SIZE (in)	LENGTH (ft)	VELOCIT Y	tt (min)	
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
On-Site Basins																						
		D1	P1	0.92	0.70	9.66	0.65	6.91	4.46													
		D2	P2	1.04	0.73	6.97	0.76	7.76	5.86													
		D3	P3	1.11	0.80	7.24	0.89	7.66	6.79													
		D4	P4	1.02	0.85	6.89	0.87	7.79	6.77													
		D5	P5	0.37	0.43	10.16	0.16	6.77	1.08													
		D6	P6	1.76	0.81	6.29	1.42	8.01	11.41													
		D7	P7	0.29	0.50	8.11	0.14	7.37	1.06													
		D8	P8	1.70	0.39	24.35	0.66	4.46	2.92													
		D9	P9	1.01	0.36	17.81	0.36	5.26	1.89													
Off-Site Basins																						
		OD1	OP1	0.06	0.35	13.01	0.02	6.11	0.13													
		OD2	OP2	0.03	0.76	5.00	0.02	8.55	0.19													

Kimley»Horn

PROJECT NAME: Windermere Filing No. 2
DATE: 10/14/2024
PROJECT NUMBER: 196160000
CALCULATED BY: DPM
CHECKED BY: NMB

PROPOSED RATIONAL CALCULATIONS SUMMARY

DESIGN POINT	TRIBUTARY BASINS	TRIBUTARY AREA (AC)	PEAK FLOWS (CFS)	
			Q5	Q100
On-Site Basins				
D1	P1	0.92	2.00	4.46
D2	P2	1.04	2.71	5.86
D3	P3	1.11	3.41	6.79
D4	P4	1.02	3.56	6.77
D5	P5	0.37	0.21	1.08
D6	P6	1.76	5.81	11.41
D7	P7	0.29	0.29	1.06
D8	P8	1.70	0.32	2.92
D9	P9	1.01	0.09	1.89
TOTAL		**9.22**	**18.39**	**42.25**
Off-Site Basins				
OD1	OP1	0.06	0.00	0.13
OD2	OP2	0.03	0.09	0.19
OD3	D16 (EX.)	2.73	4.90	10.70
TOTAL		**2.82**	**5.00**	**11.02**

APPENDIX C - HYDRAULIC CALCULATIONS

Hydraulic calculations to be provided on subsequent submittals

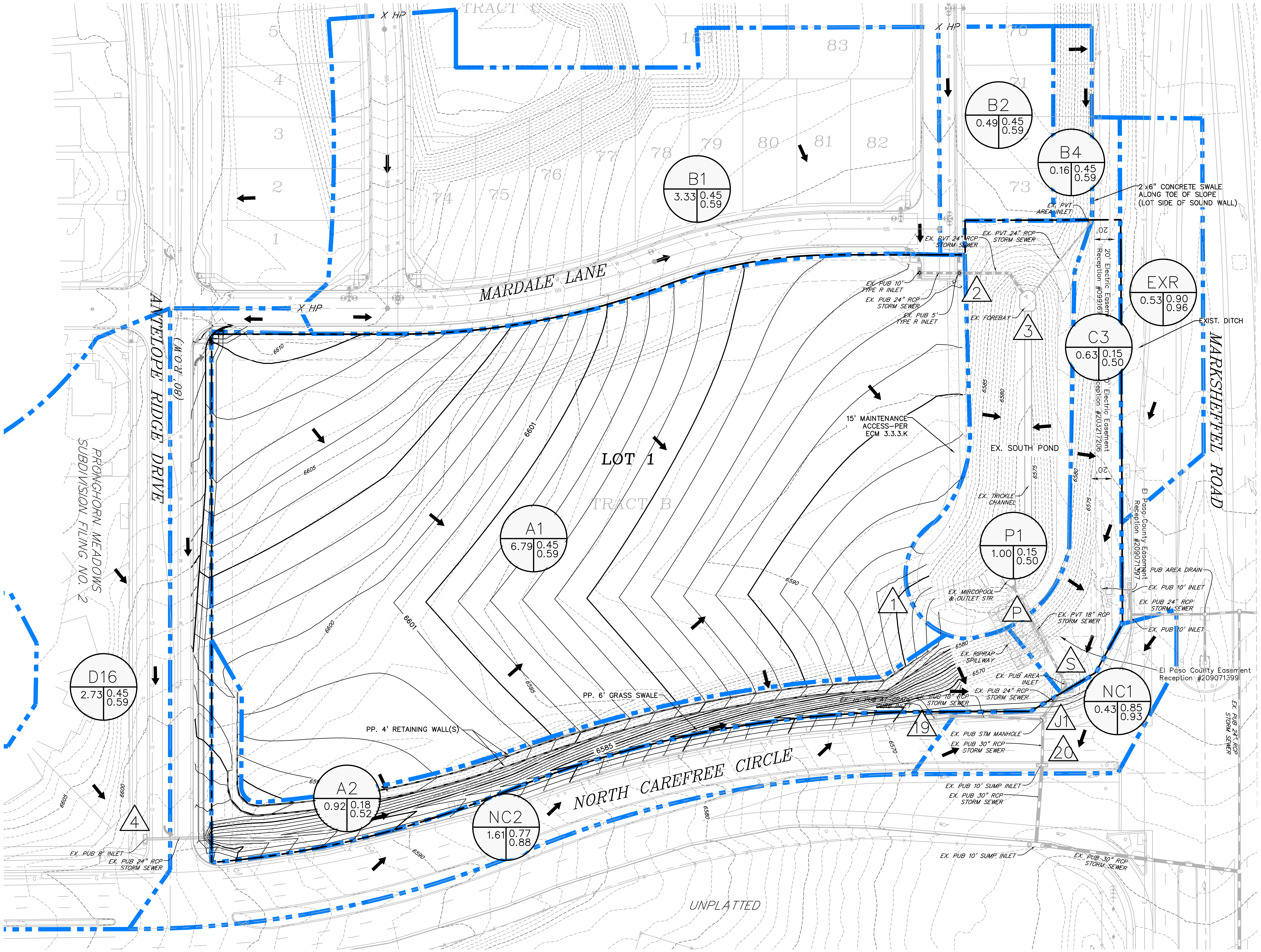
will review with next submittal

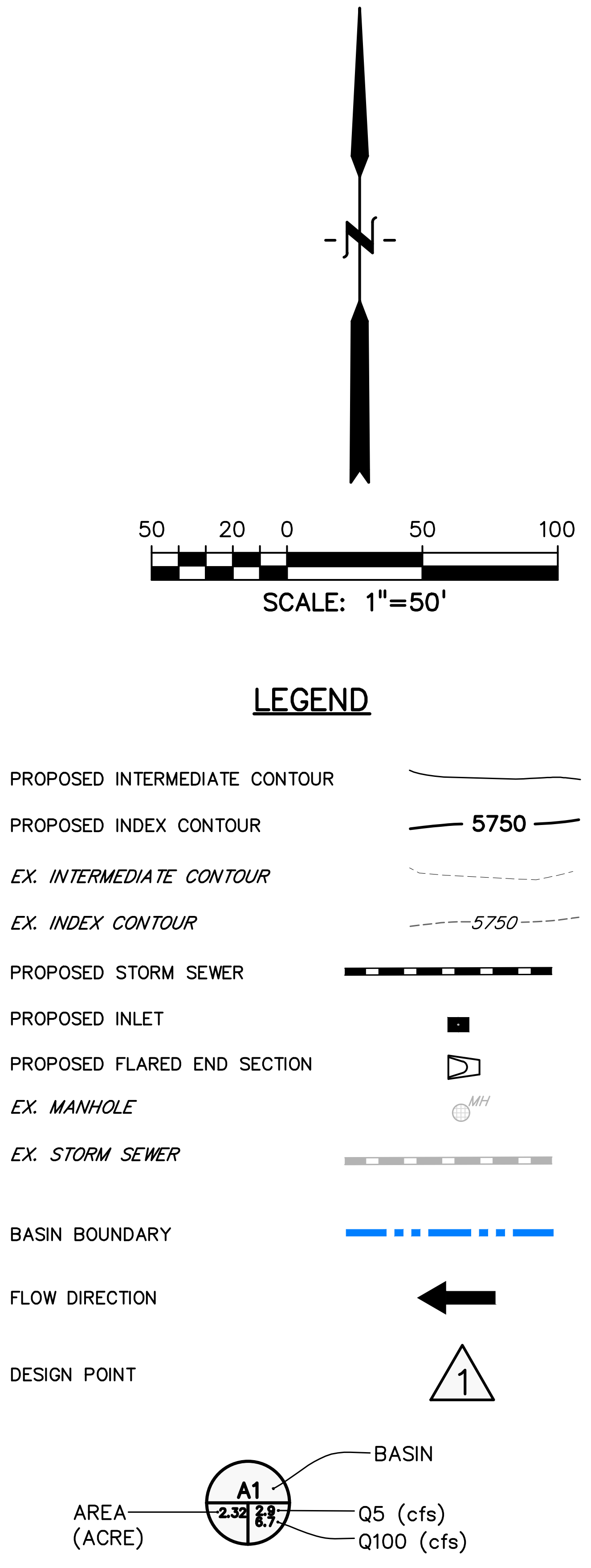
APPENDIX D - EXISTING AND PROPOSED DRAINAGE MAP

Please move maps to the end of the report

EXISTING CONDITIONS DRAINAGE MAP USED FOR THIS FDR

Update to latest PDR submitted with all engineering comments addressed.





BASIN	AREA (AC)	Q5 (cfs)	Q100 (cfs)
A1	6.79	12.6	27.9
B1	3.33	7.2	16.0
B2	0.49	1.0	2.3
B4	0.16	0.4	0.8
P1	1.00	0.5	2.7
D16	2.73	4.9	10.7
A2	0.92	0.7	3.4
NC2	1.61	6.3	12.1
EXR	0.53	2.4	4.4
C3	0.63	0.5	2.5
Pond Release	1.00	0.3	10.6
NC1	0.43	1.9	3.4

DP	AREA (AC)	Q5 (cfs)	Q100 (cfs)
1	6.79	12.6	27.9
2	3.82	8.1	17.7
3	11.78	19.8	45.8
19	1.61	6.3	12.1
4	2.73	4.9	10.7
P	1.00	0.3	10.6
S	4.81	7.8	29.2
J1	6.42	12.4	38.0
20	6.85	13.7	40.4

COUNTY FILE NO.: SP223

PREPARED BY:

DREXEL, BARRELL & CO.
Engineers • Surveyors
101 SAHWATCH ST. STE 100
COLORADO SPGS, COLORADO 80903
CONTACT: TIM D. McCONNELL, P.E.
(719)260-0887
COLORADO SPRINGS • LAFAYETTE

CLIENT:

COLO WINDERMERE #2, LLC
4164 AUSTIN BLUFFS PWY, #361
COLORADO SPRINGS, CO 80918
(719) 200-9594
CONTACT: JAMES TODD STEPHENS

DRAINAGE PLANS FOR
WINDERMERE FILING 2
N. MARKSHEFFEL ROAD
EL PASO COUNTY, COLORADO

ISSUE	DATE
INITIAL ISSUE	4/1/22
REVISED	8/2/24

DESIGNED BY: KGV
DRAWN BY: KGV
CHECKED BY: TDM
FILE NAME:

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF DREXEL, BARRELL & CO.

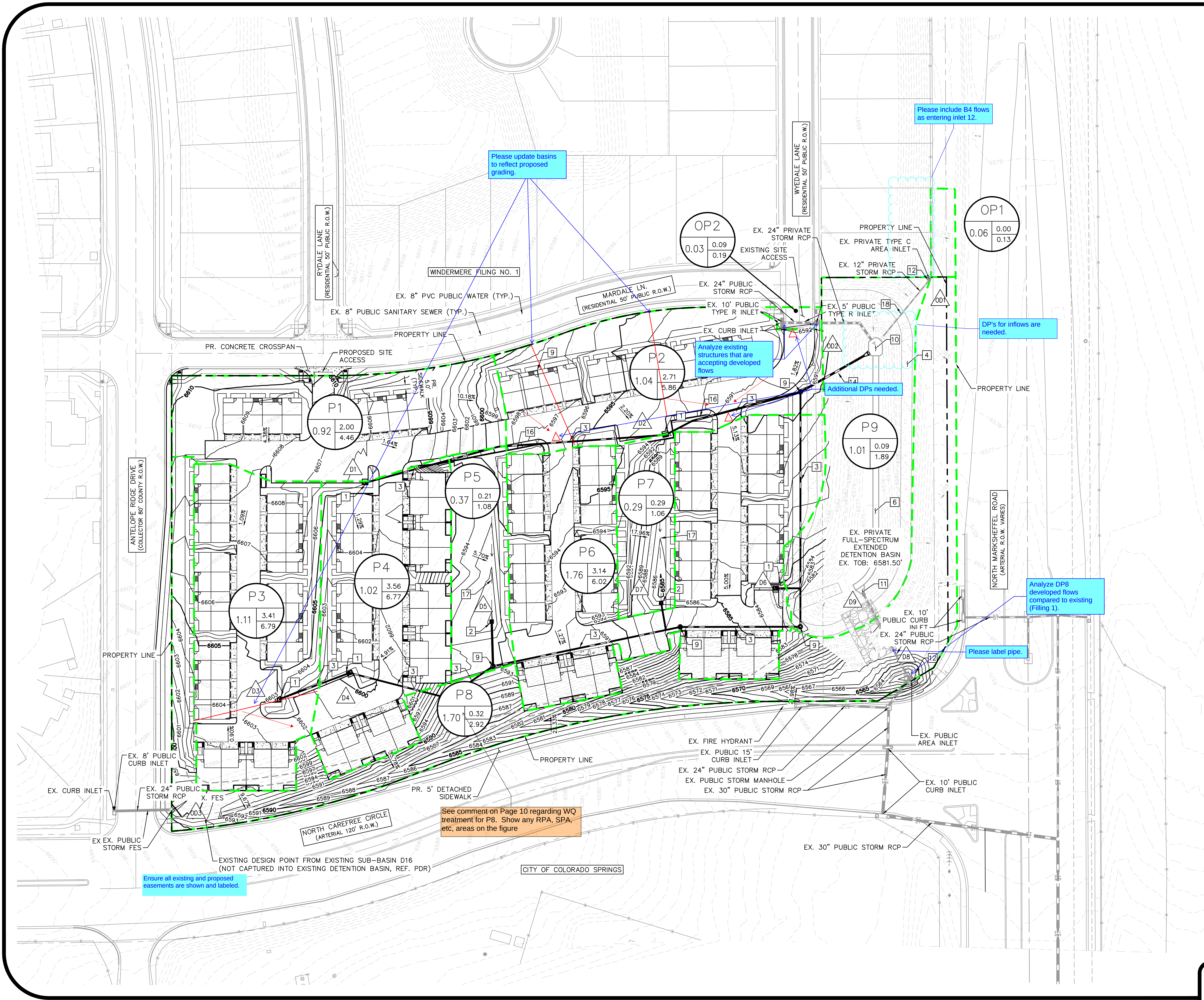
DRAWING SCALE:
HORIZONTAL: 1" = 50'
VERTICAL: N/A

PROPOSED DRAINAGE MAP

PROJECT NO. 21187-03CSCV
DRAWING NO.

DR

SHEET: 1 OF 1



Please update basins to reflect proposed grading.

Please include B4 flows as entering inlet 12.

DP's for inflows are needed.

Analyze existing structures that are accepting developed flows

Additional DPs needed.

Analyze DP8 developed flows compared to existing (Filing 1).

Please label pipe.

See comment on Page 10 regarding WQ treatment for P8. Show any RPA, SPA, etc, areas on the figure

Ensure all existing and proposed easements are shown and labeled.

Date: November 08, 2024 – 12:04pm / User: maria.langer
Path: K:\COS_LA\196160000 – Windemere\CADD\Drainage\Proposed Conditions Drainage Map_On-Site.dwg

LEGEND

— — — —	PROPERTY LINE
— XXXX —	EX. MAJOR CONTOUR
- - XXXX - -	EX. MINOR CONTOUR
— **XXXX** —	PR. MAJOR CONTOUR
— XXXX —	PR. MINOR CONTOUR
🟩 🟩 🟩	PR. DRAINAGE BASIN BOUNDARY
A / B / C / D	A = BASIN DESIGNATION B = AREA IN ACRES C = 5–YR RUNOFF D = 100–YR RUNOFF
△ #	# = DESIGN POINT DESIGNATION
X.XX% →	EXISTING SLOPE ARROW
X.XX% →	PROPOSED SLOPE ARROW

Kimley»Horn

PROJECT NAME: Windermere Filing No. 2
DATE: 10/14/2024
PROJECT NUMBER: 196160000
CALCULATED BY: DPM
CHECKED BY: NMB

PROPOSED RATIONAL CALCULATIONS SUMMARY

DESIGN POINT	TRIBUTARY BASINS	TRIBUTARY AREA (AC)	PEAK FLOWS (CFS)	
			Q5	Q100
On-Site Basins				
D1	P1	0.92	2.00	4.46
D2	P2	1.04	2.71	5.86
D3	P3	1.11	3.41	6.79
D4	P4	1.02	3.56	6.77
D5	P5	0.37	0.21	1.08
D6	P6	1.76	5.81	11.41
D7	P7	0.29	0.29	1.06
D8	P8	1.70	0.32	2.92
D9	P9	1.01	0.09	1.89
TOTAL		**9.22**	**18.39**	**42.25**
Off-Site Basins				
OD1	OP1	0.06	0.00	0.13
OD2	OP2	0.03	0.09	0.19
OD3	D16 (EX.)	2.73	4.90	10.70
TOTAL		**2.82**	**5.00**	**11.02**

KEY NOTES

1	PROPOSED PRIVATE 5' CDOT TYPE–R CURB INLET
2	PROPOSED PRIVATE CDOT TYPE–C AREA INLET
3	PROPOSED PRIVATE 18" STORM PIPE
4	EXISTING 15' WIDE POND MAINTENANCE ACCESS ROAD
5	EXISTING 24" STORM PIPE
6	EXISTING 6' WIDE CONCRETE TRICKLE CHANNEL
7	EXISTING RIPRAP EMERGENCY SPILLWAY
8	PROPOSED RESIDENTIAL TOWNHOUSE BUILDING
9	PROPOSED STORM MANHOLE
10	EXISTING CONCRETE FOREBAY WITH T–BAFFLES
11	EXISTING PRIVATE MODIFIED CDOT TYPE–C OUTLET CONTROL STRUCTURE & MICROPOOL
12	EXISTING PUBLIC CDOT TYPE–C AREA INLET
13	EXISTING 18" STORM OUTFALL PIPE
14	PROPOSED 24" STORM PIPE
15	PROPOSED 18" STORM PIPE
16	PROPOSED RETAINING WALL (BY OTHERS)
17	PROPOSED DRAINAGE SWALE
18	EXISTING 12" STORM PIPE

WINDERMERE FILING NO. 2 –
PROPOSED CONDITIONS
DRAINAGE MAP

Kimley»Horn

2 N NEVADA AVE., SUITE 900, COLORADO SPRINGS, 80903
PHONE: 719–453–0180

APPENDIX E - PRELIMINARY DRAINAGE REPORT – DREXEL, BARRELL & CO.

Please only include relevant pages of the PDR (text, calcs, maps).

PRELIMINARY DRAINAGE REPORT
for
WINDERMERE FILING NO. 2

Colorado Springs, CO

August 2024

Prepared for:

Colo Windermere #2, LLC
4164 Austin Bluffs Parkway, #361
Colorado Springs, CO 80918
Contact: James Todd Stephens

Prepared by:

Drexel, Barrell & Co.
101 Sahwatch St, Suite 100
Colorado Springs, CO 80903
Contact: Tim McConnell, P.E.
(719) 260-0887

TABLE OF CONTENTS

APPENDICES

PRELIMINARY DRAINAGE REPORT
for
WINDERMERE FILING NO. 2
Colorado Springs, Colorado

1.0 CERTIFICATION STATEMENTS

ENGINEER'S STATEMENT

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by El Paso County for drainage reports, and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omission on my part in preparing this report.

Tim D. McConnell, P.E. Date
Colorado P.E. License No. 33797
For and on Behalf of Drexel, Barrell & Co.

DEVELOPER'S STATEMENT

I, the developer have read and will comply with all the requirements specified in this drainage report and plan.

Business Name: Colo Windermere #2, LLC

By:
James Todd Stephens Date
Title: Owner
Address: 4164 Austin Bluffs Parkway, #361
Colorado Springs, CO 80918

EL PASO COUNTY

Filed in accordance with the requirements of the El Paso County Land Development Code, Drainage Criteria Manual Volumes 1 and 2, and the Engineering Criteria Manual, as amended.

County Engineer/ECM Administrator Date

CONDITIONS

PRELIMINARY DRAINAGE REPORT

for

WINDERMERE FILING NO. 2

Colorado Springs, Colorado

2.0 PURPOSE

This report is prepared by Drexel, Barrel & Co in support of the Windermere Filing No. 2 subdivision. This preliminary drainage report is presented in order to determine the adequacy of the existing drainage facilities based upon the anticipated development. This report is associated with a preliminary plan amendment, which triggered the need for this drainage analysis. This development is in the concept stage and as such no site work, grading or drainage and utility installation is to occur at this time. The drainage report will be required to be updated upon final layout, grading and drainage design.

3.0 GENERAL SITE DESCRIPTION

Location

The site is located at the northwest corner of N. Carefree Cir. and Marksheffel Rd. - the E 1/2 of Section 29, Township 13 S, Range 65 W of the 6th P.M., El Paso County, Colorado.

The site is bound on the west by Antelope Ridge Dr., on the north by the Windermere Filing No. 1 subdivision (Pronghorn Meadows Circle), on the east by Marksheffel Rd., and on the south by N. Carefree Cir.

Site Conditions

The site is approximately 9.26 acres in size and is proposed as a multi-family home subdivision. The proposed site development includes approximately 200 multi-family units. The site has recently been overlot graded, seeded and mulched as part of the Windermere Filing No. 1 development to the north. The site is located within the Sand Creek Drainage Basin. Historically, this site drains to the southeast towards the intersection of N. Carefree Circle and Marksheffel Road.

This site was studied as part of the approved Preliminary Drainage Report for Windermere & Final Drainage Report for Windermere Filing No. 1, by Classic Consulting (October 2014) and the more recently approved Final Drainage Report for Windermere Filing No. 1, by Drexel, Barrell & Co. (April 2022).

Soils

According to the Soil Survey of El Paso County Area, Colorado, prepared by the U.S. Department of Agriculture Soil Conservation Service, the site is underlain by Truckton sandy loam, a type 'A' hydrologic soil. See appendix for map.

Climate

This area of El Paso County can be described as the foothills, with total precipitation amounts typical of a semi-arid region. Winters are generally cold and dry, and summers relatively warm and dry. Precipitation ranges from 12 to 14 inches per year, with the majority of this moisture occurring in the spring and summer in the form of rainfall. Thunderstorms are common during the summer months.

Floodplain Statement

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel #08041C0543 G (December 7, 2018) the project site is within a designated Zone X area described as "area of minimal hazard". A firmette map is included in the appendix.

4.0 HISTORIC HYDROLOGY

The existing condition described in the previously approved *Preliminary Drainage Report for Windermere & Final Drainage Report for Windermere Filing No. 1, by Classic Consulting (October 2014)* of the project area is presented here for reference, specifically for the offsite basins that have not changed from the time of the Classic Consulting report.

A copy of the existing conditions map from the Classic Consulting report is provided in the appendix and presented as the historic condition. Reference Section 5.0 below for the existing condition analysis.

5.0 EXISTING HYDROLOGY

As described above, the Windermere Filing No. 2 site was overlot graded as part of the Windermere Filing No. 1 development and studied as part of the previously approved *Final Drainage Report for Windermere Filing No. 1, by Drexel, Barrell & Co. (April 2022).* A full-spectrum detention facility was designed as part of Filing No.1 and in order to minimize future grading within the detention facility area, the volume was based on assumed final build-out watershed imperviousness of 68%.

The following basin descriptions are pulled directly from the previously approved Windermere Filing No. 1 Final Drainage Report.

> *South area – tributary to existing N. Carefree/Marksheffel storm system*
>
> *Basin C3 covers an area of 0.63-acres of pond embankment and is located along the southeasterly project boundary along N. Marksheffel Road. This basin generates flows of Q_5=0.5 cfs and Q_{100}=2.5 cfs that travel offsite to the east and ultimately south along N. Marksheffel Road towards the existing storm inlet at DP-S. As this basin is to remain undeveloped, the discharge of flows offsite is acceptable under MS4 criteria.*
>
> *Existing Design Point 4 covers runoff from Basin D-16 of the Pronghorn Meadows Subdivision to the west of this project development. An existing 8' sump curb inlet intercepts the runoff (Q_5=4.9 cfs and Q_{100}=10.7 cfs) and directs it via existing 24" RCP across Antelope Ridge Drive, where it currently discharges into a roadside swale along N. Carefree Circle. Design and extension of this storm system to the east and connection to the existing storm sewer system at DP-S will be completed at the time of development of Tract B, and will be analyzed at that time by a final drainage report for Tract B.*
>
> *Basin C4 is located along the southerly project boundary of Tract B along N. Carefree*

Circle and generates flows of Q_5=2.1 cfs and Q_{100}=6.9 cfs that travel to the south and ultimately combine with flows from Design Point 4 in a roadside swale traveling east along N. Carefree Circle towards DP-S.

A portion of basin C4 (0.72-acres) is conservatively assumed to cover future development of Tract B that will drain offsite and will not be treated for Water Quality. As per El Paso County ECM App I.7.1.C.1, this area is less than 20% of site area or 1-acre, and is due to grading restrictions (an exclusion listed in ECM App I.7.1.B), the discharge of these flows offsite to the southern drainageway is permitted under County MS4 criteria. This assumption of grading and future use will be required to be reviewed at the time of replat for future development of Tract B. To meet this criteria, this area will be required to remain impervious, or be redirected to drain to the detention pond.

DP-S is located at the existing area inlet in Basin C3. The flows leave this inlet via an existing 24" storm pipe that connects to the existing storm system in N. Carefree Cir., which then carries the flows to the south. This design point reflects the flows from Basins C3 & C4, detained flows released by the south detention facility, offsite Basin EXR, and offsite Basin D-16. The combined flows at DP-S are Q_5=10.0 cfs and Q_{100}=33.7 cfs, which is less than the existing condition at Ex. DP-6 of Q_5=18.4 cfs and Q_{100}=42.6cfs.

Existing Design Point 19 represents the flows generated by offsite Basin NC2 (Q_5=5.1 cfs and Q_{100}=9.8 cfs), these flows are picked up by the existing 15' triple at-grade inlet just west of the intersection with N. Marksheffel Road. The flows then leave this inlet via an existing 18" storm pipe to the east, ultimately converging with the flows from DP-S at an existing manhole at existing design point J1.

Flows of Q_5=15.1 cfs and Q_{100}=43.5 cfs leave DP-J1 via an existing 24" storm pipe and are carried to the existing 10' sump inlet at Existing DP-20 in offsite Basin NC1. The flows leave this existing inlet via an existing 30" storm pipe ultimately traveling to the south via the Marksheffel Road storm system. Developed runoff rates at DP-20 (Q_5=17.0 cfs and Q_{100}=46.9 cfs) are less than those in the existing condition (Q_5=24.2 cfs and Q_{100}=53.3 cfs, thereby reducing impact to the existing storm sewer system.

6.0 PROPOSED HYDROLOGY

This preliminary drainage report is presented in order to determine the adequacy of the existing drainage facilities based upon the anticipated development. This report is associated with a preliminary plan amendment, which triggered the need for this drainage analysis. This development is in the concept stage and as such no site work, grading or drainage and utility installation is to occur at this time. The drainage report will be required to be updated upon final layout, grading and drainage design.

The Rational Method was used to determine runoff quantities for the 5- and 100-year storm recurrence intervals, and Mile High Flood District design software (MHFD-Detention v.4.03) for pond analysis. See below for a summary runoff table and description of each design point.

The basins and design points described below are based on a preliminary concept site design. Grading and subsequent areas tributary to the detention facility are subject to change and any areas not tributary to the detention facility will be assessed for water quality treatment in adherence to County drainage criteria at the final drainage report stage.

Rational Method Runoff Summary

BASIN	AREA (AC)	Q5 (cfs)	Q100 (cfs)
A1	6.79	12.6	27.9
B1	3.33	7.2	16.0
B2	0.49	1.0	2.3
B4	0.16	0.4	0.8
P1	1.00	0.5	2.7
D16	2.73	4.9	10.7
A2	0.92	0.7	3.4
NC2	1.61	6.3	12.1
EXR	0.53	2.4	4.4
C3	0.63	0.5	2.5
Pond Release	1.00	0.3	10.6
NC1	0.43	1.9	3.4

Design Point 1 represents the flows generated by basin A1 (Q_5=12.6 cfs and Q_{100}=27.9 cfs). These flows sheet flow across the site, from northwest to southeast, before being discharged into the existing detention facility. No early grading is proposed with this concept design, and it is acknowledged that prior to any grading an adequate method will need to be provided for flows to discharge into the existing detention facility.

Design Point 2 covers flow from offsite basins B1 and B2. Flows of Q_5=8.1 cfs and Q_{100}=17.7 cfs travel via the existing private 24" RCP storm sewer to the east and discharge into the north end of the existing detention facility.

Design Point 3 represents all flows reaching the existing detention facility (Basins B4, P1, DP1, and DP2) for a total flow of Q_5=19.8 cfs and Q_{100}=45.8 cfs. The existing detention facility and modifications for this developed condition are described further below.

Design Point 4 is identical to DP-4-EX in the historic and existing condition, and represents flows (Q_5= 4.9cfs and Q_{100}=10.7cfs) from offsite basin D16 which discharges on to the Windermere property. In the developed condition, it is proposed that the roadside ditch be continued to capture flows that are not able to be captured by the detention facility due to grading restraints. This swale would allow flows to continue to the east to be captured by the existing Type D area inlet at the intersection of N. Carefree Cir. and Marksheffel Road. As the grading for the site is refined, the area tributary to the detention facility will be maximized to the extent possible given the site grading constraints. Appropriate erosion control measures will be provided at the terminus of the swale to aid in erosion and scour mitigation.

Design Point 19 is equivalent to DP-19-EX from the historic and existing condition, and consists of runoff from off-site basin NC-2 with a flow of Q_5= 6.3cfs and Q_{100}=12.1cfs) An existing 15' Type R at-grade curb inlet just west of the intersection of N. Carefree Circle and Marksheffel Road intercepts a portion of this runoff (Q_5=4.8 cfs and Q_{100}=8.1 cfs) and discharges to the east via public 18" RCP storm sewer.

Design Point S is located at the same existing area inlet as DP-6-EX. In the developed condition flows reaching this point, from basins EXR, A2, C3, DP4, in addition to the proposed pond release rate will equal Q_5=7.8 cfs and Q_{100}=29.2 cfs. Flows exit this area inlet by public 24" RCP to the south.

Design Point J1 is located at the existing manhole on the north side of N. Carefree Circle and represents the combining of flows from DP-19 and DP-S. Flows of Q_5=12.4 cfs and Q_{100}=38.0 cfs continue to the south via the existing public 30" RCP towards DP-20.

Design Point 20 (equivalent to DP-EX-20) as in the existing condition consists of surface runoff from basin NC-1, flowby from the at-grade inlet at DP-19 and pipe flow from DP-J1. An existing public 10' Type R sump inlet intercepts all the surface runoff and combines it with the upstream flows from DP-J1 and DP-19 existing at-grade inlet capture. Total developed runoff at this location is Q_5=13.7 cfs and Q_{100}=40.4 cfs. This runoff continues within the existing Marksheffel Road storm system to the south. Should the inlet be clogged, the resulting runoff will continue east via the neighboring curb and gutter.

7.0 EXISTING DETENTION/WATER QUALITY FACILITY

As part of the overlot design for Windermere Filing No. 1, the detention pond located in the southeast corner of the property was designed as a full-spectrum detention facility to capture flows from the Windermere Filing No. 2 basins.

In order to minimize future grading within the detention facility area, the volume was based on an assumed final build-out watershed imperviousness of 68.0%, which considered Windermere Filing No. 2 (Windermere Filing No. 1 – Tract B) as potentially higher density than single-family residential. As part of the Windermere Filing 1 overlot grading, the pond was excavated to full volume and the outlet structure and associated piping installed. An interim orifice plate (assuming full developed condition within the street right-of-way, but no further development) was installed to allow for appropriate WQCV drain time. Once the design is finalized at the final drainage report stage, the orifice plate will need to be switched out to allow for discharge of the developed flows. It is anticipated based on this preliminary design that the restrictor plate will need to be raised to 7.80" above the invert of the 18" outfall pipe. No other portion of the detention facility will need to be modified.

Based on the analysis in this preliminary report, the developed condition encompasses a total of 12.79 acres that is tributary to this existing facility, with a composite imperviousness of 54.9% for the final fully developed condition. Required volumes are listed below.

		Required Volume		
	Imperviousness	**WQCV**	**EURV**	**100-YR**
FINAL	54.9%	0.24	0.83	1.29

The actual pond volume at the proposed spillway stage is 1.15 acre-feet. A concrete forebay with an energy dissipater has been installed where the flows enter the pond. The volume of the forebay was designed for 3% of the WQCV volume for the pond, as is still within that limit for this concept design condition. The flows exit the forebay through a notch, discharging into the concrete trickle channel at the bottom of the pond. The trickle channel conveys the flows to the micropool. The outlet structure then releases the flows at a reduced flow rate with the use of a plate with orifice holes, into a proposed 18" pipe with restrictor plate, discharging into an existing storm inlet at the corner of N. Carefree Circle and Marksheffel Rd, after which the flows continue to the south via the existing storm sewer system.

In accordance with El Paso County criteria, the modified Type C outlet structure with a permanent micropool will release the WQCV over a 40-hour period. Switching out of the orifice plate will ensure that the WQCV release rate remains within criteria for the final developed condition. The outlet structure will remain in place and in this preliminary stage will result in release rates of Q_5=0.3 cfs and Q_{100}=10.6 cfs. For comparison, the existing basin EX-A released flow rates of Q_5=11.3 cfs and Q_{100}=28.2 cfs.

A 27-ft wide riprap emergency spillway is located on the south side of the pond. In the event that water overtops the spillway, flow will discharge into existing area inlet at the intersection of N. Carefree Cir and Marksheffel Rd, where it is then picked up by the existing storm system.

All detention facility calculations, including excerpts for forebay volumes, micropool surface areas, outlet structures, discharge pipes and spillway design are provided in the appendix.

The pond has a 15' wide maintenance access that provides access to the pond bottom, forebay and outlet structure per ECM 3.3.3.K. A private maintenance agreement and O&M manual has been established for this pond as required by the County. Necessary modifications to this maintenance access will be provided with the final drainage report.

8.0 FOUR-STEP PROCESS

This project conforms to the City of Colorado Springs/El Paso County Four Step Process. The process focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls.

1. ***Employ Runoff Reduction Practices:*** Proposed impervious areas on this site (roofs, asphalt/sidewalk) will sheet flow across landscaped ground as much as possible to slow runoff and increase time of concentration prior to being conveyed to the proposed public streets and storm sewer system. This will minimize directly connected impervious areas within the project site.

2. ***Implement BMP's that provide a Water Quality Capture Volume with slow release:*** Runoff from this project will be treated through capture and slow release of the WQCV in apermanent Extended Detention Basin designed per current City of El Paso County drainage criteria.

3. **Stabilize Drainage Ways:** Flows from the detention facility are released directly into the existing storm sewer system and no stabilization will be necessary.

4. **Implement Site Specific and Other Source Control BMP's:** The site is proposed as a residential development, and as such standard household source control will be utilized in order to minimize potential pollutants entering the storm system. Example source control measures consist of: garages for storage of household chemicals, trash receptacles for individual households and in common areas for pet waste. The need for Industrial and Commercial BMP's was considered, however per ECM I.7.2.A the need for industrial and commercial BMPs are not applicable for this project.

9.0 GEOTECHNICAL HAZARDS

In accordance with geotechnical recommendations, the project design is intended to direct runoff away from structures, and into the receiving storm sewer system and water quality/detention basins. This will be accomplished by a variety of means, i.e. curb and gutter and storm sewer. Per "Soils and Geology Study, Windermere Subdivision" by RMG, October 26, 2020 (Revised January 18, 2021), and updated with an addendum for Tract B (March 30, 2022)

10.0 FACILITY MAINTENANCE

Ownership and maintenance of all public facilities, generally located within the public right-of-way will be by El Paso County. Ownership and maintenance of all tracts and private facilities will be by the Sands Metropolitan District #4.

11.0 CONSTRUCTION COST ESTIMATE

Construction cost estimate will be provided with the Final Drainage Report.

12.0 DRAINAGE/BRIDGE FEES

Tract B was considered as an open space tract for the drainage fee calculation for Windermere Filing No. 1. Development of this tract will require payment of drainage and bridge fees associated with the proposed impervious acreage. This will be determined with the Final Drainage Report for this development as site imperviousness is confirmed.

13.0 CONCLUSIONS

The Windermere Filing No. 2 project has been designed in accordance with El Paso County criteria. The detention facility has been designed to limit the release of storm runoff to historic conditions. This development will not negatively impact or increase flows in the downstream facilities.

14.0 REFERENCES

The sources of information used in the development of this study are listed below:

1. City of Colorado Springs "Drainage Criteria Manual", 2016.

2. Urban Storm Drainage Criteria Manuals, Urban Drainage and Flood Control District. June 2001, Revised October 2019.

3. Soil Survey for Colorado Springs and El Paso County, Colorado, U.S. Department of Agriculture, Soil Conservation Service, June 1980.

4. "Flood Insurance Studies for Colorado Springs and El Paso County, Colorado", prepared by the Federal Emergency Management Agency (FEMA), 2018.

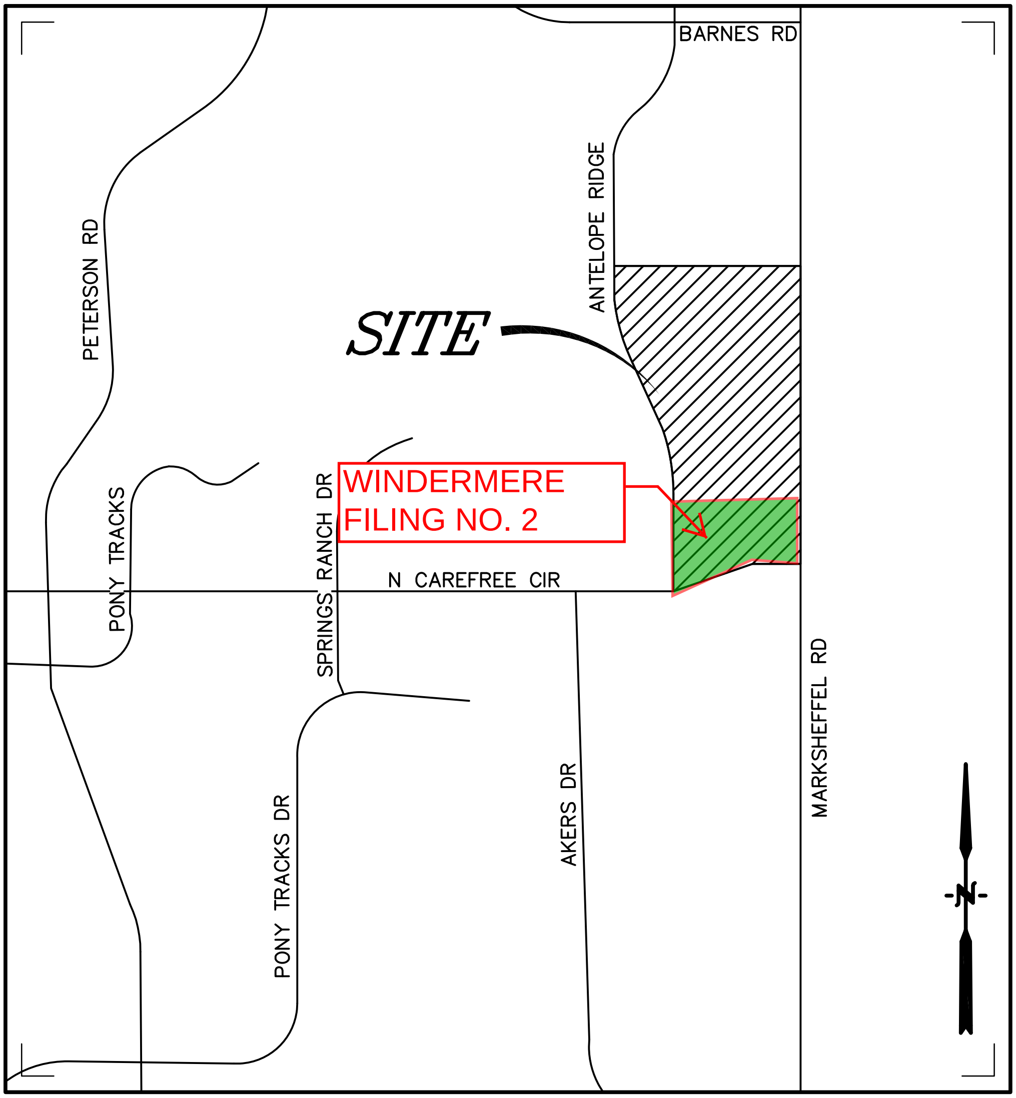
5. "Soils and Geology Study, Windermere Subdivision", prepared by RMG, October 26, 2020, Revised January 18, 2021.

6. "Preliminary Drainage Report for Windermere & Final Drainage Report for Windermere Filing No. 1," prepared by Classic Consulting Engineers & Surveyors, October 2014.

7. "Final Drainage Report Marksheffel Road from Constitution Ave. to Dublin Rd.," by CH2M Hill, dated May 2008 and Marksheffel Road Construction Drawings by Wilson & Company.

8. “Final Drainage Report for Windermere Filing No. 1” prepared by Drexel, Barrell & Co., March 8, 2022.

APPENDIX



Vicinity Map
Not to scale

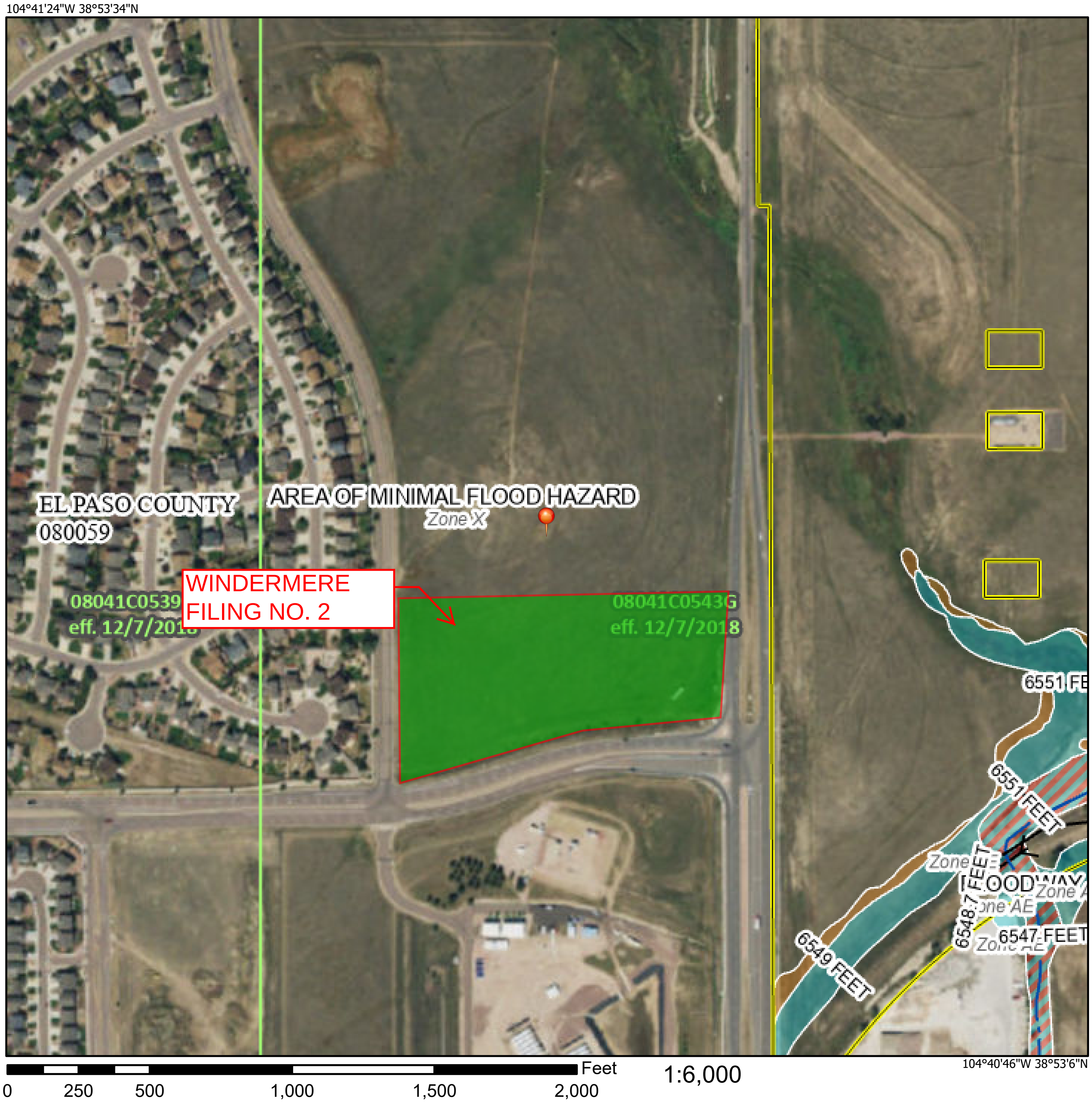
WINDERMERE
COLORADO SPRINGS, CO
VICINITY MAP

Drexel, Barrell & Co.
Engineers • Surveyors

DATE:	DWG. NO. **VMAP**
JOB NO: **21187-00CSCV**	SHEET 1 OF 1

National Flood Hazard Layer FIRMette

FEMA



Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS	▨	Without Base Flood Elevation (BFE) *Zone A, V, A99*
		With BFE or Depth *Zone AE, AO, AH, VE, AR*
	▨	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	▨	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
	▨	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	▨	Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
	▨	Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN	Area of Minimal Flood Hazard *Zone X*
	☐	Effective LOMRs
	▨	Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES	– — – –	Channel, Culvert, or Storm Sewer
	┃┃┃┃┃┃┃	Levee, Dike, or Floodwall
OTHER FEATURES	(B) 20.2 / 17.5	Cross Sections with 1% Annual Chance Water Surface Elevation
	8 — — —	Coastal Transect
	~~ 513 ~~~~	Base Flood Elevation Line (BFE)
	━━	Limit of Study
	━━	Jurisdiction Boundary
	— – – —	Coastal Transect Baseline
	– ——	Profile Baseline
	——	Hydrographic Feature
MAP PANELS	☐	Digital Data Available
	☐	No Digital Data Available
	☒	Unmapped

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

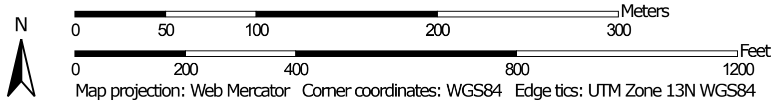
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 9/8/2021 at 3:46 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Hydrologic Soil Group—El Paso County Area, Colorado

Map Scale: 1:4,170 if printed on A portrait (8.5" x 11") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

▭ Area of Interest (AOI)

Soils

Soil Rating Polygons

- ▭ A
- ▭ A/D
- ▭ B
- ▭ B/D
- ▭ C
- ▭ C/D
- ▭ D
- ▭ Not rated or not available

Soil Rating Lines

- 〰 A
- 〰 A/D
- 〰 B
- 〰 B/D
- 〰 C
- 〰 C/D
- 〰 D
- 〰 Not rated or not available

Soil Rating Points

- ▣ A
- ▣ A/D
- ▣ B
- ▣ B/D
- ▣ C
- ▣ C/D
- ▣ D
- ▣ Not rated or not available

Water Features

- 〰 Streams and Canals

Transportation

- ┼┼┼ Rails
- 〰 Interstate Highways
- 〰 US Routes
- 〰 Major Roads
- 〰 Local Roads

Background

- ▩ Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 15, Oct 10, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 15, 2011—Jun 17, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
97	Truckton sandy loam, 3 to 9 percent slopes	A	56.4	100.0%
Totals for Area of Interest			**56.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

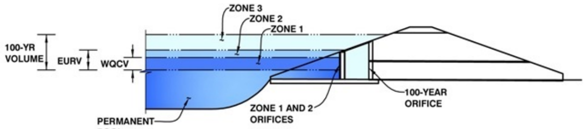
APPROVED DRAINAGE REPORT EXCERPTS

WINDERMERE FILING NO. 1 FDR EXCERPT
SOUTH POND INTERIM DESIGN

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: Windermere Filing No. 1
Basin ID: South Pond - Interim Condition



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.52	0.118	Orifice Plate
Zone 2 (EURV)	3.53	0.124	Orifice Plate
Zone 3 (100-year)	4.82	0.253	Weir&Pipe (Restrict)
Total (all zones)		0.496	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP) — Calculated Parameters for Underdrain

Underdrain Orifice Invert Depth =		ft (distance below the filtration media surface)	Underdrain Orifice Area =		ft^2
Underdrain Orifice Diameter =		inches	Underdrain Orifice Centroid =		feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP) — Calculated Parameters for Plate

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	3.53	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	25.40	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.18	2.35					
Orifice Area (sq. inches)	0.67	0.67	0.67					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular) — Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe) — Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.40	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	6.40	N/A	feet
Overflow Weir Front Edge Length =	3.92	N/A	feet	Overflow Weir Slope Length =	3.92	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	16.92	N/A	
Horiz. Length of Weir Sides =	3.92	N/A	feet	Overflow Grate Open Area w/o Debris =	10.76	N/A	ft^2
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	5.38	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice) — Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.64	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.34	N/A	feet
Restrictor Plate Height Above Pipe Invert =	7.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.35	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal) — Calculated Parameters for Spillway

Spillway Invert Stage=	6.94	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.55	feet
Spillway Crest Length =	27.00	feet	Stage at Top of Freeboard =	8.49	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.58	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	1.80	acre-ft

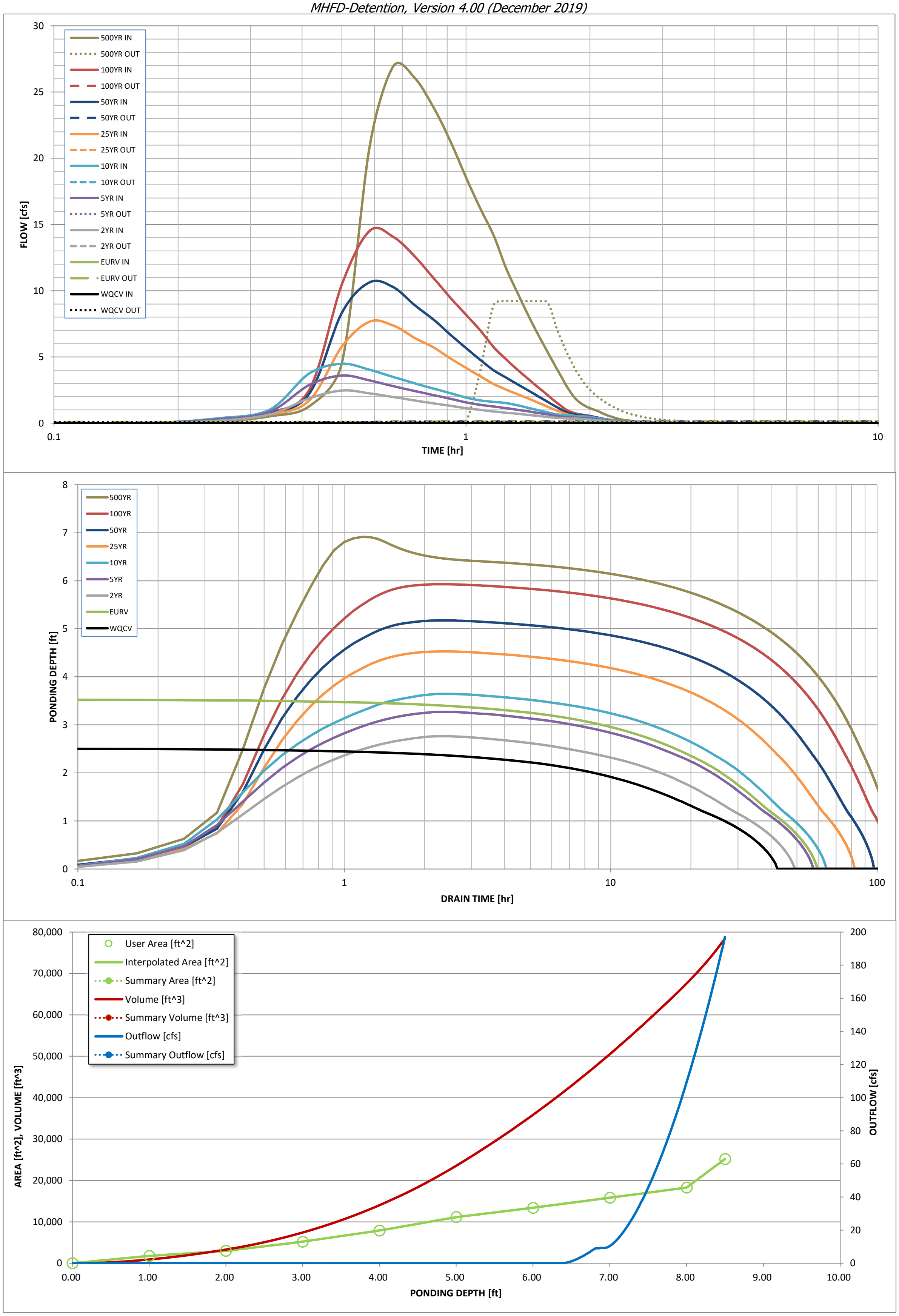
Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.49
CUHP Runoff Volume (acre-ft) =	0.118	0.243	0.156	0.221	0.279	0.448	0.608	0.825	1.590
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.156	0.221	0.279	0.448	0.608	0.825	1.590
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.2	0.3	2.9	5.6	9.1	20.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.03	0.27	0.52	0.84	1.89
Peak Inflow Q (cfs) =	N/A	N/A	2.5	3.6	4.5	7.7	10.6	14.5	27.0
Peak Outflow Q (cfs) =	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	9.2
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.3	0.0	0.0	0.0	0.4
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Plate	Plate	Plate	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.8
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	53	44	51	57	71	83	99	103
Time to Drain 99% of Inflow Volume (hours) =	**40**	57	47	55	61	77	91	108	116
Maximum Ponding Depth (ft) =	2.51	3.53	2.76	3.27	3.64	4.53	5.17	5.93	6.91
Area at Maximum Ponding Depth (acres) =	0.10	0.15	0.11	0.14	0.16	0.22	0.27	0.30	0.36
Maximum Volume Stored (acre-ft) =	0.118	0.243	0.144	0.204	0.260	0.427	0.585	0.799	1.127

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)



DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.10
	0:15:00	0.00	0.00	0.18	0.30	0.37	0.25	0.31	0.30	0.52
	0:20:00	0.00	0.00	0.66	0.86	1.01	0.64	0.75	0.80	1.28
	0:25:00	0.00	0.00	1.87	2.88	3.75	1.72	2.23	2.52	4.55
	0:30:00	0.00	0.00	2.47	3.59	4.48	5.79	8.34	10.48	20.89
	0:35:00	0.00	0.00	2.25	3.22	4.03	7.67	10.63	14.52	26.95
	0:40:00	0.00	0.00	1.98	2.79	3.48	7.36	10.26	14.06	26.08
	0:45:00	0.00	0.00	1.71	2.42	3.01	6.45	8.92	12.61	23.86
	0:50:00	0.00	0.00	1.50	2.13	2.62	5.72	7.82	10.97	21.29
	0:55:00	0.00	0.00	1.31	1.84	2.26	4.89	6.68	9.47	18.56
	1:00:00	0.00	0.00	1.13	1.57	1.94	4.17	5.67	8.18	16.22
	1:05:00	0.00	0.00	1.00	1.38	1.72	3.54	4.78	7.01	14.18
	1:10:00	0.00	0.00	0.89	1.26	1.61	2.96	3.99	5.75	11.72
	1:15:00	0.00	0.00	0.79	1.14	1.52	2.54	3.44	4.83	9.85
	1:20:00	0.00	0.00	0.71	1.01	1.35	2.18	2.93	4.04	8.14
	1:25:00	0.00	0.00	0.62	0.89	1.16	1.86	2.47	3.34	6.64
	1:30:00	0.00	0.00	0.54	0.77	0.97	1.53	2.02	2.69	5.30
	1:35:00	0.00	0.00	0.46	0.65	0.81	1.23	1.59	2.08	4.03
	1:40:00	0.00	0.00	0.40	0.53	0.66	0.94	1.18	1.51	2.87
	1:45:00	0.00	0.00	0.36	0.45	0.59	0.69	0.84	1.03	1.94
	1:50:00	0.00	0.00	0.35	0.42	0.55	0.56	0.66	0.76	1.43
	1:55:00	0.00	0.00	0.31	0.39	0.52	0.49	0.58	0.63	1.13
	2:00:00	0.00	0.00	0.28	0.36	0.48	0.46	0.53	0.55	0.93
	2:05:00	0.00	0.00	0.22	0.29	0.38	0.36	0.41	0.42	0.68
	2:10:00	0.00	0.00	0.18	0.23	0.30	0.28	0.32	0.31	0.49
	2:15:00	0.00	0.00	0.14	0.18	0.23	0.21	0.24	0.23	0.34
	2:20:00	0.00	0.00	0.11	0.14	0.18	0.16	0.18	0.17	0.24
	2:25:00	0.00	0.00	0.08	0.11	0.14	0.13	0.14	0.13	0.18
	2:30:00	0.00	0.00	0.06	0.08	0.10	0.09	0.11	0.10	0.14
	2:35:00	0.00	0.00	0.05	0.06	0.08	0.07	0.08	0.07	0.10
	2:40:00	0.00	0.00	0.04	0.05	0.06	0.05	0.06	0.06	0.08
	2:45:00	0.00	0.00	0.03	0.03	0.04	0.04	0.04	0.04	0.06
	2:50:00	0.00	0.00	0.02	0.02	0.03	0.03	0.03	0.03	0.04
	2:55:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.03
	3:00:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02
	3:05:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

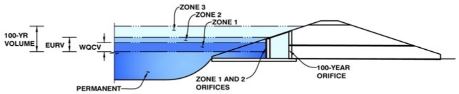
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: **Windermere South - FINAL**

Basin ID:

WINDERMERE FILING NO. 1 FDR EXCERPT
SOUTH POND FINAL DESIGN



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type = **EDB**
Watershed Area = 10.89 acres
Watershed Length = 700 ft
Watershed Length to Centroid = 400 ft
Watershed Slope = 0.040 ft/ft
Watershed Imperviousness = 68.00% percent
Percentage Hydrologic Soil Group A = 100.0% percent
Percentage Hydrologic Soil Group B = 0.0% percent
Percentage Hydrologic Soil Groups C/D = 0.0% percent
Target WQCV Drain Time = 40.0 hours
Location for 1-hr Rainfall Depths = User Input

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.242	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.931	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.641	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.838	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.996	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	1.198	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.395	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	1.633	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.49 in.) =	2.459	acre-feet	3.49	inches
Approximate 2-yr Detention Volume =	0.607	acre-feet		
Approximate 5-yr Detention Volume =	0.792	acre-feet		
Approximate 10-yr Detention Volume =	0.953	acre-feet		
Approximate 25-yr Detention Volume =	1.143	acre-feet		
Approximate 50-yr Detention Volume =	1.257	acre-feet		
Approximate 100-yr Detention Volume =	1.373	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) = 0.242 acre-feet
Zone 2 Volume (EURV - Zone 1) = 0.689 acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) = 0.442 acre-feet
Total Detention Basin Volume = 1.373 acre-feet
Initial Surcharge Volume (ISV) = user ft^3
Initial Surcharge Depth (ISD) = user ft
Total Available Detention Depth (H_{total}) = user ft
Depth of Trickle Channel (H_{TC}) = user ft
Slope of Trickle Channel (S_{TC}) = user ft/ft
Slopes of Main Basin Sides (S_{main}) = user H:V
Basin Length-to-Width Ratio ($R_{L/W}$) = user

Initial Surcharge Area (A_{ISV}) = user ft^2
Surcharge Volume Length (L_{ISV}) = user ft
Surcharge Volume Width (W_{ISV}) = user ft
Depth of Basin Floor (H_{FLOOR}) = user ft
Length of Basin Floor (L_{FLOOR}) = user ft
Width of Basin Floor (W_{FLOOR}) = user ft
Area of Basin Floor (A_{FLOOR}) = user ft^2
Volume of Basin Floor (V_{FLOOR}) = user ft^3
Depth of Main Basin (H_{MAIN}) = user ft
Length of Main Basin (L_{MAIN}) = user ft
Width of Main Basin (W_{MAIN}) = user ft
Area of Main Basin (A_{MAIN}) = user ft^2
Volume of Main Basin (V_{MAIN}) = user ft^3
Calculated Total Basin Volume (V_{total}) = **user** acre-feet

Depth Increement = ft

Depth Increment = ft

Stage - Storage Description	Stage (ft)	Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	40	0.001		
6574	--	1.00	--	--	--	1,801	0.041	920	0.021
6575	--	2.00	--	--	--	3,008	0.069	3,325	0.076
6576	--	3.00	--	--	--	5,232	0.120	7,445	0.171
6577	--	4.00	--	--	--	7,923	0.182	14,022	0.322
6578	--	5.00	--	--	--	11,161	0.256	23,564	0.541
6579	--	6.00	--	--	--	13,425	0.308	35,857	0.823
6580	--	7.00	--	--	--	15,853	0.364	50,496	1.159
6581	--	8.00	--	--	--	18,293	0.420	67,569	1.551
6581.5	--	8.50	--	--	--	25,208	0.579	78,445	1.801
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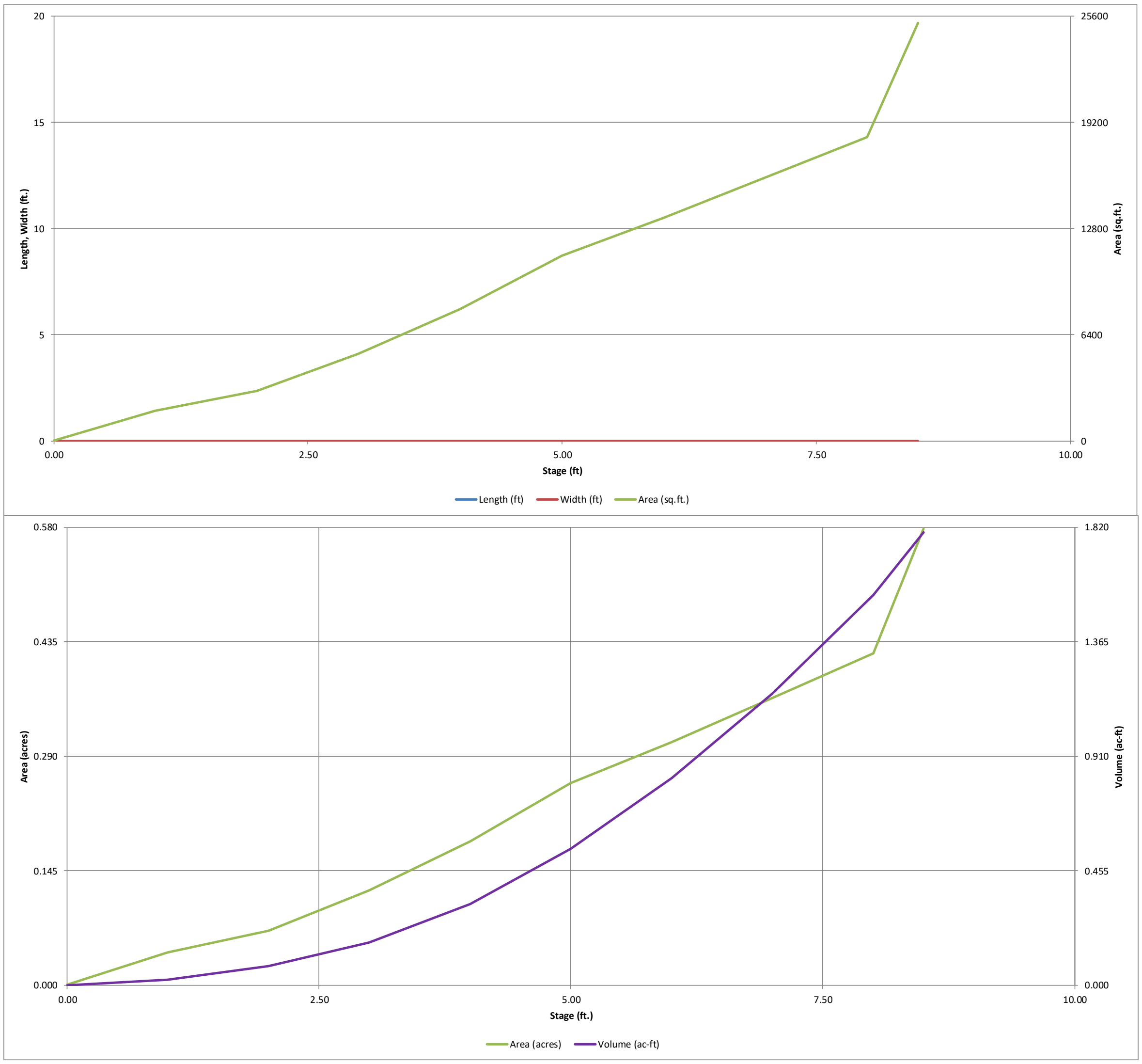
WINDERMERE FILING NO. 1 FDR EXCERPT
SOUTH POND FINAL DESIGN

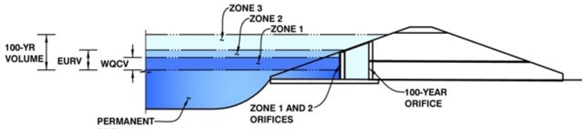


WINDERMERE FILING NO. 1 FDR EXCERPT
SOUTH POND FINAL DESIGN

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: **Windermere South - FINAL**
Basin ID:



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.52	0.242	Orifice Plate
Zone 2 (EURV)	6.34	0.689	Orifice Plate
Zone 3 (100-year)	7.57	0.442	Weir&Pipe (Restrict)
	Total (all zones)	1.373	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP) — Calculated Parameters for Underdrain

Underdrain Orifice Invert Depth =		ft (distance below the filtration media surface)	Underdrain Orifice Area =		ft^2
Underdrain Orifice Diameter =		inches	Underdrain Orifice Centroid =		feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP) — Calculated Parameters for Plate

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	6.34	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	25.40	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	2.11	4.23					
Orifice Area (sq. inches)	1.24	1.24	1.24					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular) — Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	N/A	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	N/A	N/A	feet
Vertical Orifice Diameter =	N/A	N/A	inches				

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe) — Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.40	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	6.40	N/A	feet
Overflow Weir Front Edge Length =	3.92	N/A	feet	Overflow Weir Slope Length =	3.92	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	16.92	N/A	
Horiz. Length of Weir Sides =	3.92	N/A	feet	Overflow Grate Open Area w/o Debris =	10.76	N/A	ft^2
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	5.38	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice) — Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.64	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.34	N/A	feet
Restrictor Plate Height Above Pipe Invert =	7.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.35	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal) — Calculated Parameters for Spillway

Spillway Invert Stage=	6.94	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.55	feet
Spillway Crest Length =	27.00	feet	Stage at Top of Freeboard =	8.49	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.58	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	1.80	acre-ft

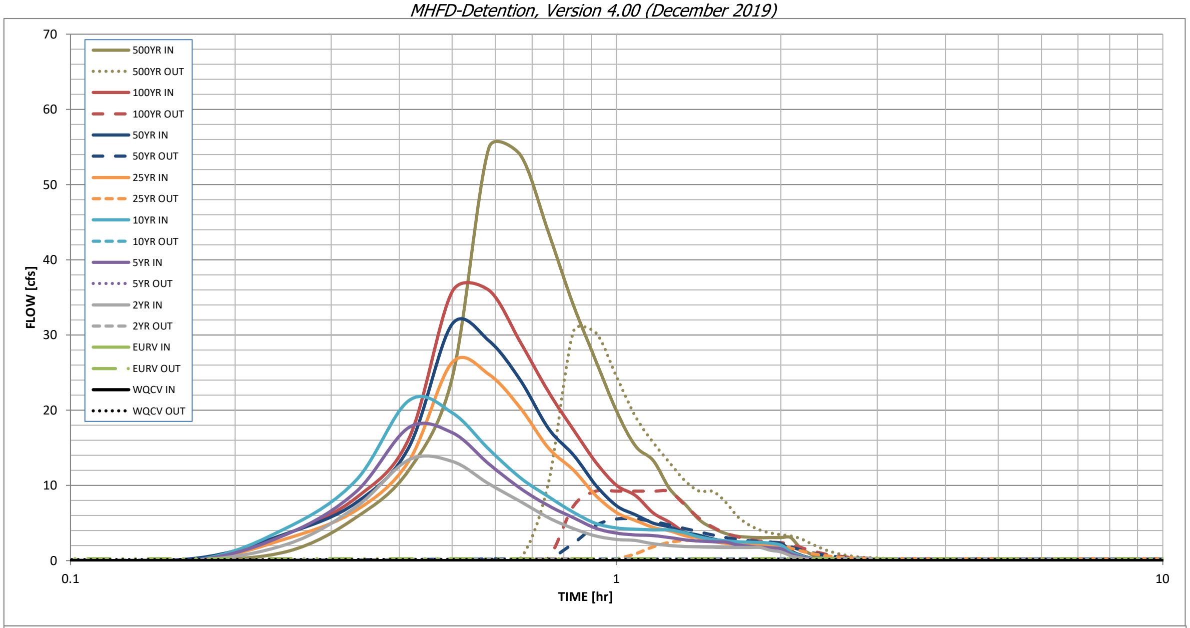
Routed Hydrograph Results

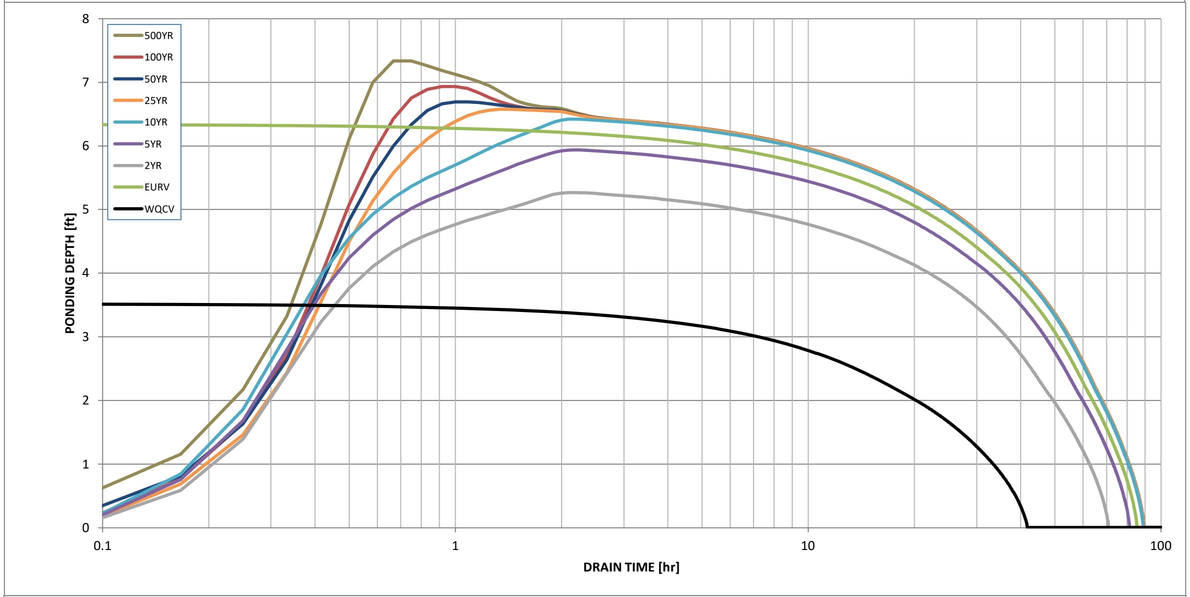
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

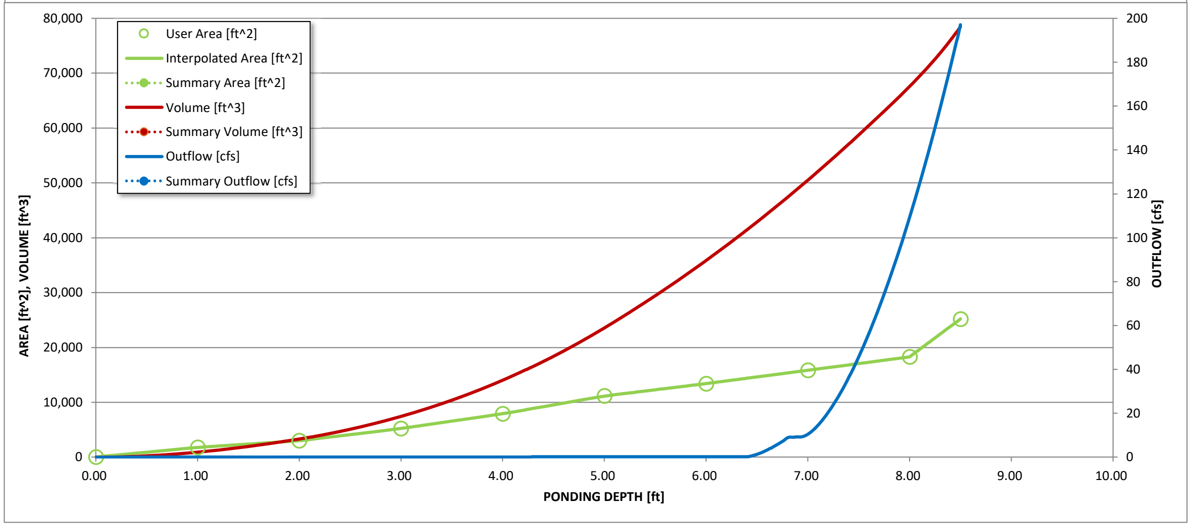
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.49
CUHP Runoff Volume (acre-ft) =	0.242	0.931	0.641	0.838	0.996	1.198	1.395	1.633	2.459
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.641	0.838	0.996	1.198	1.395	1.633	2.459
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.2	0.3	2.9	5.6	9.1	20.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.03	0.27	0.52	0.84	1.89
Peak Inflow Q (cfs) =	N/A	N/A	13.4	17.7	21.3	26.3	31.4	35.9	54.9
Peak Outflow Q (cfs) =	0.1	0.2	0.2	0.2	0.3	2.7	5.5	9.2	30.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	1.1	0.9	1.0	1.0	1.5
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.2	0.5	0.8	0.9
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	75	63	72	78	77	76	74	69
Time to Drain 99% of Inflow Volume (hours) =	**40**	81	68	77	84	84	83	83	80
Maximum Ponding Depth (ft) =	3.53	6.34	5.26	5.94	6.42	6.57	6.69	6.93	7.33
Area at Maximum Ponding Depth (acres) =	0.15	0.33	0.27	0.30	0.33	0.34	0.35	0.36	0.38
Maximum Volume Stored (acre-ft) =	0.243	0.931	0.609	0.802	0.954	1.008	1.046	1.134	1.282

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







DETENTION BASIN OUTLET ST

WINDERMERE FILING NO. 1 FDR EXCERPT
SOUTH POND FINAL DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

Time Interval
5.00 min

SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.02	1.24
0:15:00	0.00	0.00	2.20	3.58	4.43	2.98	3.64	3.62	5.72
0:20:00	0.00	0.00	7.15	9.15	10.68	6.68	7.69	8.35	12.02
0:25:00	0.00	0.00	13.38	17.69	21.29	13.23	15.05	16.20	24.26
0:30:00	0.00	0.00	13.20	16.99	19.67	26.35	31.45	35.75	54.89
0:35:00	0.00	0.00	10.18	12.85	14.80	24.76	29.25	35.94	53.97
0:40:00	0.00	0.00	7.86	9.61	11.02	20.31	24.00	29.05	43.65
0:45:00	0.00	0.00	5.71	7.29	8.49	14.97	17.57	22.45	33.95
0:50:00	0.00	0.00	4.27	5.70	6.40	12.02	14.05	17.39	26.56
0:55:00	0.00	0.00	3.25	4.28	4.93	8.64	9.99	13.05	19.85
1:00:00	0.00	0.00	2.81	3.64	4.33	6.38	7.27	9.99	15.21
1:05:00	0.00	0.00	2.65	3.41	4.15	5.32	6.06	8.64	13.31
1:10:00	0.00	0.00	2.23	3.33	4.09	4.41	4.99	6.33	9.55
1:15:00	0.00	0.00	2.01	3.06	4.06	3.95	4.46	5.08	7.52
1:20:00	0.00	0.00	1.88	2.76	3.68	3.31	3.73	3.74	5.42
1:25:00	0.00	0.00	1.80	2.60	3.14	3.00	3.37	3.03	4.32
1:30:00	0.00	0.00	1.76	2.50	2.81	2.55	2.87	2.57	3.60
1:35:00	0.00	0.00	1.73	2.44	2.62	2.30	2.58	2.32	3.22
1:40:00	0.00	0.00	1.73	2.08	2.51	2.16	2.42	2.24	3.10
1:45:00	0.00	0.00	1.73	1.88	2.44	2.08	2.34	2.19	3.03
1:50:00	0.00	0.00	1.73	1.76	2.41	2.05	2.30	2.19	3.03
1:55:00	0.00	0.00	1.36	1.70	2.30	2.03	2.28	2.19	3.03
2:00:00	0.00	0.00	1.15	1.57	2.02	2.03	2.28	2.19	3.03
2:05:00	0.00	0.00	0.65	0.89	1.16	1.16	1.30	1.25	1.73
2:10:00	0.00	0.00	0.36	0.50	0.65	0.66	0.74	0.71	0.98
2:15:00	0.00	0.00	0.18	0.27	0.34	0.35	0.39	0.37	0.51
2:20:00	0.00	0.00	0.08	0.13	0.16	0.18	0.20	0.19	0.26
2:25:00	0.00	0.00	0.03	0.05	0.05	0.06	0.07	0.07	0.09
2:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

North Pond (North Forebay)

FOREBAY VOLUME

Req'd V=3% x WQCV

Ex DP 24	Impervious	Area
	0.34	79.05

WQCV= 1.0826 ac-ft
V= 0.0325 ac-ft
Actual V 0.0409 ac-ft

FOREBAY RELEASE NOTCH WIDTH

5-YR NOTCH

$Q=CLH^{3/2}$

Q_{100}= 111.3 cfs
2% of Q= 2.23 cfs
C= 2.6
H (height of forebay wall)= 1 ft

L= 10 in
3 in min.

FOREBAY RELEASE NOTCH WIDTH

100-YR NOTCH

$Q=CLH^{3/2}$

Q_{100}= 199.7 cfs
2% of Q= 3.99 cfs
C= 2.6
H (height of forebay wall)= 1 ft

L= 18 in
3 in min.

North Pond (South Forebay)

FOREBAY VOLUME

Req'd V=3% x WQCV

DPM1	Impervious	Area
	0.65	40.15

WQCV= 0.8503 ac-ft
V= 0.0255 ac-ft
Actual V 0.0310 ac-ft

FOREBAY RELEASE NOTCH WIDTH

5-YR NOTCH

$Q=CLH^{3/2}$

Q_{100}= 54.8 cfs
2% of Q= 1.10 cfs
C= 2.6
H (height of forebay wall)= 1 ft

L= 5 in
3 in min.

FOREBAY RELEASE NOTCH WIDTH

100-YR NOTCH

$Q=CLH^{3/2}$

Q_{100}= 119.4 cfs
2% of Q= 2.39 cfs
C= 2.6
H (height of forebay wall)= 1 ft

L= 11 in
3 in min.

South Pond (Forebay)

FOREBAY VOLUME

Req'd V=3% x WQCV

From Detention spreadsheet
WQCV= 0.052 ac-ft
V= 0.0016 ac-ft
Actual V 0.0040 ac-ft

FOREBAY RELEASE NOTCH WIDTH

$Q=CLH^{3/2}$

Q_{100}= 17.9 cfs
2% of Q= 0.36 cfs
C= 2.6
H (height of forebay wall)= 1 ft

L= 2 in
3 in min.

WINDERMERE FILING NO. 1 FDR EXCERPT
SOUTH POND FINAL DESIGN

Figure 13-12c. Emergency Spillway Protection

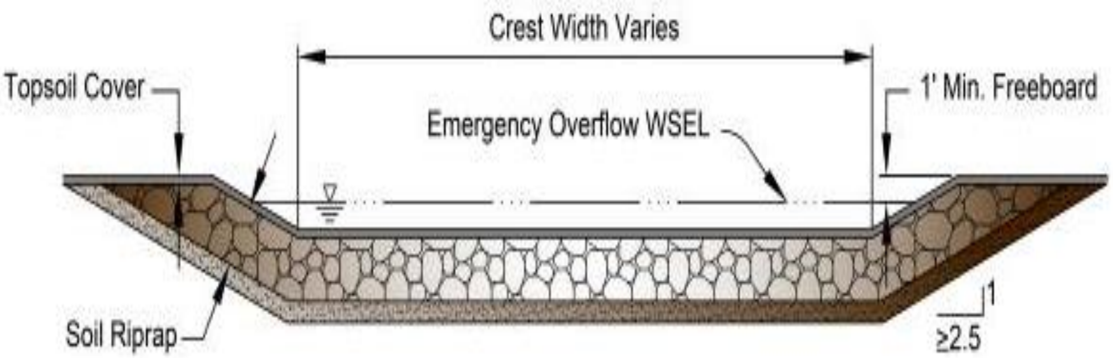
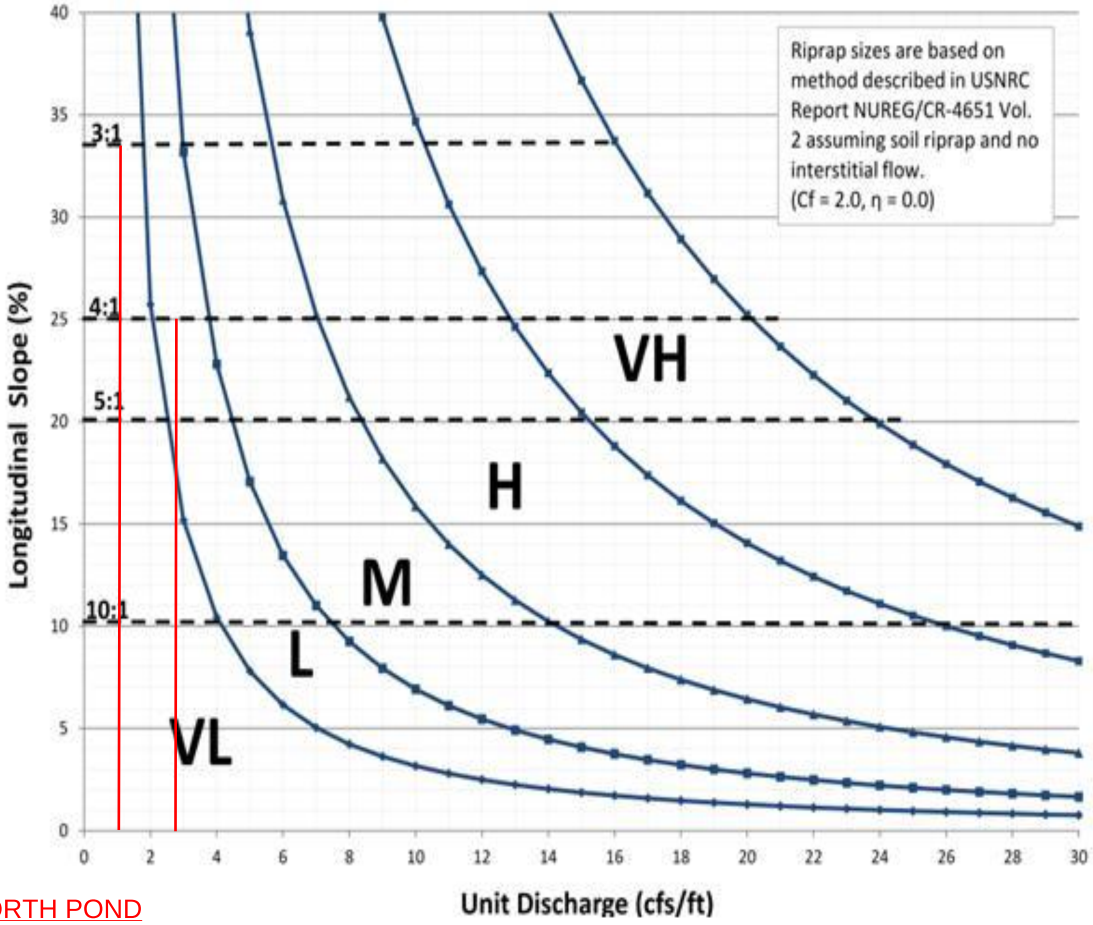


Figure 13-12d. Riprap Types for Emergency Spillway Protection



NORTH POND
UNIT DISCHARGE= 194.1/70=2.7cfs
SOUTH POND
UNIT DISCHARGE= 35.9/27= 1.3cfs

HYDROLOGIC ANALYSIS

PROJECT INFORMATION

Drexel, Barrell & Co.

PROJECT:	Windermere 2
PROJECT NO:	21187-03
DESIGN BY:	KGV
REV. BY:	TDM
AGENCY:	El Paso County
REPORT TYPE:	Preliminary
DATE:	6/5/2024

Soil Type: A

	C2*	C5*	C10*	C100*	% IMPERV
Landscape/Lawn		0.15		0.50	0
Residential (<1/8 acre)		0.45		0.59	65
Asphalt/Sidewalk		0.90		0.96	100

PROPOSED

SUB-BASIN	SURFACE DESIGNATION	AREA ACRE	COMPOSITE RUNOFF COEFFICIENTS C2	C5	C10	C100	% IMPERV
A1	Landscape/Lawn	0.06		0.15		0.50	0
	Residential (<1/8 acre)	6.69		0.45		0.59	65
	Asphalt/Sidewalk	0.04		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL A1		6.79					
A2	Landscape/Lawn	0.88		0.15		0.50	0
	Residential (<1/8 acre)	0.00		0.45		0.59	65
	Asphalt/Sidewalk	0.03		0.90		0.96	100
	WEIGHTED AVERAGE			0.18		0.52	4%
TOTAL A2		0.92					
POND							
P1	Landscape/Lawn	1.00		0.15		0.50	0
	Residential (<1/8 acre)	0.00		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.15		0.50	0%
TOTAL P1		1.00					
OFFSITE							
B1	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	3.33		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL B1		3.33					
B2	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	0.49		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL B2		0.49					
B4	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	0.16		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL B4		0.16					

Tributary to Pond		**12.70**					**55.0%**
D16	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	2.73		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.45		0.59	65%
TOTAL D16		2.73					
NC2	Landscape/Lawn	0.27		0.15		0.50	0
	Residential (<1/8 acre)	0.00		0.45		0.59	65
	Asphalt/Sidewalk	1.34		0.90		0.96	100
	WEIGHTED AVERAGE			0.77		0.88	83%
TOTAL NC2		1.61					
EXR	Landscape/Lawn	0.00		0.15		0.50	0
	Residential (<1/8 acre)	0.00		0.45		0.59	65
	Asphalt/Sidewalk	0.53		0.90		0.96	100
	WEIGHTED AVERAGE			0.90		0.96	100%
TOTAL EXR		0.53					
C3	Landscape/Lawn	0.63		0.15		0.50	0
	Residential (<1/8 acre)	0.00		0.45		0.59	65
	Asphalt/Sidewalk	0.00		0.90		0.96	100
	WEIGHTED AVERAGE			0.15		0.50	0%
TOTAL C3		0.63					
NC1	Landscape/Lawn	0.03		0.15		0.50	0
	Residential (<1/8 acre)	0.00		0.45		0.59	65
	Asphalt/Sidewalk	0.40		0.90		0.96	100
	WEIGHTED AVERAGE			0.85		0.93	93%
TOTAL NC1		0.43					

PROJECT INFORMATION

PROJECT:	Windermere 2
PROJECT NO:	21187-03
DESIGN BY:	KGV
REV. BY:	TDM
AGENCY:	El Paso County
REPORT TYPE:	Preliminary
DATE:	6/5/2024

Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

PROPOSED **TIME OF CONCENTRATION STANDARD FORM SF-2**

SUB-BASIN DATA					**INITIAL/OVERLAND TIME (t_i)**				**TRAVEL TIME (t_t)**					**PIPE TRAVEL TIME (t_p)**				**TIME OF CONC. t_c**		**FINAL t_c**
BASIN	DESIGN PT:	C_5	C_{100}	AREA	LENGTH	HT	SLOPE	t_i	LENGTH	HT	SLOPE	VEL.	t_t	LENGTH	SLOPE	VEL.	t_t	COMP.	MINIMUM	
				Ac	Ft	FT	%	Min	Ft	FT	%	FPS	Min	Ft	%	FPS	Min	t_c	t_c	**Min**
A1	1	0.45	0.59	6.79	100	2	3.0	8.4	855	21	3.7	10.1	1.4					9.8	5	**9.8**
B1		0.45	0.59	3.33	35	1	3.5	4.7	885	30	3.4	10.8	1.4					6.1	5	**6.1**
B2		0.45	0.59	0.49	50	2	4.0	5.4	725	20	2.8	9.8	1.2					6.6	5	**6.6**
B1+B2	2	0.45	0.59	3.82	From Basin B1			6.1						212	0.5	5.1	0.7	6.8	5	**6.8**
B4		0.45	0.59	0.16	50	17	33.3	2.7	185	3	1.5	4.0	0.8					3.4	5	**5.0**
P1		0.15	0.50	1.00	100	1	1.0	17.8	205	10	4.8	12.8	0.3					18.0	5	**18.0**
DP1+DP2+B4+P1	3	0.42	0.58	11.78	From Design Point 1			9.8	250	2.5	1.0	4.0	1.0					10.9	5	**10.9**
D16	4	0.45	0.59	2.73	200	10	5.0	10.1	350	12	3.5	6.5	0.9					11.0	5	**11.0**
A2		0.18	0.52	0.92	50	10	5.9	6.7	992	25	3.3	8.5	1.9					8.7	5	**8.7**
NC2	19	0.77	0.88	1.61	50	2	4.0	2.7	1340	35	2.6	9.4	2.4					5.1	5	**5.1**
EXR		0.90	0.96	0.53	20	2	10.0	0.8	320	6	2.0	4.9	1.1					1.9	5	**5.0**
C3		0.15	0.50	0.63	60	12	20.0	5.1	455	15	3.3	5.6	1.4					6.4	5	**6.4**
EXR+C3+DP6+A2	S	0.41	0.61	4.81	From Design Point 6			11.0						850	3.0	11.8	1.2	12.2	5	**12.2**
DP19+DPS	J1	0.50	0.67	6.42	From Design Point S			12.2						100	1.0	5.9	0.3	12.4	5	**12.4**
NC1		0.85	0.93	0.43	45	1	2.2	2.4	185	4	2.2	8.7	0.4					2.8	5	**5.0**
DPJ1+NC1	20	0.52	0.69	6.85	From Design Point J1			12.4						50	1.0	8.4	0.1	12.5	5	**12.5**

PROJECT INFORMATION

PROJECT:	Windermere 2
PROJECT NO:	21187-03
DESIGN BY:	KGV
REV. BY:	TDM
AGENCY:	El Paso County
REPORT TYPE:	Preliminary
DATE:	6/5/2024

Drexel, Barrell & Co.

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

PROPOSED **RUNOFF** **5 YR STORM** **P1=** **1.50**

			DIRECT RUNOFF				
BASIN (S)	**DESIGN POINT**	**AREA (AC)**	**RUNOFF COEFF**	**t_c (MIN)**	**C * A**	**I (IN/HR)**	**Q (CFS)**
A1	1	6.79	0.45	9.8	3.06	4.13	**12.6**
B1		3.33	0.45	6.1	1.50	4.84	**7.2**
B2		0.49	0.45	6.6	0.22	4.72	**1.0**
B1+B2	2	3.82	0.45	6.8	1.72	4.68	**8.1**
B4		0.16	0.45	5.0	0.07	5.10	**0.4**
P1		1.00	0.15	18.0	0.15	3.17	**0.5**
DP1+DP2+B4+P1	3	11.78	0.42	10.9	5.00	3.97	**19.8**
D16	4	2.73	0.45	11.0	1.23	3.96	**4.9**
A2		0.92	0.18	8.7	0.16	4.32	**0.7**
NC2	19	1.61	0.77	5.1	1.25	5.08	**6.3**
EXR		0.53	0.90	5.0	0.48	5.10	**2.4**
C3		0.63	0.15	6.4	0.09	4.76	**0.5**
Pond Release	P						**0.3**
EXR+C3+DP5+POND RELEASE	S	4.81	0.41	12.2	1.96	3.80	**7.8**
DP19+DPS	J1	6.42	0.50	12.4	3.21	3.76	**12.4**
NC1		0.43	0.85	5.0	0.36	5.10	**1.9**
DPJ1+NC1	20	6.85	0.52	12.5	3.57	3.75	**13.7**

PROJECT INFORMATION

Drexel, Barrell & Co.

PROJECT:	Windermere 2
PROJECT NO:	21187-03
DESIGN BY:	KGV
REV. BY:	TDM
AGENCY:	El Paso County
REPORT TYPE:	Preliminary
DATE:	6/5/2024

RATIONAL METHOD CALCULATIONS FOR STORM WATER RUNOFF

PROPOSED **RUNOFF** **100 YR STORM** **P1=** **2.52**

			DIRECT RUNOFF				
BASIN (S)	**DESIGN POINT**	**AREA (AC)**	**RUNOFF COEFF**	**t_c (MIN)**	**C * A**	**I (IN/HR)**	**Q (CFS)**
A1	1	6.79	0.59	9.8	4.02	6.93	**27.9**
B1		3.33	0.59	6.1	1.96	8.12	**16.0**
B2		0.49	0.59	6.6	0.29	7.92	**2.3**
B1+B2	2	3.82	0.59	6.8	2.25	7.87	**17.7**
B4		0.16	0.59	5.0	0.09	8.58	**0.8**
P1		1.00	0.50	18.0	0.50	5.33	**2.7**
DP1+DP2+B4+P1	3	11.78	0.58	10.9	6.87	6.67	**45.8**
D16	4	2.73	0.59	11.0	1.61	6.65	**10.7**
A2		0.92	0.52	8.7	0.48	7.26	**3.4**
NC2	19	1.61	0.88	5.1	1.42	8.54	**12.1**
EXR		0.53	0.96	5.0	0.51	8.58	**4.4**
C3		0.63	0.50	6.4	0.32	8.00	**2.5**
Pond Release	P						**10.6**
EXR+C3+DP5+POND RELEASE	S	4.81	0.61	12.2	2.91	6.38	**29.2**
DP19+DPS	J1	6.42	0.67	12.4	4.33	6.32	**38.0**
NC1		0.43	0.93	5.0	0.40	8.58	**3.4**
DPJ1+NC1	20	6.85	0.69	12.5	4.73	6.29	**40.4**

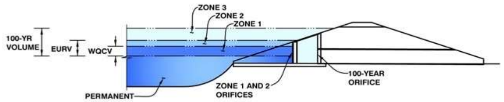
HYDRAULIC ANALYSIS

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: **Windermere Filing No. 1**
Basin ID: **Pond - Final**

WINDERMERE FILING NO. 2 SOUTH POND
FINAL DESIGN DEVELOPED CONDITION



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	12.79	acres
Watershed Length =	1,000	ft
Watershed Length to Centroid =	350	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	54.90%	percent
Percentage Hydrologic Soil Group A =	100.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.235	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.831	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.593	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.785	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.938	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	1.163	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.384	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	1.660	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.49 in.) =	2.617	acre-feet	3.49	inches
Approximate 2-yr Detention Volume =	0.537	acre-feet		
Approximate 5-yr Detention Volume =	0.705	acre-feet		
Approximate 10-yr Detention Volume =	0.856	acre-feet		
Approximate 25-yr Detention Volume =	1.041	acre-feet		
Approximate 50-yr Detention Volume =	1.157	acre-feet		
Approximate 100-yr Detention Volume =	1.289	acre-feet		

KHA: WQCV Required

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.235	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.596	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.458	acre-feet
Total Detention Basin Volume =	1.289	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

KHA: Detention Volume Required

Please provide final analysis of the existing pond. If this is the final analysis please state it.

Depth Increement = | | ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	40	0.001		
6574	--	1.00	--	--	--	1,801	0.041	920	0.021
6575	--	2.00	--	--	--	3,008	0.069	3,325	0.076
6576	--	3.00	--	--	--	5,232	0.120	7,445	0.171
6577	--	4.00	--	--	--	7,923	0.182	14,022	0.322
6578	--	5.00	--	--	--	11,161	0.256	23,564	0.541
6579	--	6.00	--	--	--	13,425	0.308	35,857	0.823
6580	--	7.00	--	--	--	15,853	0.364	50,496	1.159
6581	--	8.00	--	--	--	18,293	0.420	67,569	1.551
6581.5	--	8.50	--	--	--	25,208	0.579	78,445	1.801
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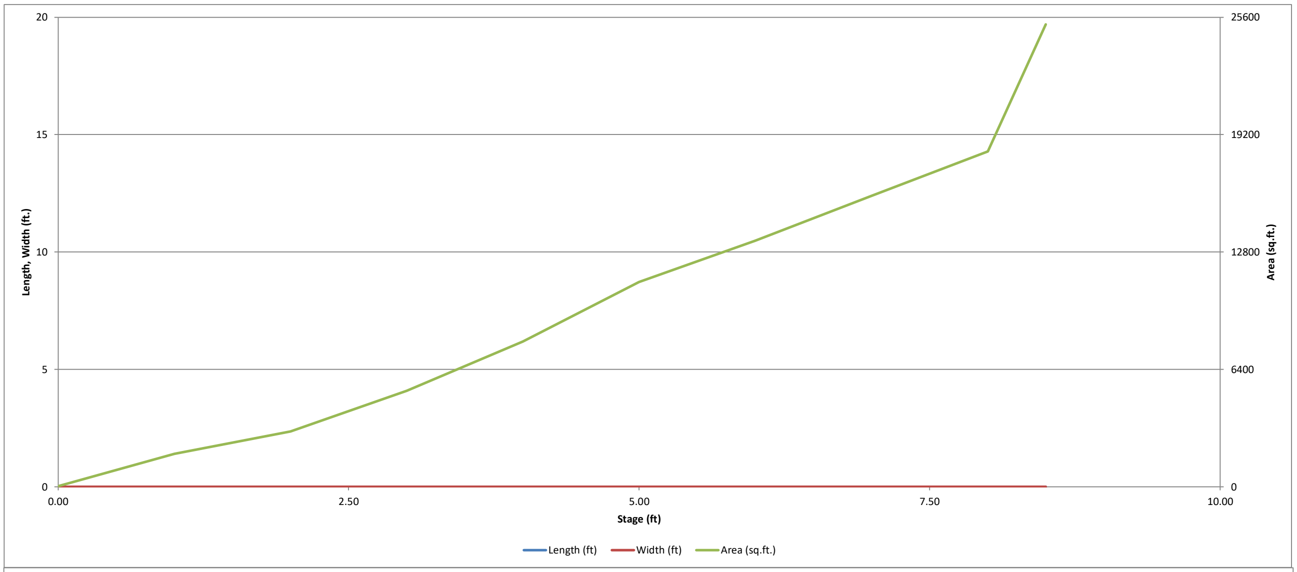
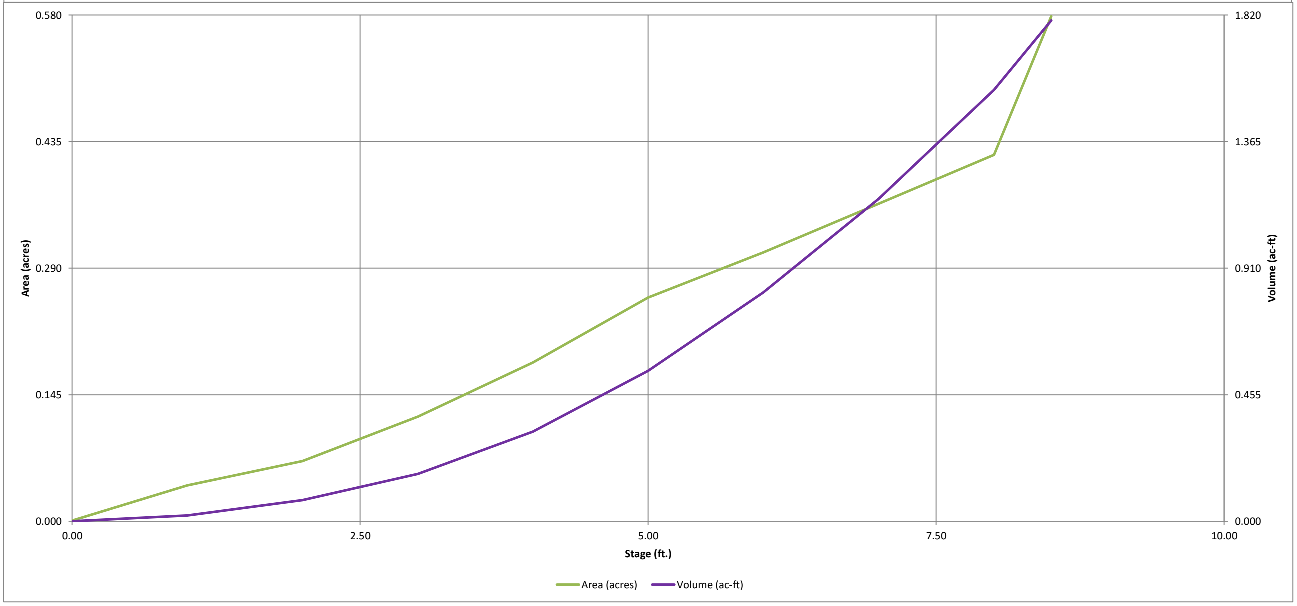
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

WINDERMERE FILING NO. 2 SOUTH POND
FINAL DESIGN DEVELOPED CONDITION



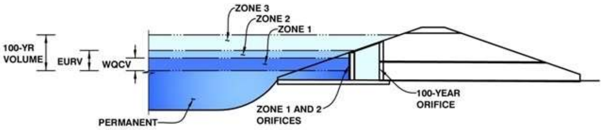


WINDERMERE FILING NO. 2 SOUTH POND
FINAL DESIGN DEVELOPED CONDITION

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: Windermere Filing No. 1
Basin ID: Pond - Final



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.48	0.235	Orifice Plate
Zone 2 (EURV)	6.03	0.596	Orifice Plate
Zone 3 (100-year)	7.35	0.458	Weir&Pipe (Restrict)
Total (all zones)		1.289	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =		ft (distance below the filtration media surface)
Underdrain Orifice Diameter =		inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =		ft^2
Underdrain Orifice Centroid =		feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	6.03	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	24.10	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

WQ Orifice Area per Row =	N/A	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	2.01	4.02					
Orifice Area (sq. inches)	1.10	1.70	2.00					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	N/A	N/A	inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir (and No Outlet Pipe)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.40	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	3.92	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	3.92	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	6.40	N/A	feet
Overflow Weir Slope Length =	3.92	N/A	feet
Grate Open Area / 100-yr Orifice Area =	14.68	N/A	
Overflow Grate Open Area w/o Debris =	10.78	N/A	ft^2
Overflow Grate Open Area w/ Debris =	5.39	N/A	ft^2

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	7.80		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.73	N/A	ft^2
Outlet Orifice Centroid =	0.38	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.44	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.94	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	27.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.55	feet
Stage at Top of Freeboard =	8.49	feet
Basin Area at Top of Freeboard =	0.58	acres
Basin Volume at Top of Freeboard =	1.80	acre-ft

Routed Hydrograph Results

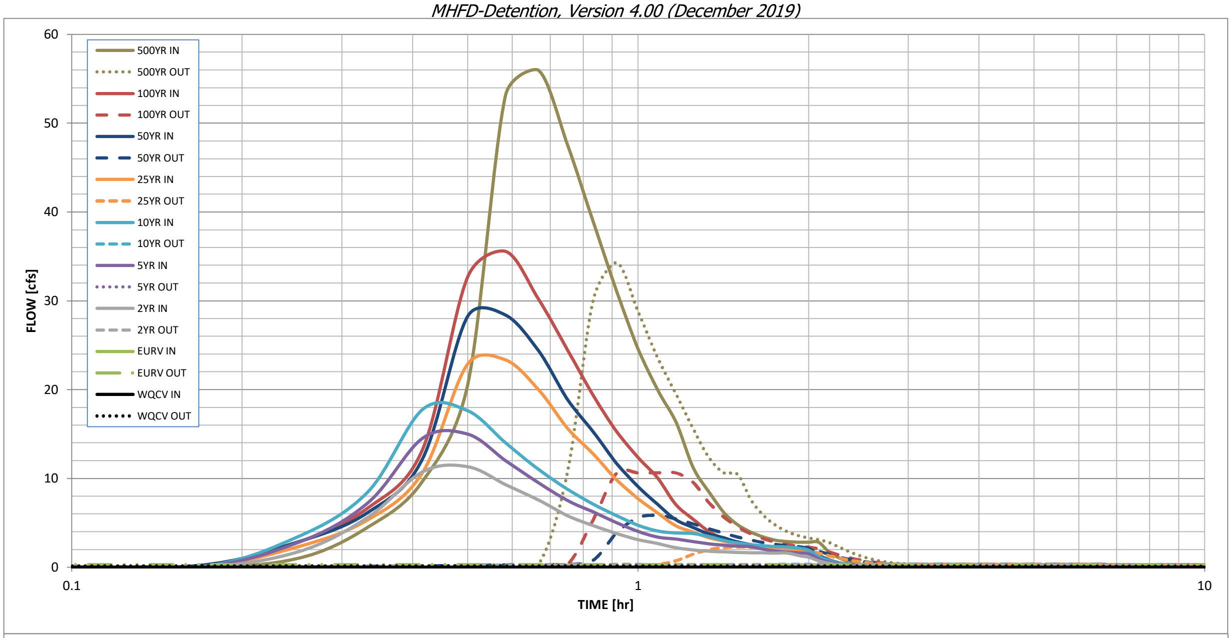
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

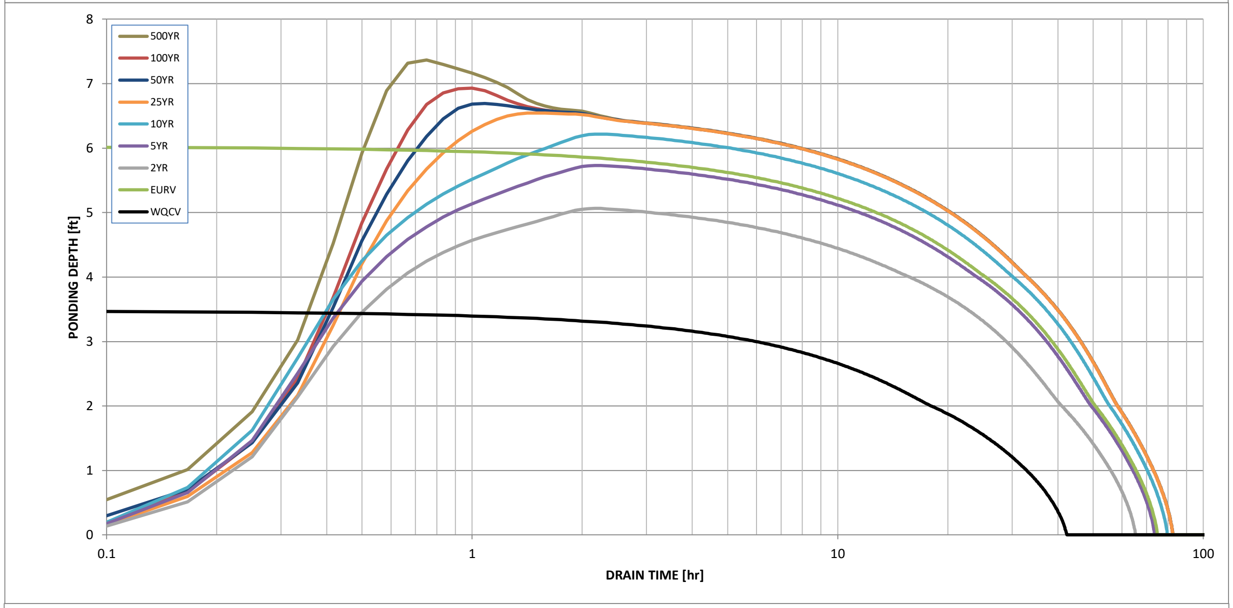
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.49
CUHP Runoff Volume (acre-ft) =	0.235	0.831	0.593	0.785	0.938	1.163	1.384	1.660	2.617
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.593	0.785	0.938	1.163	1.384	1.660	2.617
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.3	0.4	3.3	6.4	10.4	23.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.03	0.26	0.50	0.81	1.83
Peak Inflow Q (cfs) =	N/A	N/A	11.3	15.0	17.8	23.3	28.4	35.6	56.0
Peak Outflow Q (cfs) =	0.1	0.3	0.3	0.3	0.3	2.3	5.8	10.6	34.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.1	0.8	0.7	0.9	1.0	1.5
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.2	0.5	1.0	1.0
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	64	57	64	68	69	67	65	58
Time to Drain 99% of Inflow Volume (hours) =	**40**	70	62	69	75	77	76	75	72
Maximum Ponding Depth (ft) =	3.48	6.03	5.06	5.73	6.22	6.54	6.69	6.93	7.37
Area at Maximum Ponding Depth (acres) =	0.15	0.31	0.26	0.29	0.32	0.34	0.35	0.36	0.38
Maximum Volume Stored (acre-ft) =	0.236	0.832	0.556	0.742	0.889	0.998	1.049	1.134	1.294

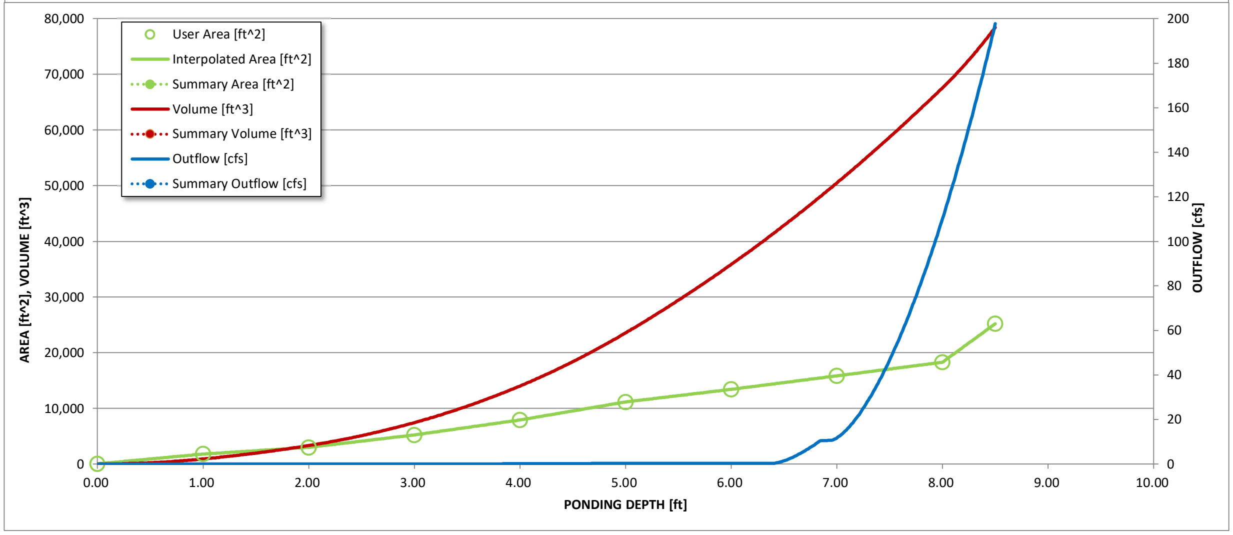
WINDERMERE FILING NO. 2 SOUTH POND
FINAL DESIGN DEVELOPED CONDITION

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







WINDERMERE FILING NO. 2 SOUTH POND
FINAL DESIGN DEVELOPED CONDITION

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

The user can override the calculated inflow hydrographs from this workbook with inflow hydrographs developed in a separate program.

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.02	0.95
	0:15:00	0.00	0.00	1.68	2.73	3.39	2.28	2.81	2.79	4.49
	0:20:00	0.00	0.00	5.61	7.23	8.47	5.32	6.15	6.66	9.68
	0:25:00	0.00	0.00	10.75	14.52	17.75	10.67	12.20	13.26	20.56
	0:30:00	0.00	0.00	11.32	14.97	17.61	22.87	28.23	32.69	53.10
	0:35:00	0.00	0.00	9.30	12.01	14.00	23.34	28.40	35.57	55.97
	0:40:00	0.00	0.00	7.55	9.51	11.03	20.01	24.38	30.21	47.63
	0:45:00	0.00	0.00	5.82	7.52	8.79	15.67	18.93	24.52	38.91
	0:50:00	0.00	0.00	4.67	6.22	7.11	12.74	15.26	19.35	31.09
	0:55:00	0.00	0.00	3.80	5.00	5.79	9.84	11.69	15.27	24.59
	1:00:00	0.00	0.00	3.09	4.02	4.72	7.73	9.07	12.35	19.94
	1:05:00	0.00	0.00	2.65	3.40	4.07	6.08	7.06	10.03	16.32
	1:10:00	0.00	0.00	2.19	3.15	3.85	4.64	5.31	7.03	11.24
	1:15:00	0.00	0.00	1.94	2.90	3.78	3.95	4.48	5.42	8.50
	1:20:00	0.00	0.00	1.80	2.64	3.47	3.31	3.74	4.04	6.17
	1:25:00	0.00	0.00	1.71	2.47	3.02	2.93	3.30	3.20	4.77
	1:30:00	0.00	0.00	1.66	2.36	2.72	2.51	2.83	2.71	3.93
	1:35:00	0.00	0.00	1.63	2.30	2.53	2.25	2.54	2.38	3.37
	1:40:00	0.00	0.00	1.60	2.01	2.40	2.09	2.35	2.17	3.03
	1:45:00	0.00	0.00	1.59	1.81	2.32	1.99	2.23	2.07	2.87
	1:50:00	0.00	0.00	1.59	1.69	2.26	1.93	2.17	2.04	2.82
	1:55:00	0.00	0.00	1.31	1.61	2.15	1.90	2.13	2.02	2.80
	2:00:00	0.00	0.00	1.13	1.50	1.92	1.88	2.11	2.02	2.80
	2:05:00	0.00	0.00	0.72	0.96	1.24	1.21	1.36	1.30	1.79
	2:10:00	0.00	0.00	0.45	0.60	0.78	0.77	0.86	0.82	1.13
	2:15:00	0.00	0.00	0.27	0.37	0.48	0.47	0.53	0.50	0.69
	2:20:00	0.00	0.00	0.15	0.22	0.28	0.28	0.31	0.30	0.41
	2:25:00	0.00	0.00	0.08	0.12	0.15	0.16	0.18	0.17	0.23
	2:30:00	0.00	0.00	0.03	0.06	0.06	0.07	0.08	0.07	0.10
	2:35:00	0.00	0.00	0.01	0.01	0.02	0.02	0.02	0.02	0.02
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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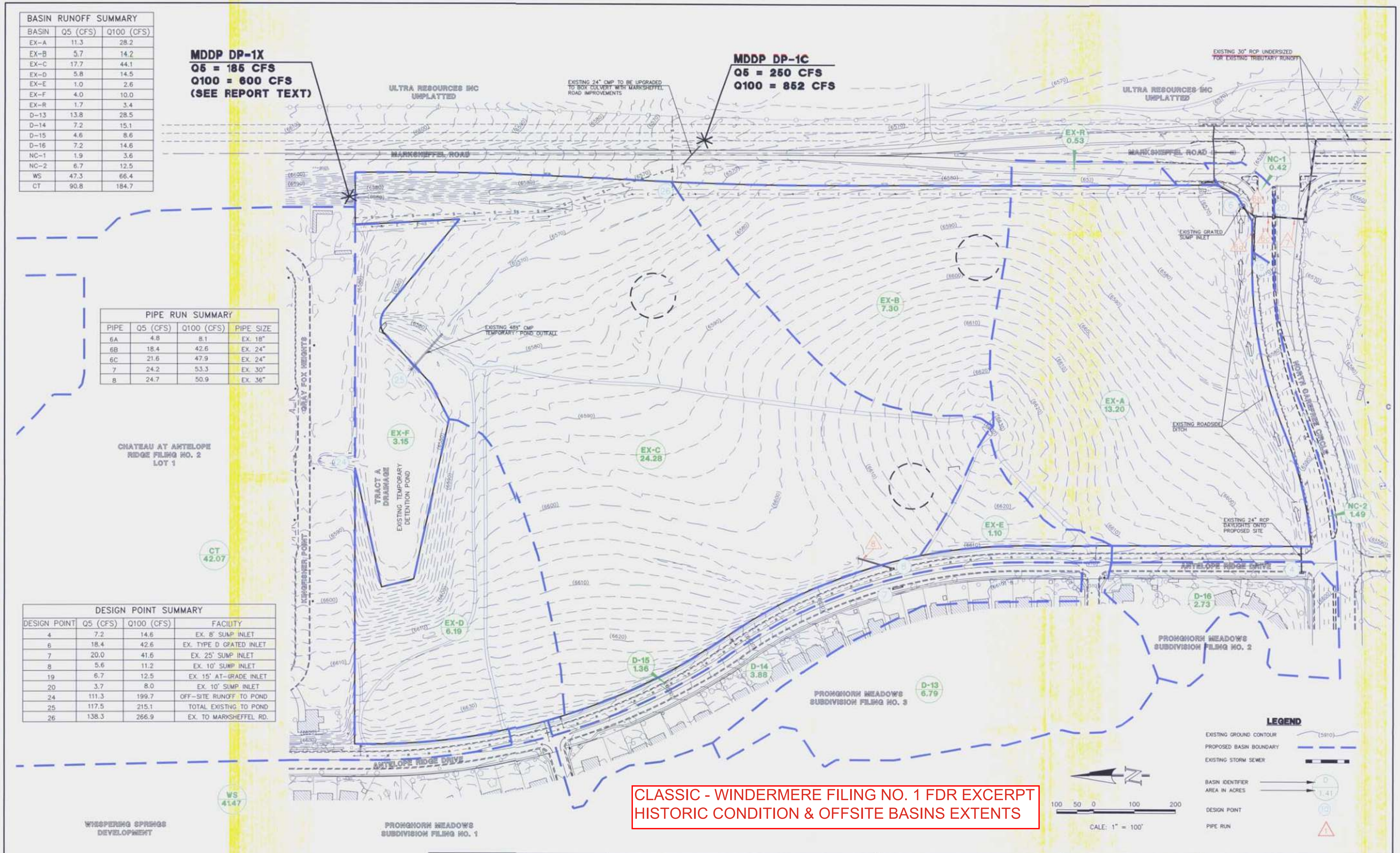
DRAINAGE MAPS



BASIN RUNOFF SUMMARY		
BASIN	Q5 (CFS)	Q100 (CFS)
EX-A	11.3	28.2
EX-B	5.7	14.2
EX-C	17.7	44.1
EX-D	5.8	14.5
EX-E	1.0	2.6
EX-F	4.0	10.0
EX-R	1.7	3.4
D-13	13.8	28.5
D-14	7.2	15.1
D-15	4.6	8.6
D-16	7.2	14.6
NC-1	1.9	3.6
NC-2	6.7	12.5
WS	47.3	66.4
CT	90.8	184.7

PIPE RUN SUMMARY			
PIPE	Q5 (CFS)	Q100 (CFS)	PIPE SIZE
6A	4.8	8.1	EX. 18"
6B	18.4	42.6	EX. 24"
6C	21.6	47.9	EX. 24"
7	24.2	53.3	EX. 30"
8	24.7	50.9	EX. 36"

DESIGN POINT SUMMARY			
DESIGN POINT	Q5 (CFS)	Q100 (CFS)	FACILITY
4	7.2	14.6	EX. 8' SUMP INLET
6	18.4	42.6	EX. TYPE D GRATED INLET
7	20.0	41.6	EX. 25' SUMP INLET
8	5.6	11.2	EX. 10' SUMP INLET
19	6.7	12.5	EX. 15' AT-GRADE INLET
20	3.7	8.0	EX. 10' SUMP INLET
24	111.3	199.7	OFF-SITE RUNOFF TO POND
25	117.5	215.1	TOTAL EXISTING TO POND
26	138.3	266.9	EX. TO MARKSHEFFEL RD.

CLASSIC - WINDERMERE FILING NO. 1 FDR EXCERPT
HISTORIC CONDITION & OFFSITE BASINS EXTENTS

48 HOURS BEFORE YOU DIG,
CALL UTILITY LOCATORS
8·11
UTILITY NOTIFICATION OF COLORADO
IT'S THE LAW

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE CAUSED BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

NO.	REVISION	DATE

REVIEW:

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF CLASSIC CONSULTING ENGINEERS AND SURVEYORS, LLC

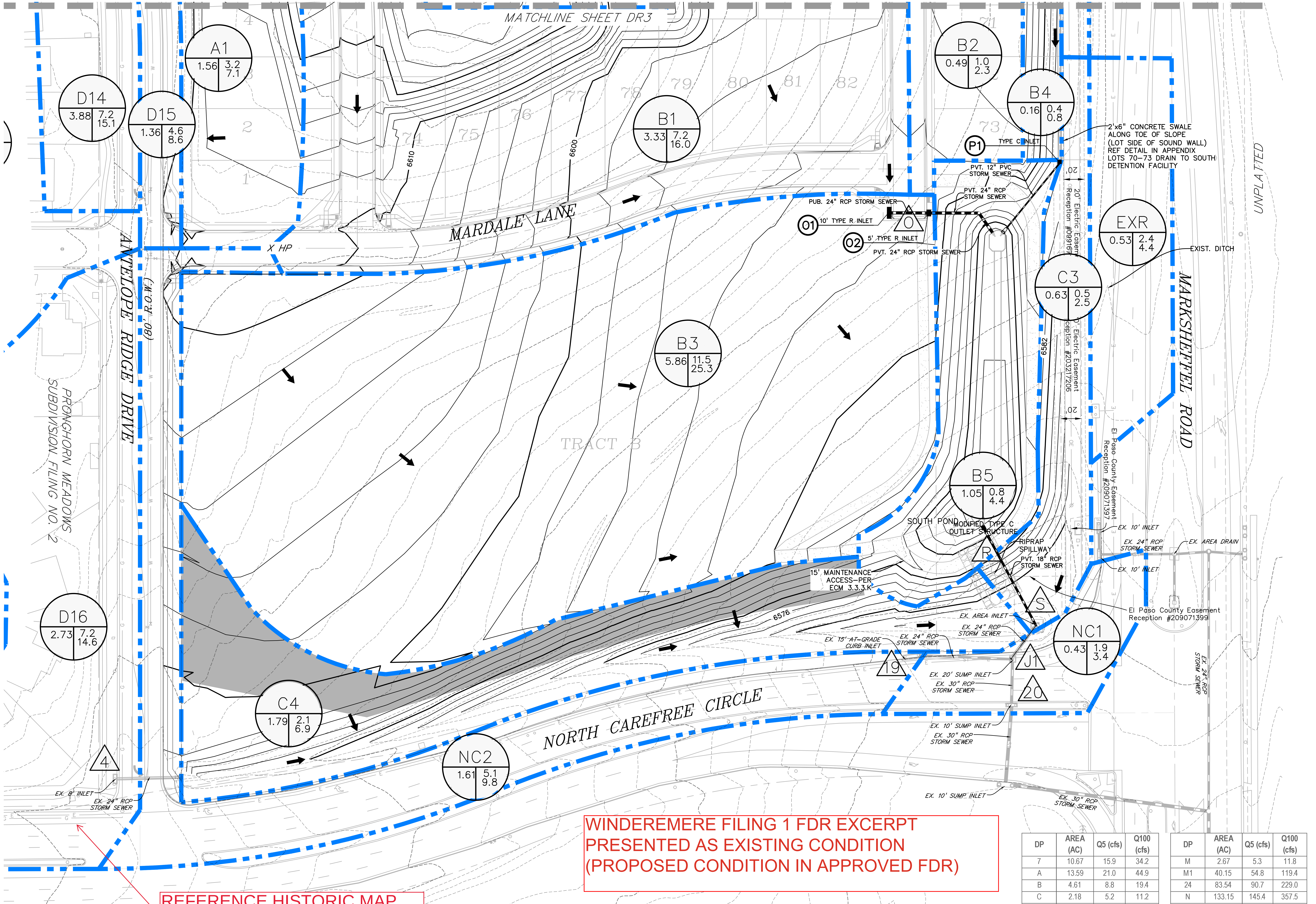
KYLE R. CAMPBELL, COLORADO P.E. #29794 DATE

CLASSIC
CONSULTING
ENGINEERS & SURVEYORS

6385 Corpote Drive, Suite 101
Colorado Sprgs, Colorado 80919
(719)785-0790
(719)785-0799(Fax)

WINDERMERE
EXISTING CONDITIONS DRAINAGE MAP
PRELIMINARY DRAINAGE REPORT WINDERMERE
FINAL DRAINAGE REPORT WINDERMERE FIL. NO. 1

DESIGNED BY	MAL	SCALE		DATE	09/01//14
DRAWN BY	MAL	(H) 1"= 100'		SHEET	1 OF 1
CHECKED BY		(V) 1"= N/A		JOB NO.	2241.000



WINDEREMERE FILING 1 FDR EXCERPT
PRESENTED AS EXISTING CONDITION
(PROPOSED CONDITION IN APPROVED FDR)

REFERENCE HISTORIC MAP
FOR BASIN D16 EXTENTS

DP	AREA (AC)	Q5 (cfs)	Q100 (cfs)
7	10.67	15.9	34.2
A	13.59	21.0	44.9
B	4.61	8.8	19.4
C	2.18	5.2	11.2
C1	20.38	29.5	63.5
D	1.01	1.7	3.8
D1	21.39	30.6	66.1
E	1.98	4.3	9.5
F	3.73	7.0	15.4
F1	27.10	38.2	82.8
G	1.56	3.0	6.6
H	2.96	6.1	13.4
H1	4.52	8.6	19.0
I	1.86	4.0	8.7
J	6.38	11.8	25.9
K	33.48	46.3	100.7
L	4.00	7.5	16.5
L1	37.48	51.4	111.8

DP	AREA (AC)	Q5 (cfs)	Q100 (cfs)
M	2.67	5.3	11.8
M1	40.15	54.8	119.4
24	83.54	90.7	229.0
N	133.15	145.4	357.5
North Pond Release		1.8	66.0
T	437.97	190.5	682.4
O	3.82	8.1	17.9
R	10.89	19.9	46.2
South Pond Release		0.2	9.2
4	2.73	4.9	10.7
S	16.57	10.0	33.7
19	1.61	5.1	9.8
J1	18.18	15.1	43.5
20	18.61	17.0	46.9
V	0.11	0.1	0.5

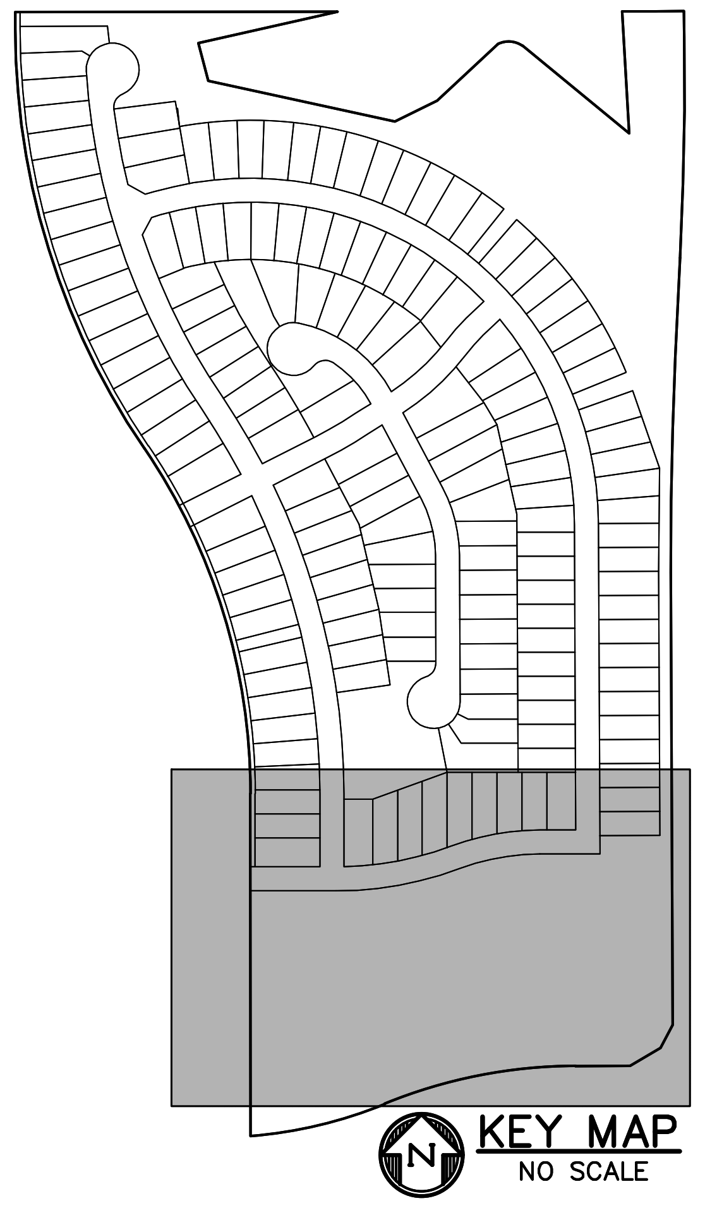
LEGEND

PROPOSED INTERMEDIATE CONTOUR	—	*EX. MANHOLE*	⊕ MH
PROPOSED INDEX CONTOUR	— 5750 —	*EX. STORM SEWER*	▬
EX. INTERMEDIATE CONTOUR	- - -	BASIN BOUNDARY	— · —
EX. INDEX CONTOUR	- - 5750 - -	FLOW DIRECTION	←
PROPOSED STORM SEWER	▬	DESIGN POINT	△1
PROPOSED INLET	■		
PROPOSED FLARED END SECTION	▷		
PROPOSED SITE LIGHTING	☐		

AREA (ACRE) — A1 2.32 2.9 6.7 — BASIN, Q5 (cfs), Q100 (cfs)

DEVELOPED AREA DRAINING OFFSITE SEE SHEET DR4 ▨

Know what's below. Call before you dig.
CALL 3–BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.



SCALE: 1"=50'

NOTE:
SEE "PRELIMINARY DRAINAGE REPORT FOR WINDERMERE," BY CLASSIC CONSULTING ENGINEERS & SURVEYORS, OCTOBER 2014 FOR EXISTING DRAINAGE MAP AND CALCULATIONS INCLUDING BASINS D16, NC1, NC2 AND THEIR DESIGN POINTS

PREPARED BY:

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CLIENT:

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DRAINAGE MAP FOR
WINDERMERE
FILING NO. 1
N. MARKSHEFFEL ROAD
EL PASO COUNTY, COLORADO

ISSUE	DATE
INITIAL ISSUE	7–9–21
RESUBMITTAL	1–5–22

DESIGNED BY:	SBN
DRAWN BY:	SBN
CHECKED BY:	TDM
FILE NAME:	

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF DREXEL, BARRELL & CO.

DRAWING SCALE:
HORIZONTAL: 1" = 50'
VERTICAL: N/A

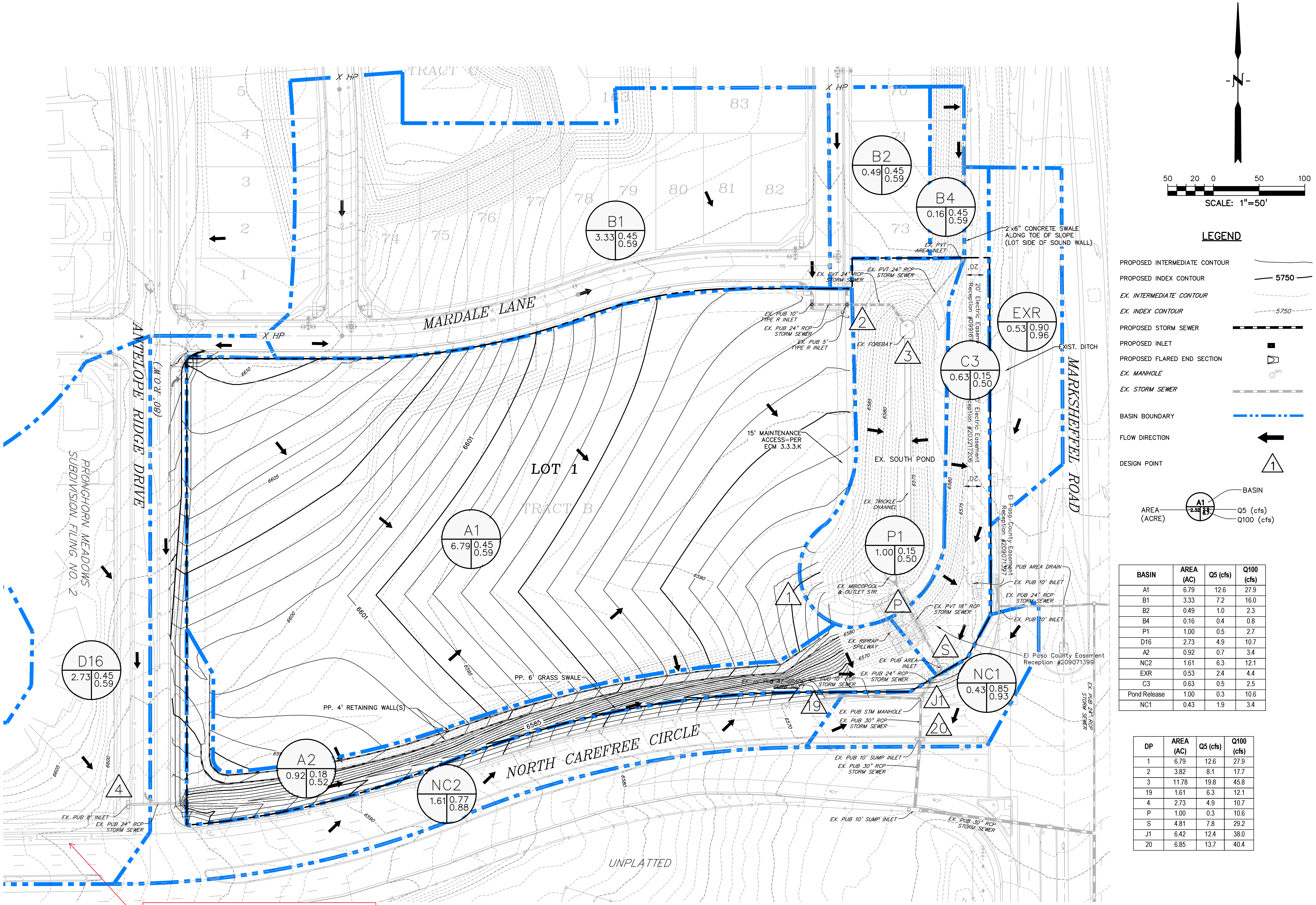
PROPOSED DRAINAGE MAP

PROJECT NO. 21187–01CSCV

DRAWING NO.

DR4

SHEET: 4 OF 5



REFERENCE HISTORIC MAP FOR BASIN D16 EXTENTS

LEGEND

PROPOSED INTERMEDIATE CONTOUR	——
PROPOSED INDEX CONTOUR	—— 5750 ——
EX. INTERMEDIATE CONTOUR	- - - -
EX. INDEX CONTOUR	- - 5750 - -
PROPOSED STORM SEWER	—■—■—
PROPOSED INLET	■
PROPOSED FLARED END SECTION	▷
EX. MANHOLE	○
EX. STORM SEWER	——
BASIN BOUNDARY	—·—·—
FLOW DIRECTION	←
DESIGN POINT	△ 1

A1 — BASIN
AREA (ACRE) — 2.32
2.9 — Q5 (cfs)
6.7 — Q100 (cfs)

BASIN	AREA (AC)	Q5 (cfs)	Q100 (cfs)
A1	6.79	12.6	27.9
B1	3.33	7.2	16.0
B2	0.49	1.0	2.3
B4	0.16	0.4	0.8
P1	1.00	0.5	2.7
D16	2.73	4.9	10.7
A2	0.92	0.7	3.4
NC2	1.61	6.3	12.1
EXR	0.53	2.4	4.4
C3	0.63	0.5	2.5
Pond Release	1.00	0.3	10.6
NC1	0.43	1.9	3.4

DP	AREA (AC)	Q5 (cfs)	Q100 (cfs)
1	6.79	12.6	27.9
2	3.82	8.1	17.7
3	11.78	19.8	45.8
19	1.61	6.3	12.1
4	2.73	4.9	10.7
P	1.00	0.3	10.6
S	4.81	7.8	29.2
J1	6.42	12.4	38.0
20	6.85	13.7	40.4

COUNTY FILE NO.: SP223

PREPARED BY:

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CLIENT:

COLO WINDERMERE #2, LLC
4164 AUSTIN BLUFFS PWY, #361
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DRAINAGE PLANS FOR
WINDERMERE FILING 2
N. MARKSHEFFEL ROAD
EL PASO COUNTY, COLORADO

ISSUE	DATE
INITIAL ISSUE	4/1/22
REVISED	8/2/24

DESIGNED BY:	KGV
DRAWN BY:	KGV
CHECKED BY:	TDM
FILE NAME:	

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF
DREXEL, BARRELL & CO.

DRAWING SCALE:
HORIZONTAL: 1" = 50'
VERTICAL: N/A

PROPOSED DRAINAGE MAP

PROJECT NO. 21187–03CSCV
DRAWING NO.

DR

SHEET: 1 OF 1

APPPENDIX F - SOILS AND GEOLOGY STUDY – RMG - Rocky Mountain Group

Architecture
Structural
Geotechnical

ARCHITECTS
RMG
ENGINEERS

Materials Testing
Forensic
Civil/Planning

ROCKY MOUNTAIN GROUP
EMPLOYEE OWNED

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

Kelli Zigler
Project Geologist

Reviewed by,
RMG – Rocky Mountain Group

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

Tony Munger, P.E.
Geotechnical Project Manager

TABLE OF CONTENTS

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.
4. *Preliminary 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 April 17, 2018.
5. *Subsurface Soil Investigation, Windermere Subdivision, El Paso County, Colorado,* prepared by RMG – Rocky Mountain Group, Job No. 142206, last dated May 28, 2015.
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.

Artificial Fill (CL and SC/SM)

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 <u>*not intended*</u> 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

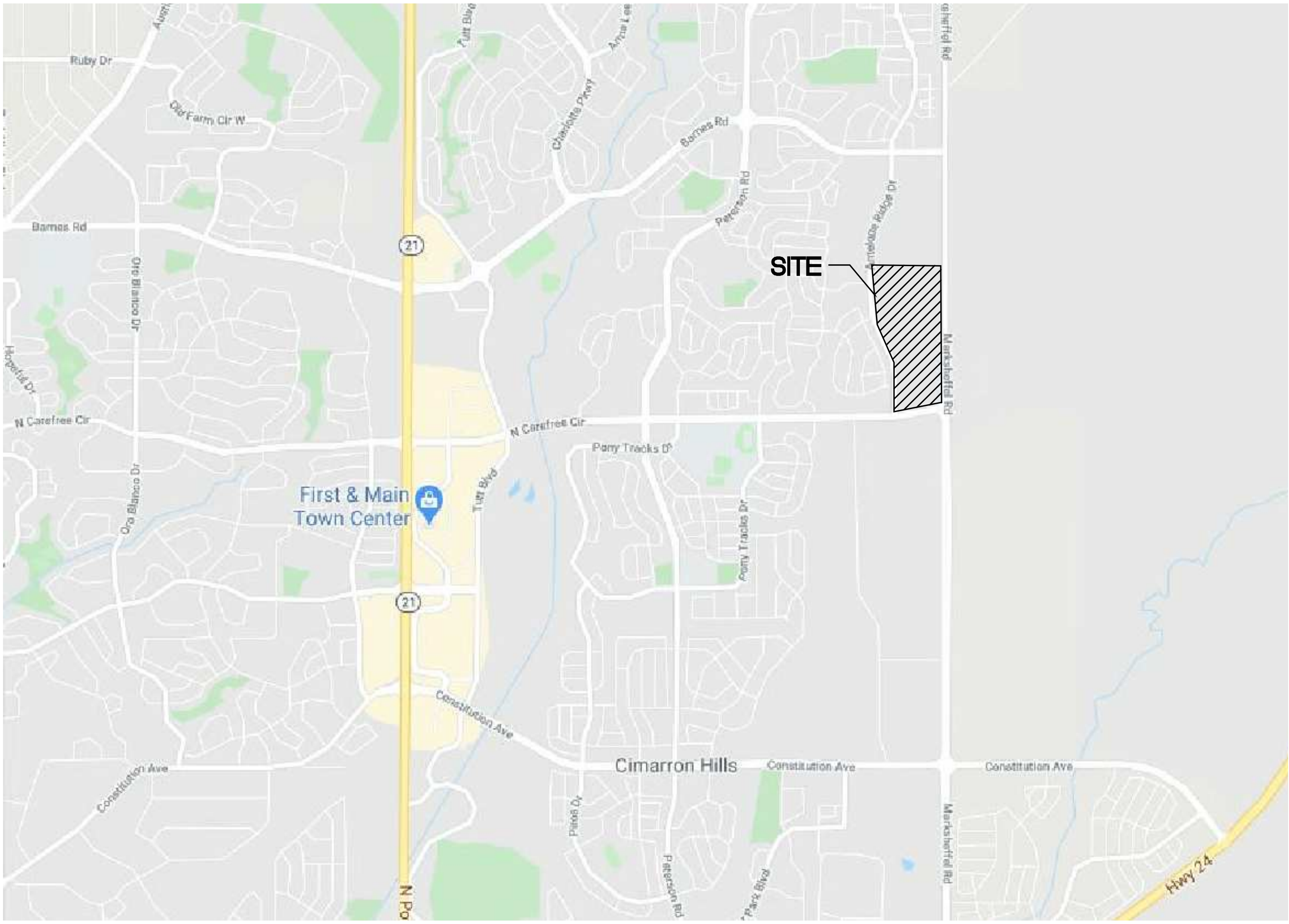
This report is for the exclusive purpose of providing geologic hazards information and preliminary geotechnical engineering recommendations. The scope of services did not include, either specifically or by implication, evaluation of wild fire hazards, environmental assessment of the site, or identification 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



NOT TO SCALE

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RMG
ENGINEERS

ROCKY MOUNTAIN GROUP

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Northern Office:
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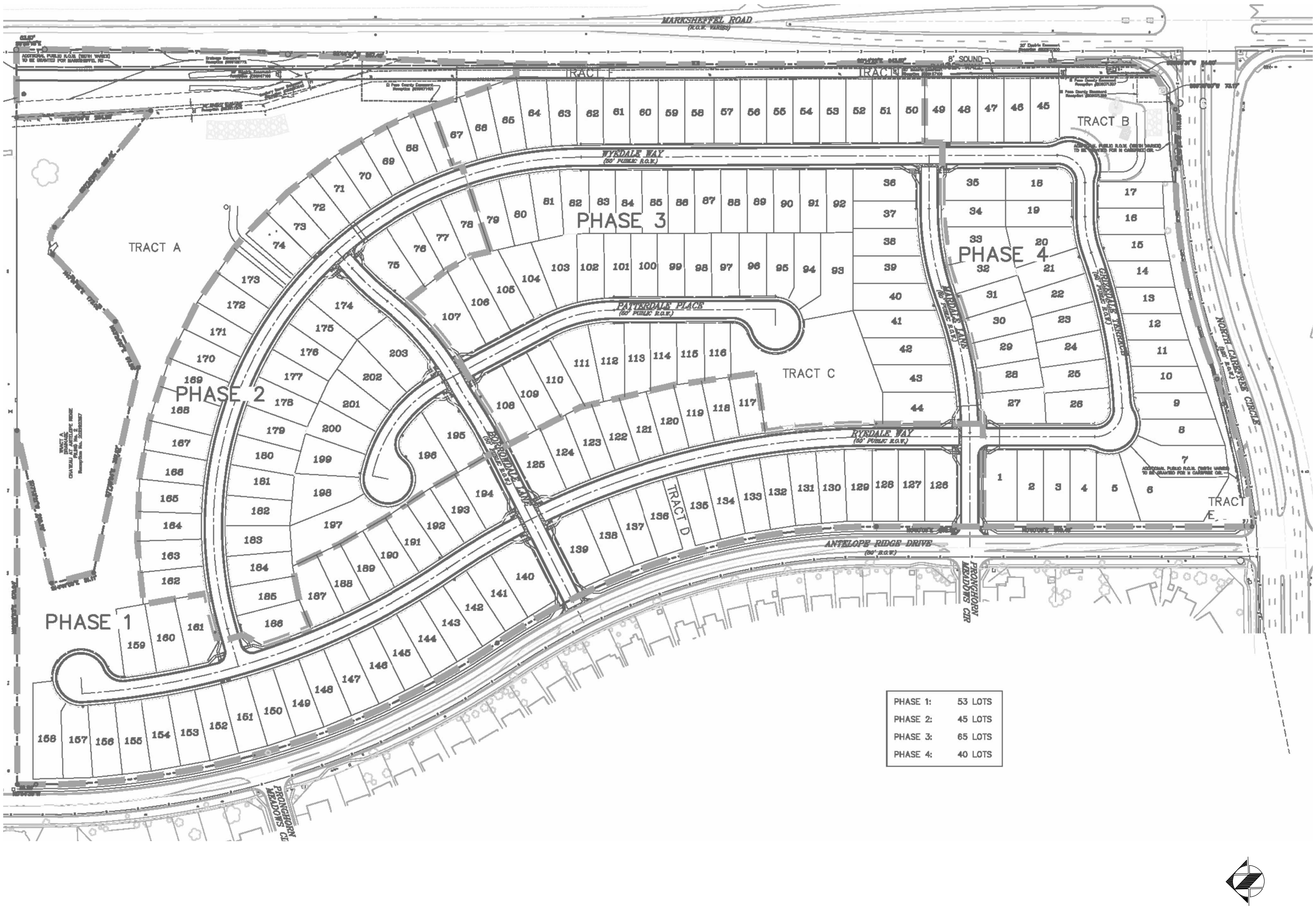
SITE VICINITY MAP

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

JOB No. 162062

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(970) 330-1071
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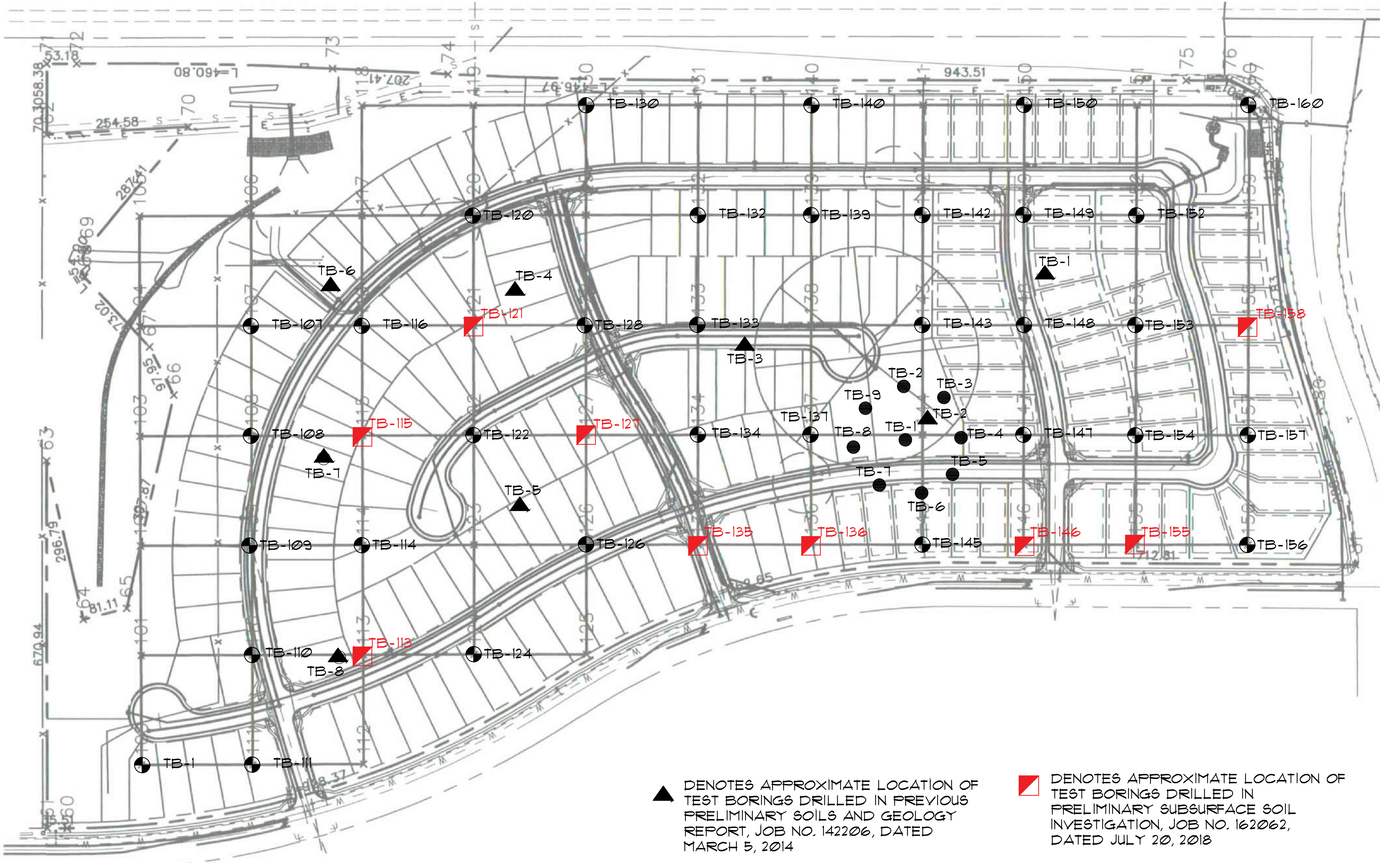
Monument Office:
(719) 488-2145
Pueblo / Canon City:
(719) 544-7750

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



NOT TO SCALE

▲ 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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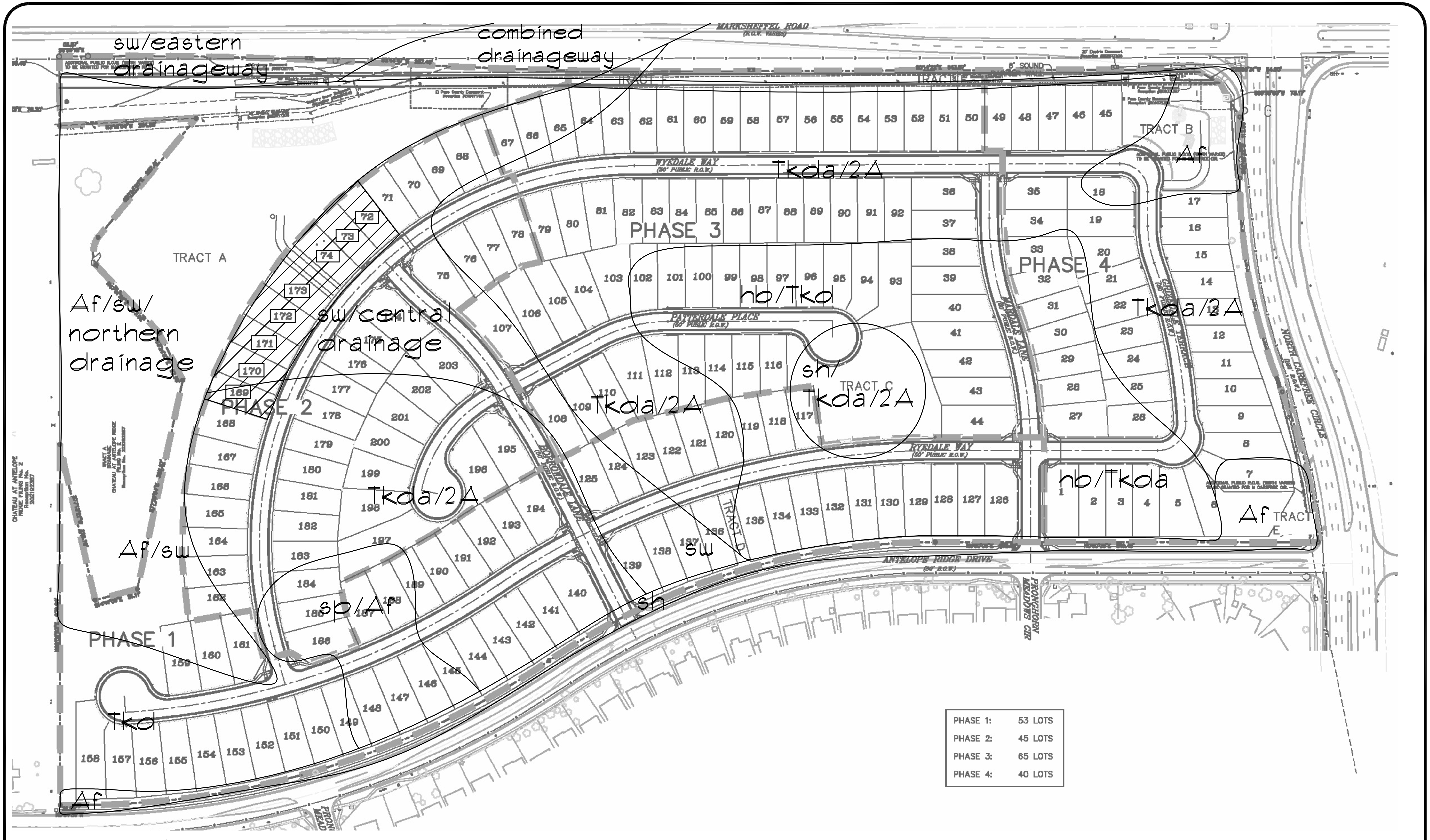
WINDERMERE SUBDIVISION
EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

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

TEST BORING LOCATION PLAN

SHEET No.
FIG-3



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.

NOT TO SCALE

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

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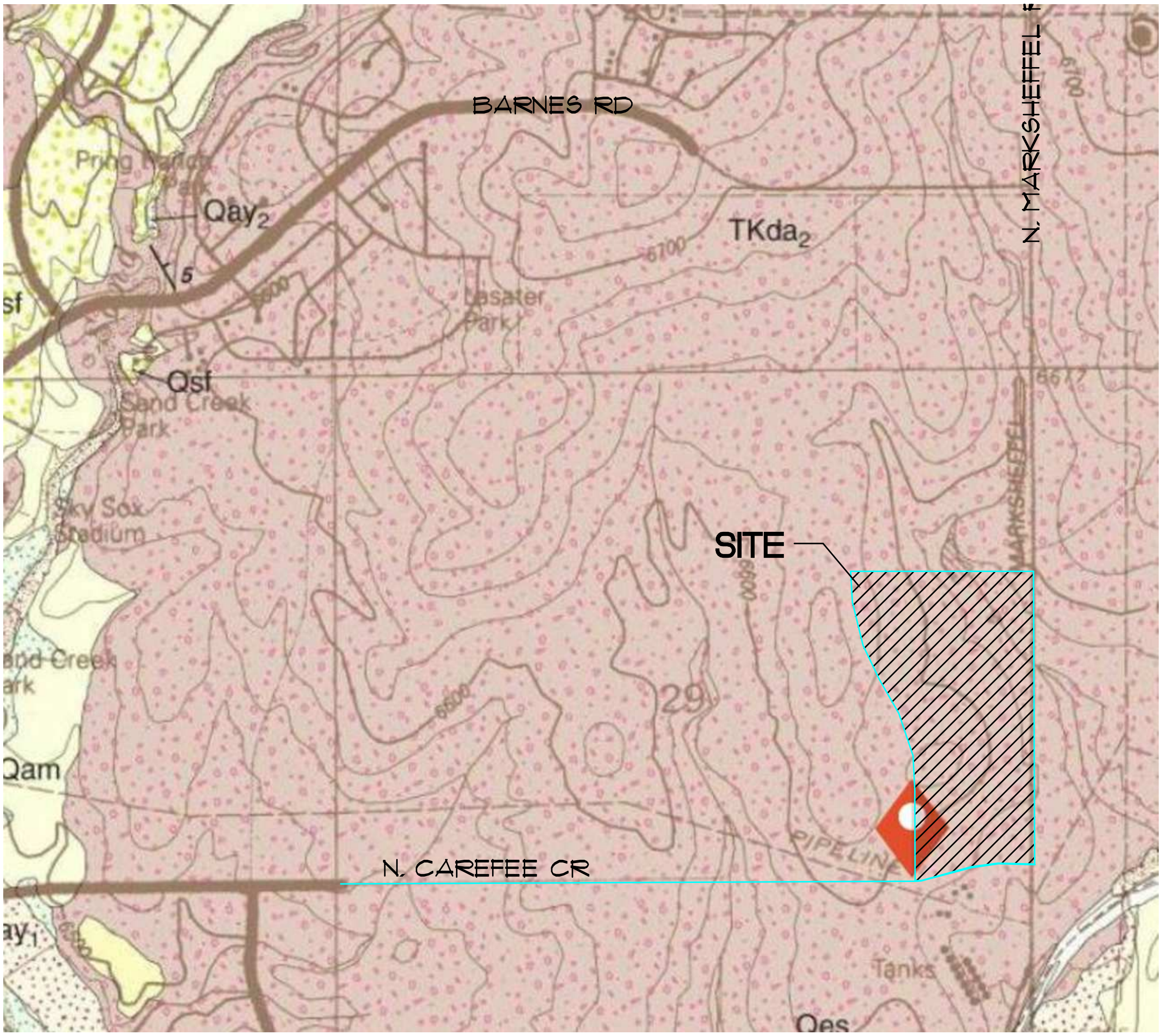
WINDERMERE
N. MARKSHEFFEL RD
EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

ENGINEER: TPM
DRAWN BY: KZ
CHECKED BY: TPM
ISSUED: 10-26-2020
REVISION:
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
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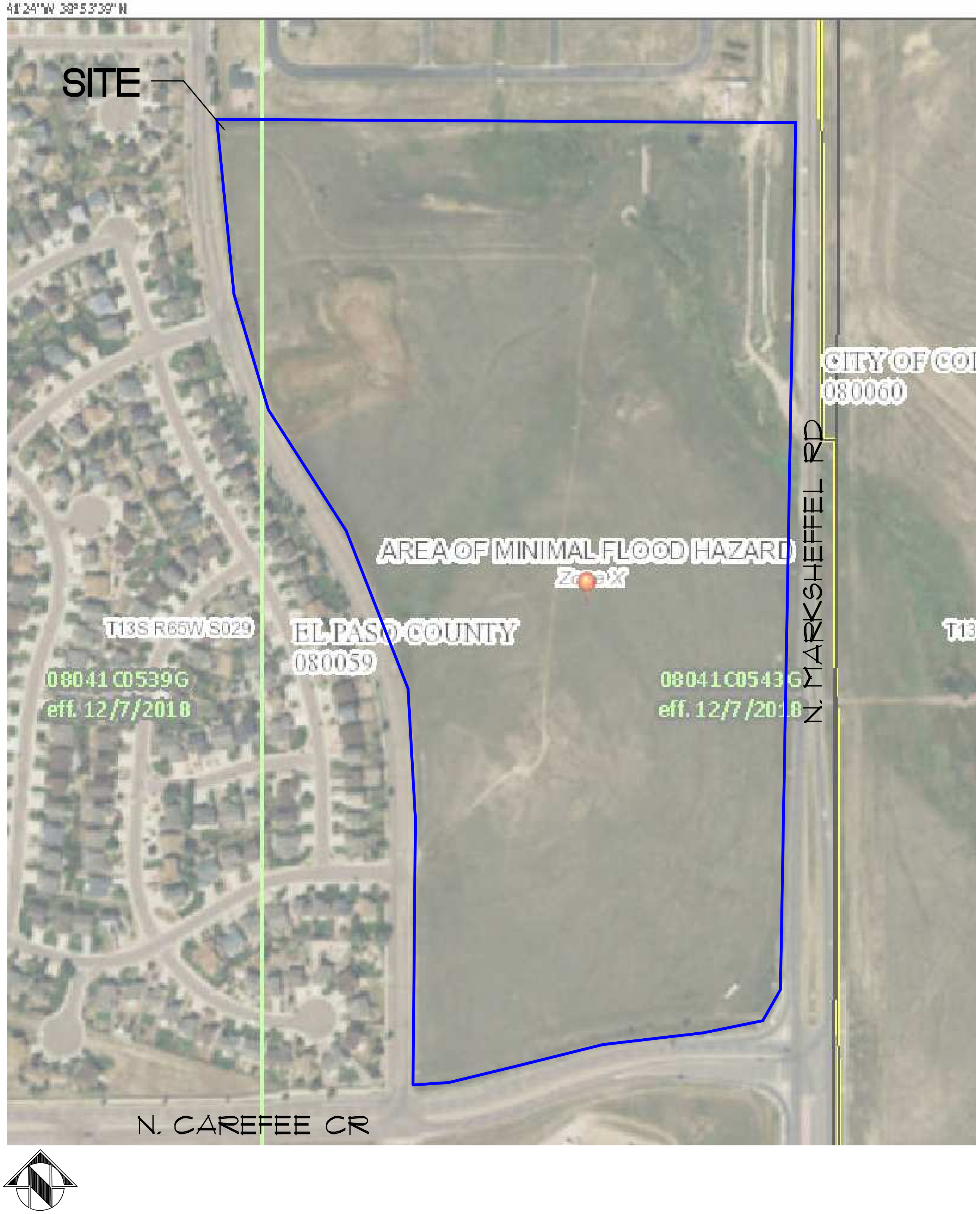
EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

JOB No. 162062

FIG No. 5

DATE 10-26-2020



NOT TO SCALE
BASE MAP PROVIDED BY: FEMA

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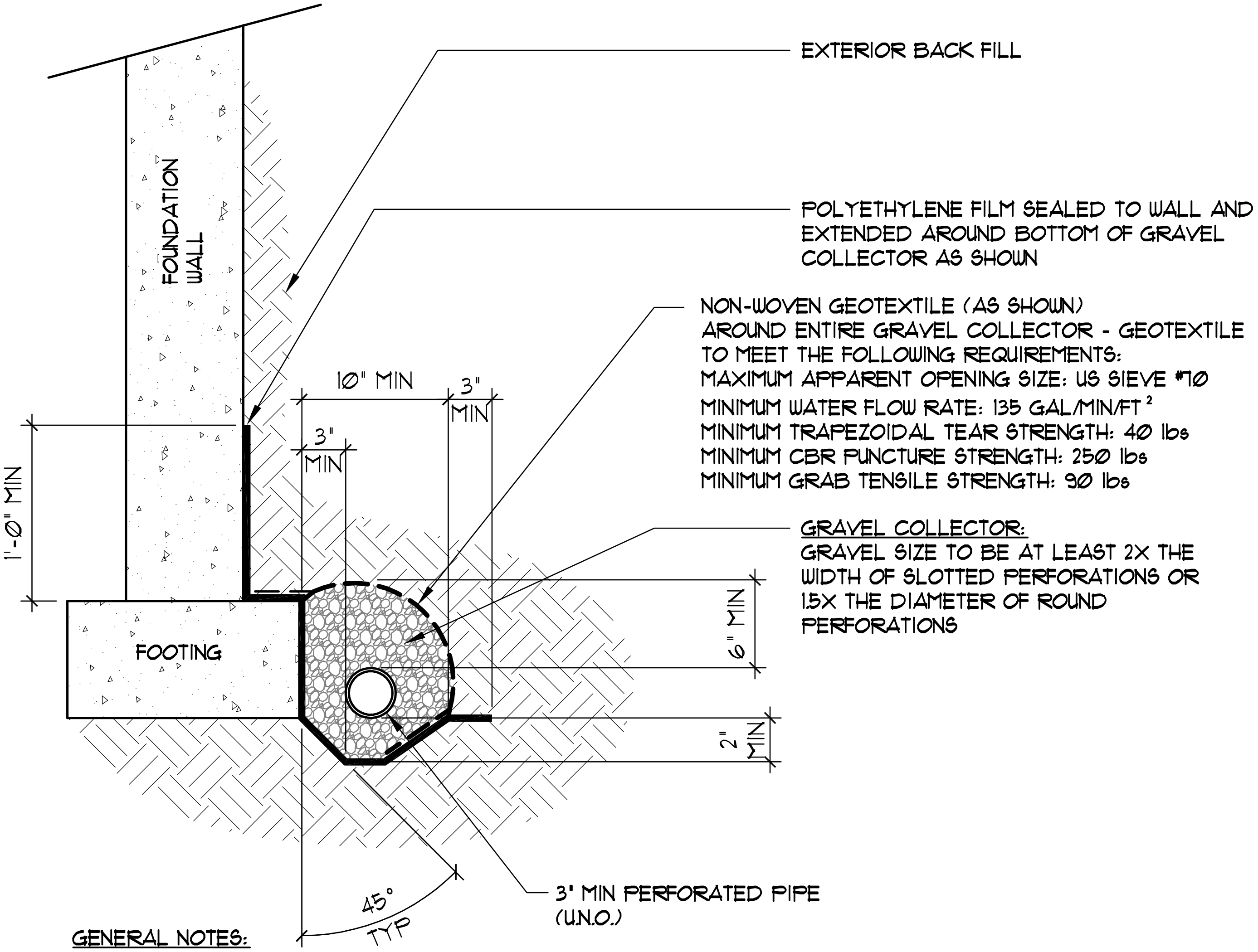
FEMA MAP

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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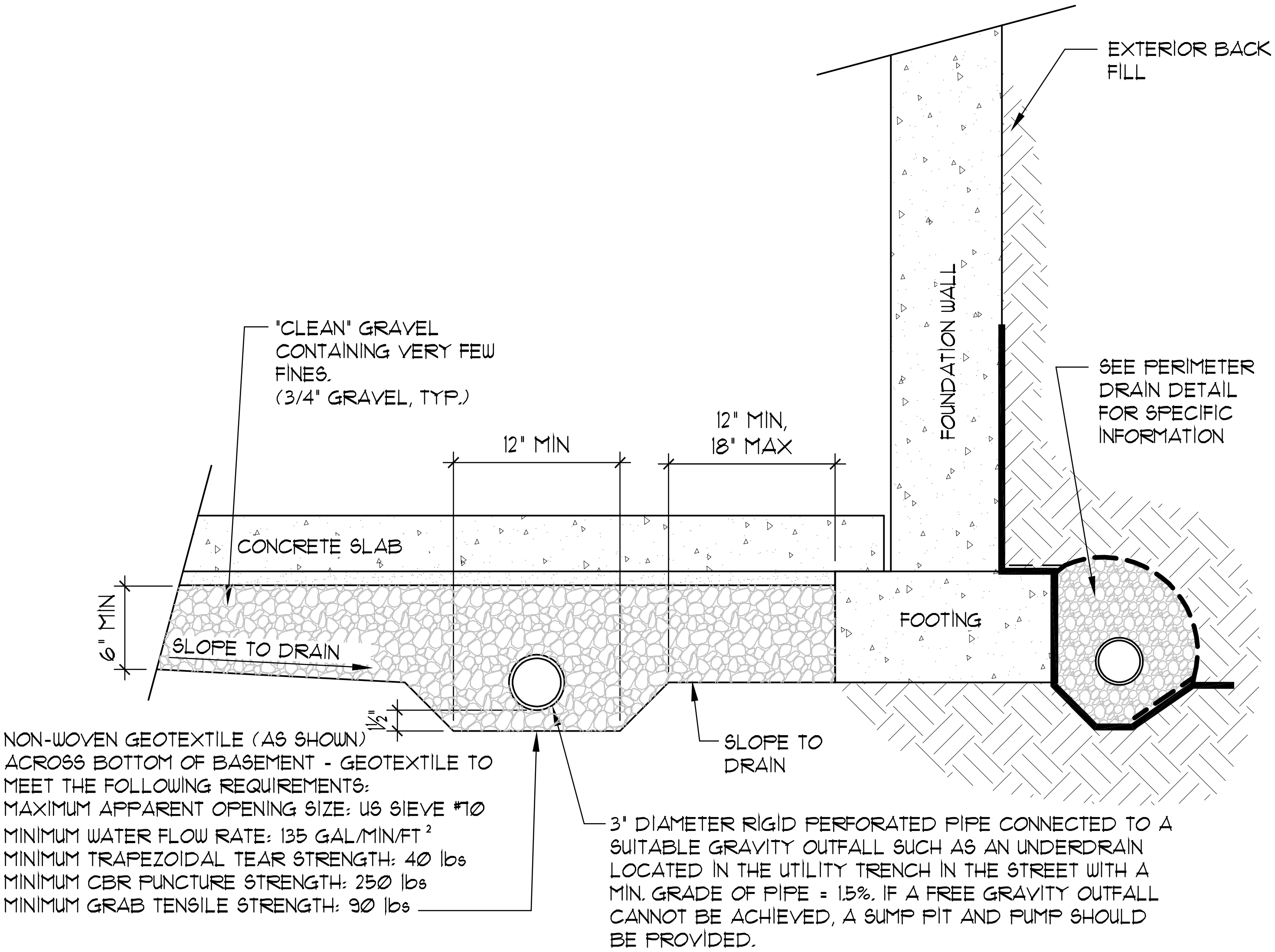
PERIMETER DRAIN

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.

3. 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.

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.

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
SANDSTONE, SILTY, blue, very hard, moist		⁚			
	25	⁚			
	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
SANDSTONE, SILTY TO CLAYEY, brown, very hard, moist	15		■	50/6"	17.4
	20				
SANDSTONE, SILTY, blue, very hard, moist	25		■	50/3"	--

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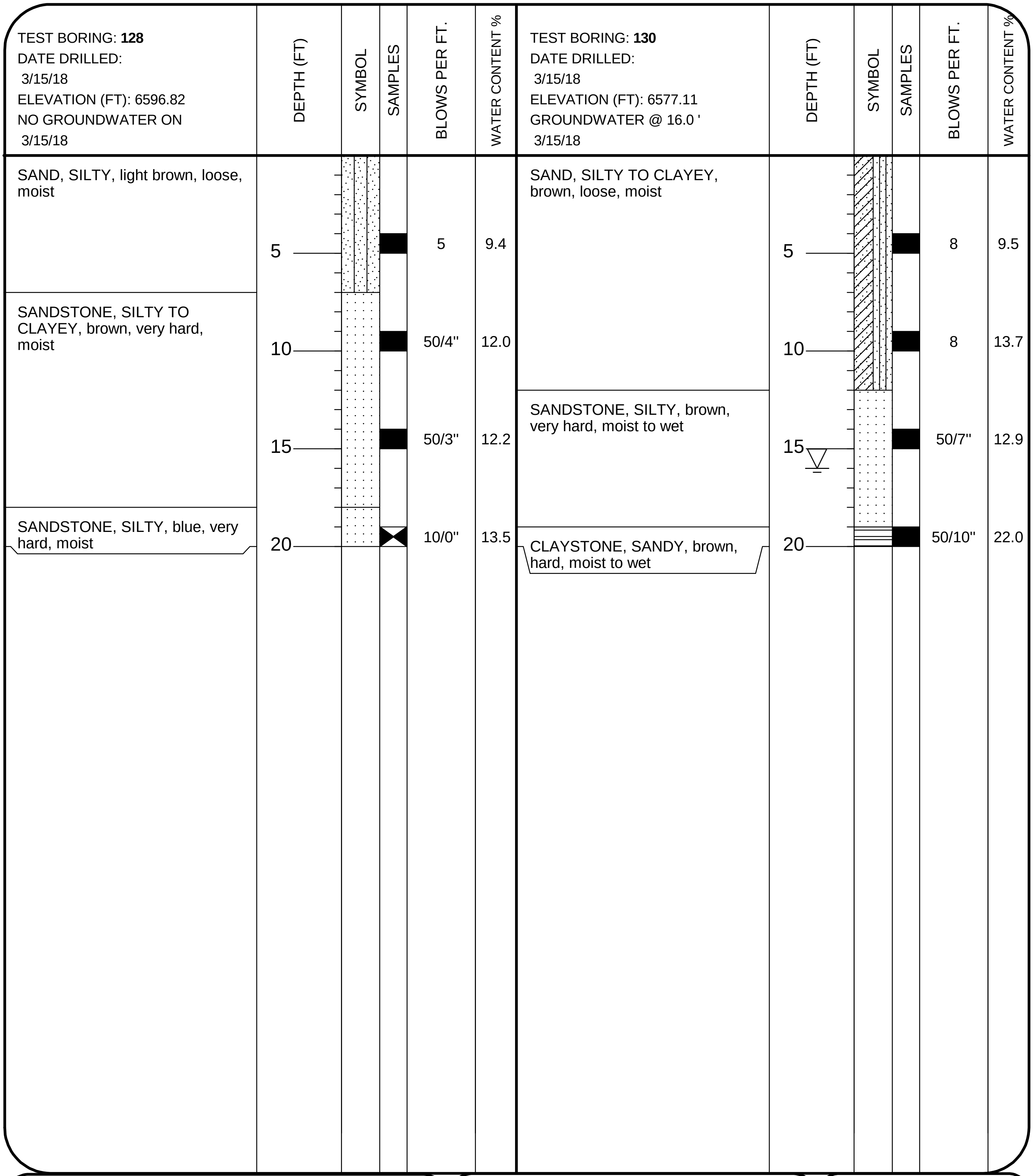
TEST BORING LOGS

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
CLAYSTONE, SANDY, brown, hard, moist to wet					
	20		■	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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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

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

AUGER REFUSAL AT 30' DUE TO HARD BEDROCK

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

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

AUGER REFUSAL AT 25' DUE TO HARD BEDROCK

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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)	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)	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
SANDSTONE, SILTY, blue and dark gray, moist	25				
	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
PAGE 1 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
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

JOB No. 162062
FIGURE No. 21
PAGE 2 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
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								

SUMMARY OF LABORATORY TEST RESULTS

JOB No. 162062
FIGURE No. 21

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
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								

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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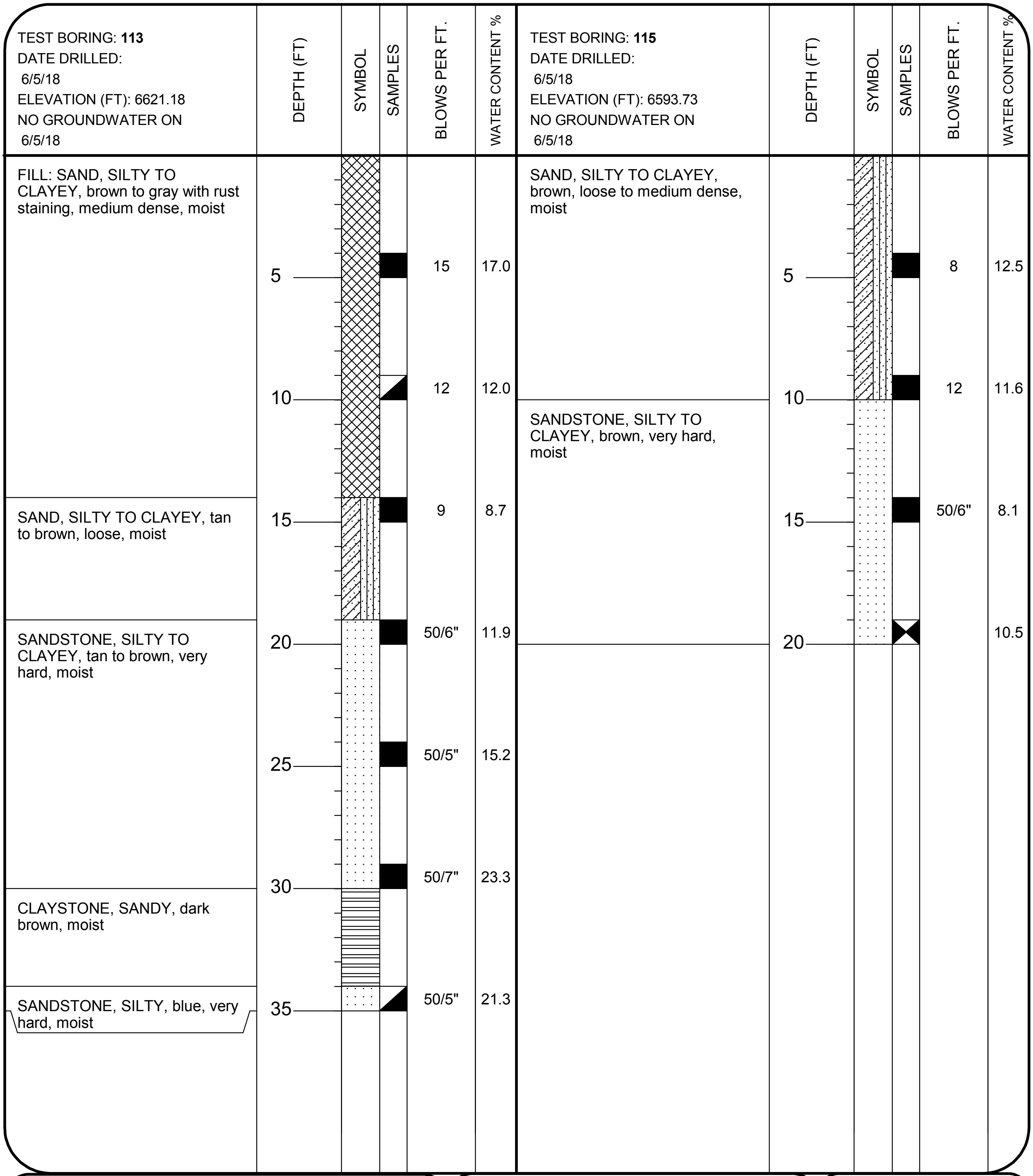
SUMMARY OF LABORATORY TEST RESULTS

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

FILL: SAND, SILTY TO CLAYEY, brown to gray with rust staining, medium dense, moist

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

SANDSTONE, SILTY TO CLAYEY, tan to brown, very hard, moist

CLAYSTONE, SANDY, dark brown, moist

SANDSTONE, SILTY, blue, very hard, moist

DEPTH (FT)	BLOWS PER FT.	WATER CONTENT %
5	15	17.0
10	12	12.0
15	9	8.7
20	50/6"	11.9
25	50/5"	15.2
30	50/7"	23.3
35	50/5"	21.3

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

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

SANDSTONE, SILTY TO CLAYEY, brown, very hard, moist

DEPTH (FT)	BLOWS PER FT.	WATER CONTENT %
5	8	12.5
10	12	11.6
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

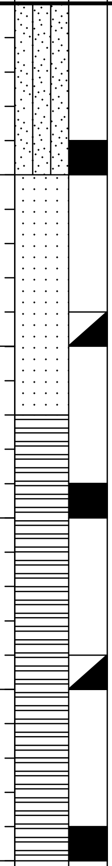
JOB No. 162062

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)	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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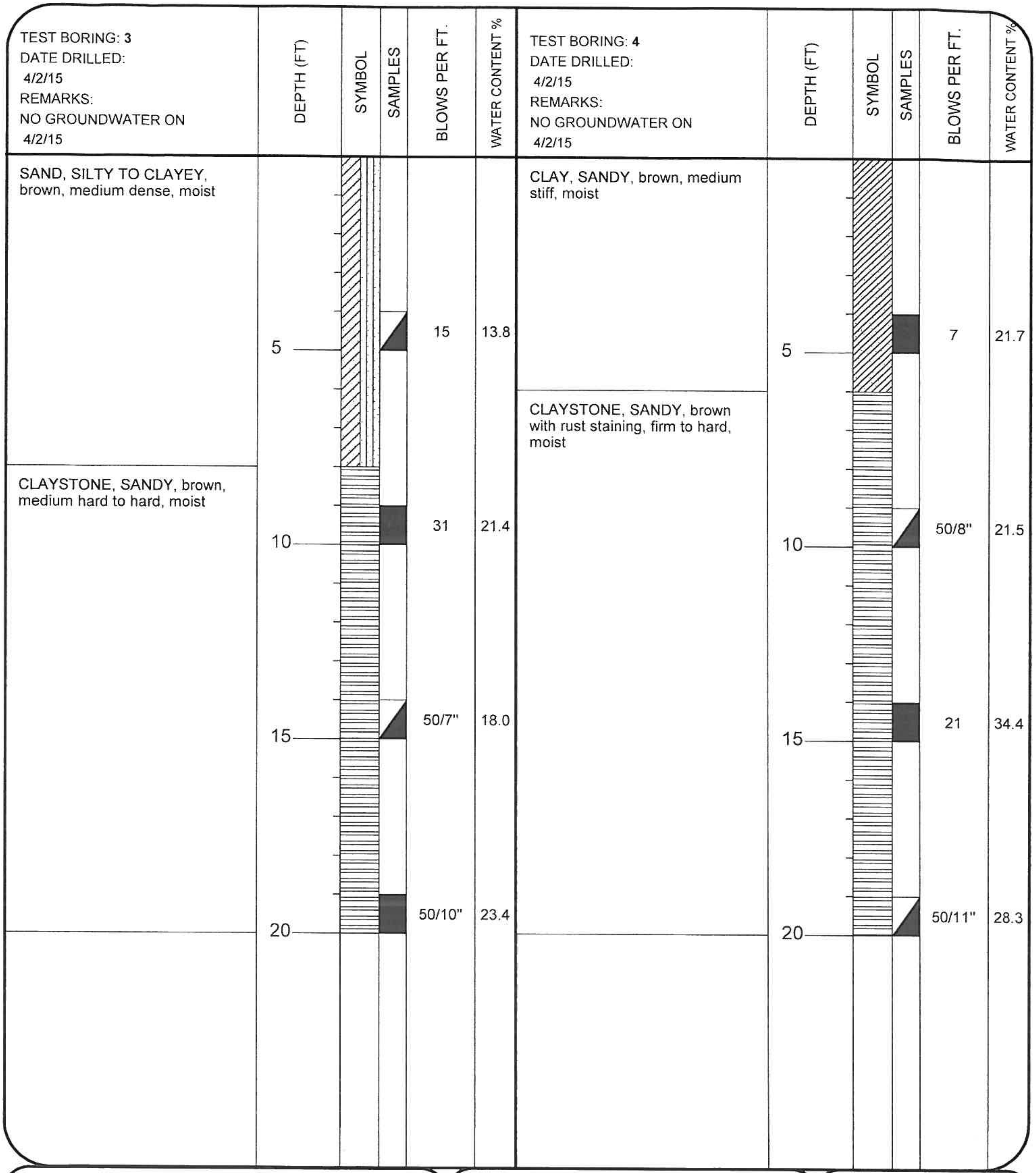
TEST BORING LOGS

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)	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)	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					
SANDSTONE, SILTY, brown with rust staining, hard, moist	5			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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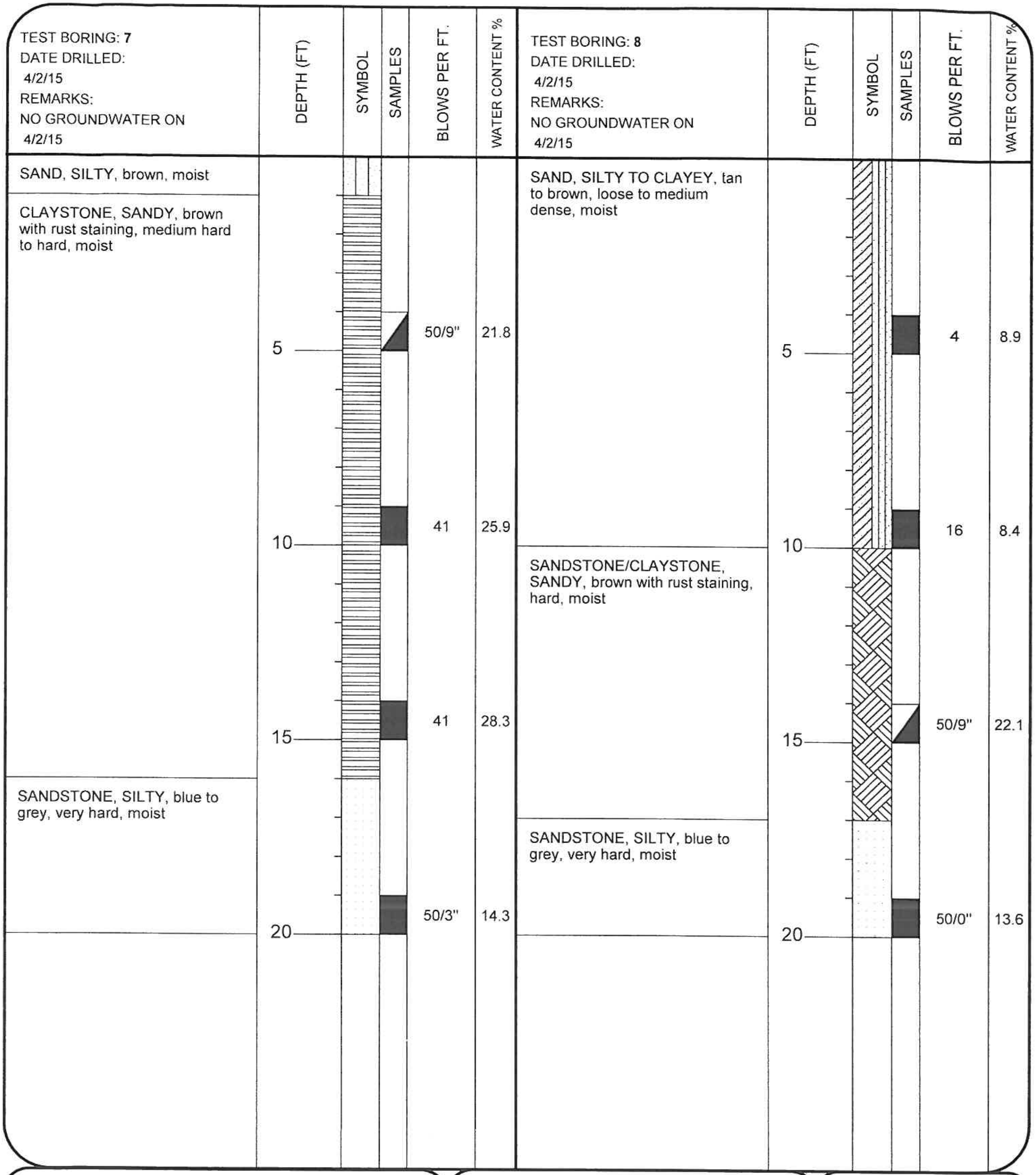
TEST BORING LOGS

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

SAND, SILTY, brown, moist

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

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

BLOWS PER FT.	WATER CONTENT %
50/9"	21.8
41	25.9
41	28.3
50/3"	14.3

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

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

SANDSTONE/CLAYSTONE, SANDY, brown with rust staining, hard, moist

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

BLOWS PER FT.	WATER CONTENT %
4	8.9
16	8.4
50/9"	22.1
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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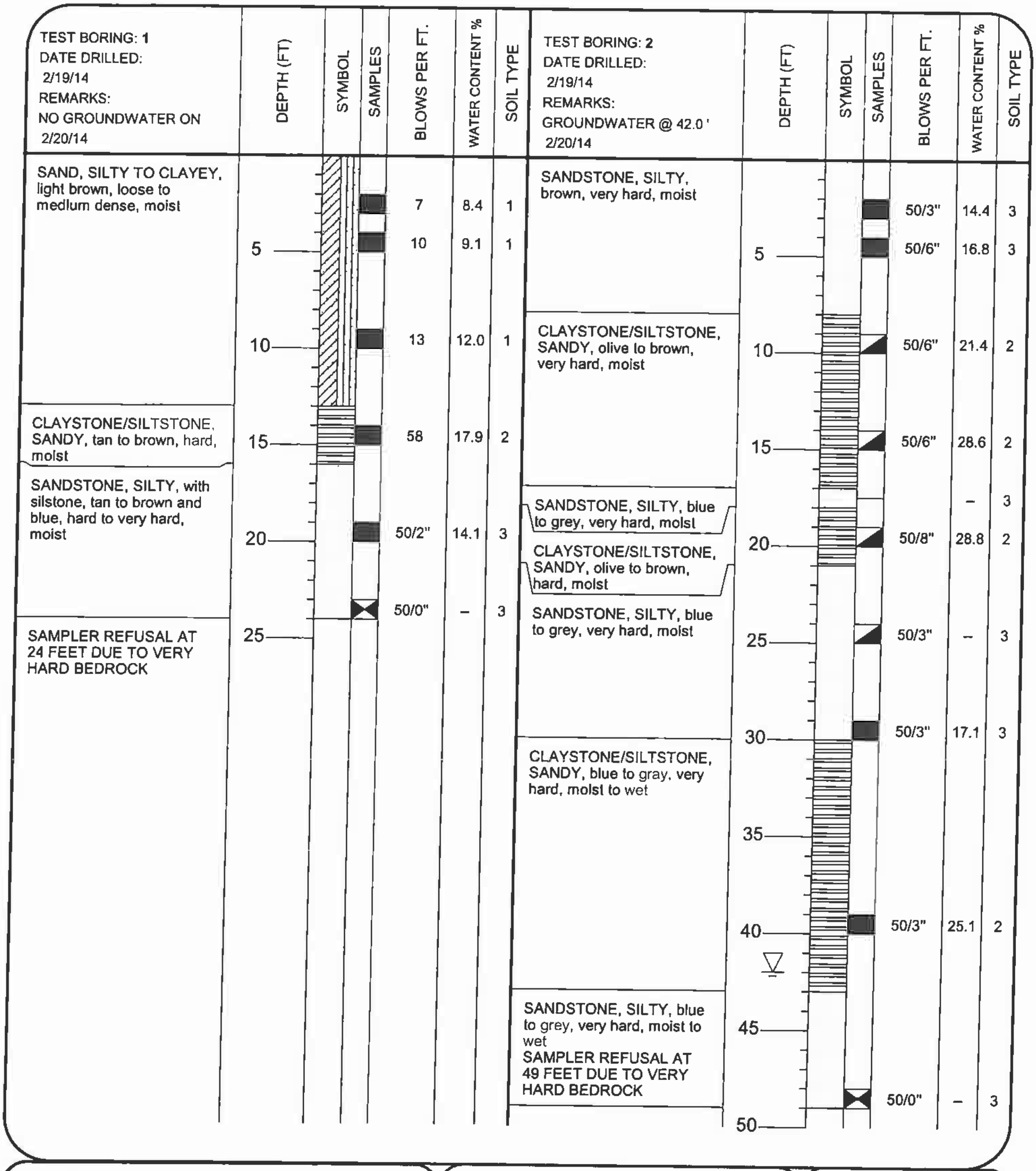
SUMMARY OF LABORATORY TEST RESULTS

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

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

BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
7	8.4	1
10	9.1	1
13	12.0	1
58	17.9	2
50/2"	14.1	3
50/0"	–	3

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

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

BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
50/3"	14.4	3
50/6"	16.8	3
50/6"	21.4	2
50/6"	28.6	2
	–	3
50/8"	28.8	2
50/3"	–	3
50/3"	17.1	3
50/3"	25.1	2
50/0"	–	3

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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

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

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
			50/0"	–	3
20					

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

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

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
				--	3
20					

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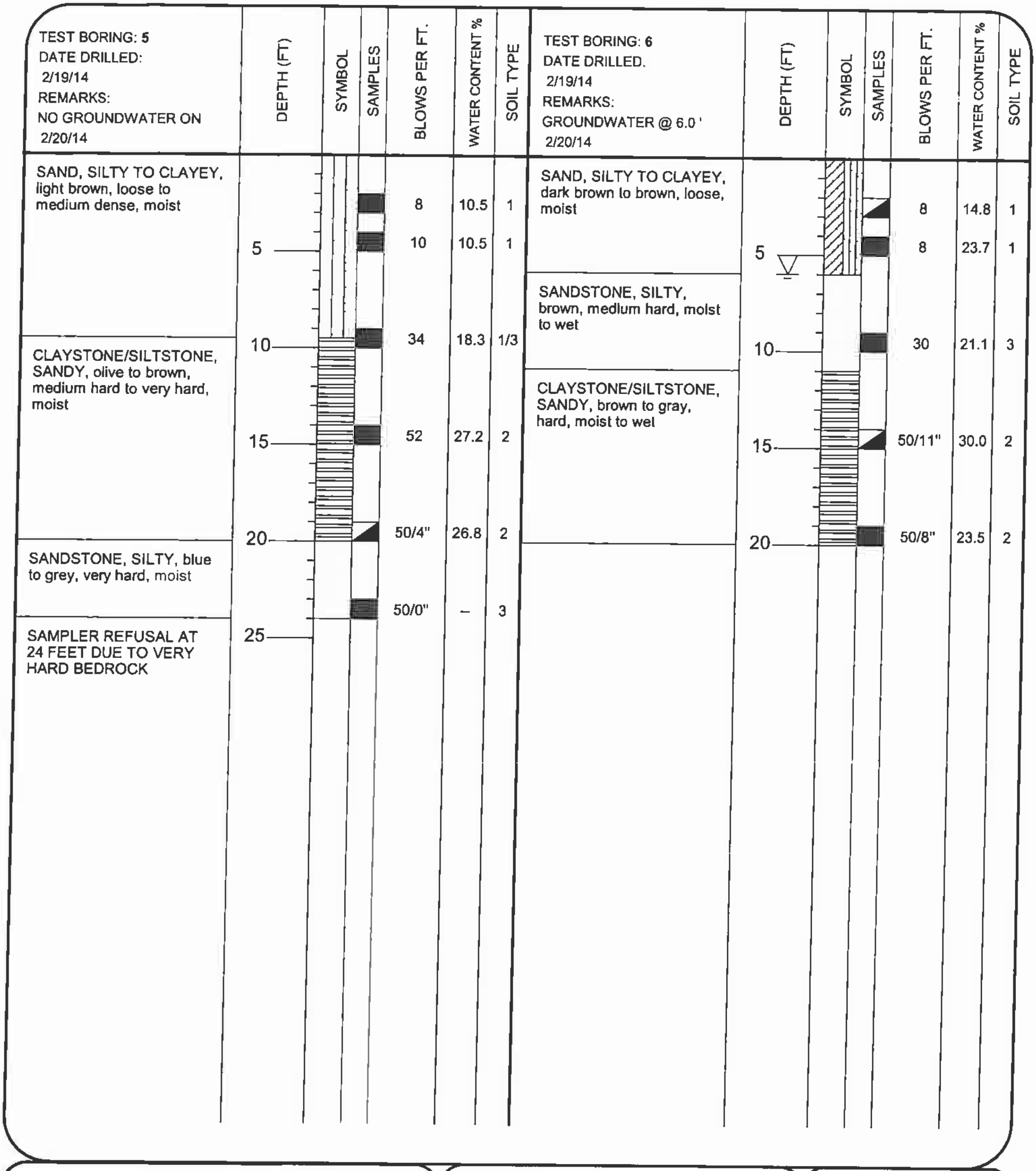
TEST BORING LOGS

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)	BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
SAND, SILTY TO CLAYEY, light brown, loose to medium dense, moist		8	10.5	1
	5	10	10.5	1
CLAYSTONE/SILTSTONE, SANDY, olive to brown, medium hard to very hard, moist	10	34	18.3	1/3
	15	52	27.2	2
SANDSTONE, SILTY, blue to grey, very hard, moist	20	50/4"	26.8	2
		50/0"	–	3
SAMPLER REFUSAL AT 24 FEET DUE TO VERY HARD BEDROCK	25			

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

	DEPTH (FT)	BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
SAND, SILTY TO CLAYEY, dark brown to brown, loose, moist		8	14.8	1
	5	8	23.7	1
SANDSTONE, SILTY, brown, medium hard, moist to wet	10	30	21.1	3
CLAYSTONE/SILTSTONE, SANDY, brown to gray, hard, moist to wet	15	50/11"	30.0	2
	20	50/8"	23.5	2

Colorado Springs (Corporate Office)
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Colorado Springs, CO 80918
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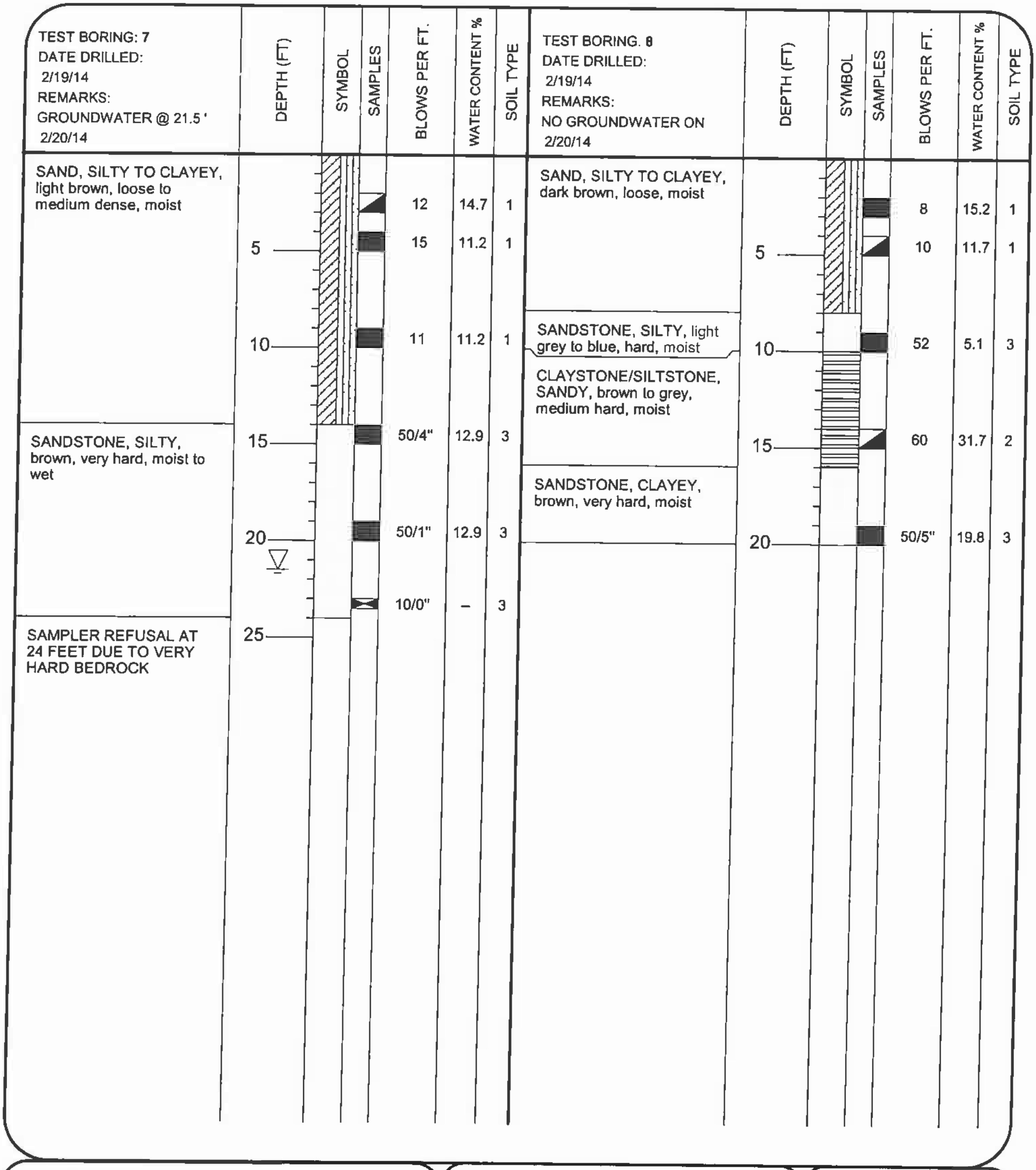
TEST BORING LOGS

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
			12	14.7	1
5			15	11.2	1
10			11	11.2	1
15			50/4"	12.9	3
20			50/1"	12.9	3
			10/0"	–	3
25					

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

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

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
			8	15.2	1
5			10	11.7	1
10			52	5.1	3
15			60	31.7	2
20			50/5"	19.8	3

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

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

CLAYSTONE/SILTSTONE, SANDY, brown to grey, medium hard, moist

SANDSTONE, CLAYEY, brown, very hard, moist

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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

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

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RMG
Engineers / Architects

Materials Testing
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Civil/Planning

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

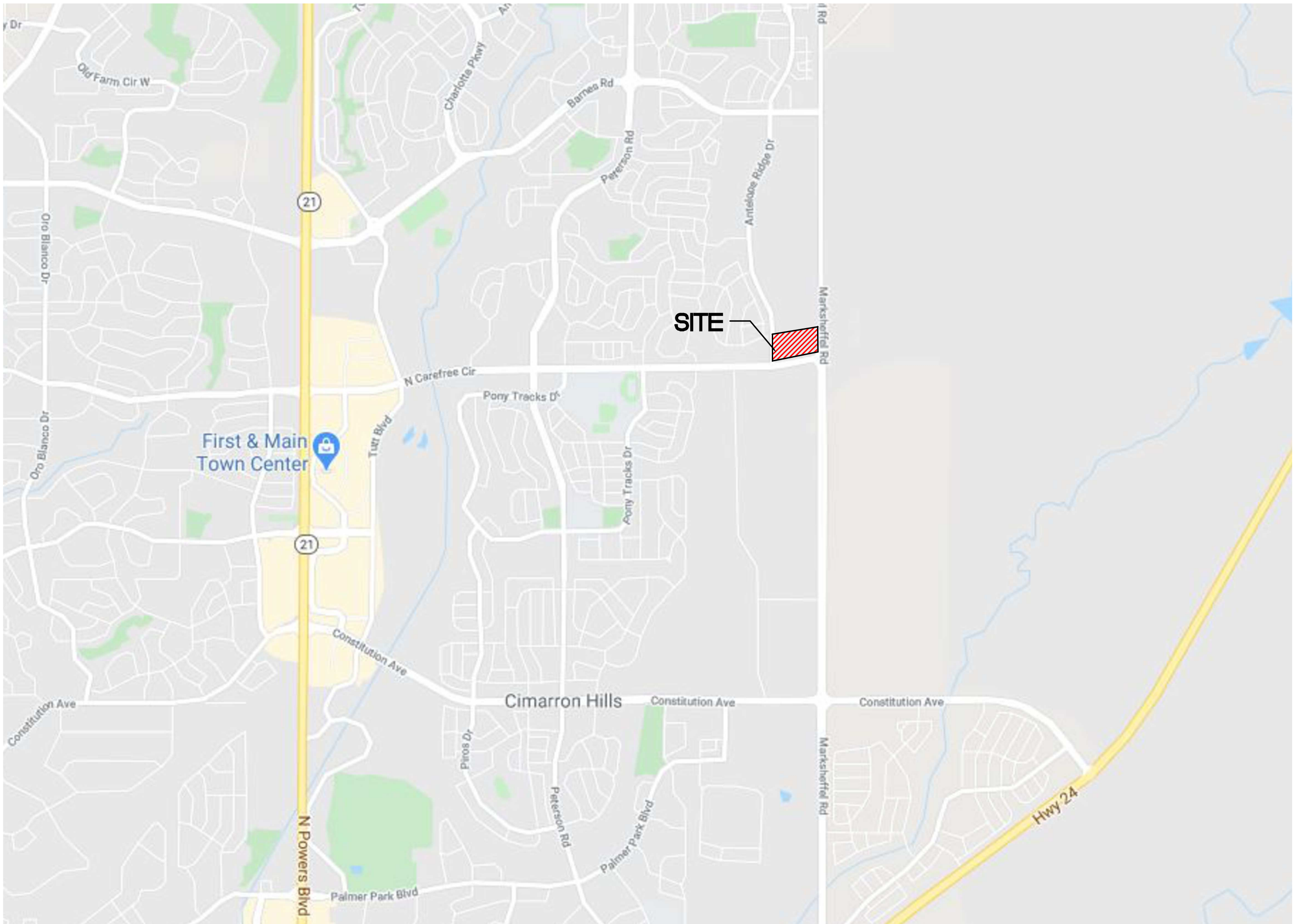
Kelli Zigler
Project Geologist

Reviewed by,

RMG – Rocky Mountain Group

ANTHONY P. MUNGER
4/1/22
39818

Tony Munger, P.E.
Geotechnical Project Manager



NOT TO SCALE

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ROCKY MOUNTAIN GROUP

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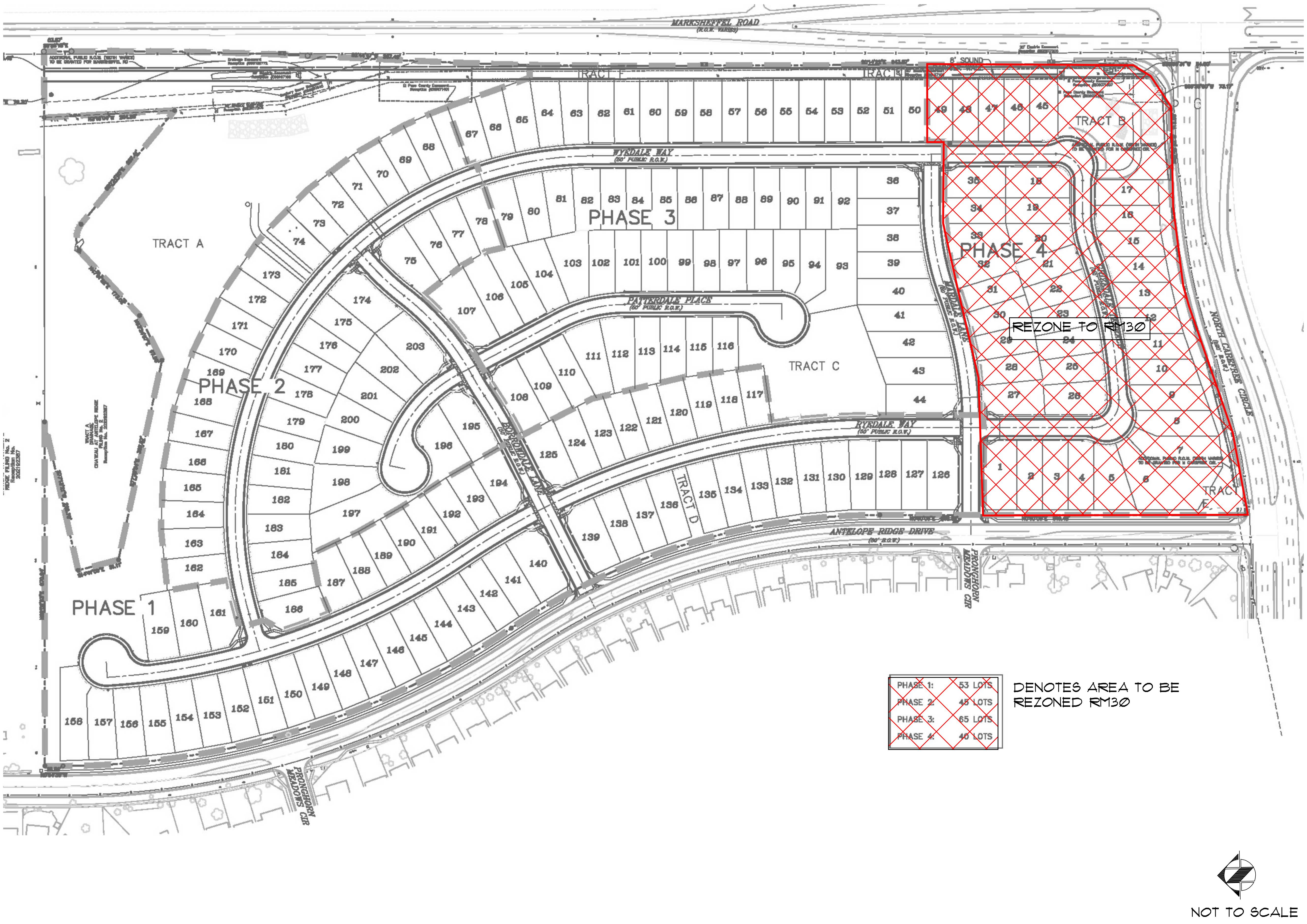
SITE VICINITY MAP

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



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

DENOTES AREA TO BE
REZONED RM30

JOB No. 162062

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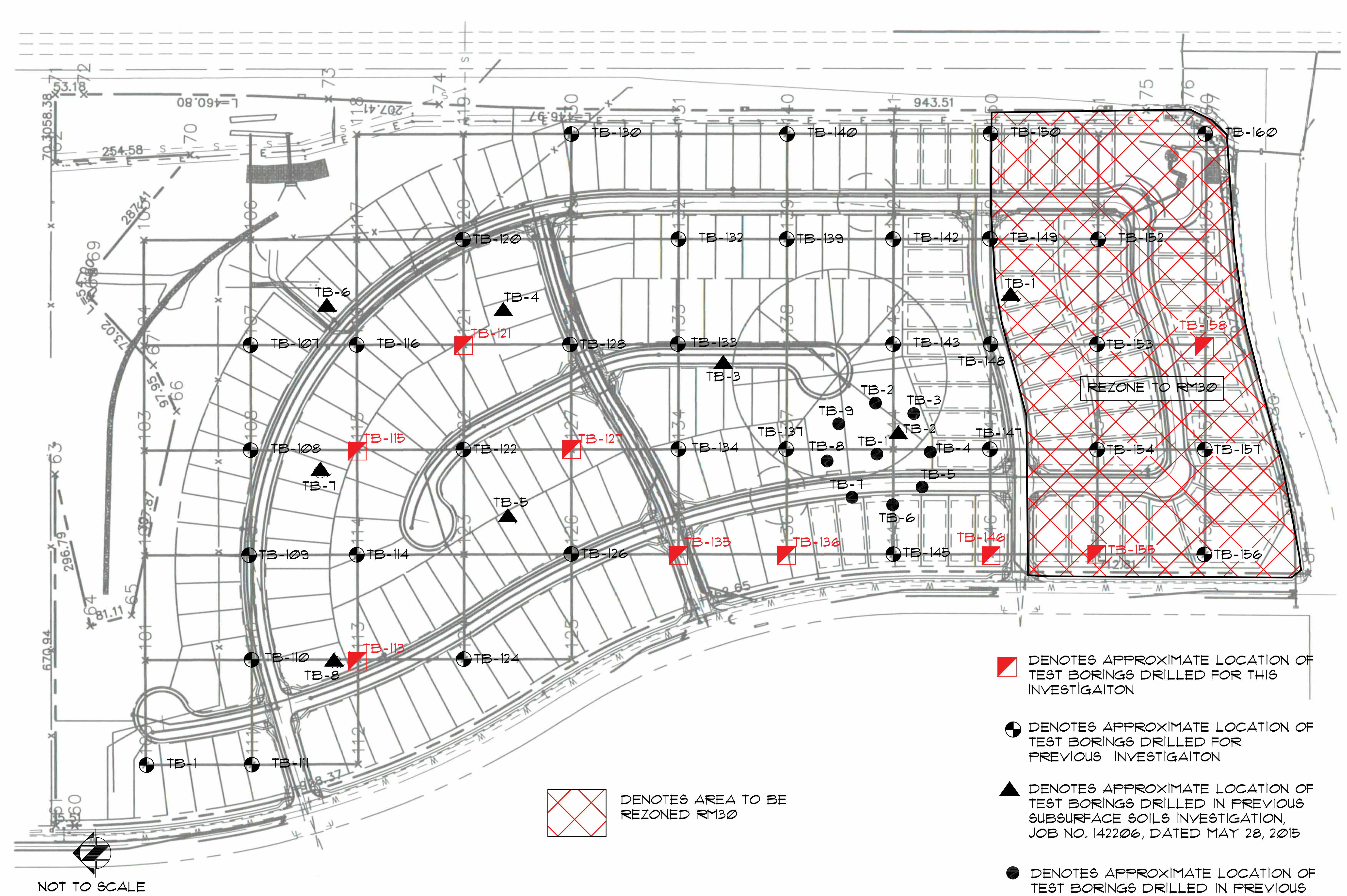
WINDERMERE
N. MARKSHEFFEL RD
EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

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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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

JOB No. 162062

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ENGINEERS
ROCKY MOUNTAIN GROUP

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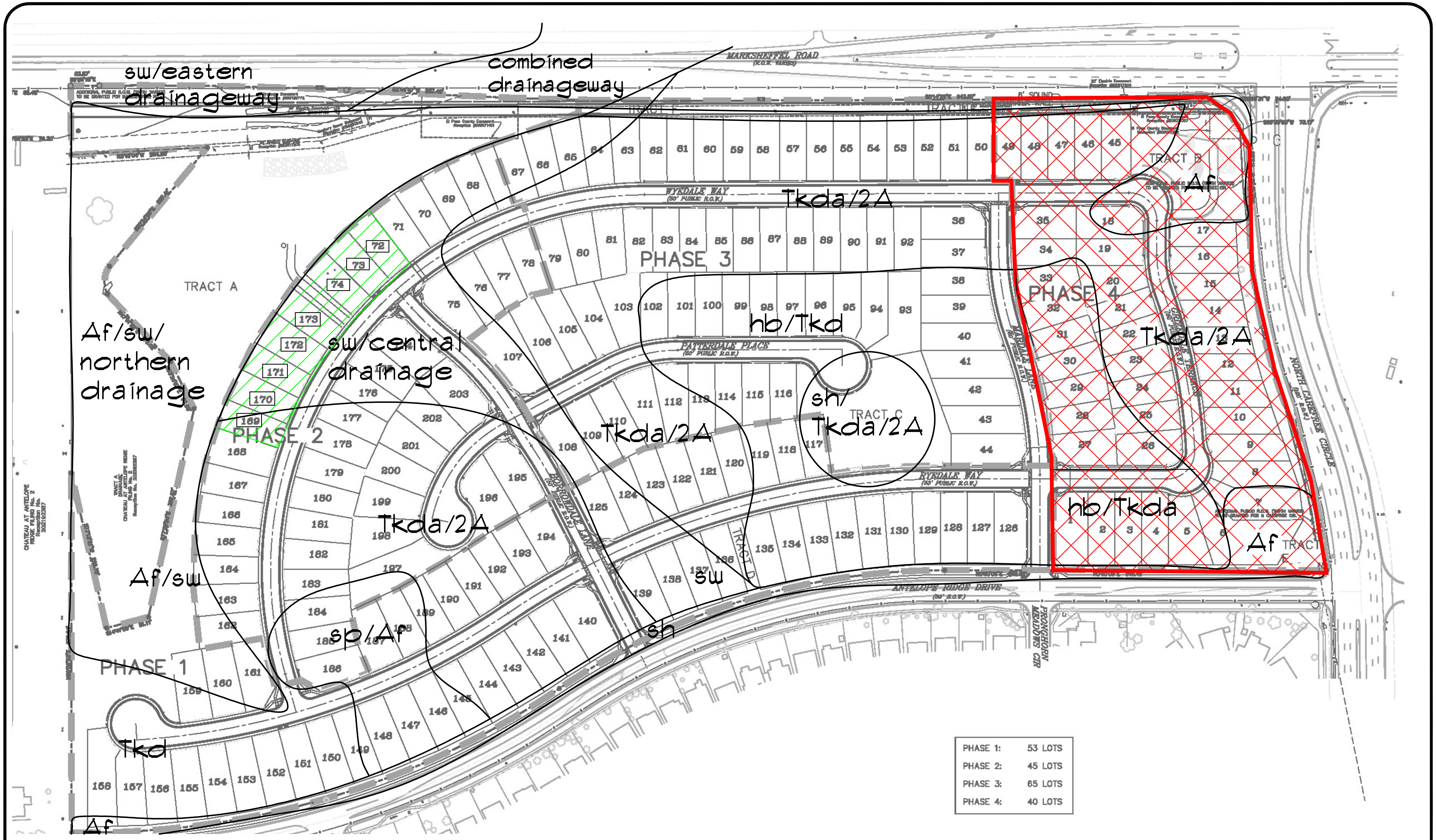


PHASE 1:	53 LOTS
PHASE 2:	45 LOTS
PHASE 3:	65 LOTS
PHASE 4:	40 LOTS

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

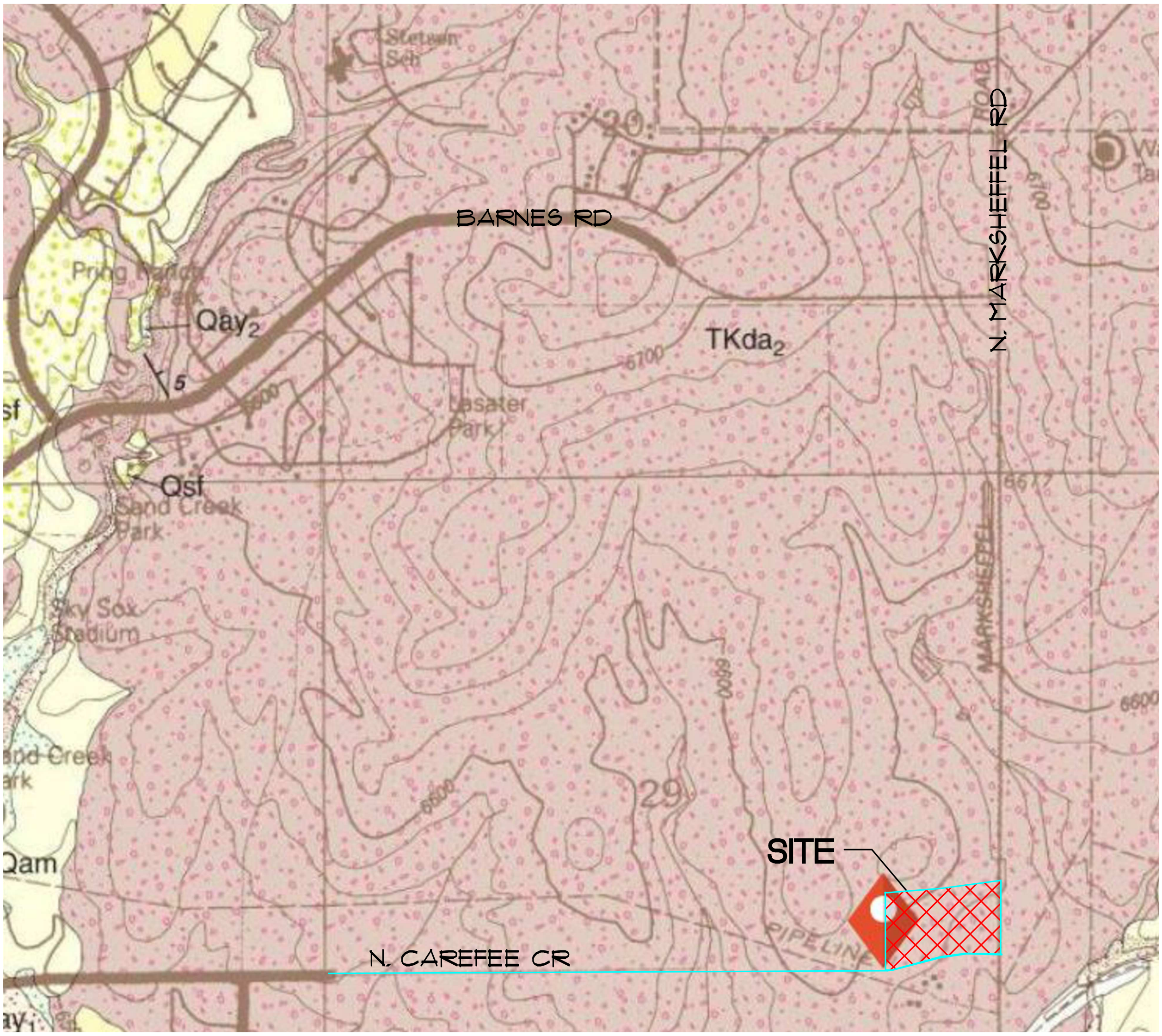
BASE MAP PROVIDED BY: GOOGLE AND DREXEL, BARREL & CO.

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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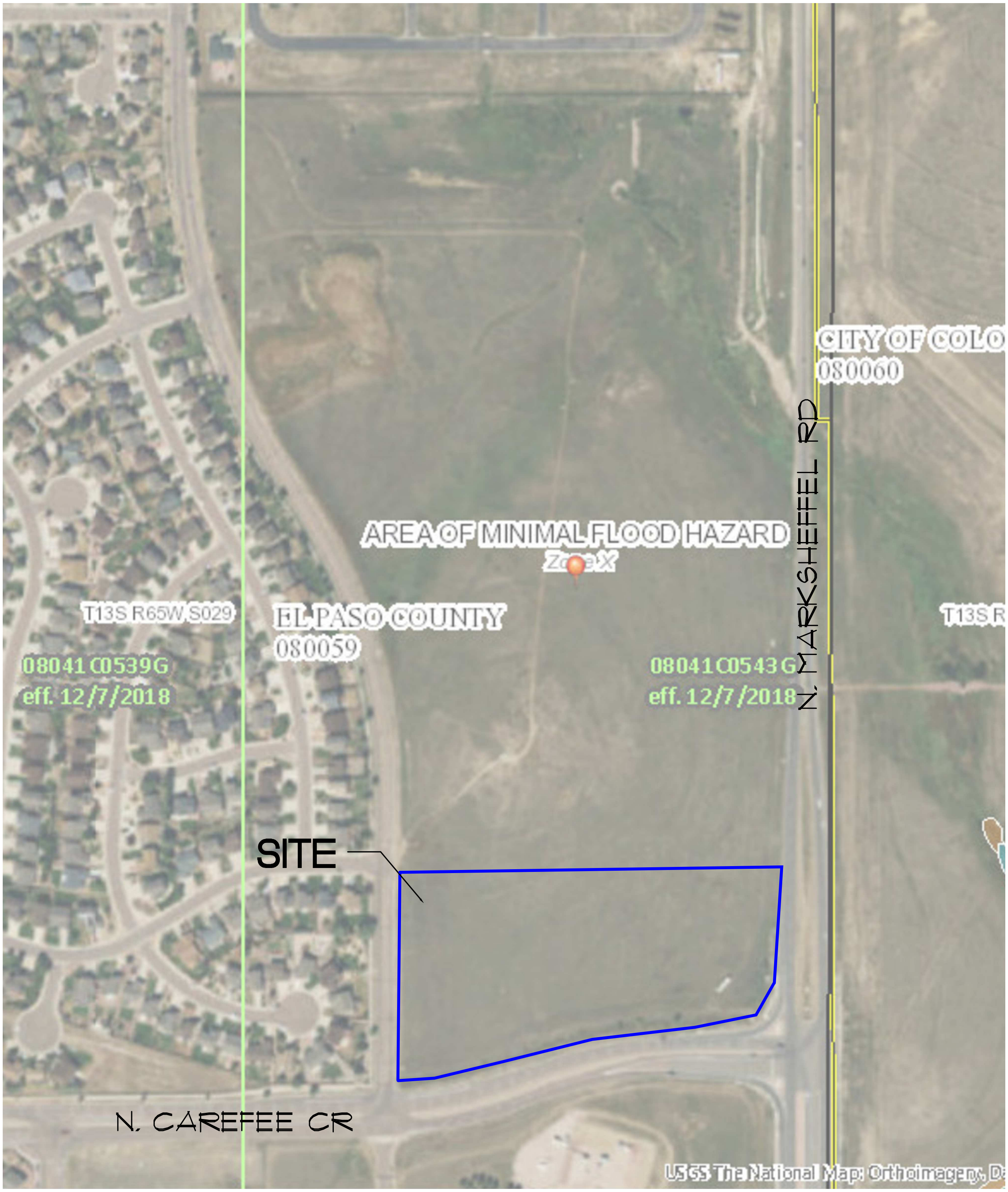
FALCON NW QUADRANGLE

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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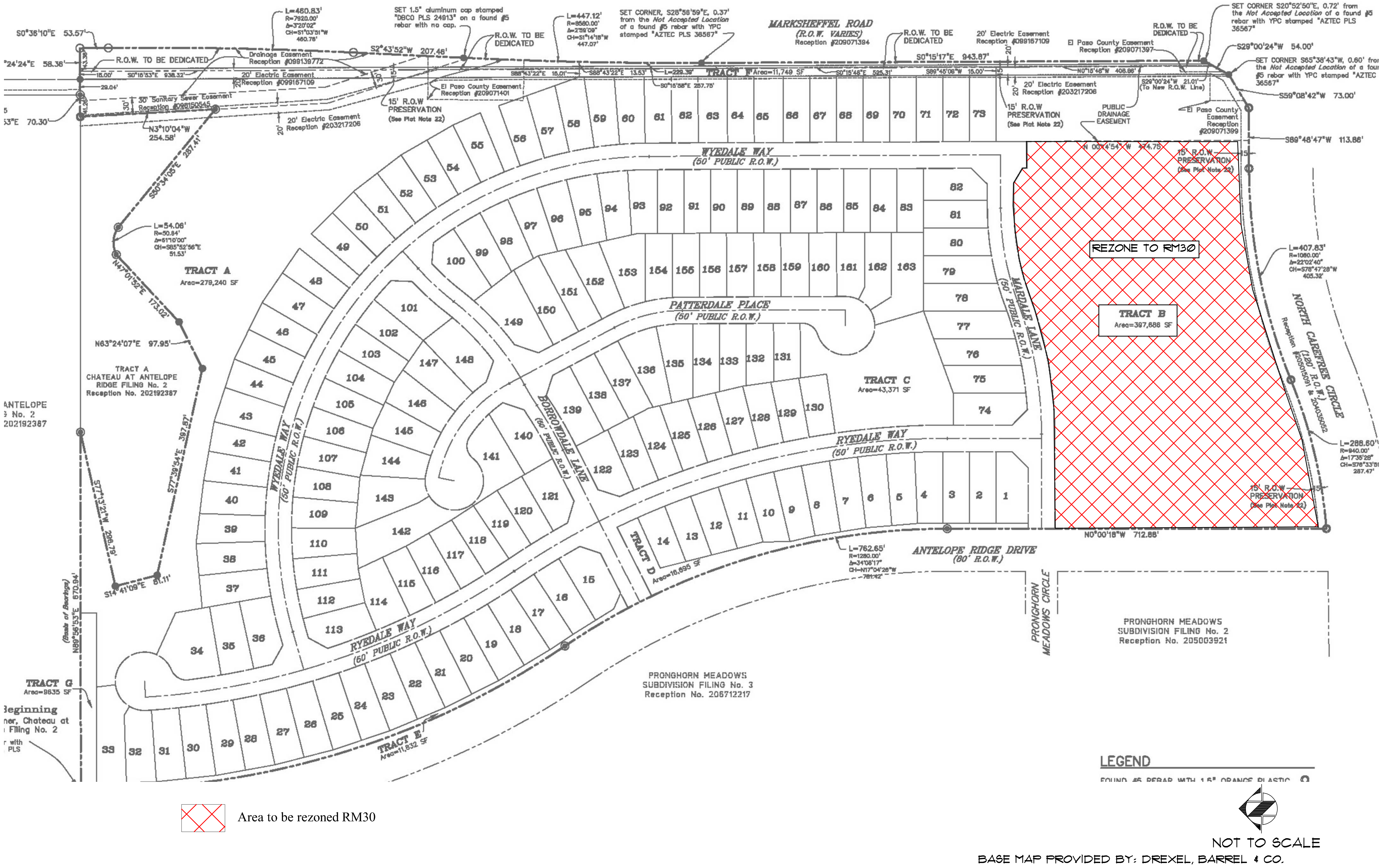
FEMA MAP

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



NOT TO SCALE

BASE MAP PROVIDED BY: DREXEL, BARREL & CO.

JOB No. 162062

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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

Architecture
Structural
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Materials Testing
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ROCKY MOUNTAIN GROUP
EMPLOYEE OWNED

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
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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

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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.
4. *Preliminary 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 April 17, 2018.
5. *Subsurface Soil Investigation, Windermere Subdivision, El Paso County, Colorado,* prepared by RMG – Rocky Mountain Group, Job No. 142206, last dated May 28, 2015.
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.

Artificial Fill (CL and SC/SM)

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.

<u>Mitigation</u>
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.

<u>Mitigation</u>
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.

<u>Mitigation</u>

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.

<u>Mitigation</u>

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

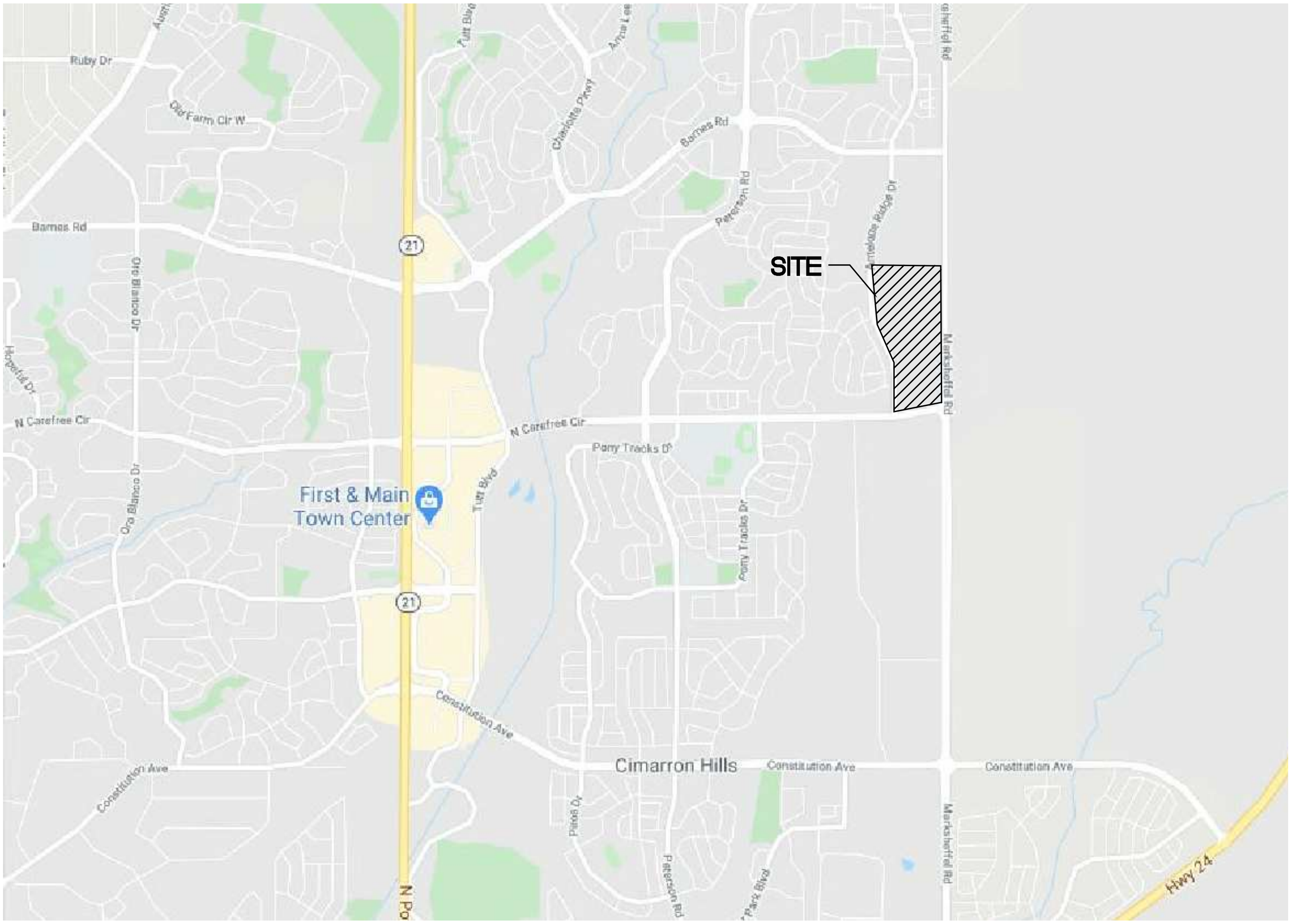
This report is for the exclusive purpose of providing geologic hazards information and preliminary geotechnical engineering recommendations. The scope of services did not include, either specifically or by implication, evaluation of wild fire hazards, environmental assessment of the site, or identification 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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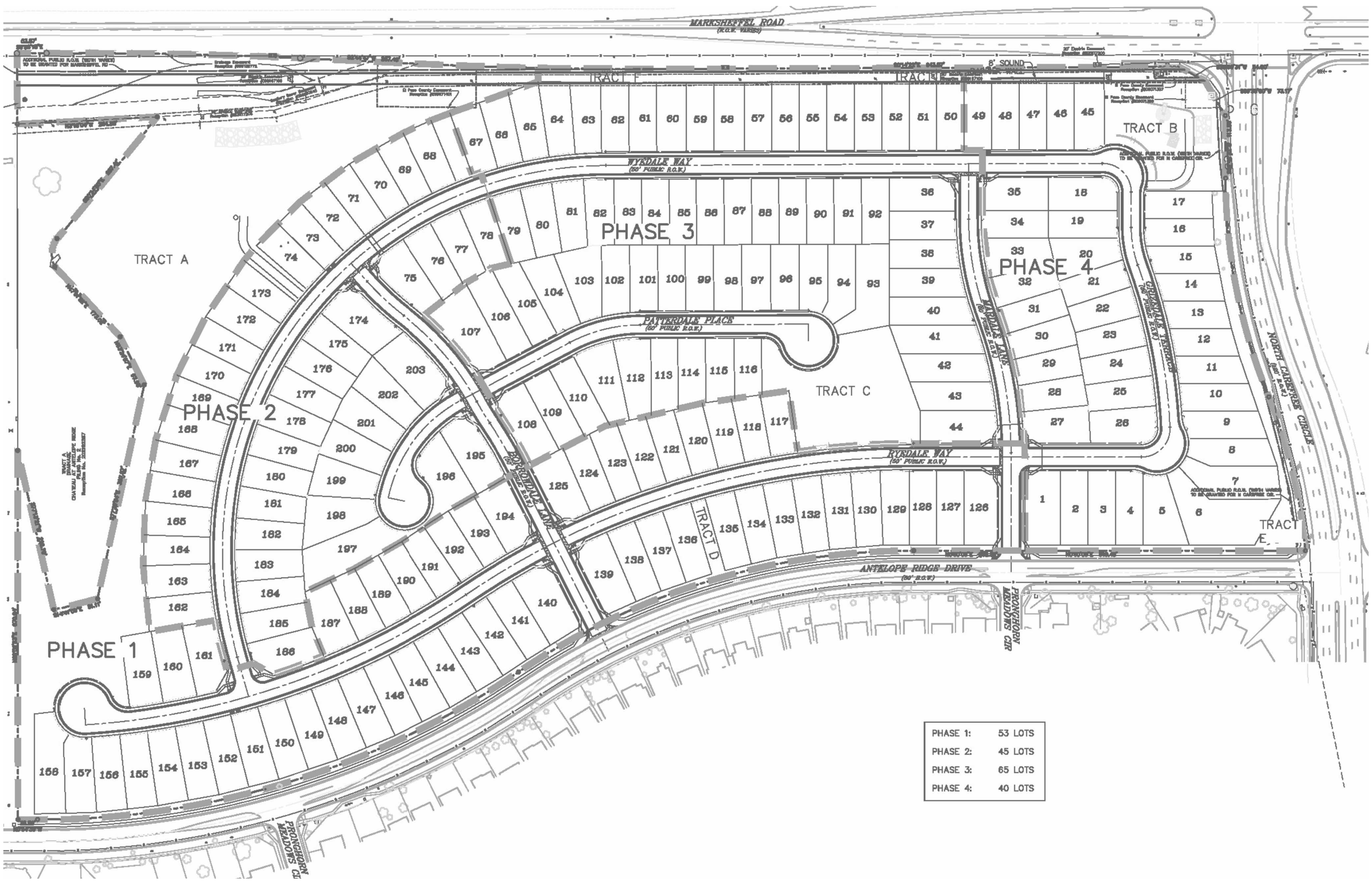
SITE VICINITY MAP

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

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JOB No. 162062

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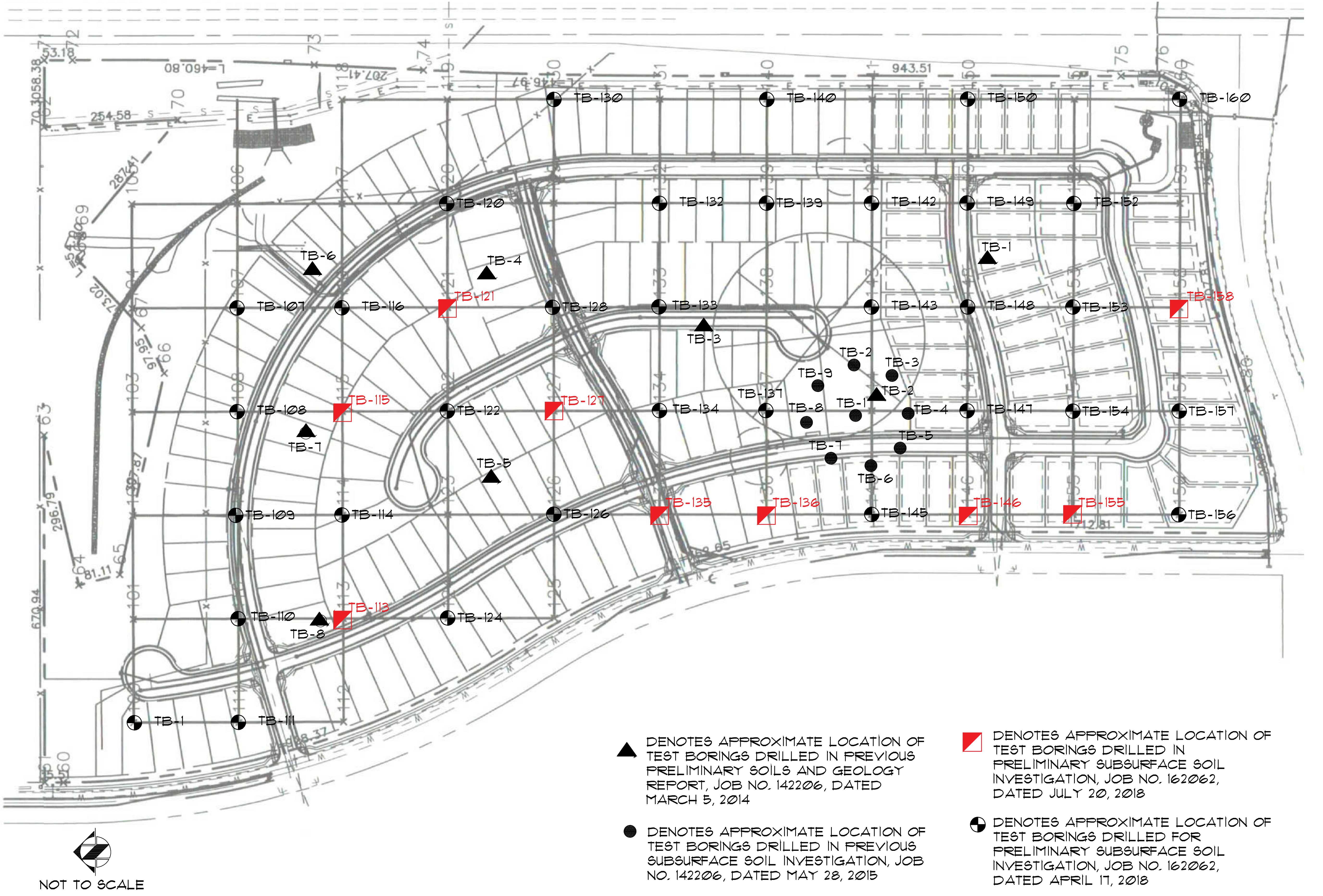
WINDERMERE
N. MARKSHEFFEL RD
EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

ENGINEER:	TPM
DRAWN BY:	KZ
CHECKED BY:	TPM
ISSUED:	10-26-2020
REVISION:	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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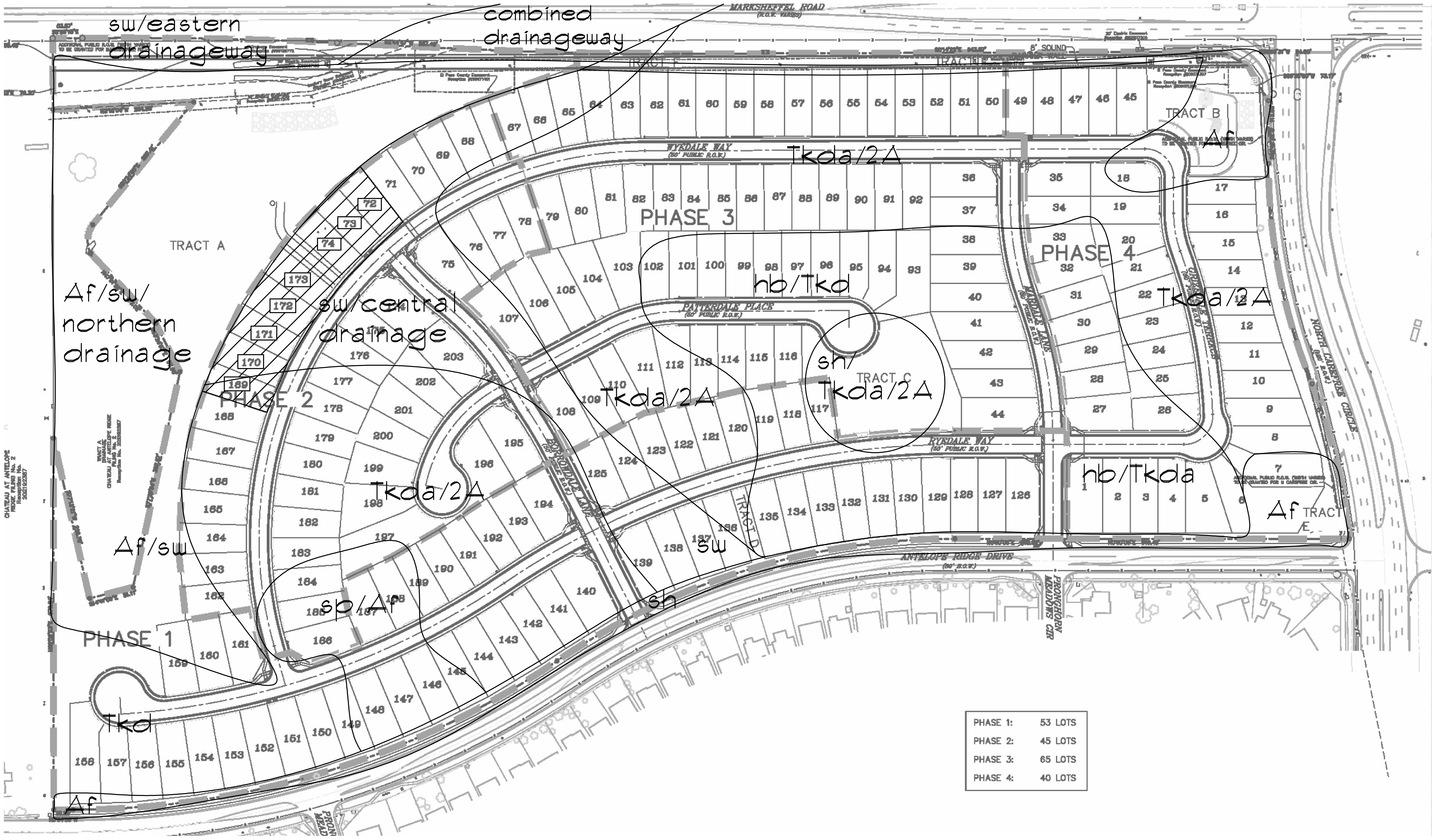
WINDERMERE SUBDIVISION
EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

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

TEST BORING LOCATION PLAN

SHEET No.
FIG-3



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.

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

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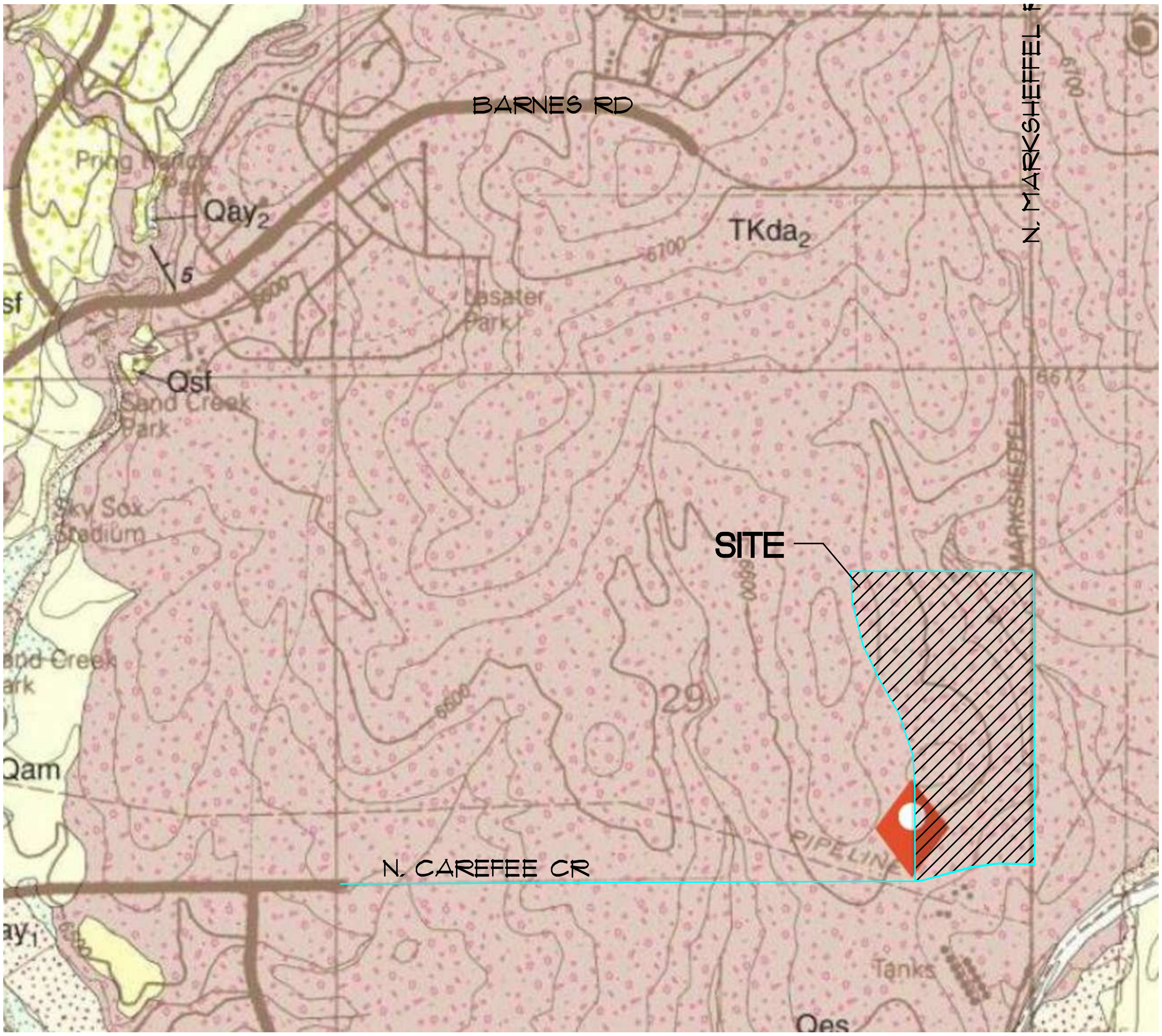
WINDERMERE
N. MARKSHEFFEL RD
EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

ENGINEER: TPM
DRAWN BY: KZ
CHECKED BY: TPM
ISSUED: 10-26-2020
REVISION: 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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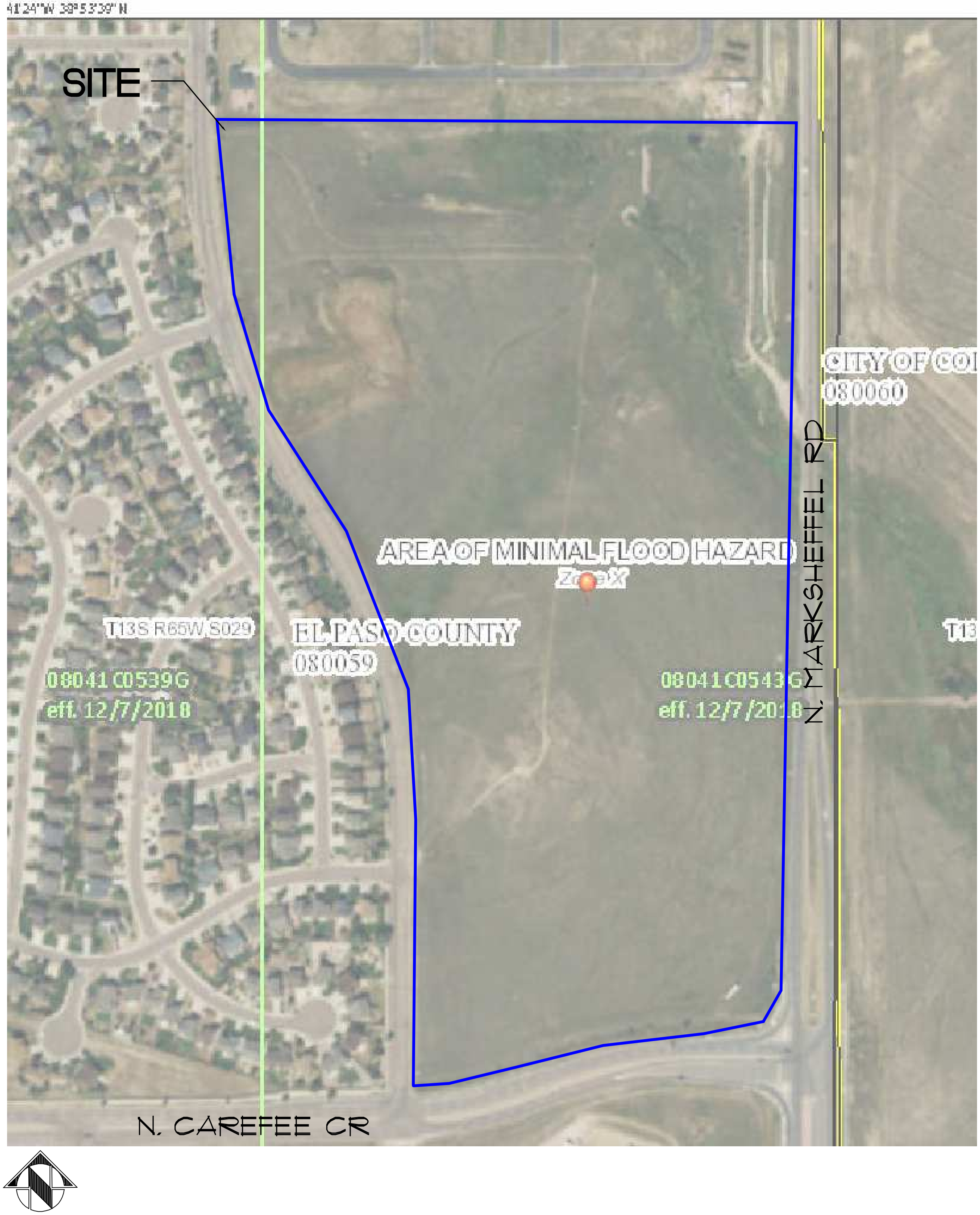
FALCON NW QUADRANGLE

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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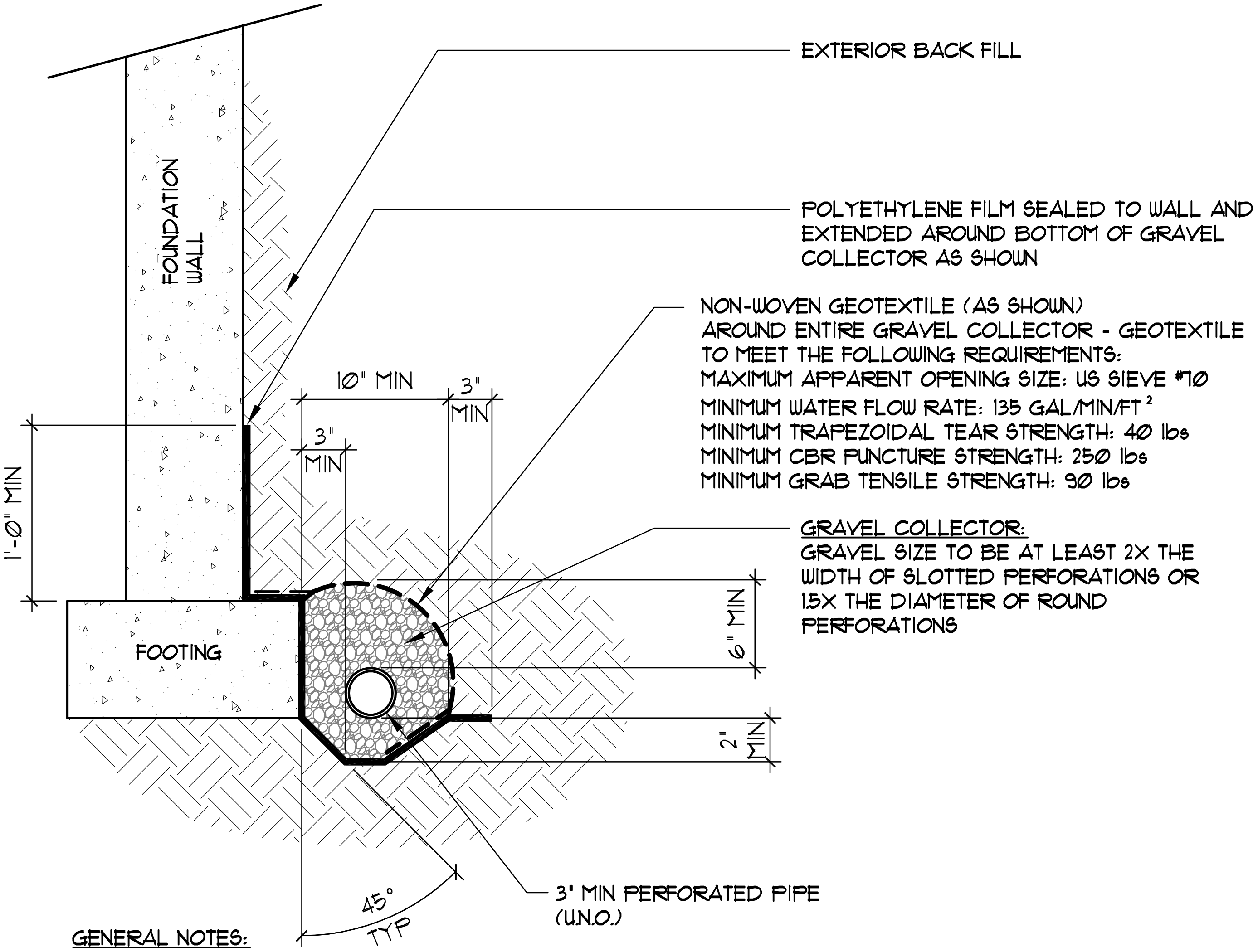
FEMA MAP

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

JOB No. 162062

FIG No. 6

DATE 10-26-2020



EXTERIOR BACK FILL

POLYETHYLENE FILM SEALED TO WALL AND EXTENDED AROUND BOTTOM OF GRAVEL COLLECTOR AS SHOWN

NON-WOVEN GEOTEXTILE (AS SHOWN) AROUND ENTIRE GRAVEL COLLECTOR - GEOTEXTILE TO MEET THE FOLLOWING REQUIREMENTS:
MAXIMUM APPARENT OPENING SIZE: US SIEVE #10
MINIMUM WATER FLOW RATE: 135 GAL/MIN/FT ^{2}
MINIMUM TRAPEZOIDAL TEAR STRENGTH: 40 lbs
MINIMUM CBR PUNCTURE STRENGTH: 250 lbs
MINIMUM GRAB TENSILE STRENGTH: 90 lbs

GRAVEL COLLECTOR:
GRAVEL SIZE TO BE AT LEAST 2X THE WIDTH OF SLOTTED PERFORATIONS OR 1.5X THE DIAMETER OF ROUND PERFORATIONS

3' MIN PERFORATED PIPE (U.N.O.)

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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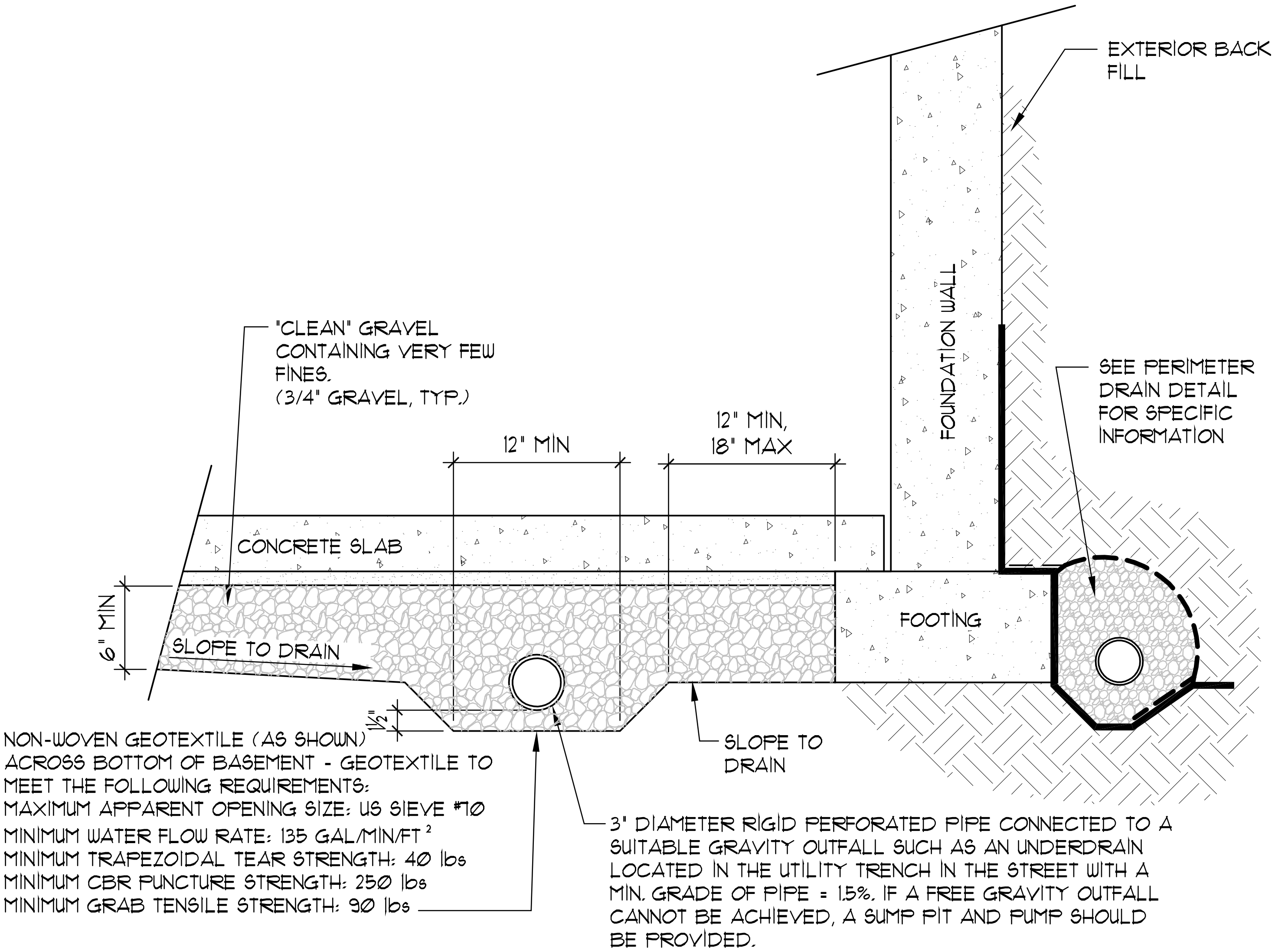
PERIMETER DRAIN

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.

3. 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.

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

SANDSTONE, SILTY TO CLAYEY, tan and brown to light gray, very hard, moist

CLAYSTONE, SANDY, tan to brown with rust staining, medium hard, moist

SANDSTONE, SILTY, blue, very hard, moist

DEPTH (FT)	SAMPLES	BLOWS PER FT.	WATER CONTENT %
5	■	50/6"	15.5
10	■	50/3"	11.9
15	■	50/7"	19.7
20	■	31	31.0
25			
30	■	50/3"	18.1

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

SAND, SILTY, brown, medium dense, moist

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

CLAYSTONE, SANDY, brown, hard, moist to wet

DEPTH (FT)	SAMPLES	BLOWS PER FT.	WATER CONTENT %
5	■	13	9.5
10	■	17	13.6
▽			
15	◢	50/10"	20.8
20	■	50/8"	25.6

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Architectural
Structural
Forensics

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Geotechnical
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Civil, Planning

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Colorado Spings, CO 80918
(719) 548-0600
SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

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
SANDSTONE, SILTY, blue, very hard, moist		⁘			
	25	⁘			
	30	⁘	■	50/3"	16.1

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TEST BORING LOGS

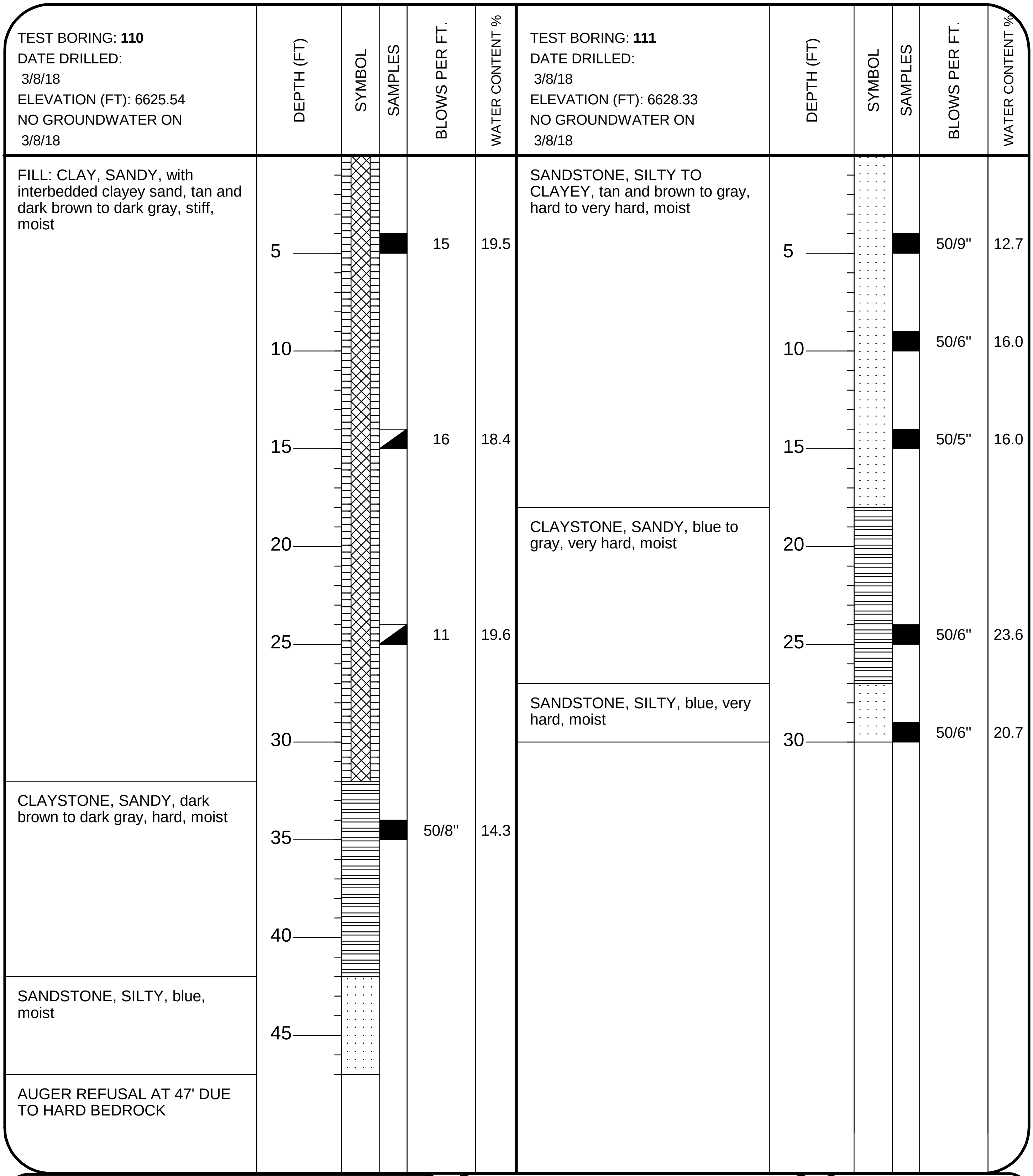
JOB No. 162062

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

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



TEST BORING 110

FILL: CLAY, SANDY, with interbedded clayey sand, tan and dark brown to dark gray, stiff, moist

CLAYSTONE, SANDY, dark brown to dark gray, hard, moist

SANDSTONE, SILTY, blue, moist

AUGER REFUSAL AT 47' DUE TO HARD BEDROCK

BLOWS PER FT.	WATER CONTENT %
15	19.5
16	18.4
11	19.6
50/8"	14.3

TEST BORING 111

SANDSTONE, SILTY TO CLAYEY, tan and brown to gray, hard to very hard, moist

CLAYSTONE, SANDY, blue to gray, very hard, moist

SANDSTONE, SILTY, blue, very hard, moist

BLOWS PER FT.	WATER CONTENT %
50/9"	12.7
50/6"	16.0
50/5"	16.0
50/6"	23.6
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)	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)	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
SANDSTONE, SILTY TO CLAYEY, brown, very hard, moist	15	■	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
CLAYSTONE, SANDY, brown, hard, moist to wet	20			50/10"	22.0

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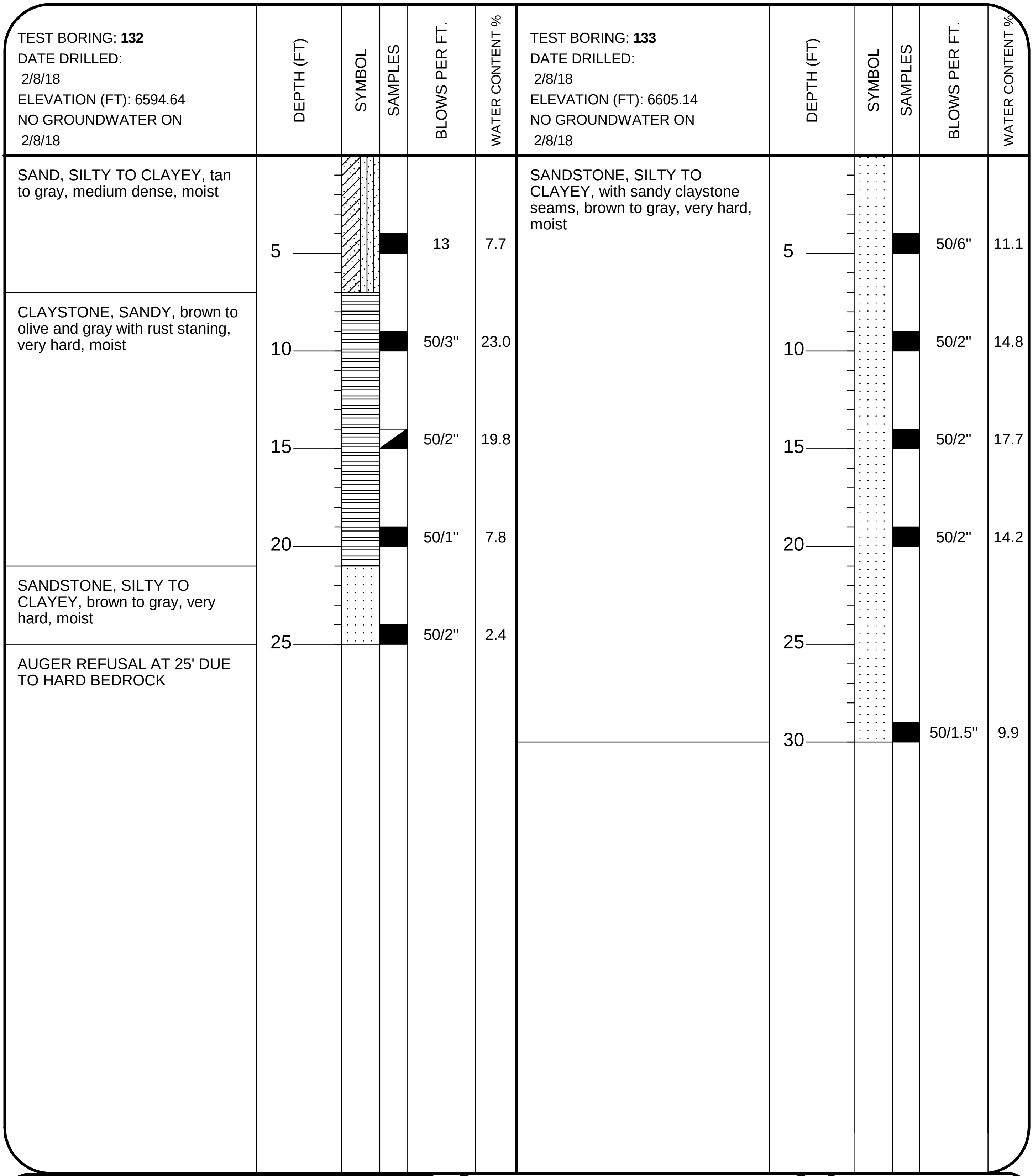
TEST BORING LOGS

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

SAND, SILTY TO CLAYEY, tan to gray, medium dense, moist

CLAYSTONE, SANDY, brown to olive and gray with rust staning, very hard, moist

SANDSTONE, SILTY TO CLAYEY, brown to gray, very hard, moist

AUGER REFUSAL AT 25' DUE TO HARD BEDROCK

DEPTH (FT)	BLOWS PER FT.	WATER CONTENT %
5	13	7.7
10	50/3"	23.0
15	50/2"	19.8
20	50/1"	7.8
25	50/2"	2.4

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

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

DEPTH (FT)	BLOWS PER FT.	WATER CONTENT %
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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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

	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SANDSTONE, SILTY TO CLAYEY, with sandy claystone seams, brown to gray, very hard, moist	5		■	50/3"	13.7
	10		■	50/3"	11.3
	15		■	50/6"	10.4
	20		■	50/4"	10.0
	25				
	30		■	50/3"	7.8
AUGER REFUSAL AT 30' DUE TO HARD BEDROCK					

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

	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAYSTONE, SANDY, tan to olive and gray, very hard, moist	5		■	50/3"	22.7
	10		■	50/3"	18.7
SANDSTONE, SILTY, blue, very hard, moist	15		■	50/3"	12.6
	20		■	50/3"	11.2
	25		■	50/2"	18.1
AUGER REFUSAL AT 25' DUE TO HARD BEDROCK					

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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

TEST BORING: 139	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

TEST BORING: 140	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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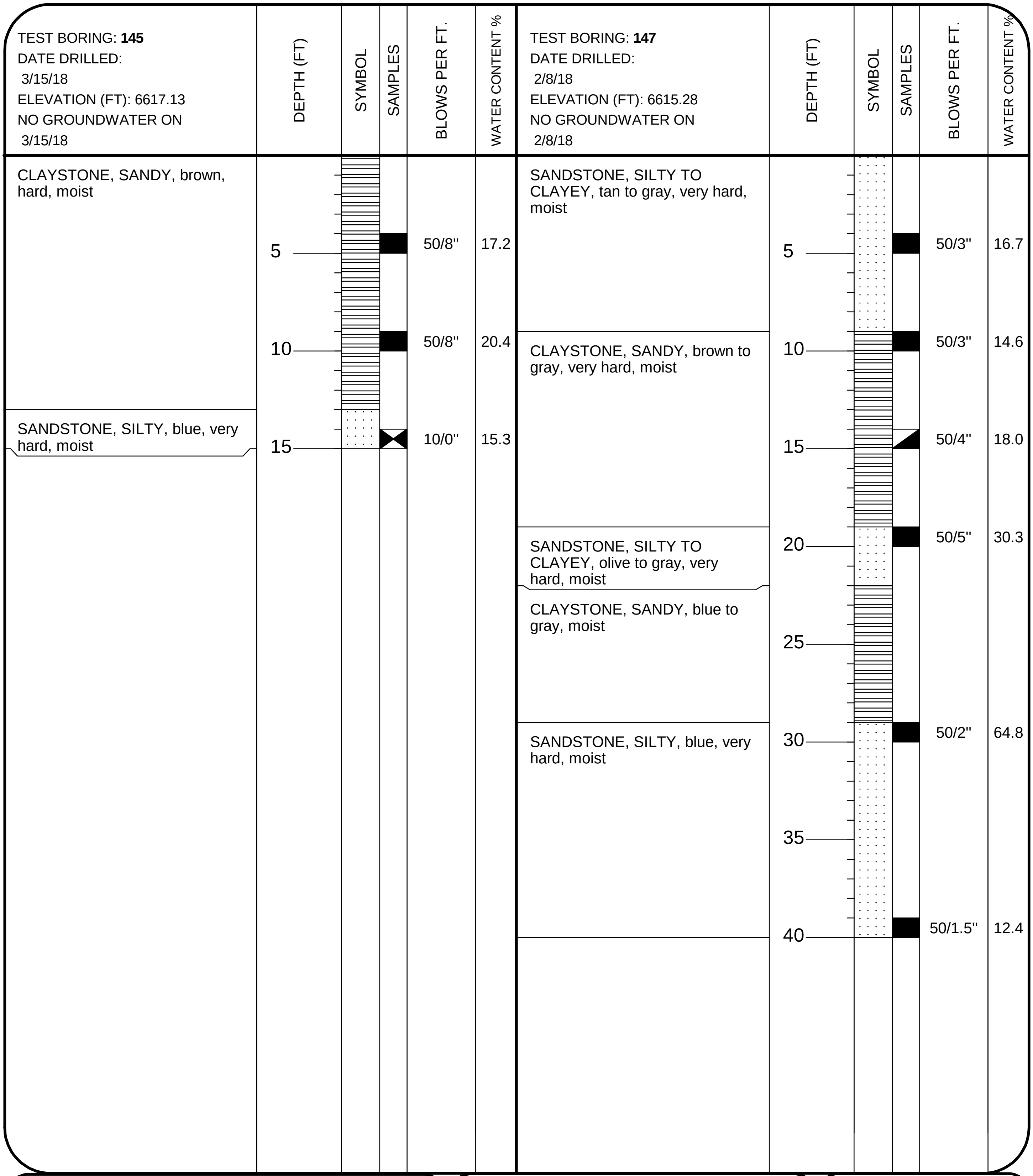
TEST BORING LOGS

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

CLAYSTONE, SANDY, brown, hard, moist

SANDSTONE, SILTY, blue, very hard, moist

DEPTH (FT)	BLOWS PER FT.	WATER CONTENT %
5	50/8"	17.2
10	50/8"	20.4
15	10/0"	15.3

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

SANDSTONE, SILTY TO CLAYEY, tan to gray, very hard, moist

CLAYSTONE, SANDY, brown to gray, very hard, moist

SANDSTONE, SILTY TO CLAYEY, olive to gray, very hard, moist

CLAYSTONE, SANDY, blue to gray, moist

SANDSTONE, SILTY, blue, very hard, moist

DEPTH (FT)	BLOWS PER FT.	WATER CONTENT %
5	50/3"	16.7
10	50/3"	14.6
15	50/4"	18.0
20	50/5"	30.3
25		
30	50/2"	64.8
35		
40	50/1.5"	12.4

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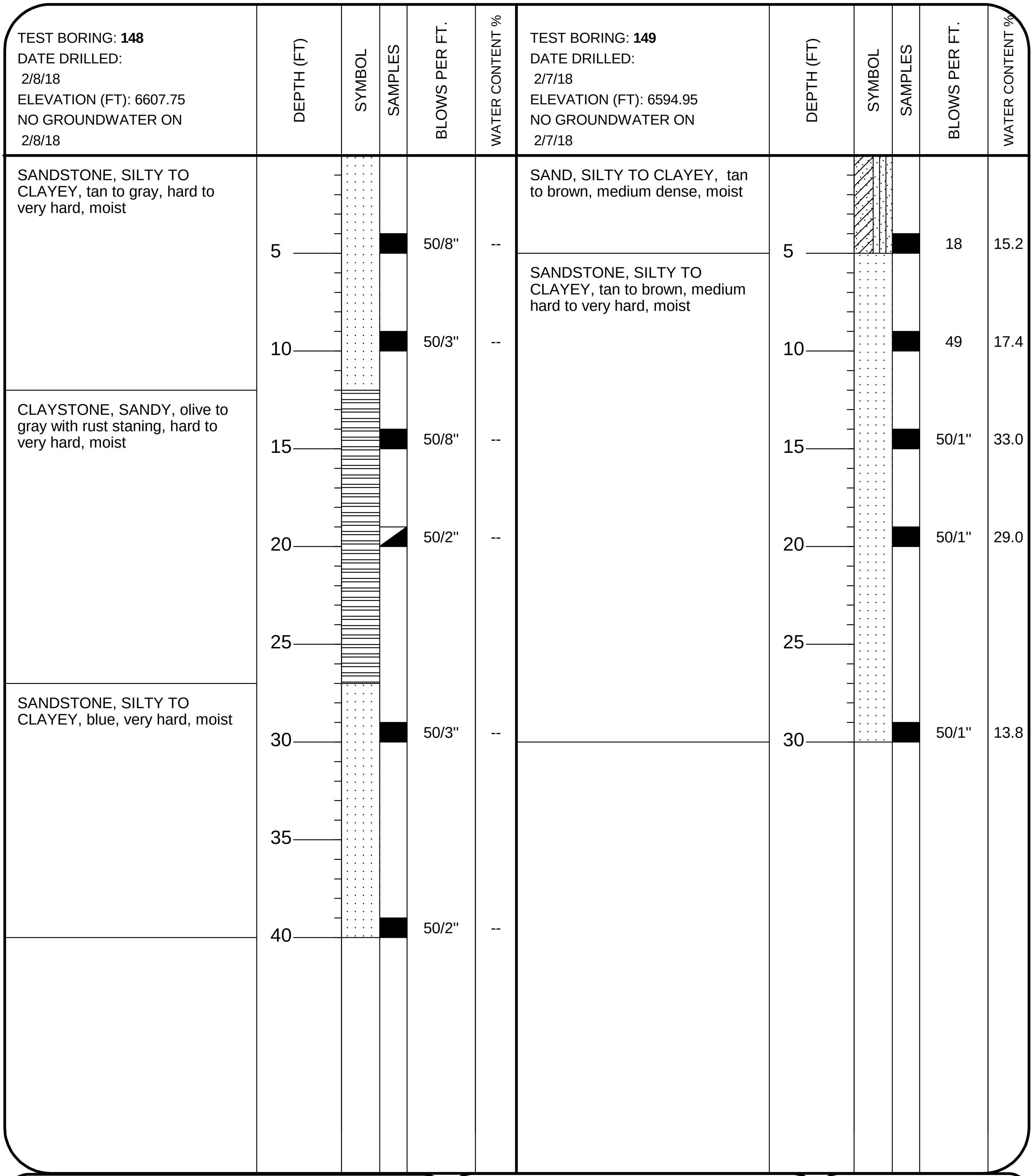
JOB No. 162062

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)	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)	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
SANDSTONE, SILTY, blue and dark gray, moist	25				
	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
PAGE 1 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
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

JOB No. 162062
FIGURE No. 21
PAGE 2 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
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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SUMMARY OF LABORATORY TEST RESULTS

JOB No. 162062
FIGURE No. 21
PAGE 3 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
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

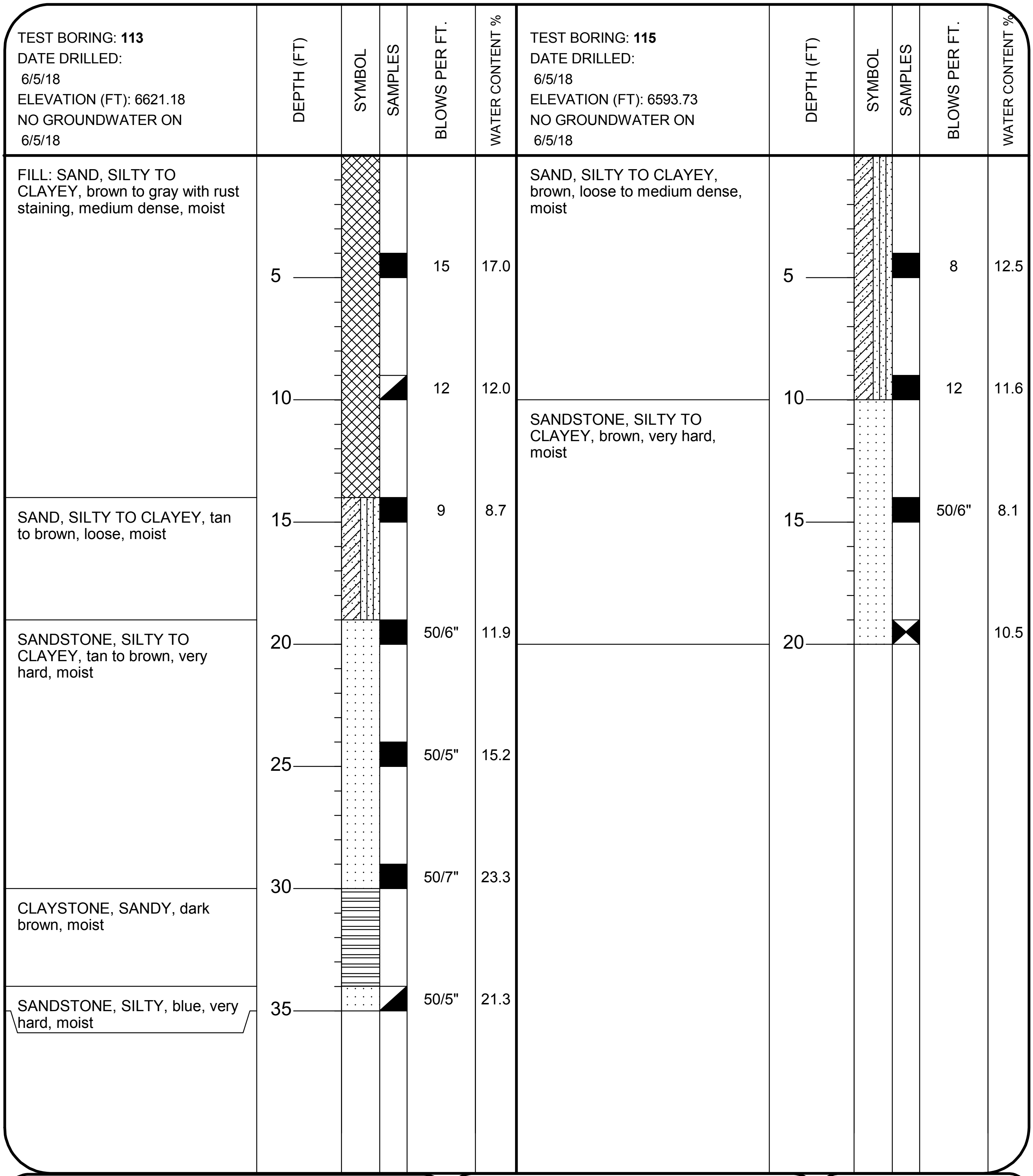
Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	FHA Expansion Pressure (psf)	% Swell/ Collapse	USCS Classification
160	14.0	14.7								

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

FILL: SAND, SILTY TO CLAYEY, brown to gray with rust staining, medium dense, moist

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

SANDSTONE, SILTY TO CLAYEY, tan to brown, very hard, moist

CLAYSTONE, SANDY, dark brown, moist

SANDSTONE, SILTY, blue, very hard, moist

DEPTH (FT)	BLOWS PER FT.	WATER CONTENT %
5	15	17.0
10	12	12.0
15	9	8.7
20	50/6"	11.9
25	50/5"	15.2
30	50/7"	23.3
35	50/5"	21.3

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

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

SANDSTONE, SILTY TO CLAYEY, brown, very hard, moist

DEPTH (FT)	BLOWS PER FT.	WATER CONTENT %
5	8	12.5
10	12	11.6
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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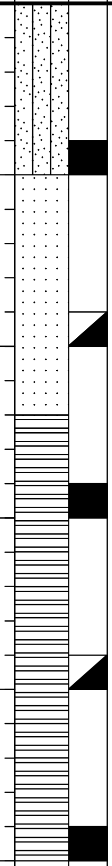
TEST BORING LOG

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)	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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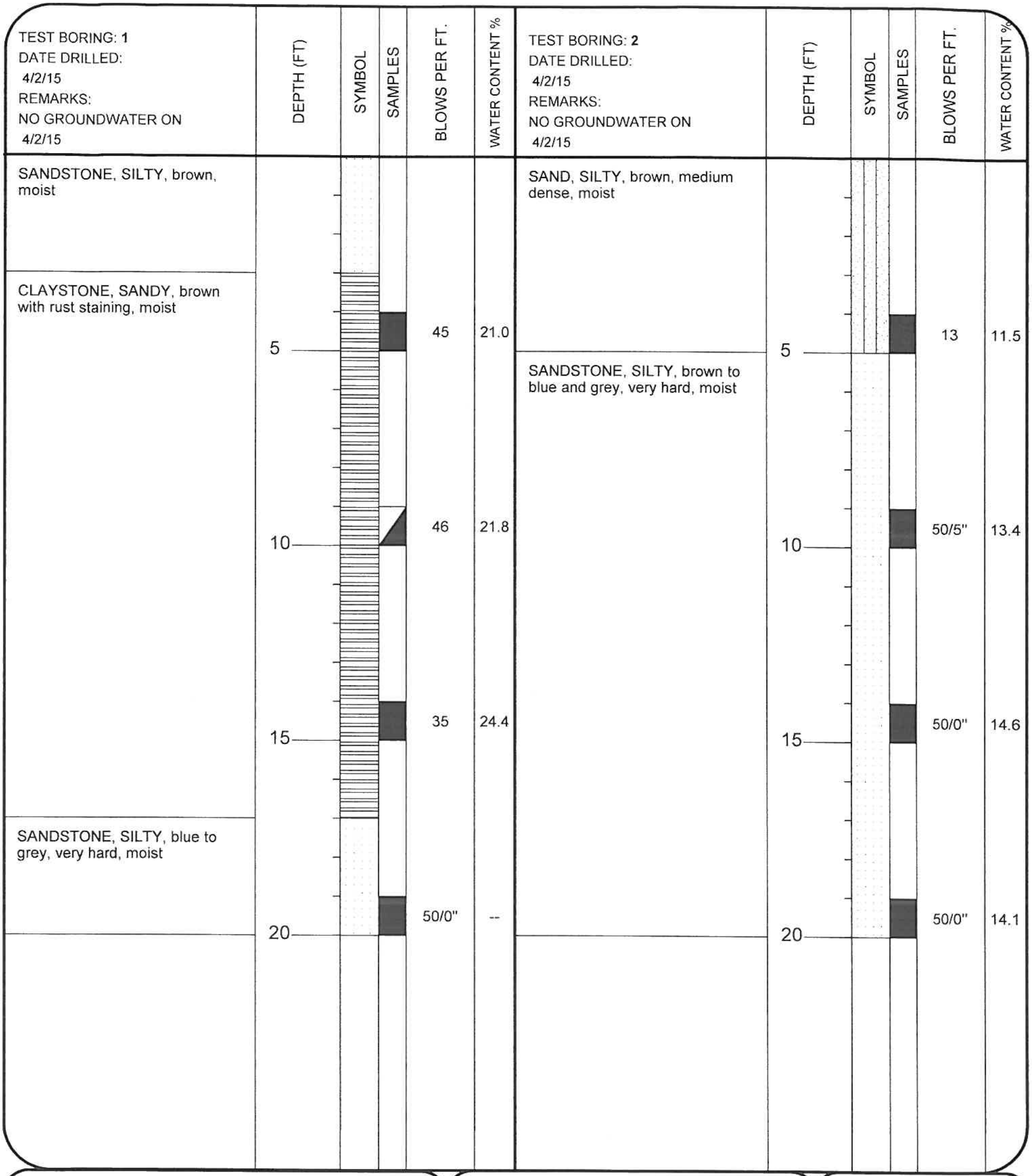
SUMMARY OF LABORATORY TEST RESULTS

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)	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)	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

	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, SILTY TO CLAYEY, brown, medium dense, moist	5	▨	◢	15	13.8
CLAYSTONE, SANDY, brown, medium hard to hard, moist	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

	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown, medium stiff, moist	5	▨	■	7	21.7
CLAYSTONE, SANDY, brown with rust staining, firm to hard, moist	10	▤	◢	50/8"	21.5
	15	▤	■	21	34.4
	20	▤	◢	50/11"	28.3

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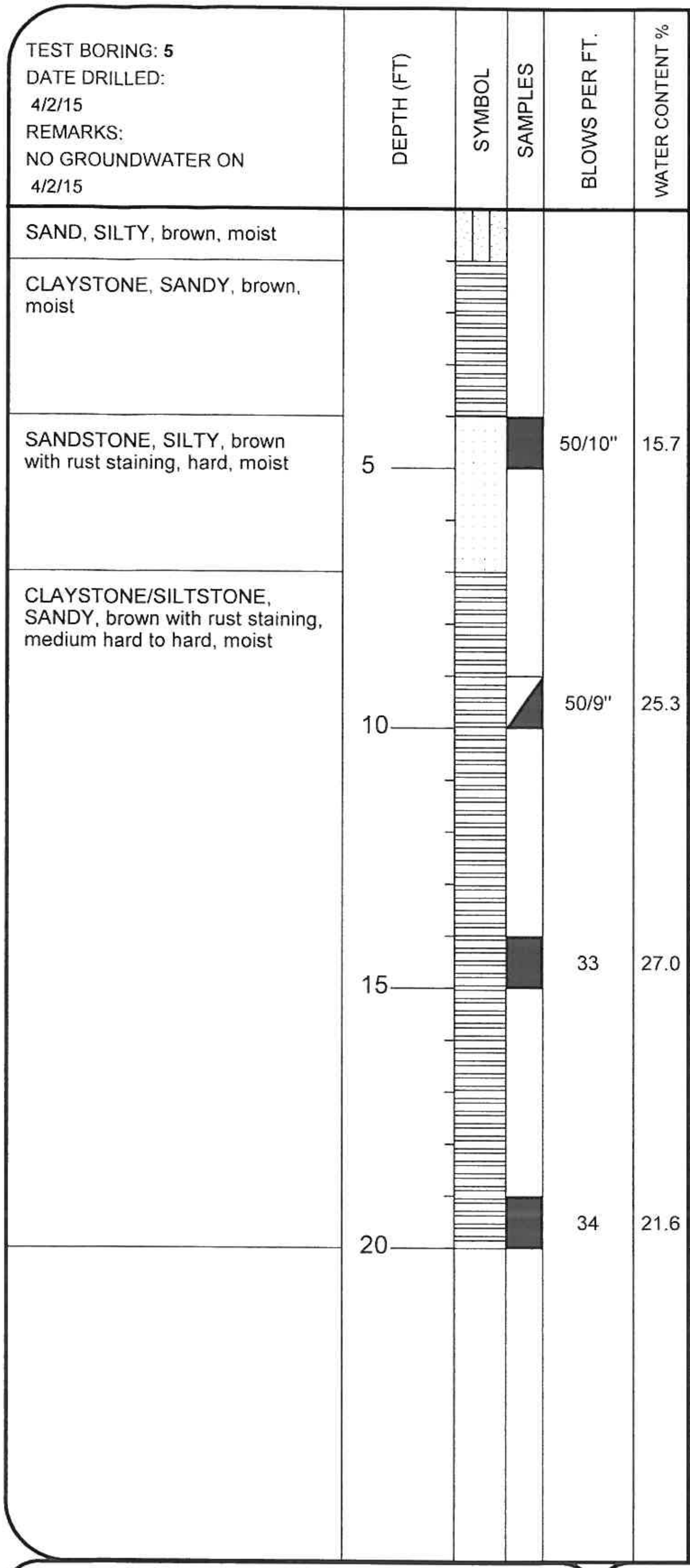
TEST BORING LOGS

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

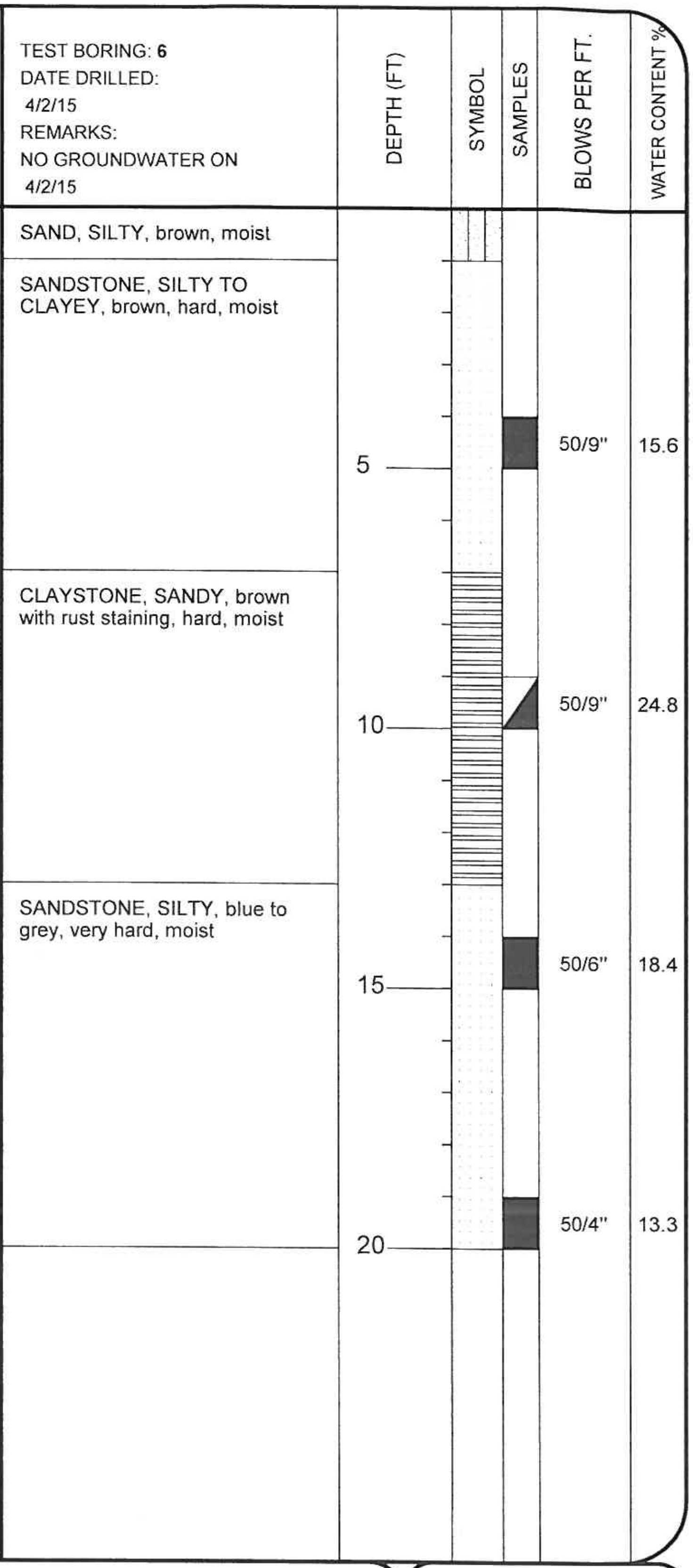
SAND, SILTY, brown, moist

CLAYSTONE, SANDY, brown, moist

SANDSTONE, SILTY, brown with rust staining, hard, moist

CLAYSTONE/SILTSTONE, SANDY, brown with rust staining, medium hard to hard, moist

DEPTH (FT)	BLOWS PER FT.	WATER CONTENT %
5	50/10"	15.7
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

SAND, SILTY, brown, moist

SANDSTONE, SILTY TO CLAYEY, brown, hard, moist

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

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

DEPTH (FT)	BLOWS PER FT.	WATER CONTENT %
5	50/9"	15.6
10	50/9"	24.8
15	50/6"	18.4
20	50/4"	13.3

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TEST BORING LOGS

JOB No. 142206

FIGURE No. 6

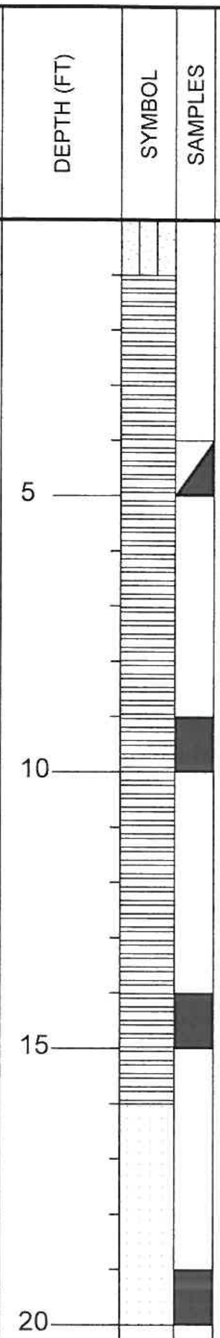
DATE 5/28/15

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

SAND, SILTY, brown, moist

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

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



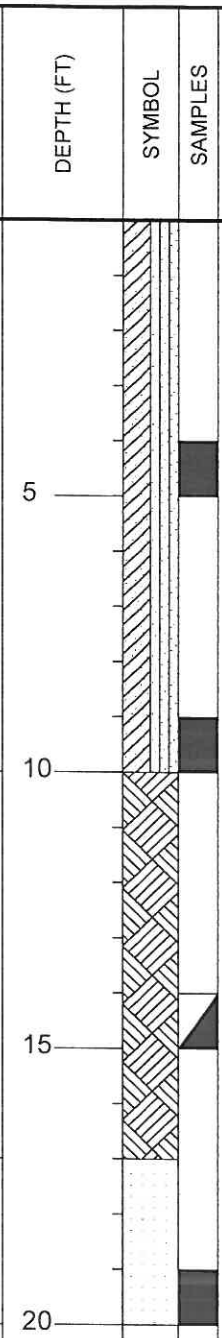
BLOWS PER FT.	WATER CONTENT %
50/9"	21.8
41	25.9
41	28.3
50/3"	14.3

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

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

SANDSTONE/CLAYSTONE, SANDY, brown with rust staining, hard, moist

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



BLOWS PER FT.	WATER CONTENT %
4	8.9
16	8.4
50/9"	22.1
50/0"	13.6

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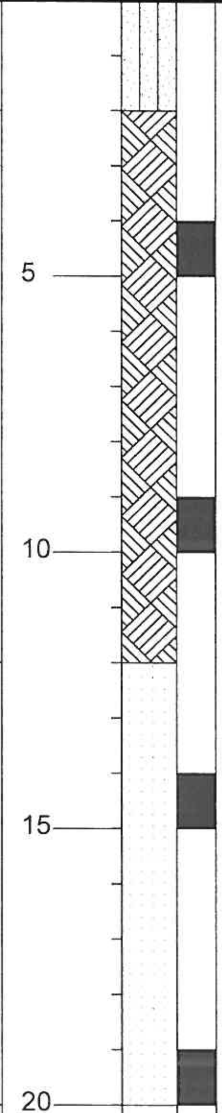
TEST BORING LOGS

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)	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
SAND, SILTY TO CLAYEY, light brown, loose to medium dense, moist			■	7	8.4	1
	5		■	10	9.1	1
	10		■	13	12.0	1
CLAYSTONE/SILTSTONE, SANDY, tan to brown, hard, moist	15		■	58	17.9	2
SANDSTONE, SILTY, with silstone, tan to brown and blue, hard to very hard, moist	20		■	50/2"	14.1	3
			⧗	50/0"	–	3
SAMPLER REFUSAL AT 24 FEET DUE TO VERY HARD BEDROCK	25					

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
SANDSTONE, SILTY, brown, very hard, moist			■	50/3"	14.4	3
	5		■	50/6"	16.8	3
CLAYSTONE/SILTSTONE, SANDY, olive to brown, very hard, moist	10		◢	50/6"	21.4	2
	15		◢	50/6"	28.6	2
SANDSTONE, SILTY, blue to grey, very hard, moist					–	3
CLAYSTONE/SILTSTONE, SANDY, olive to brown, hard, moist	20		◢	50/8"	28.8	2
SANDSTONE, SILTY, blue to grey, very hard, moist	25		◢	50/3"	–	3
	30		■	50/3"	17.1	3
CLAYSTONE/SILTSTONE, SANDY, blue to gray, very hard, moist to wet	35					
	40		■	50/3"	25.1	2
	▽					
SANDSTONE, SILTY, blue to grey, very hard, moist to wet SAMPLER REFUSAL AT 49 FEET DUE TO VERY HARD BEDROCK	45		⧗	50/0"	–	3
	50					

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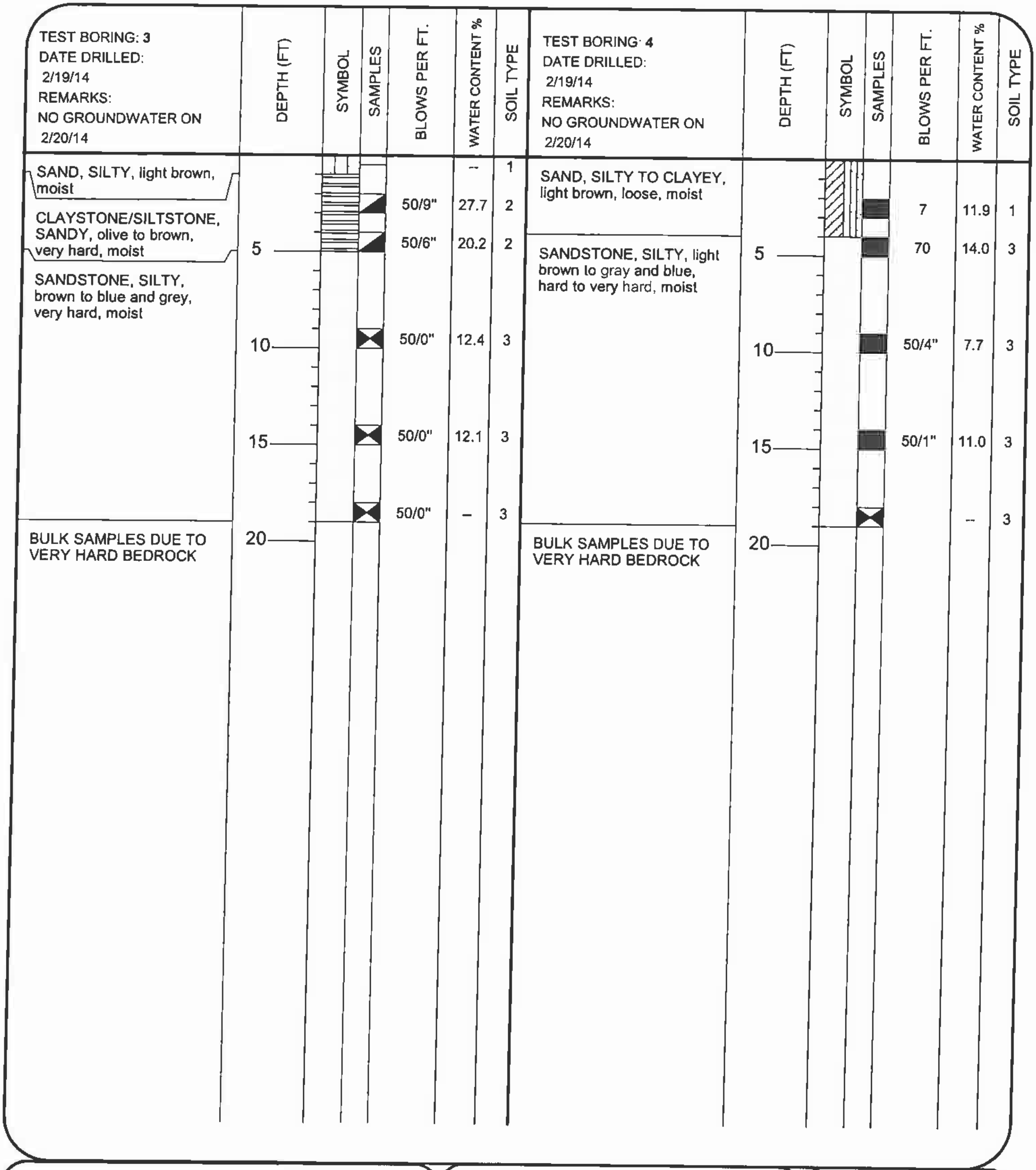
TEST BORING LOGS

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

	BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
SAND, SILTY, light brown, moist		--	1
CLAYSTONE/SILTSTONE, SANDY, olive to brown, very hard, moist	50/9"	27.7	2
	50/6"	20.2	2
SANDSTONE, SILTY, brown to blue and grey, very hard, moist	50/0"	12.4	3
	50/0"	12.1	3
	50/0"	–	3

BULK SAMPLES DUE TO VERY HARD BEDROCK

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

	BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
SAND, SILTY TO CLAYEY, light brown, loose, moist	7	11.9	1
SANDSTONE, SILTY, light brown to gray and blue, hard to very hard, moist	70	14.0	3
	50/4"	7.7	3
	50/1"	11.0	3
		--	3

BULK SAMPLES DUE TO VERY HARD BEDROCK

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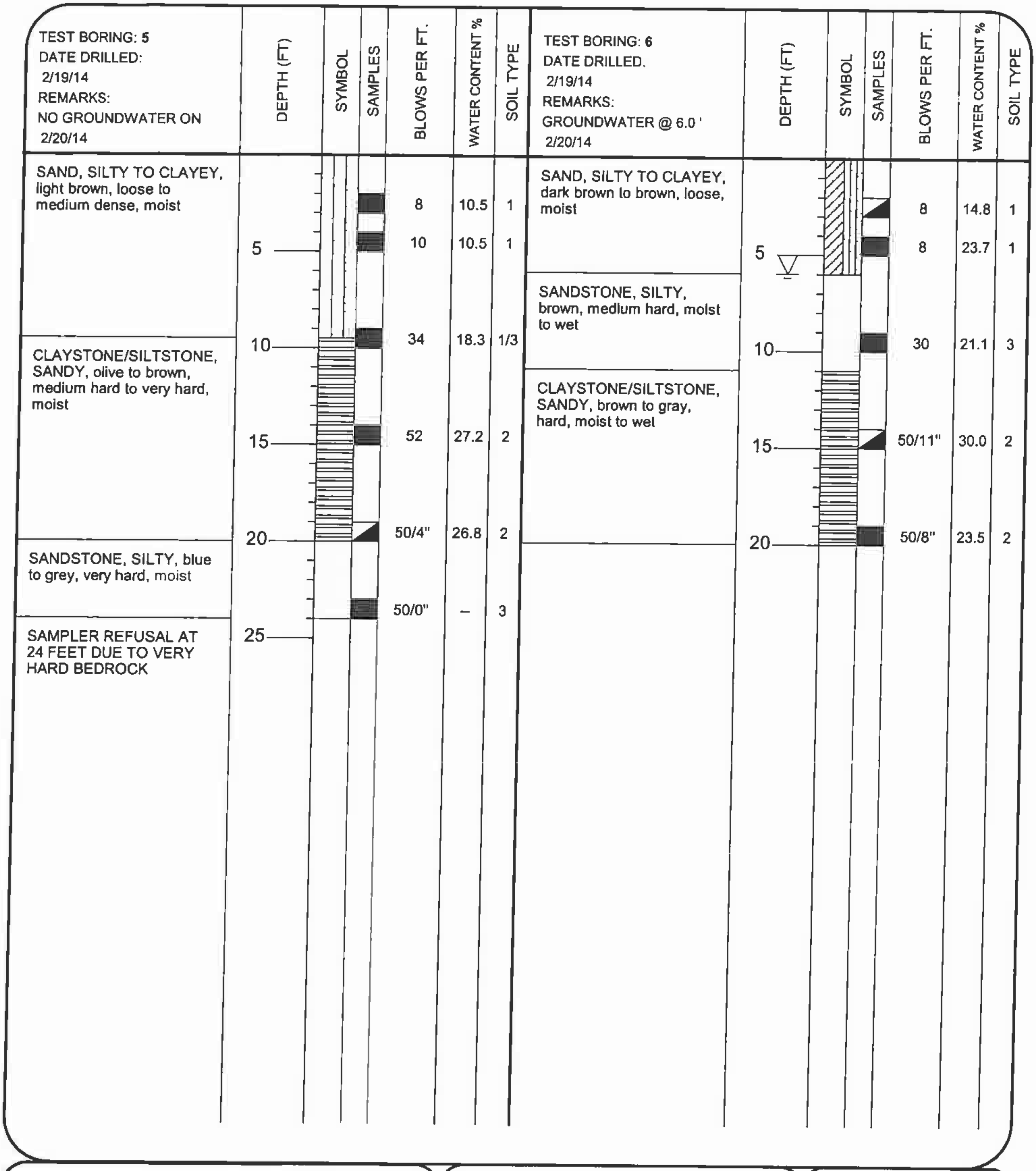
TEST BORING LOGS

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

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

DEPTH (FT)	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			

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

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

DEPTH (FT)	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

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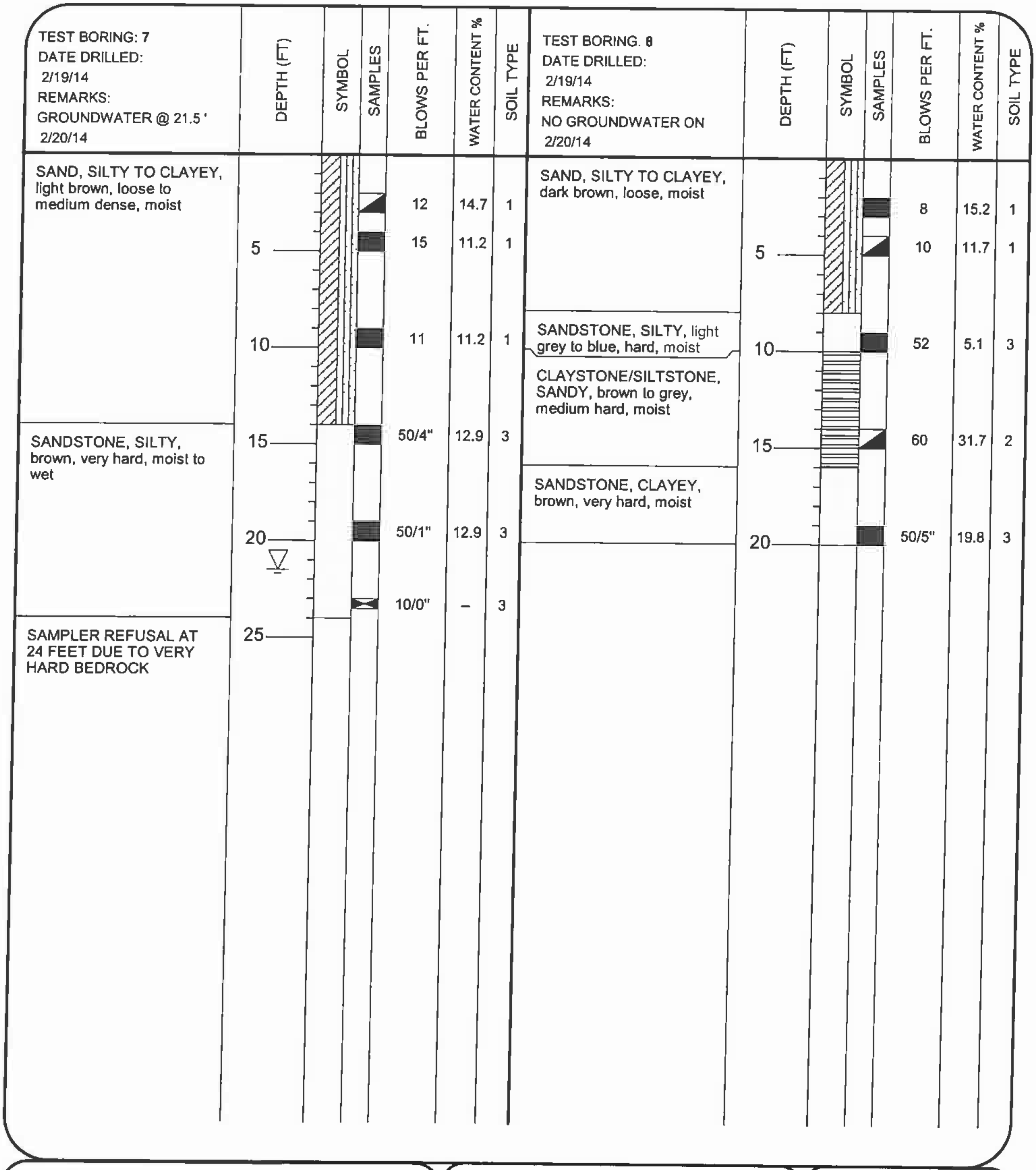
TEST BORING LOGS

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

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

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

SAMPLER REFUSAL AT 24 FEET DUE TO VERY HARD BEDROCK

BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
12	14.7	1
15	11.2	1
11	11.2	1
50/4"	12.9	3
50/1"	12.9	3
10/0"	–	3

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

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

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

CLAYSTONE/SILTSTONE, SANDY, brown to grey, medium hard, moist

SANDSTONE, CLAYEY, brown, very hard, moist

BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
8	15.2	1
10	11.7	1
52	5.1	3
60	31.7	2
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

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

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Job No. 195043

November 29, 2023

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

Re: Addendum to Soils and Geology Study – Proposed Zone Change
Windermere Subdivision – Zone Change
El Paso County, Colorado

Dear Mr. Stevens:

RMG – Rocky Mountain Group has previously completed a *Soils and Geology Study* (last revised January 18, 2021, Job No. 162062) for single-family construction. Subsequent to issuance of that report, the southern portion of the site (south of Mardale Lane) was to be rezoned to RM30 for construction of approximately 270 apartment units. Personnel of RMG provided an *Addendum to the Soils and Geology Study – Proposed Zone Change* (last dated March 30, 2022, Job No. 188268) for that rezoning of the Windermere subdivision, Filing No. 1 for Windsor Ridge Homes. However, it is our understanding the RM30 rezone was not finalized.

It is our understanding that the client is now proposing an additional revision/rezoning. RMG was provided plans titled *Concept Grading Exhibit 3*, dated August 21, 2023, prepared by Kimley Horn, showing a proposed configuration consisting of 20 proposed 4-plex multi-family structures and a proposed self-storage “Mini-Warehouse” with a footprint of approximately 33,000 square feet. The proposed multi-family area generally encompasses the western half of the proposed rezone area and the “Mini-Warehouse” generally encompasses the eastern half of the proposed rezone area.

The site was previously identified as El Paso County (EPC) Assessor parcel number 5329400016 and was included in both the above referenced reports. The site is now labeled as:

- 7653 Mardale Lane, consists of 9.13 acres and is zoned A1, EPC Assessor parcel number 5329416011.

The purpose of this addendum is to review the geologic conditions present within the southern portion of the site (previously designated as Tract B) 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.

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Northern Office:
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Monument: 719.488.2145
Woodland Park: 719.687.6077

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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 previously 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 proposed usage for the western portion of the site is to rezone to RM30 for the multi-family units and the eastern portion is to be rezoned CS for a proposed "Mini-Warehouse". The original *Soils and Geology Study* (2021) is attached and included in Appendix A. The *Addendum to the Soils and Geology Study – Proposed Zone Change* (2022) is included in Appendix B.

According to the Kimley Horn grading exhibit, the building area is near "final grade" and the proposed grading is limited to no more than one to two feet from the current grade.

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 northern 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. 183672, dated March 14, 2022.

Existing Site Conditions

The site is undeveloped and has been partially graded. A detention facility is located along the eastern property boundary and is to remain. The site does not contain vegetation or trees. The overall slope of the site is down to the south, southeast.

Areas of ponded surface water were visible throughout the last six months. The site was utilized as a stock/storage yard during the development of the single-family residences to the north.

Additional Investigations

As noted in the Colorado Geological Survey (CGS) comments in regards to the Soils and Geology Study (2021), it was noted persistent shallow groundwater occurs at this site and within the area. Seasonal groundwater monitoring was not conducted for the original approval of the subdivision. It is our understanding the El Paso County Planning Department has had extensive discussions with CGS regarding the seasonal fluctuations of groundwater across the County. Based on communication from personnel of El Paso County subsequent to those discussions, it is our understanding that if a seasonal groundwater monitoring program is not completed at the time of initial planning, El Paso County will only be agreeable to one of the following two options at the time of final plat:

1. A plat note restriction stating that no below-grade spaces or basements are to be allowed at the subject site, OR;
2. A plat note restriction stating that no below-grade habitable spaces or basements be allowed unless or until groundwater data is collected (via a monitoring program extending through all 4 seasons of the year) demonstrating that there is a minimum of 4 to 6 feet of separation from the below-grade habitable areas and the anticipated shallowest depth of the underlying seasonal groundwater fluctuations.

Based on this information, construction of below grade habitable spaces or basements shall not be permitted unless the recommended groundwater monitoring program demonstrates adequate separation from the bottom of proposed below grade spaces.

At this time, the multi-family residences are to have "tuck-under" garages with an option for a walkout basement. If any below-grade spaces are proposed (including "tuck-under garages or walkout basements), a year-long groundwater monitoring study must be undertaken to determine the separation from the proposed construction to the underlying groundwater. The results of this monitoring study will need to be submitted to El Paso County for approval prior to permitting.

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

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

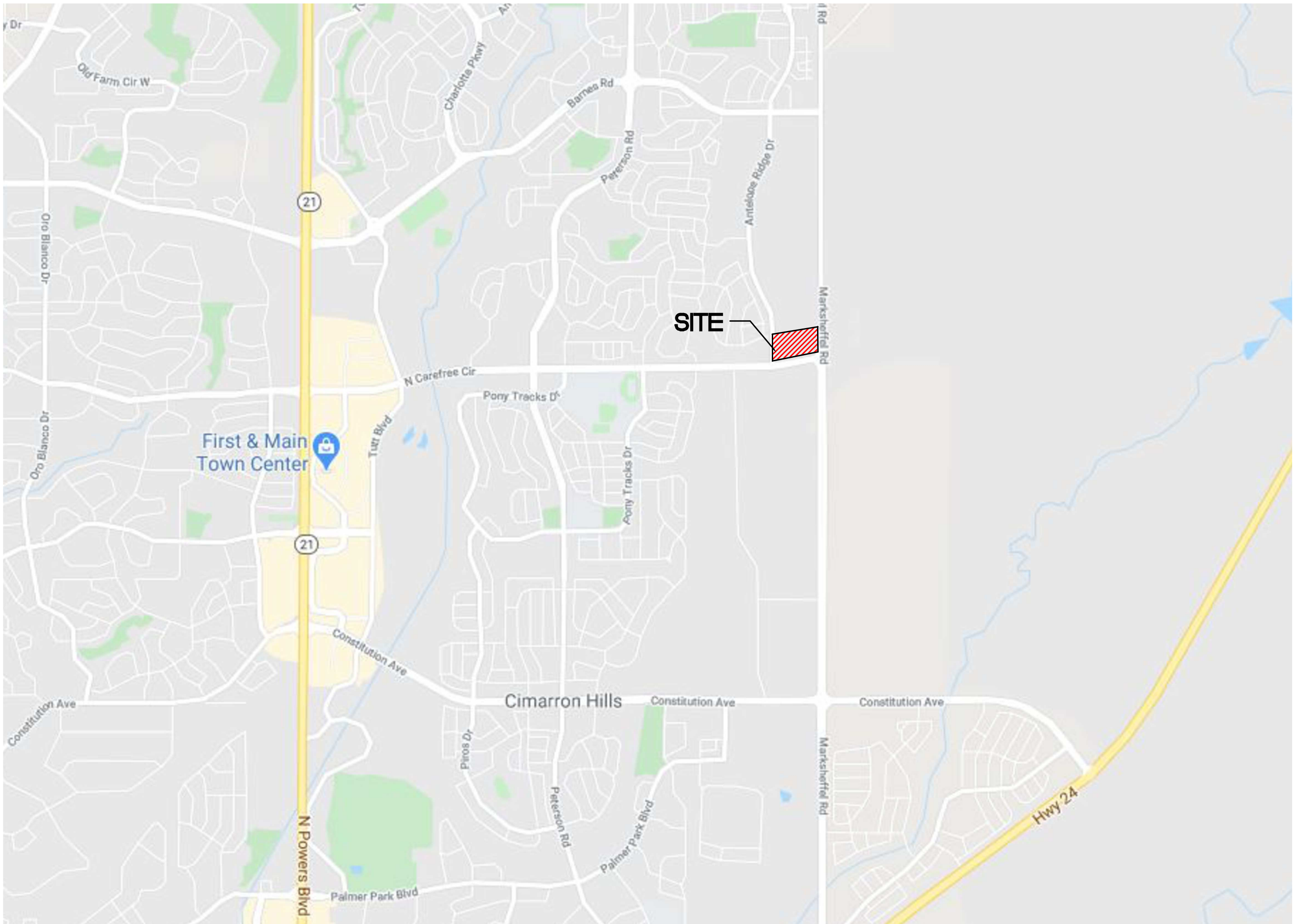
Kelli Zigler
Project Geologist

Reviewed by,

RMG – Rocky Mountain Group

COLORADO REGISTERED PROFESSIONAL ENGINEER
ANTHONY P. MUNGER
12/4/23
39818

Tony Munger, P.E.
Sr. Geotechnical Project Manager



NOT TO SCALE

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(970) 330-1071

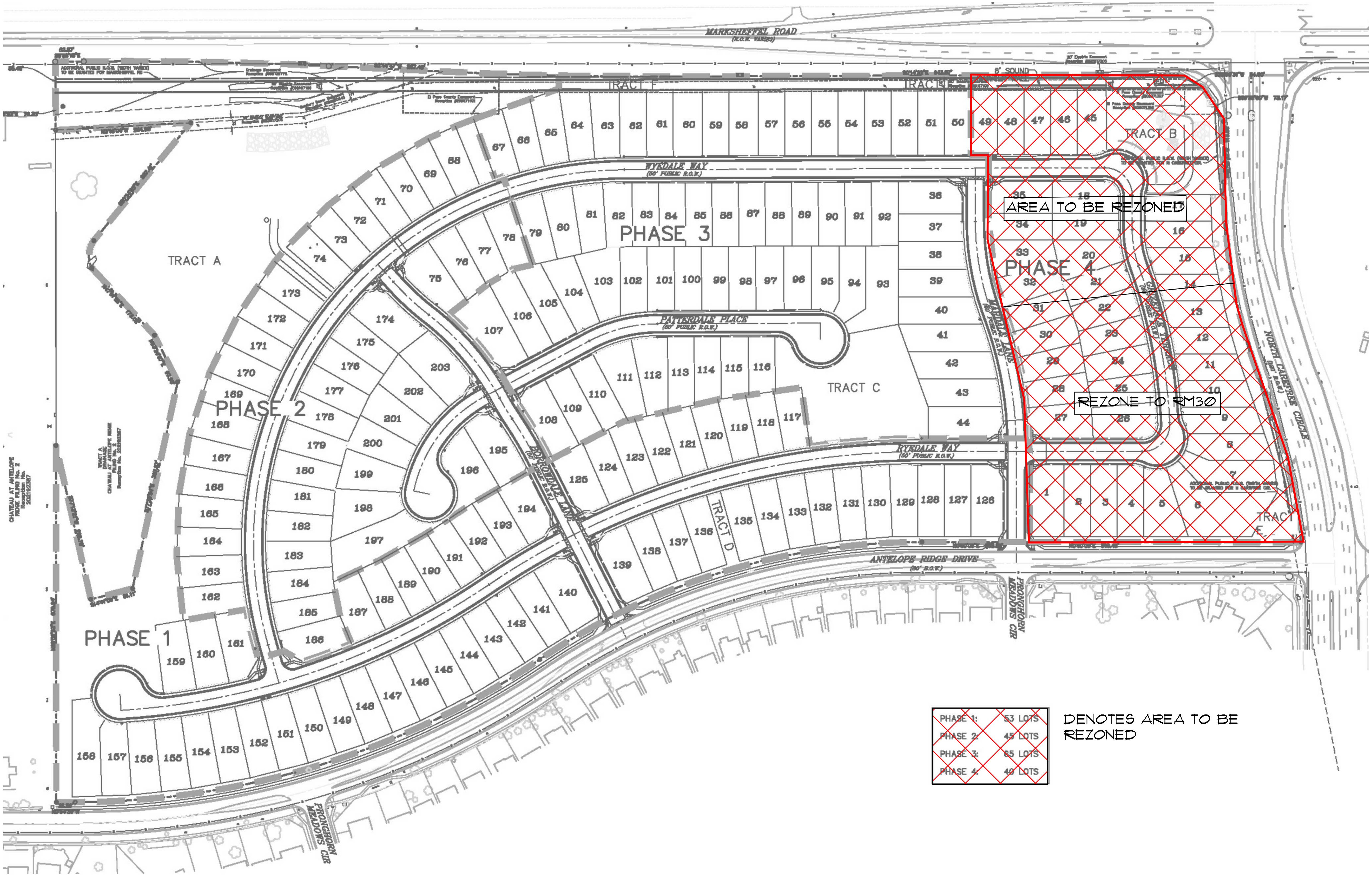
SITE VICINITY MAP

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

JOB No. 195043

FIG No. 1

DATE 11-29-2023



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

DENOTES AREA TO BE REZONED

NOT TO SCALE

BASE MAP FROM THE SOILS AND GEOLOGY STUDY (2021)

JOB No. 162062

ARCHITECTS
RMG
ENGINEERS
ROCKY MOUNTAIN GROUP

Southern Office
Colorado Springs, CO 80918
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(303) 688-9475
Northern Office:
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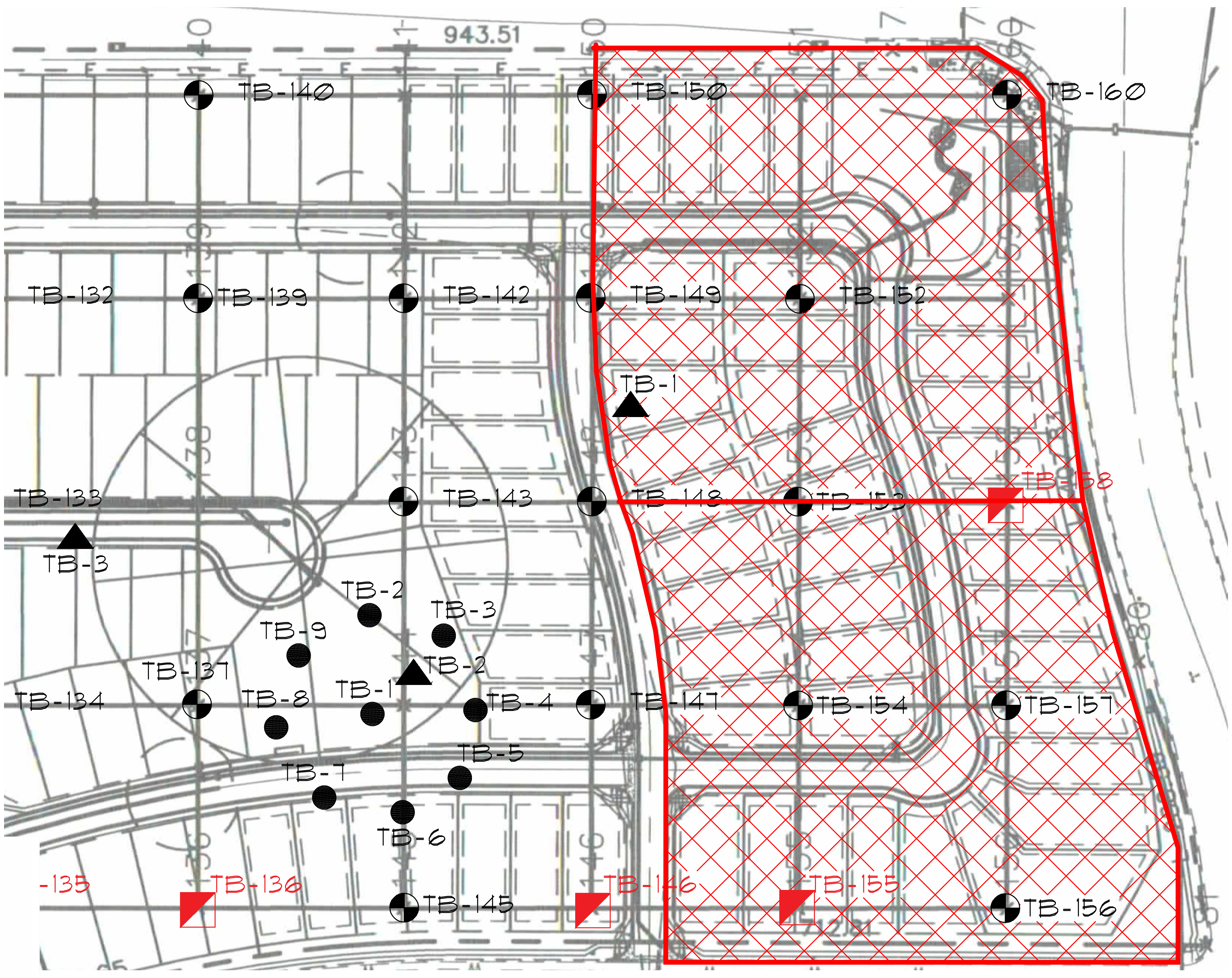
(970) 330-1071
Woodland Park Office:
(719) 687-6077
Monument Office:
(719) 488-2145
Pueblo / Canon City:
(719) 544-7750

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

ENGINEER: TPM
DRAWN BY: KZ
CHECKED BY: TPM
ISSUED: 10-26-2020
REVISION: DENOTE REZONE AREA 3-30-22
REVISION: DENOTE REZONE AREA 11-29-23

AREA TO BE REZONED

SHEET No.
FIG-2



🟥 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

▨ AREA TO BE REZONED

NOT TO SCALE

JOB No. 162062

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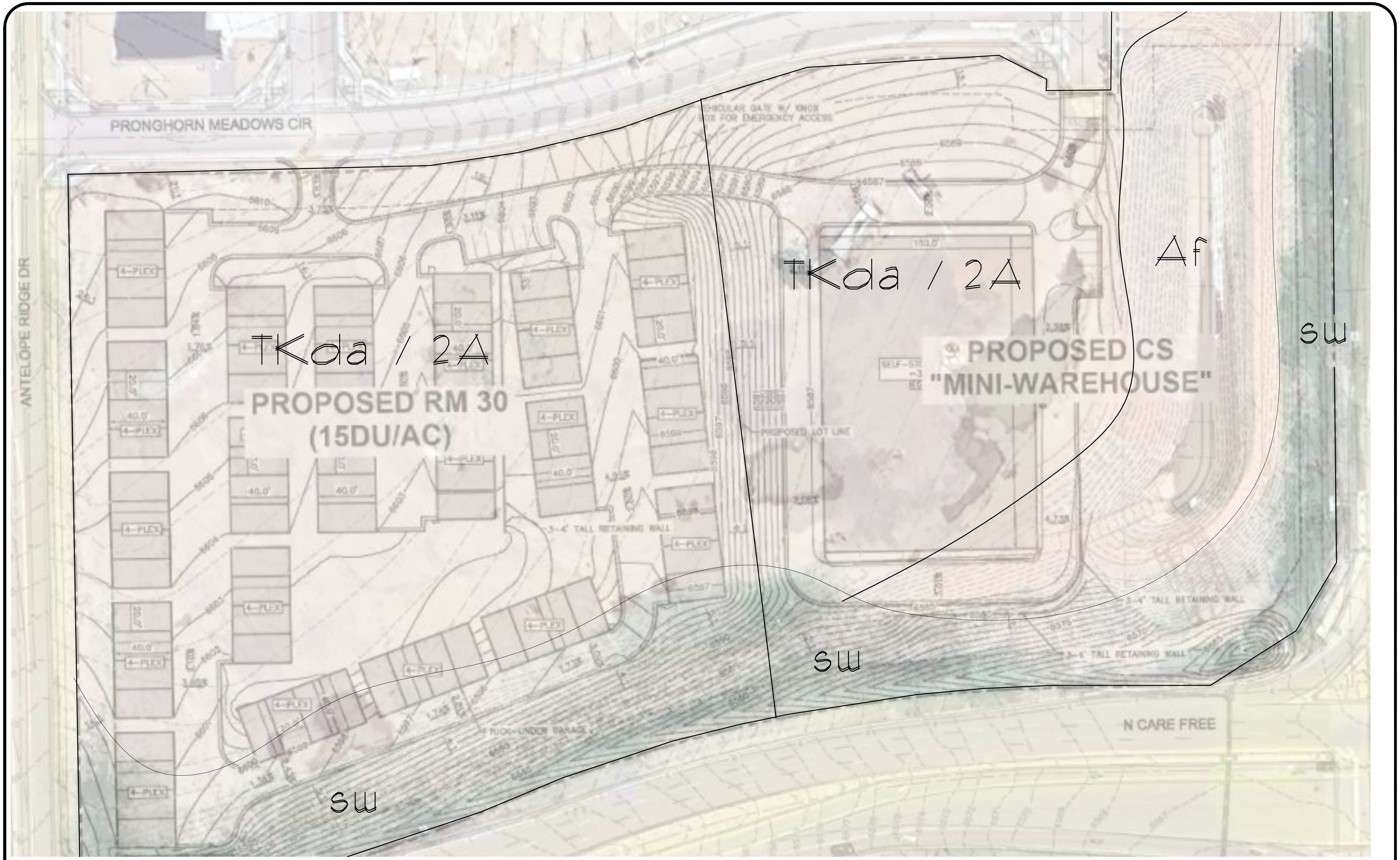
WINDERMERE
N. MARKSHEFFEL RD
EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

ENGINEER: TPM
DRAWN BY: KZ
CHECKED BY: TPM
ISSUED: 10-26-2020
REVISION: DENOTE REZONE AREA 3-30-22
REVISION: DENOTE REZONE AREA 11-29-23

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

Engineering

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

☐ AREAS TO BE REZONED

NOT TO SCALE

BASE MAP PROVIDED BY: GOOGLE AND KIMLEY HORN

JOB No. 162062

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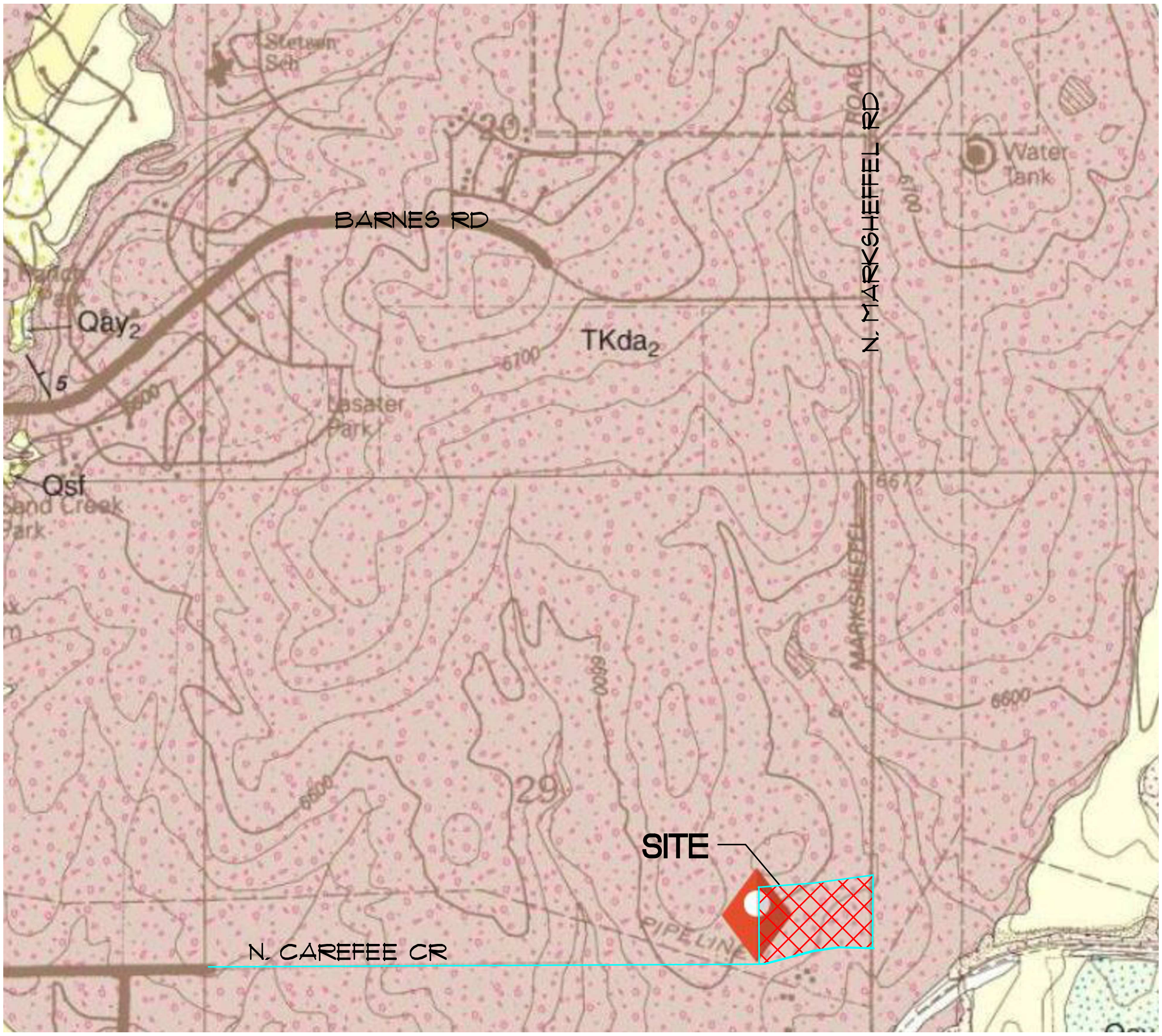
WINDERMERE
N. MARKSHEFFEL RD
EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

ENGINEER: TPM
DRAWN BY: KZ
CHECKED BY: TPM
ISSUED: 10-26-2020
REVISED: ARE TO BE REZONED 1-18-21
REVISED: AREA TO BE REZONED 12-4-23

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. 195043

FIG No. 5

DATE 11-29-2023

NOT TO SCALE
BASE MAP PROVIDED BY: FEMA

ARCHITECTS
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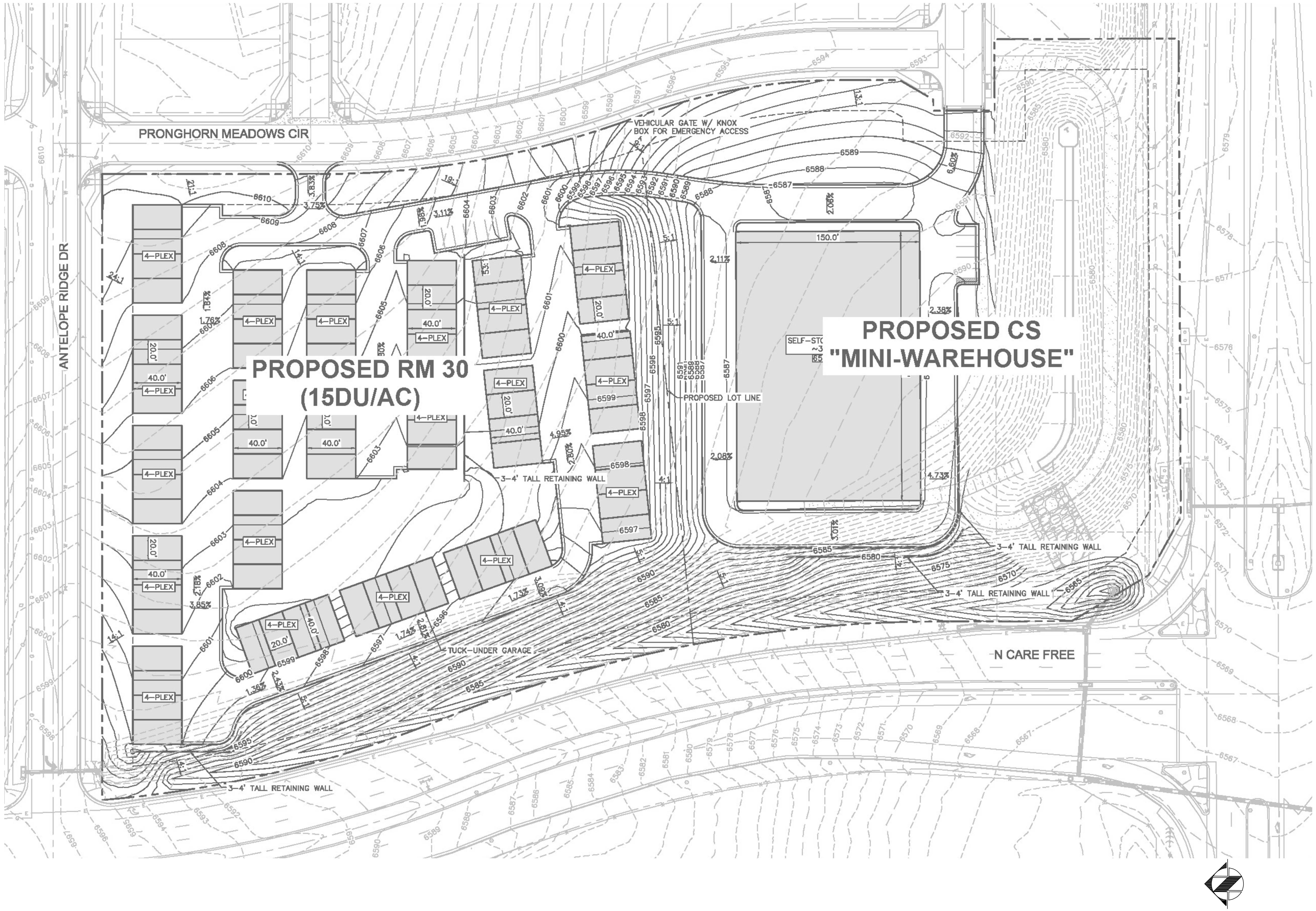
FEMA MAP

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

JOB No. 195043

FIG No. 6

DATE 11-29-2023



NOT TO SCALE

BASE MAP PROVIDED BY: KIMLEY HORN

JOB No. 162062

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RMG
ENGINEERS

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(719) 488-2145
Pueblo / Canon City:
(719) 544-7750

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

ENGINEER:	TPM
DRAWN BY:	KZ
CHECKED BY:	TPM
ISSUED:	12-4-2023

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

Architecture
Structural
Geotechnical

RMG

Materials Testing
Forensic
Civil/Planning

ROCKY MOUNTAIN GROUP
EMPLOYEE OWNED

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

ARCHITECTS
RMG
ENGINEERS
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

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

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.
4. *Preliminary 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 April 17, 2018.
5. *Subsurface Soil Investigation, Windermere Subdivision, El Paso County, Colorado,* prepared by RMG – Rocky Mountain Group, Job No. 142206, last dated May 28, 2015.
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

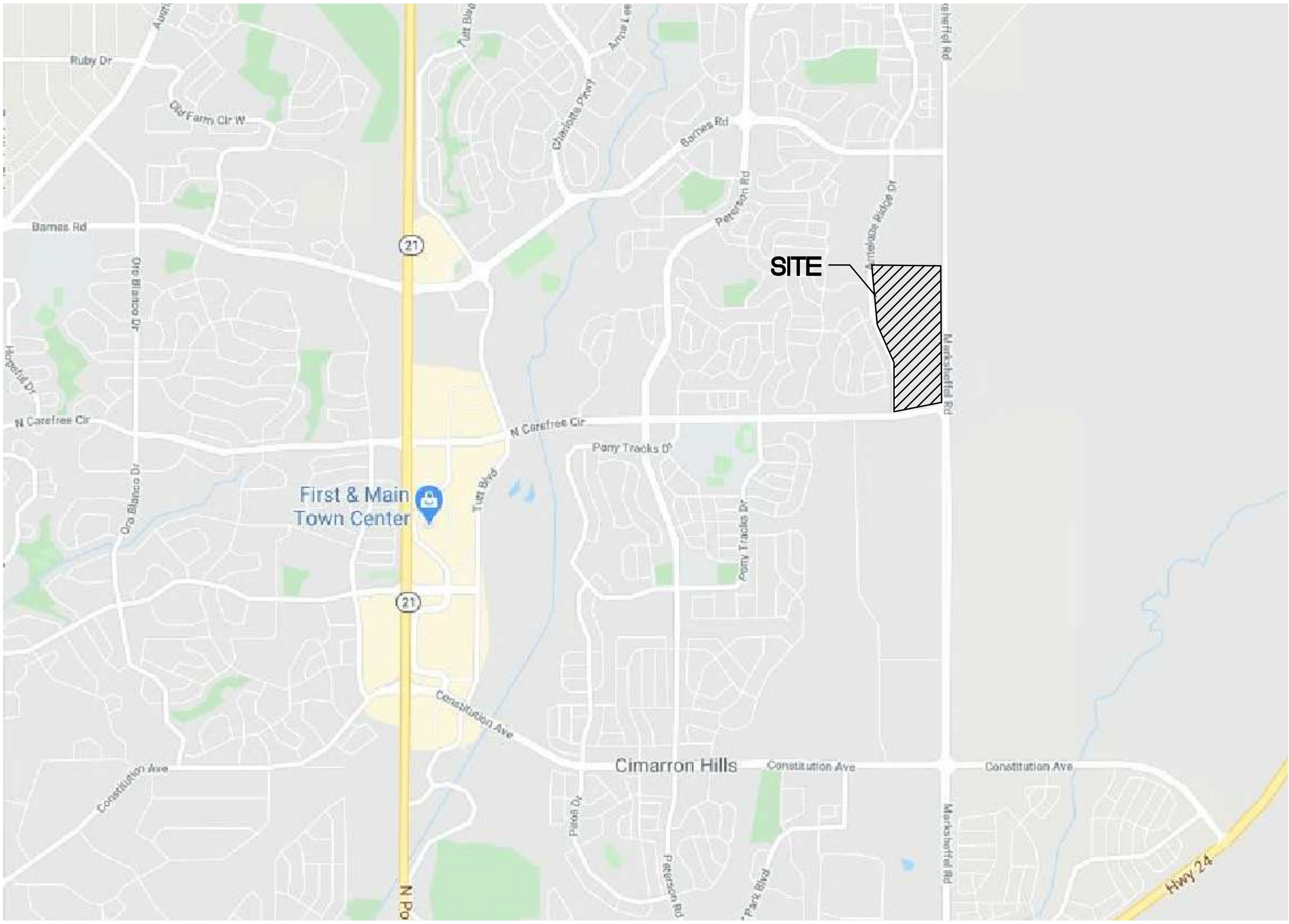
This report is for the exclusive purpose of providing geologic hazards information and preliminary geotechnical engineering recommendations. The scope of services did not include, either specifically or by implication, evaluation of wild fire hazards, environmental assessment of the site, or identification 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



NOT TO SCALE

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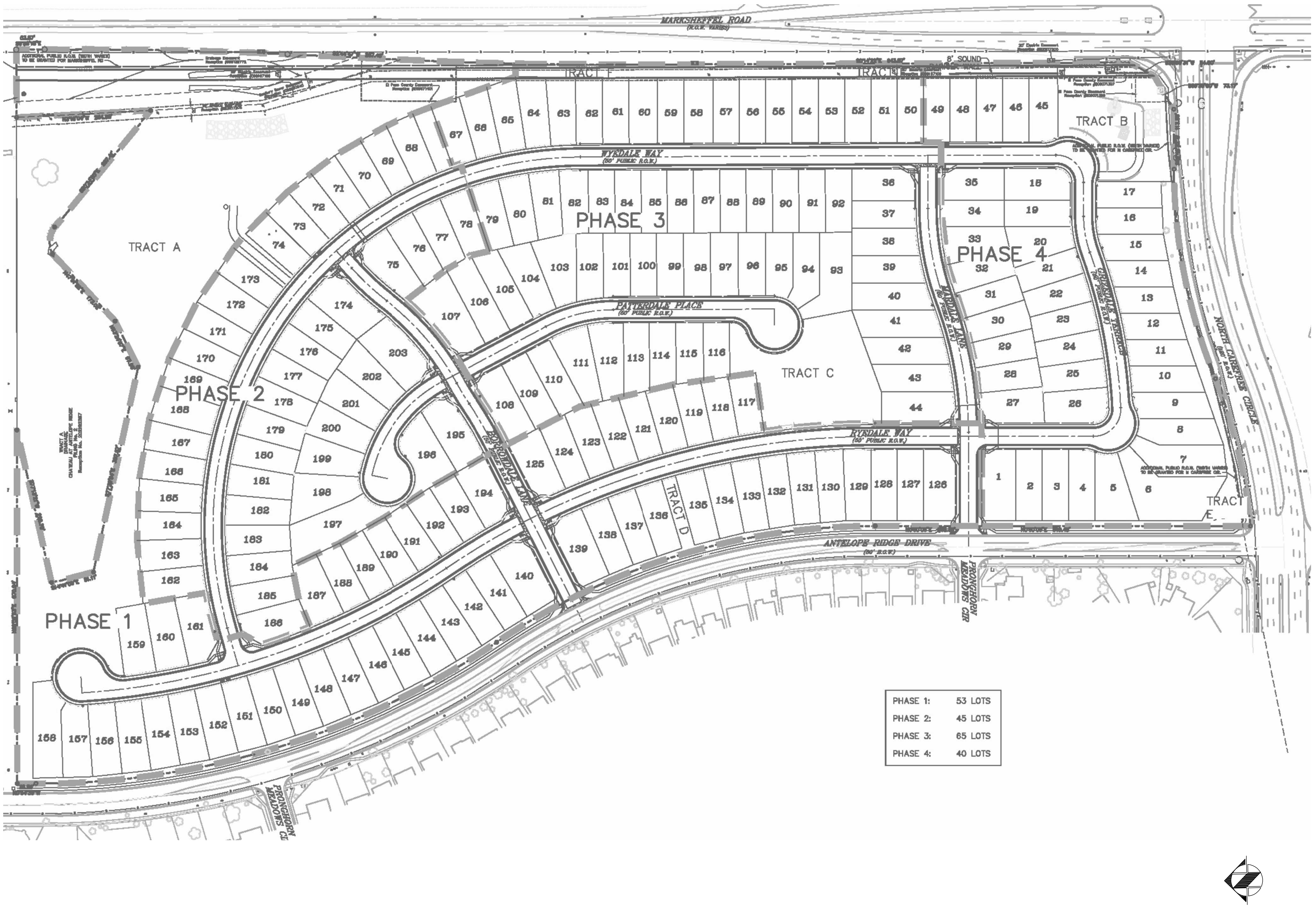
SITE VICINITY MAP

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

JOB No. 162062

FIG No. 1

DATE 10-26-2020



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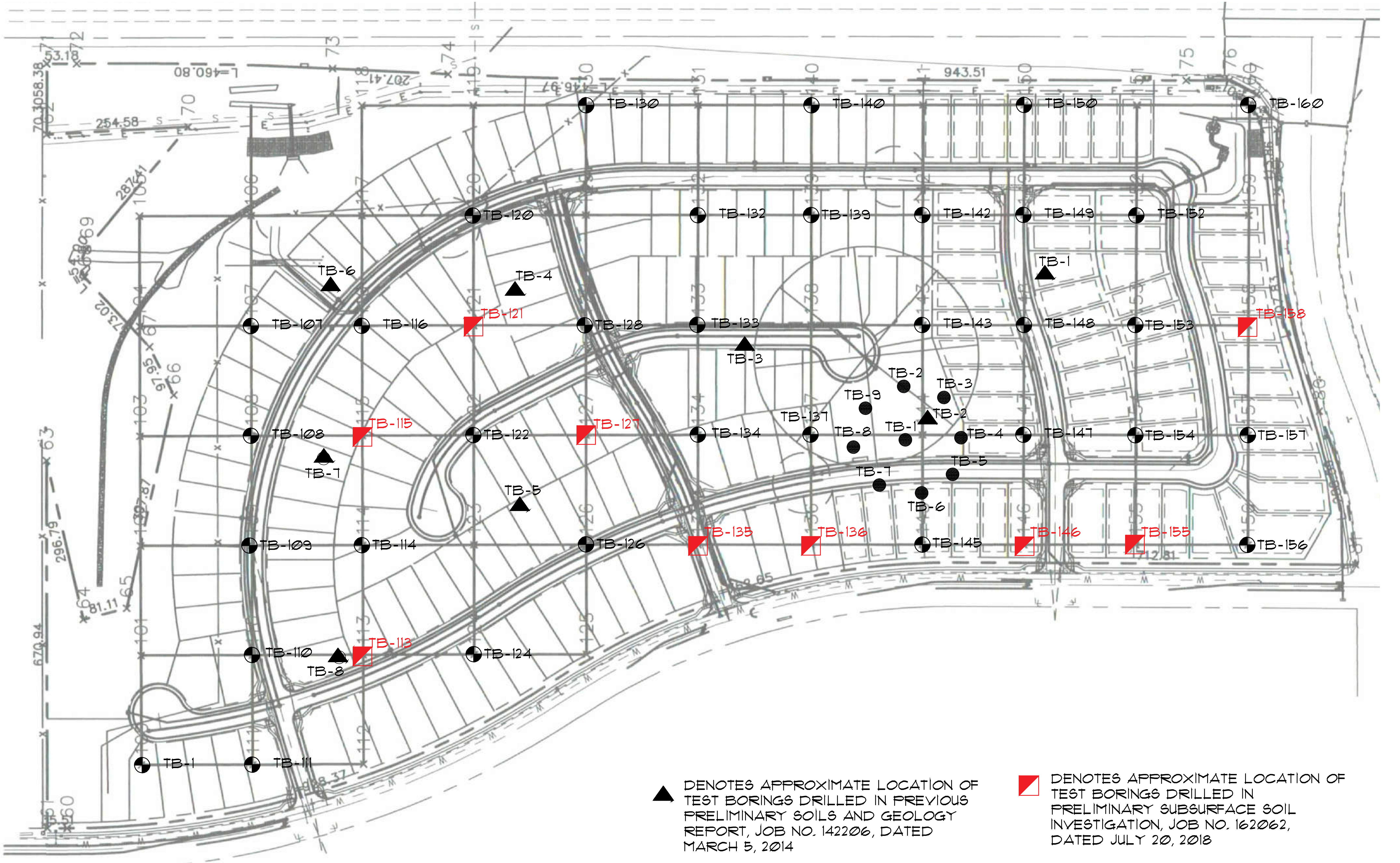
WINDERMERE
N. MARKSHEFFEL RD
EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

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

SITE PLAN

SHEET No.
FIG-2



NOT TO SCALE

▲ 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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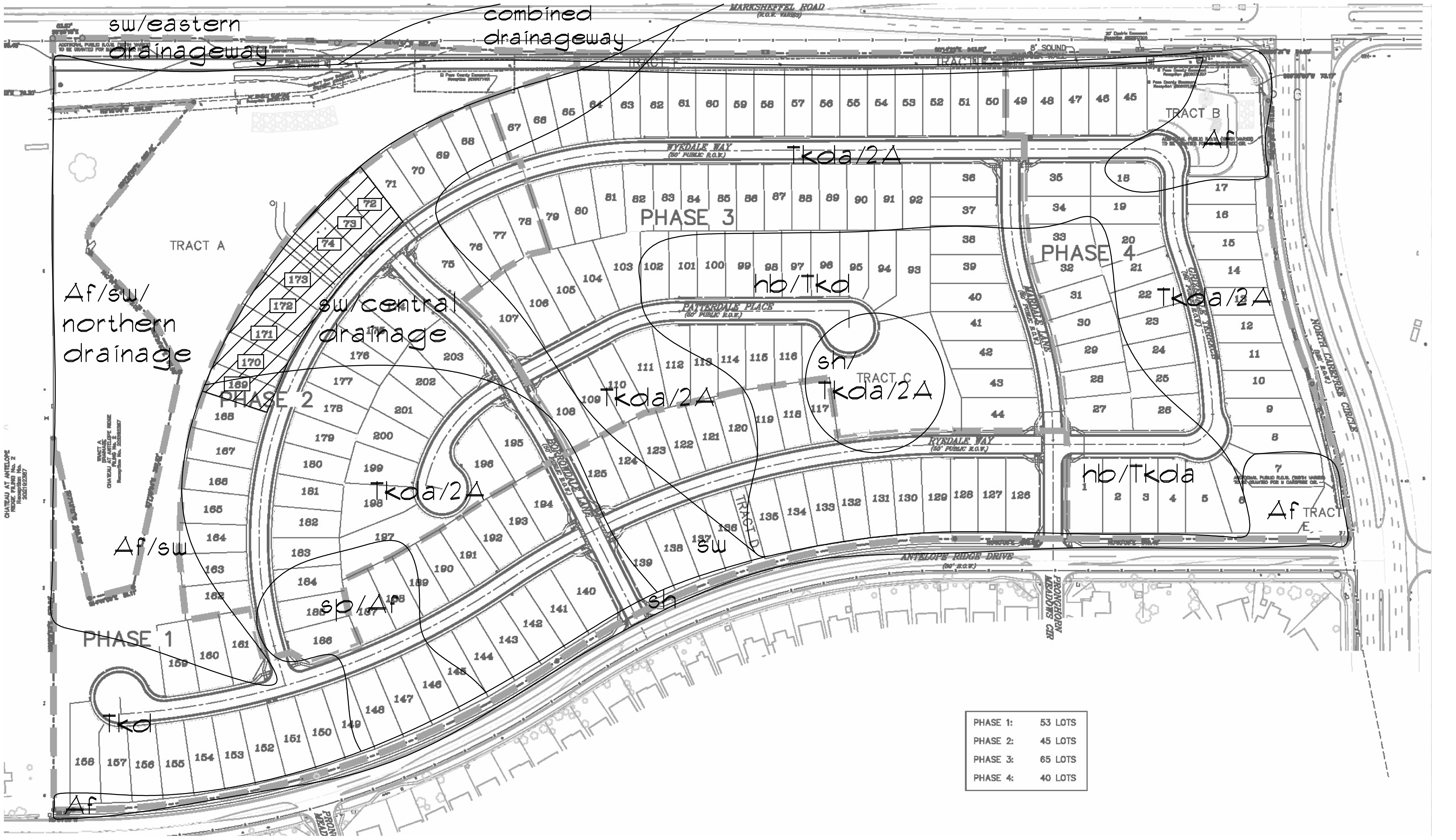
WINDERMERE SUBDIVISION
EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

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

TEST BORING LOCATION PLAN

SHEET No.
FIG-3



PHASE 1:	53 LOTS
PHASE 2:	45 LOTS
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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.

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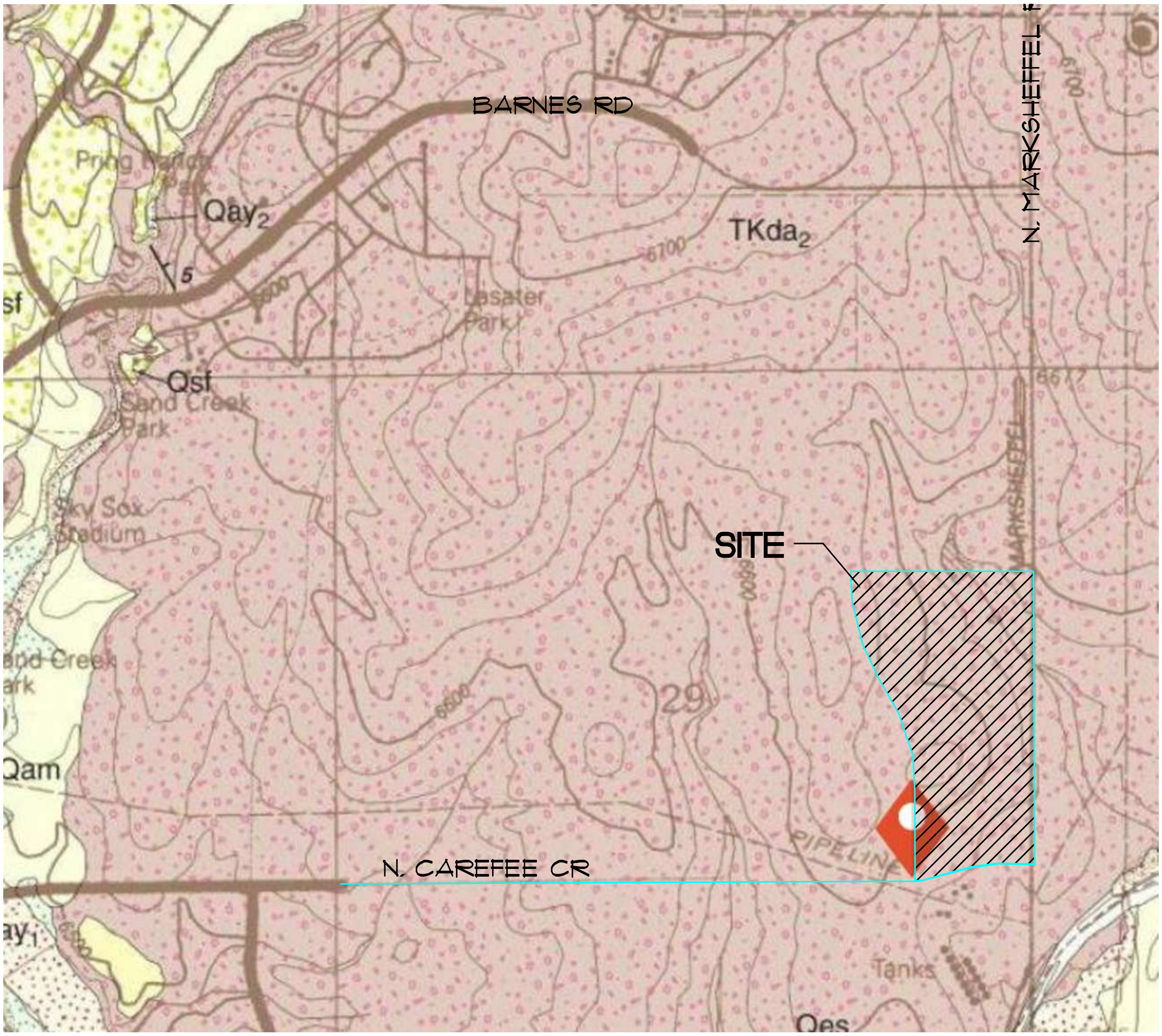
WINDERMERE
N. MARKSHEFFEL RD
EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

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

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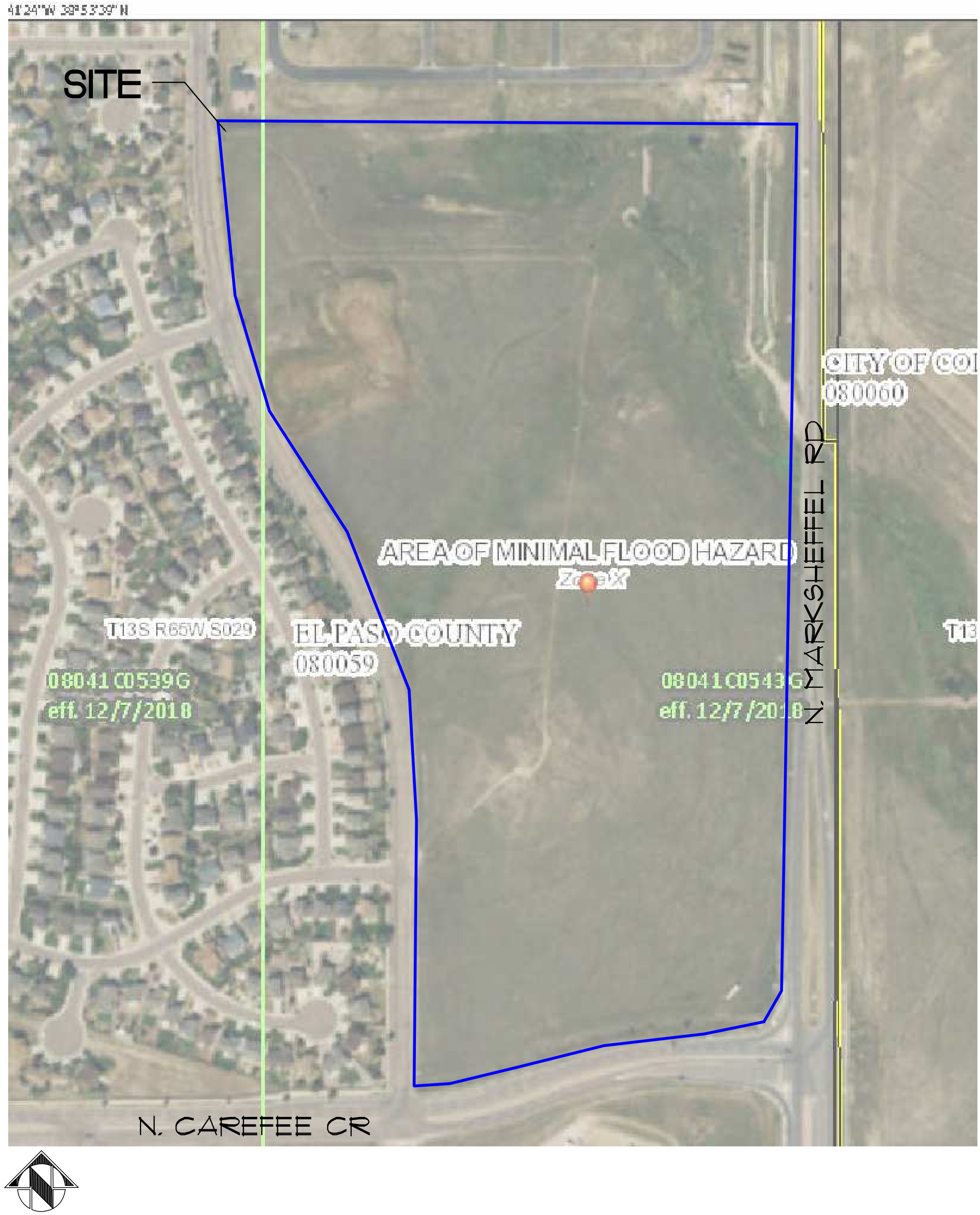
FIG No. 5

DATE 10-26-2020



NOT TO SCALE

BASE MAP PROVIDED BY: FEMA

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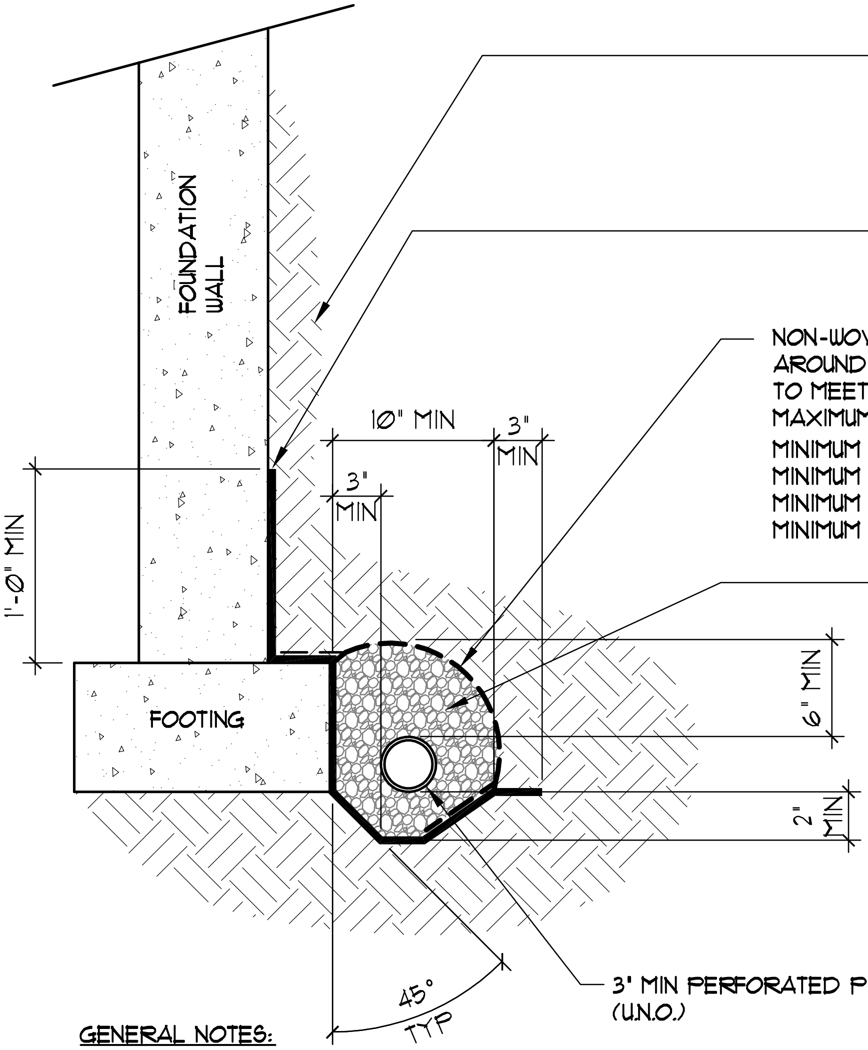
FEMA MAP

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

JOB No. 162062

FIG No. 6

DATE 10-26-2020



EXTERIOR BACK FILL

POLYETHYLENE FILM SEALED TO WALL AND
EXTENDED AROUND BOTTOM OF GRAVEL
COLLECTOR AS SHOWN

NON-WOVEN GEOTEXTILE (AS SHOWN)
AROUND ENTIRE GRAVEL COLLECTOR - GEOTEXTILE
TO MEET THE FOLLOWING REQUIREMENTS:
MAXIMUM APPARENT OPENING SIZE: US SIEVE #10
MINIMUM WATER FLOW RATE: 135 GAL/MIN/FT ^{2}
MINIMUM TRAPEZOIDAL TEAR STRENGTH: 40 lbs
MINIMUM CBR PUNCTURE STRENGTH: 250 lbs
MINIMUM GRAB TENSILE STRENGTH: 90 lbs

<u>GRAVEL COLLECTOR:</u>
GRAVEL SIZE TO BE AT LEAST 2X THE
WIDTH OF SLOTTED PERFORATIONS OR
1.5X THE DIAMETER OF ROUND
PERFORATIONS

3' MIN PERFORATED PIPE
(U.N.O.)

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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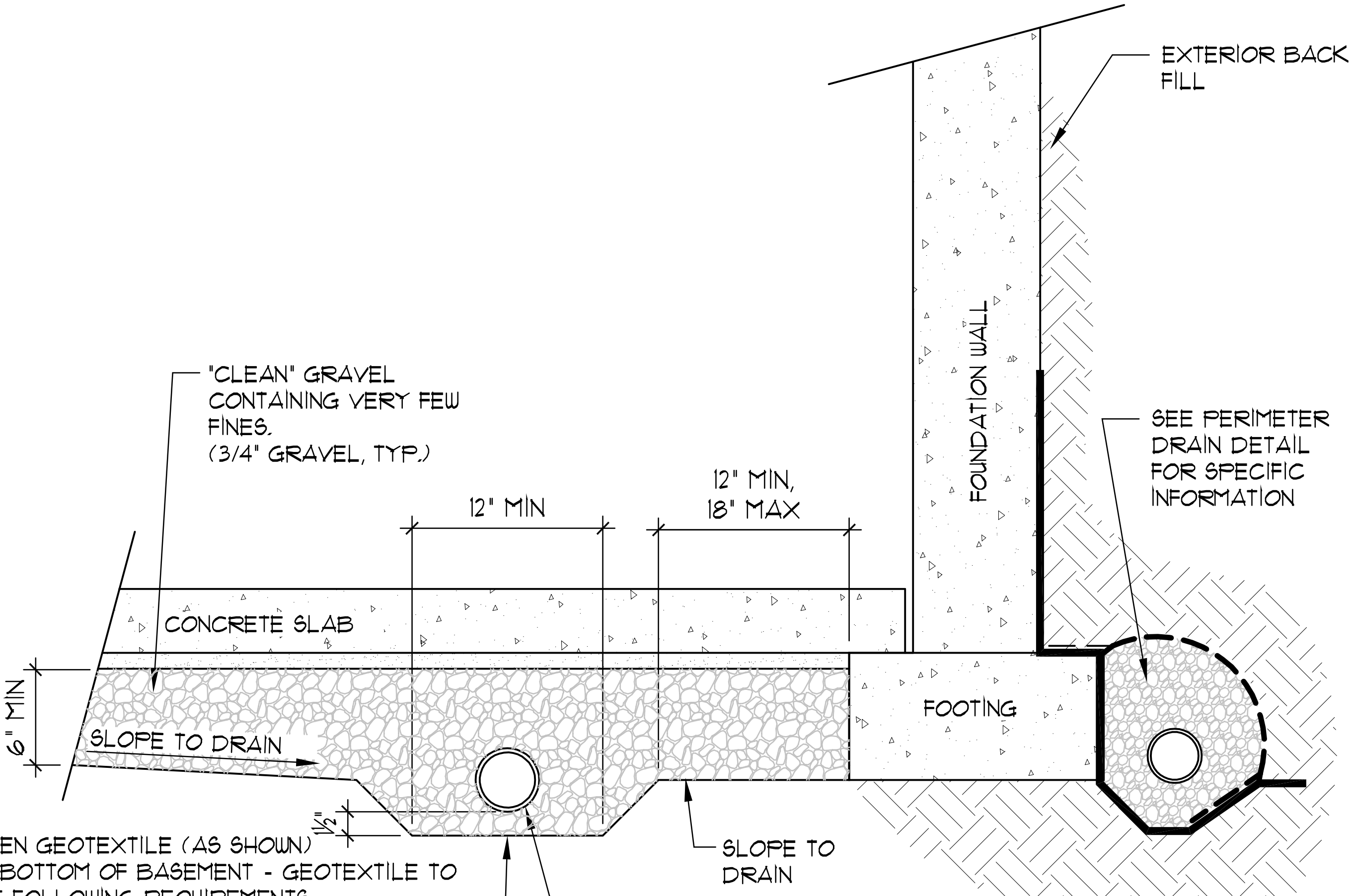
PERIMETER DRAIN

FIG No. 7



NON-WOVEN GEOTEXTILE (AS SHOWN) ACROSS BOTTOM OF BASEMENT - GEOTEXTILE TO MEET THE FOLLOWING REQUIREMENTS:
MAXIMUM APPARENT OPENING SIZE: US SIEVE #70
MINIMUM WATER FLOW RATE: 135 GAL/MIN/FT^2
MINIMUM TRAPEZOIDAL TEAR STRENGTH: 40 lbs
MINIMUM CBR PUNCTURE STRENGTH: 250 lbs
MINIMUM GRAB TENSILE STRENGTH: 90 lbs

3' DIAMETER RIGID PERFORATED PIPE CONNECTED TO A SUITABLE GRAVITY OUTFALL SUCH AS AN UNDERDRAIN LOCATED IN THE UTILITY TRENCH IN THE STREET WITH A MIN. GRADE OF PIPE = 1.5%. IF A FREE GRAVITY OUTFALL CANNOT BE ACHIEVED, A SUMP PIT AND PUMP SHOULD BE PROVIDED.

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.

3. 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.

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
SANDSTONE, SILTY, blue, very hard, moist	25				
	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
SANDSTONE, SILTY, blue, very hard, moist	25	⁙			
	30	⁙	■	50/3"	16.1

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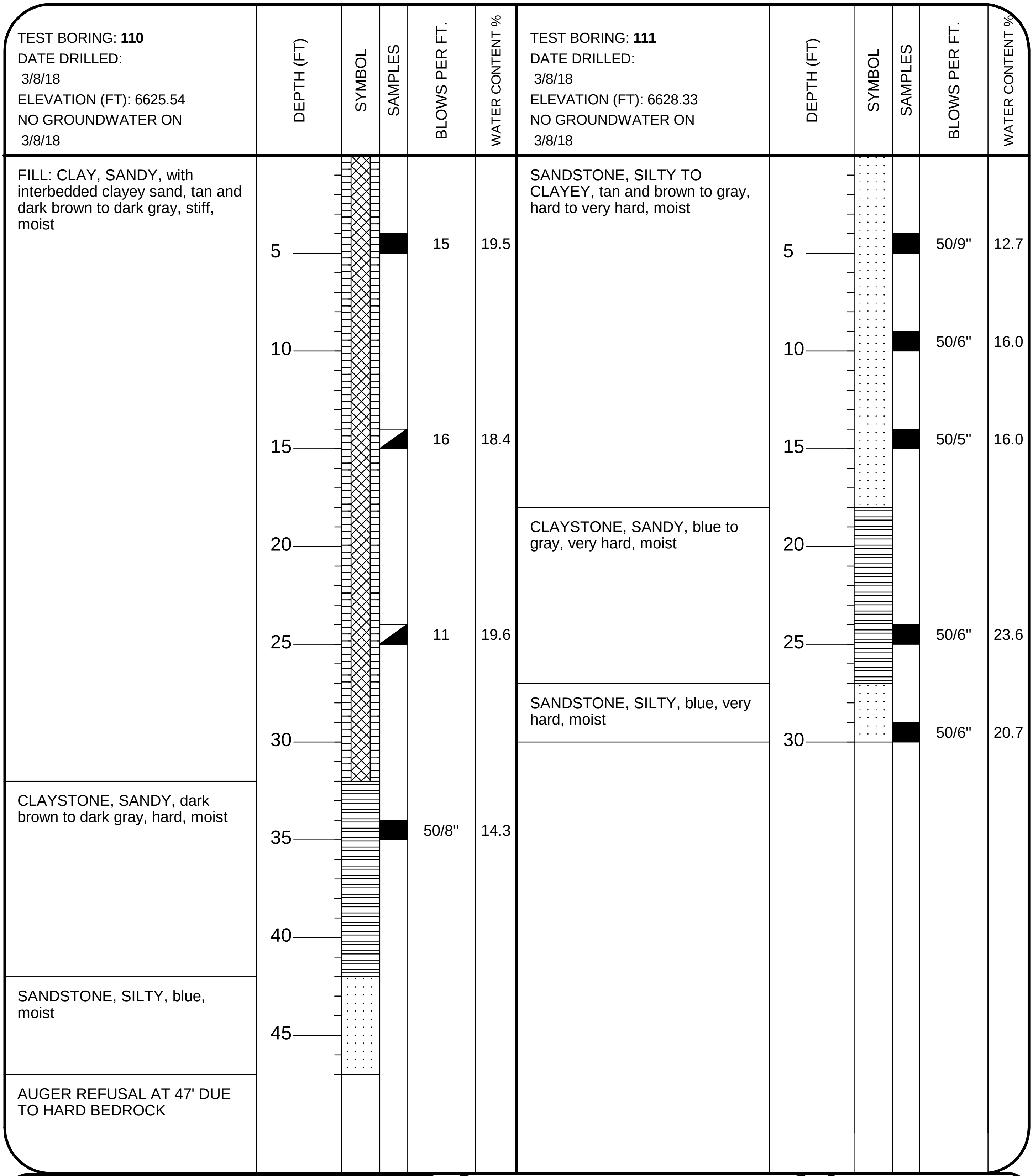
TEST BORING LOGS

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

FILL: CLAY, SANDY, with interbedded clayey sand, tan and dark brown to dark gray, stiff, moist

CLAYSTONE, SANDY, dark brown to dark gray, hard, moist

SANDSTONE, SILTY, blue, moist

AUGER REFUSAL AT 47' DUE TO HARD BEDROCK

DEPTH (FT)	BLOWS PER FT.	WATER CONTENT %
5	15	19.5
15	16	18.4
25	11	19.6
35	50/8"	14.3

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

SANDSTONE, SILTY TO CLAYEY, tan and brown to gray, hard to very hard, moist

CLAYSTONE, SANDY, blue to gray, very hard, moist

SANDSTONE, SILTY, blue, very hard, moist

DEPTH (FT)	BLOWS PER FT.	WATER CONTENT %
5	50/9"	12.7
10	50/6"	16.0
15	50/5"	16.0
25	50/6"	23.6
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
SANDSTONE, SILTY TO CLAYEY, brown, very hard, moist	15		■	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
CLAYSTONE, SANDY, brown, hard, moist to wet	20		■	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)		SAMPLES	BLOWS PER FT.	WATER CONTENT %
5	SAND, SILTY TO CLAYEY, tan to gray, medium dense, moist	■	13	7.7
10	CLAYSTONE, SANDY, brown to olive and gray with rust staning, very hard, moist	■	50/3"	23.0
15		◢	50/2"	19.8
20		■	50/1"	7.8
25	SANDSTONE, SILTY TO CLAYEY, brown to gray, very hard, moist	■	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

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

DEPTH (FT)	SAMPLES	BLOWS PER FT.	WATER CONTENT %
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

	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SANDSTONE, SILTY TO CLAYEY, with sandy claystone seams, brown to gray, very hard, moist	5	░	■	50/3"	13.7
	10	░	■	50/3"	11.3
	15	░	■	50/6"	10.4
	20	░	■	50/4"	10.0
	25	░			
	30	░	■	50/3"	7.8
AUGER REFUSAL AT 30' DUE TO HARD BEDROCK					

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

	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAYSTONE, SANDY, tan to olive and gray, very hard, moist	5	☰	■	50/3"	22.7
	10	☰	■	50/3"	18.7
SANDSTONE, SILTY, blue, very hard, moist	15	░	■	50/3"	12.6
	20	░	■	50/3"	11.2
	25	░	■	50/2"	18.1
AUGER REFUSAL AT 25' DUE TO HARD BEDROCK					

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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
SANDSTONE, SILTY, blue, moist	25				
	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

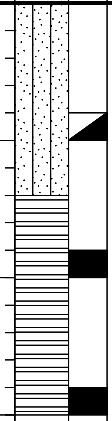
JOB No. 162062

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
PAGE 1 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
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

JOB No. 162062
FIGURE No. 21
PAGE 2 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
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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SUMMARY OF LABORATORY TEST RESULTS

JOB No. 162062
FIGURE No. 21
PAGE 3 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
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
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DATE 4/17/18

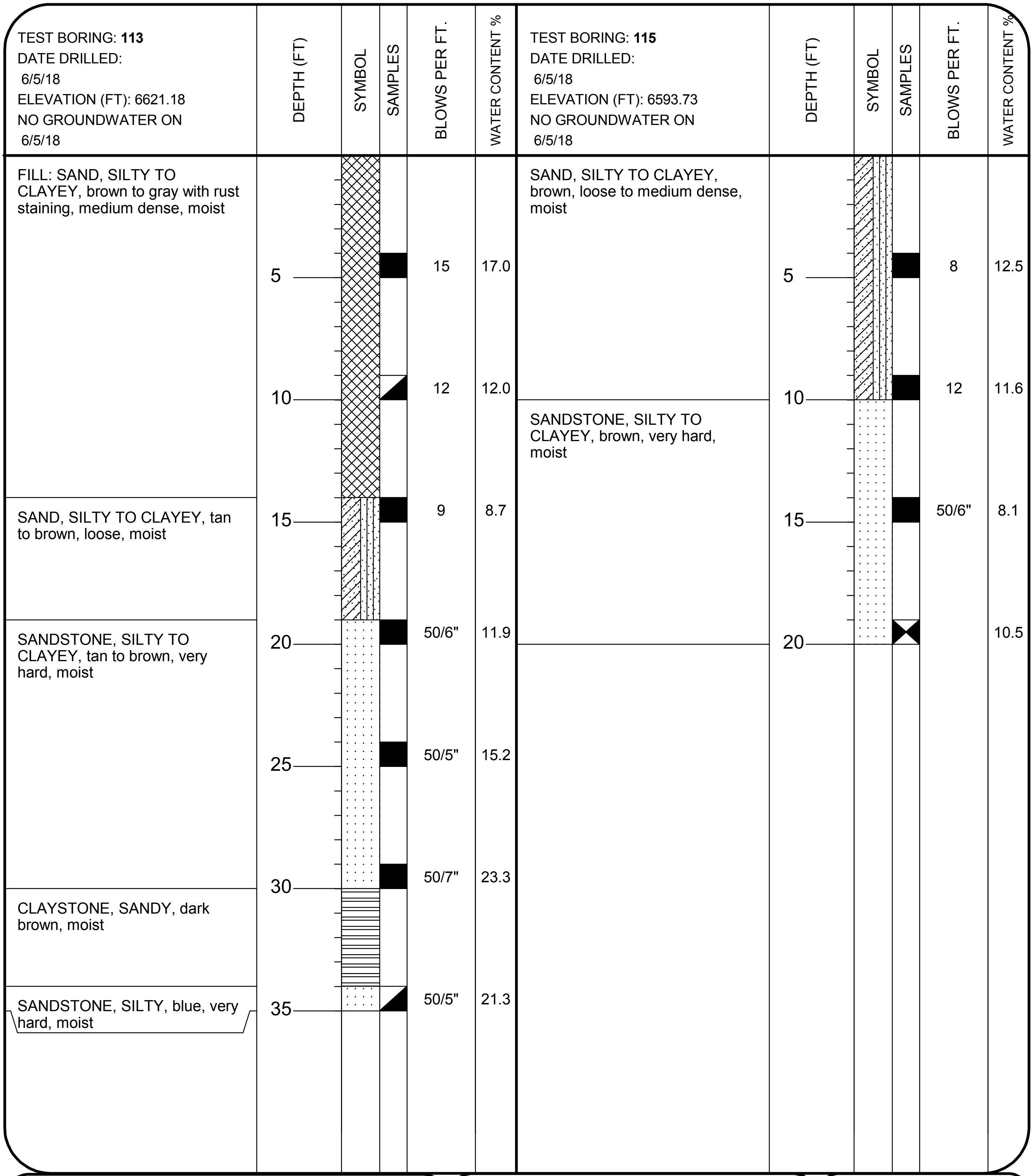
Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	FHA Expansion Pressure (psf)	% Swell/ Collapse	USCS Classification
160	14.0	14.7								

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)	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)	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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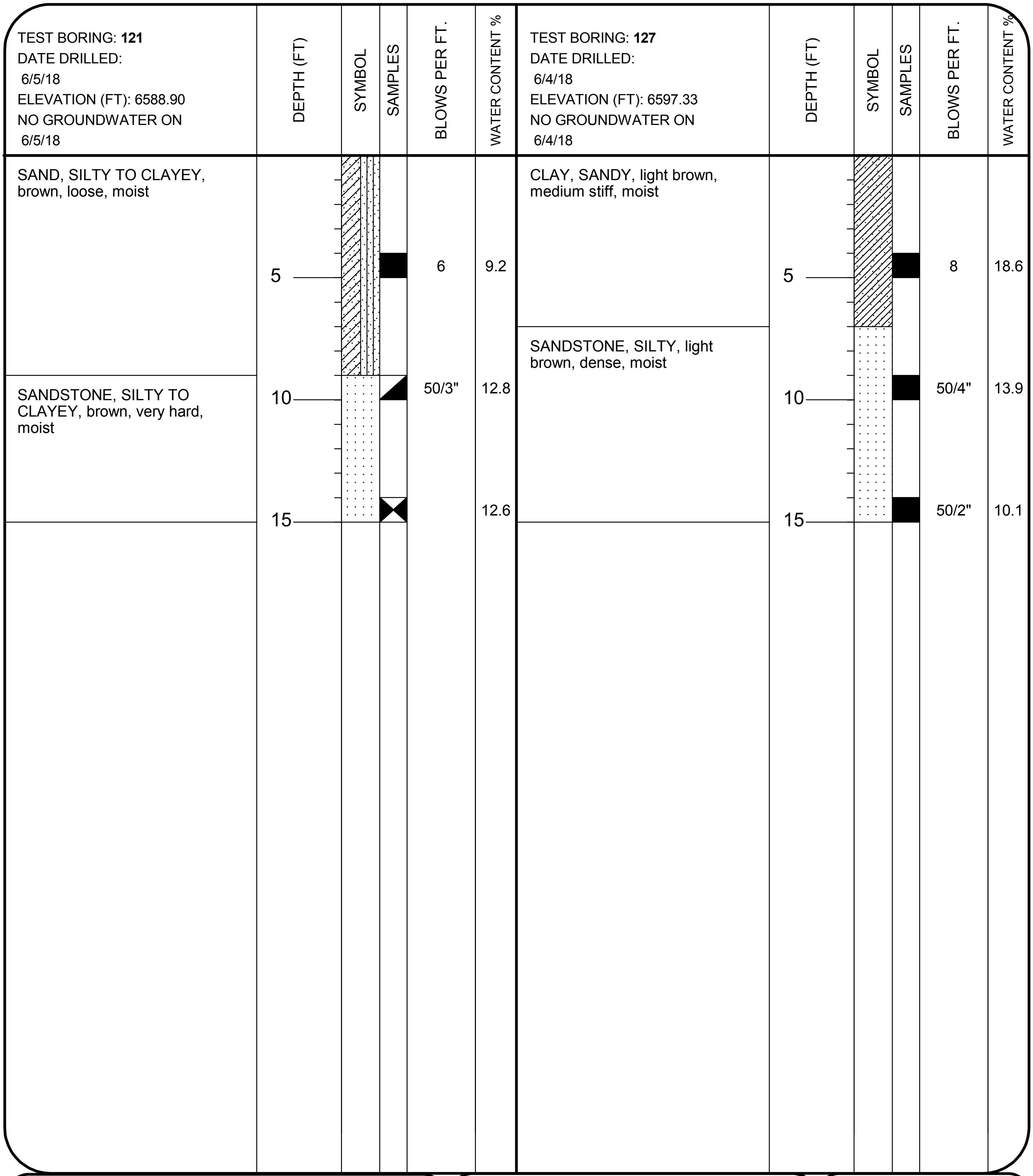
TEST BORING LOG

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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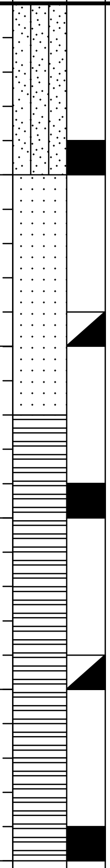
TEST BORING LOG

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)	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								

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)	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)	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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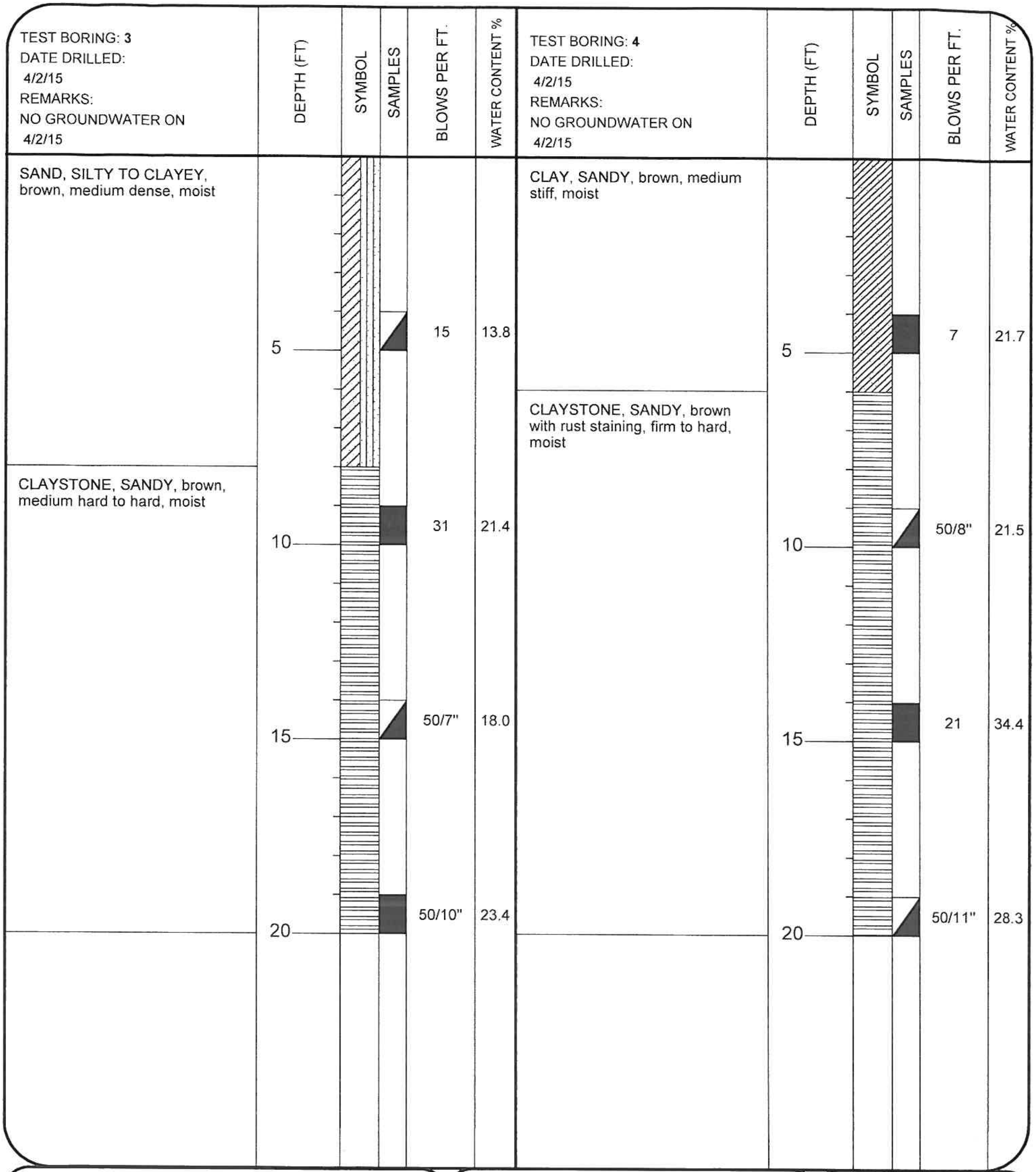
TEST BORING LOGS

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

	DEPTH (FT)	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, SILTY TO CLAYEY, brown, medium dense, moist	5		15	13.8
CLAYSTONE, SANDY, brown, medium hard to hard, moist	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

	DEPTH (FT)	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown, medium stiff, moist	5		7	21.7
CLAYSTONE, SANDY, brown with rust staining, firm to hard, moist	10		50/8"	21.5
	15		21	34.4
	20		50/11"	28.3

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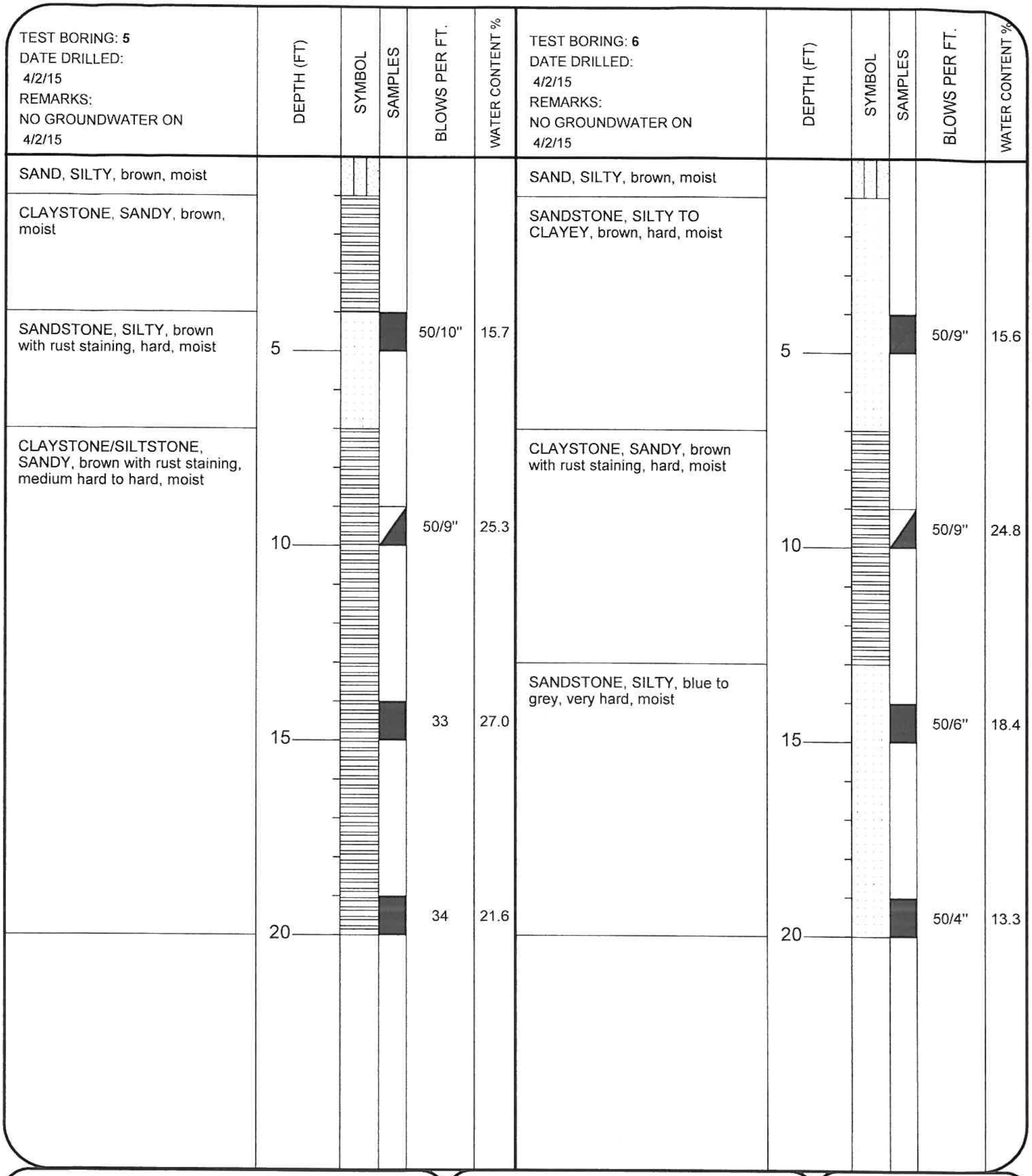
TEST BORING LOGS

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					
SANDSTONE, SILTY, brown with rust staining, hard, moist	5			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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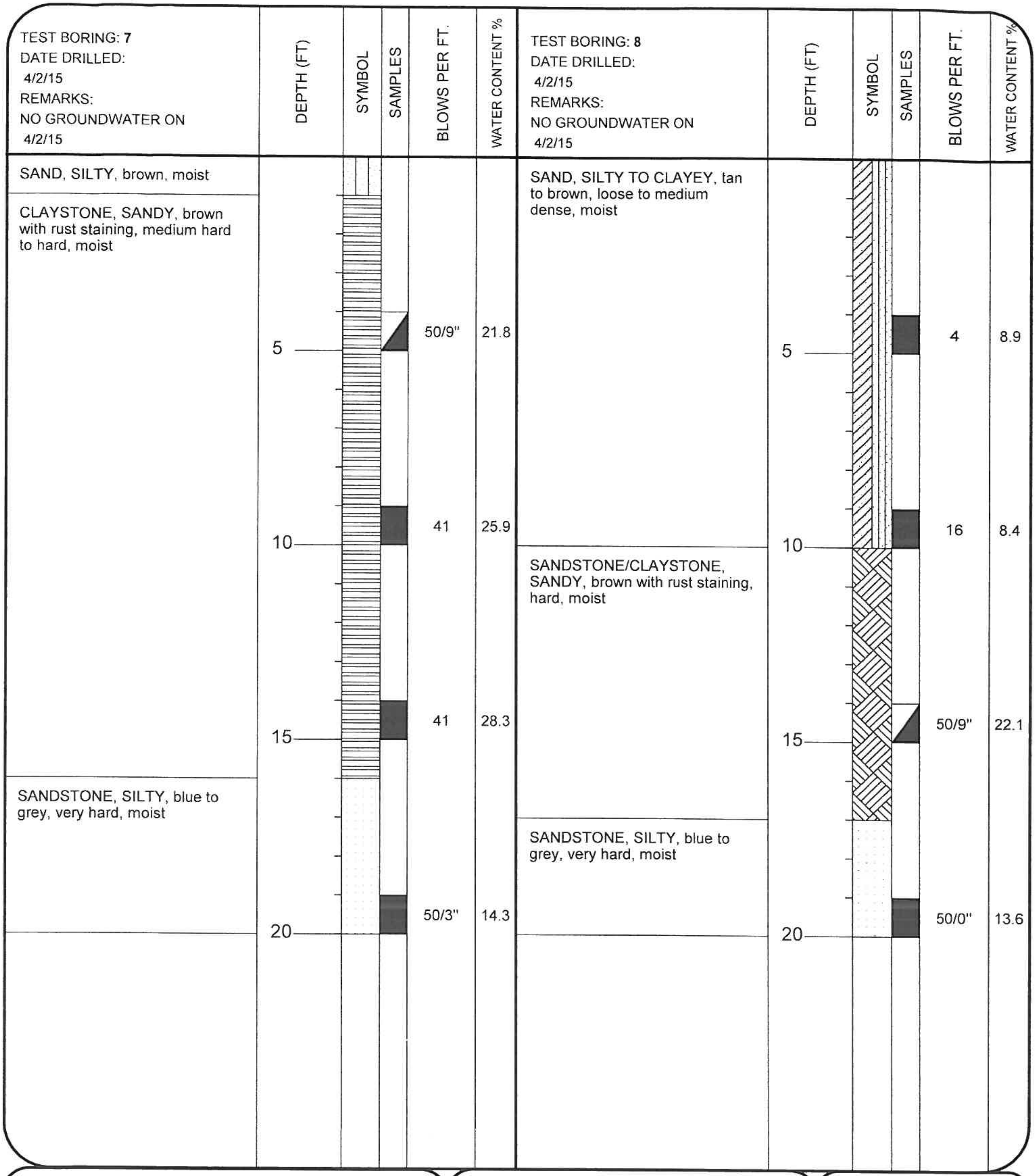
TEST BORING LOGS

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

SAND, SILTY, brown, moist

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

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

BLOWS PER FT.	WATER CONTENT %
50/9"	21.8
41	25.9
41	28.3
50/3"	14.3

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

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

SANDSTONE/CLAYSTONE, SANDY, brown with rust staining, hard, moist

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

BLOWS PER FT.	WATER CONTENT %
4	8.9
16	8.4
50/9"	22.1
50/0"	13.6

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TEST BORING LOGS

JOB No. 142206

FIGURE No. 7

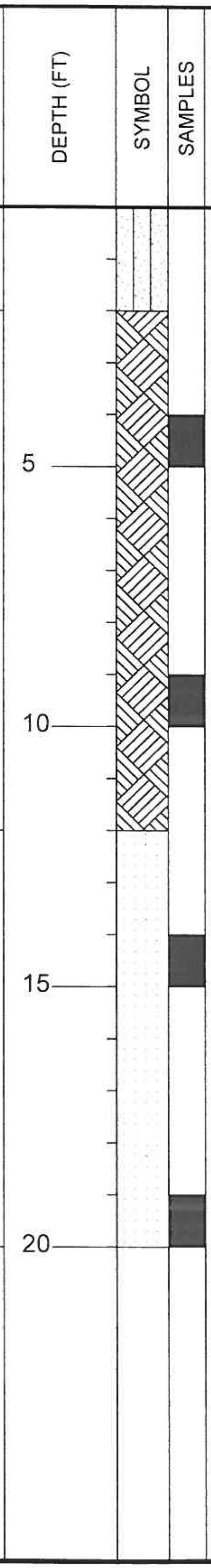
DATE 5/28/15

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

SAND, SILTY, brown, moist

SANDSTONE/CLAYSTONE, SILTY TO CLAYEY, tan to brown, medium hard to hard, moist

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



BLOWS PER FT.	WATER CONTENT %
38	19.8
50/9"	19.1
50/0"	12.0
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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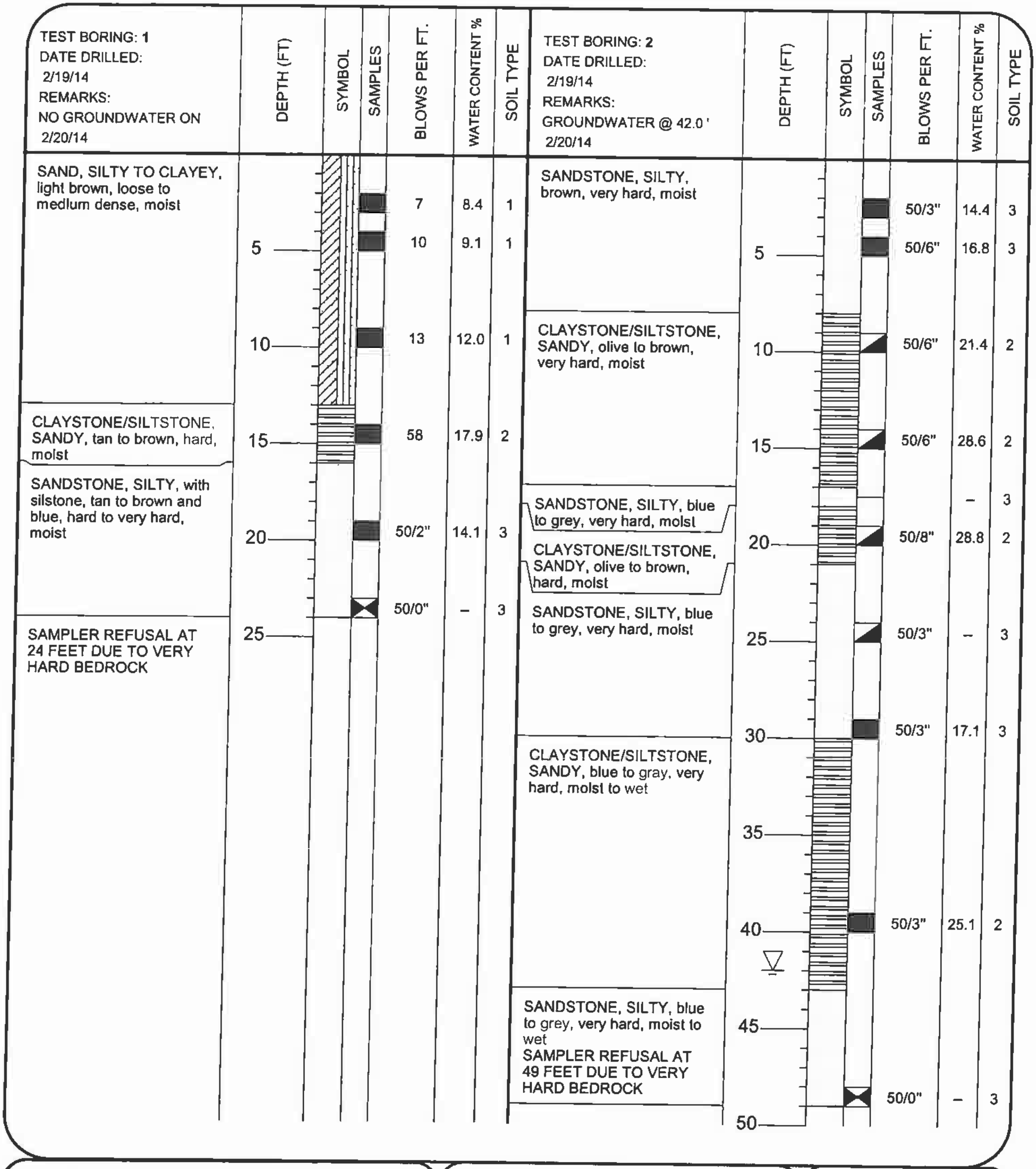
SUMMARY OF LABORATORY TEST RESULTS

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

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

BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
7	8.4	1
10	9.1	1
13	12.0	1
58	17.9	2
50/2"	14.1	3
50/0"	–	3

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

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

BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
50/3"	14.4	3
50/6"	16.8	3
50/6"	21.4	2
50/6"	28.6	2
	–	3
50/8"	28.8	2
50/3"	–	3
50/3"	17.1	3
50/3"	25.1	2
50/0"	–	3

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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
SAND, SILTY, light brown, moist					--	1
CLAYSTONE/SILTSTONE, SANDY, olive to brown, very hard, moist		▤	◢	50/9"	27.7	2
	5	▤	◢	50/6"	20.2	2
SANDSTONE, SILTY, brown to blue and grey, very hard, moist						
	10		⧗	50/0"	12.4	3
	15		⧗	50/0"	12.1	3
			⧗	50/0"	–	3
BULK SAMPLES DUE TO VERY HARD BEDROCK	20					

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
SAND, SILTY TO CLAYEY, light brown, loose, moist		▨	■	7	11.9	1
SANDSTONE, SILTY, light brown to gray and blue, hard to very hard, moist	5		■	70	14.0	3
	10		■	50/4"	7.7	3
	15		■	50/1"	11.0	3
			⧗		--	3
BULK SAMPLES DUE TO VERY HARD BEDROCK	20					

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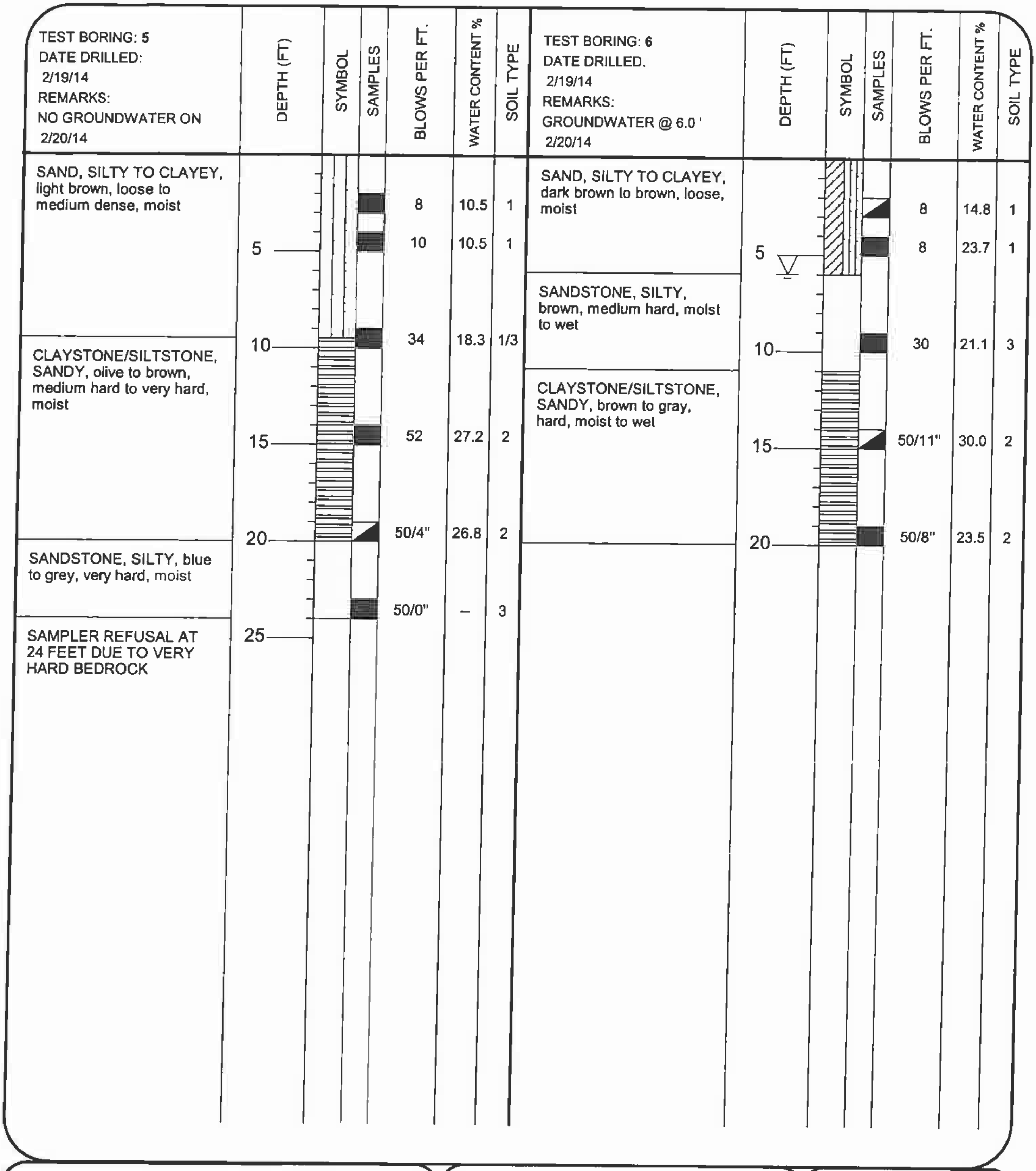
TEST BORING LOGS

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)	DESCRIPTION	BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
	SAND, SILTY TO CLAYEY, light brown, loose to medium dense, moist	8	10.5	1
5		10	10.5	1
10	CLAYSTONE/SILTSTONE, SANDY, olive to brown, medium hard to very hard, moist	34	18.3	1/3
15		52	27.2	2
20	SANDSTONE, SILTY, blue to grey, very hard, moist	50/4"	26.8	2
		50/0"	–	3
25	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)	DESCRIPTION	BLOWS PER FT.	WATER CONTENT %	SOIL TYPE
	SAND, SILTY TO CLAYEY, dark brown to brown, loose, moist	8	14.8	1
5		8	23.7	1
	SANDSTONE, SILTY, brown, medium hard, moist to wet			
10		30	21.1	3
15	CLAYSTONE/SILTSTONE, SANDY, brown to gray, hard, moist to wet	50/11"	30.0	2
20		50/8"	23.5	2

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2910 Austin Bluffs Parkway
Colorado Springs, CO 80918
Voice (719) 548-0600
Fax (719) 548-0223

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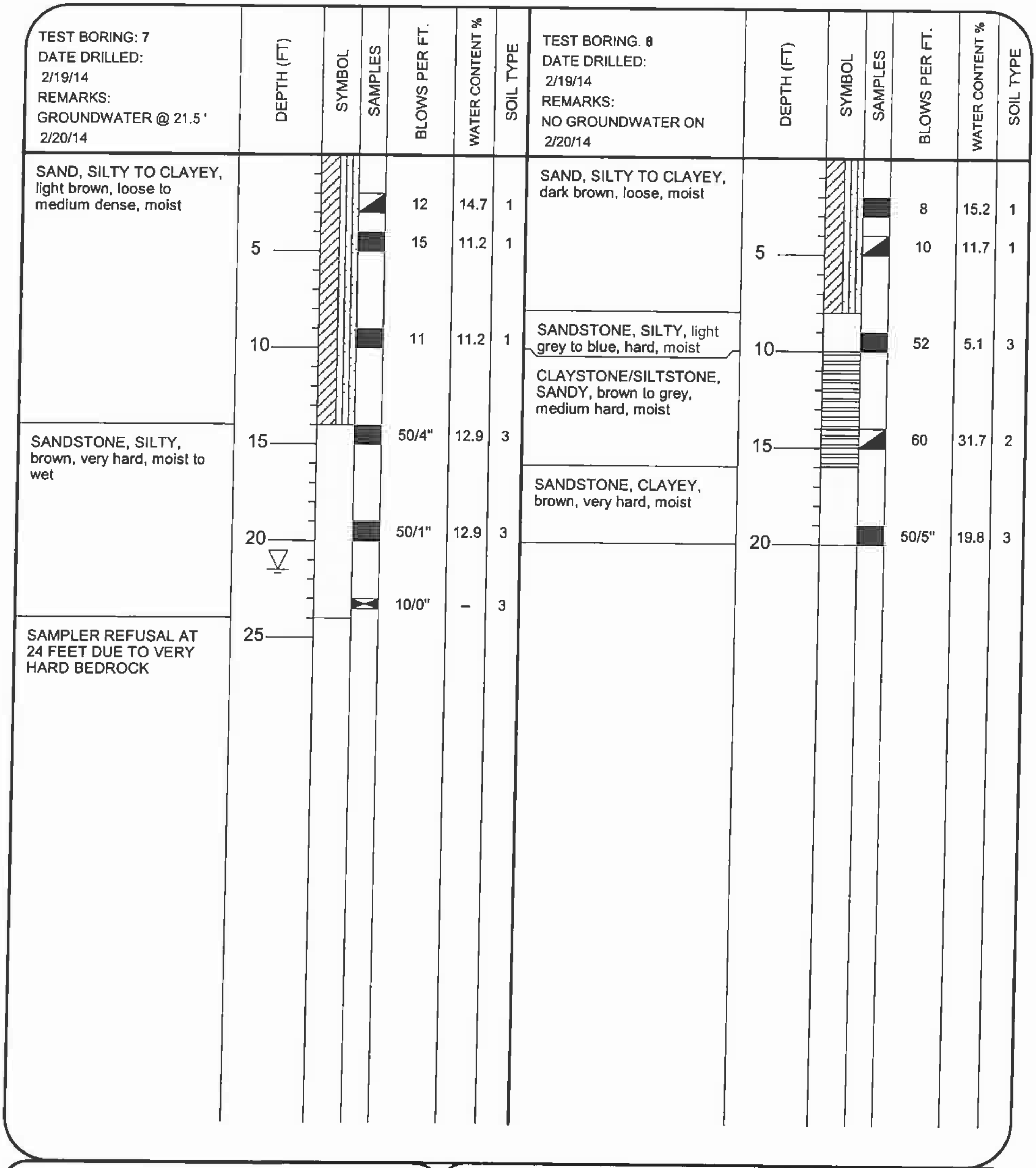
TEST BORING LOGS

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
SAMPLER REFUSAL AT 24 FEET DUE TO VERY HARD BEDROCK	25					

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
SANDSTONE, SILTY, light grey to blue, hard, moist	10			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

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

APPENDIX B

Addendum to Soils and Geology Study – Proposed Zone Change
Tract B – Windermere, Filing No. 1
El Paso County, Colorado
Prepared by RMG – Rocky Mountain Group
Job No. 188268
Last dated March 30, 2022

Architectural
Structural
Geotechnical

RMG
Engineers / Architects

Materials Testing
Forensic
Civil/Planning

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

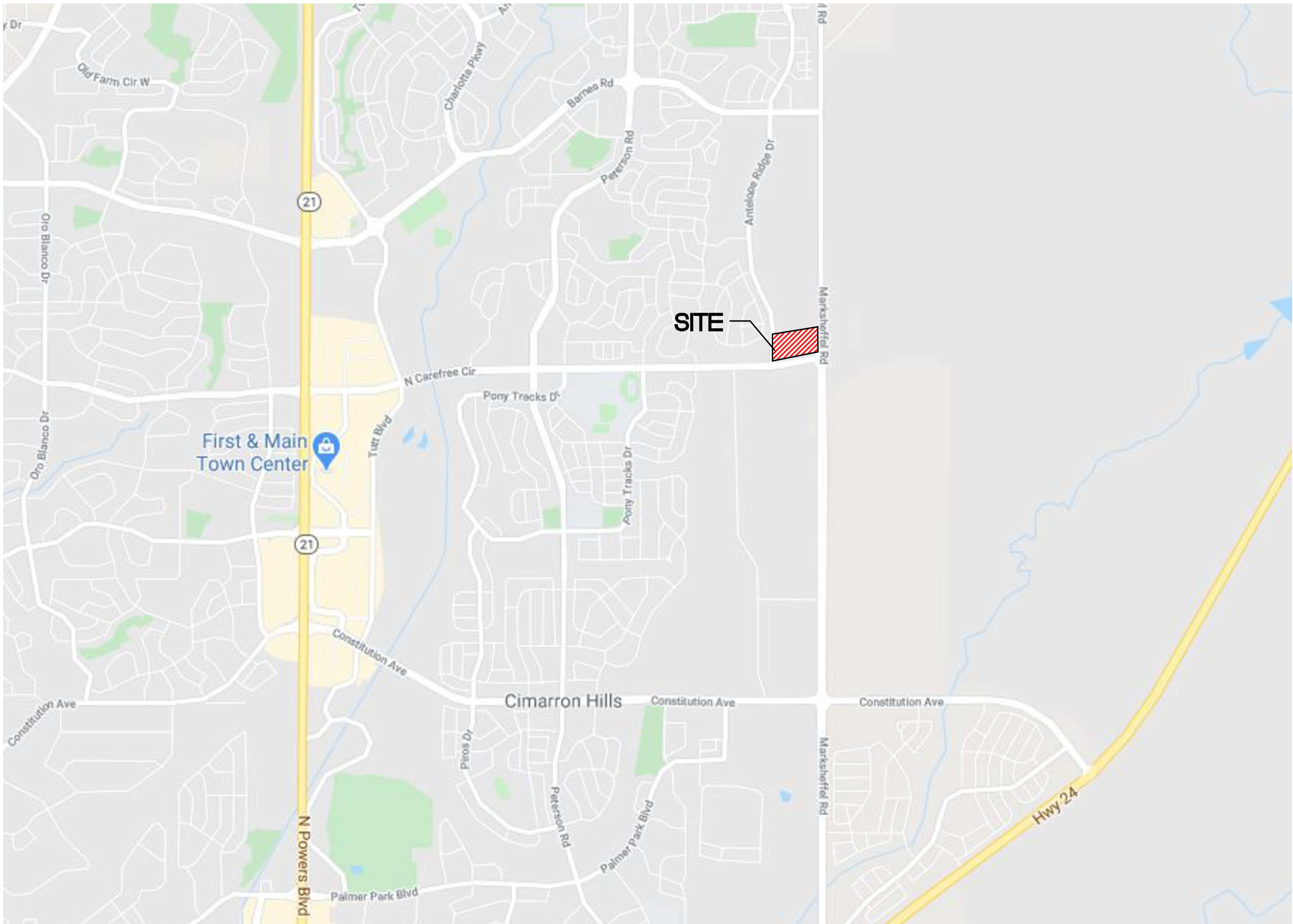
Kelli Zigler
Project Geologist

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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Englewood, CO 80112
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Northern Office:
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(970) 330-1071

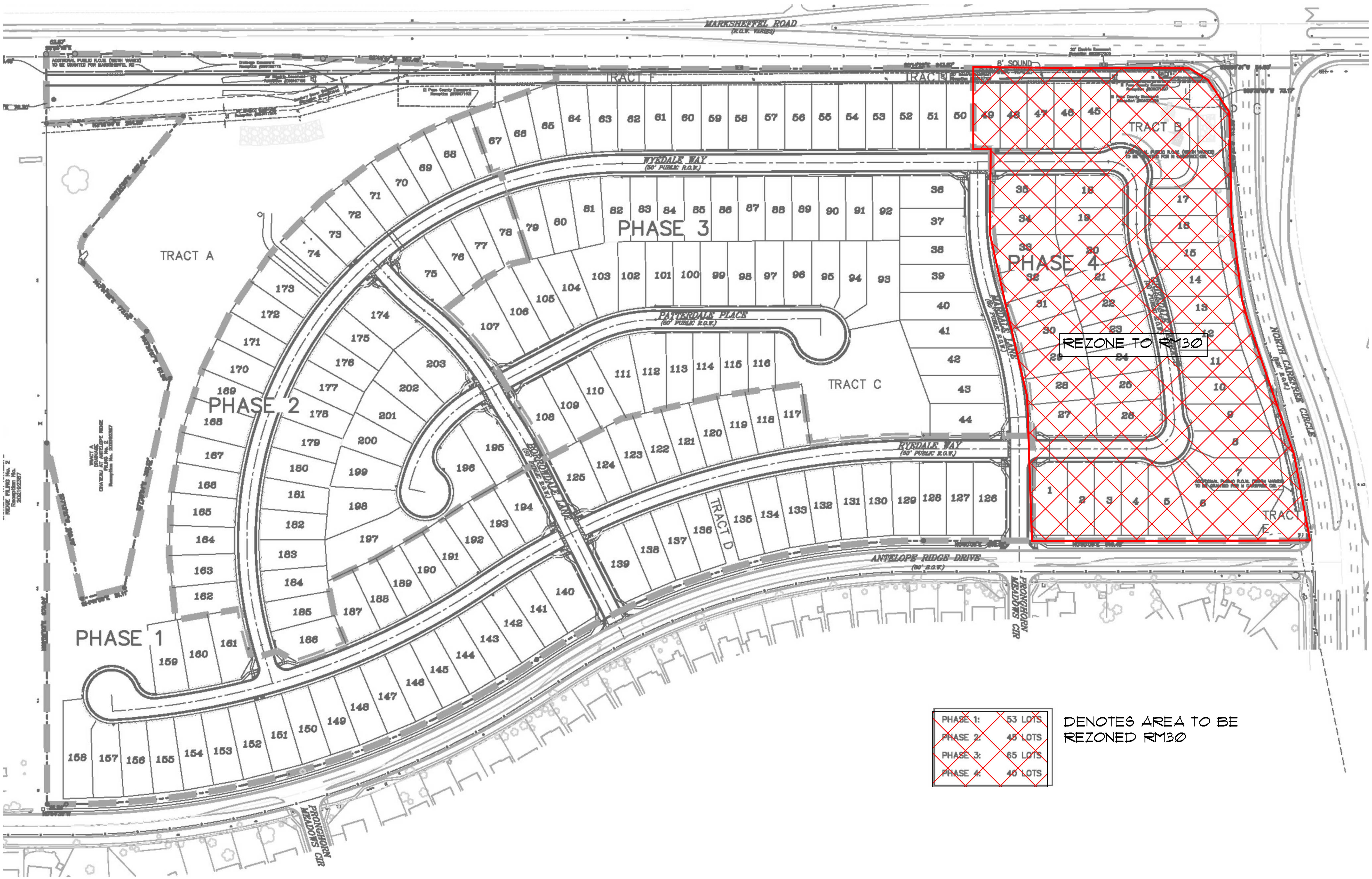
SITE VICINITY MAP

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



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

DENOTES AREA TO BE REZONED RM30

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JOB No. 162062

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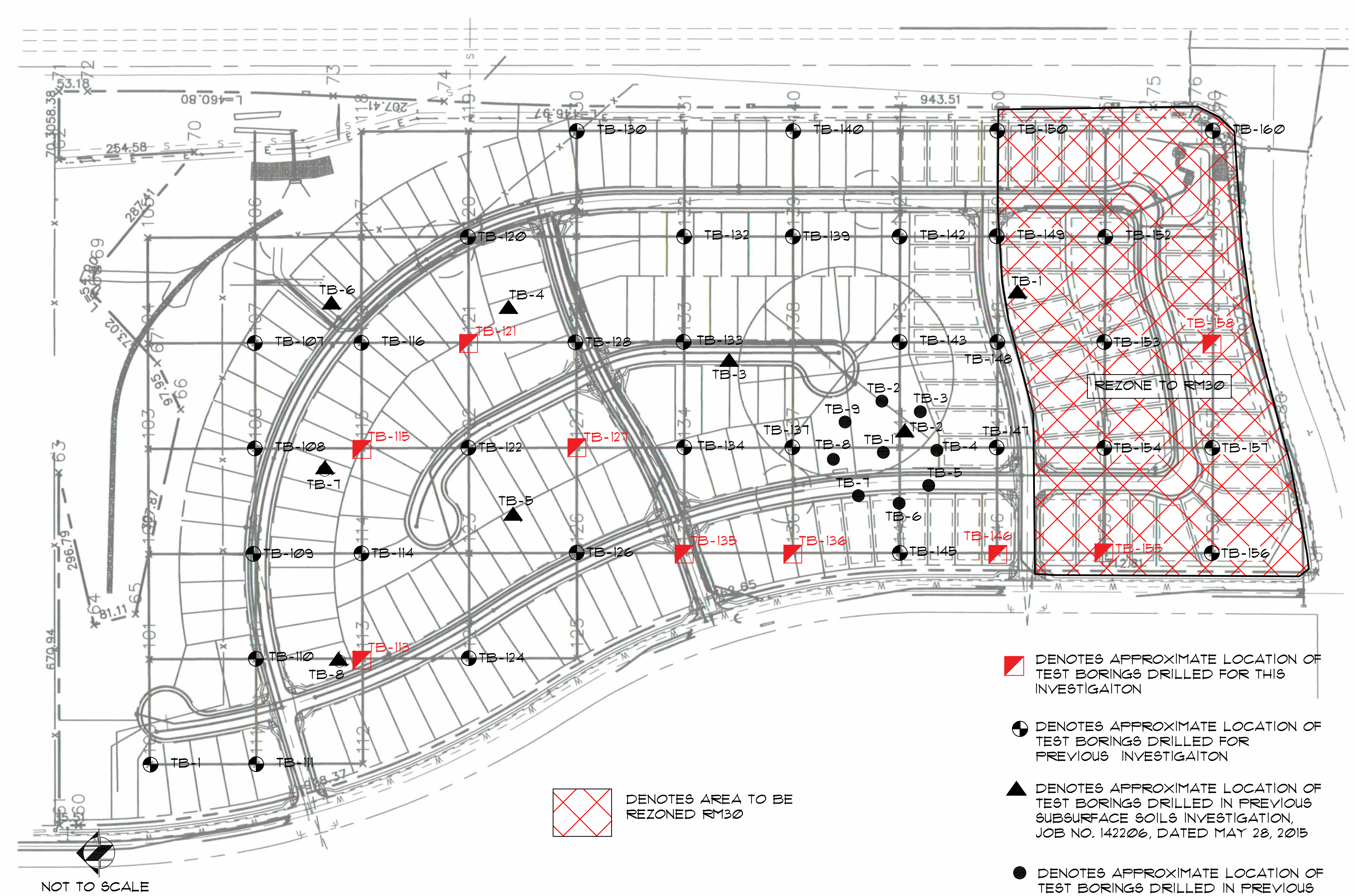
WINDERMERE
N. MARKSHEFFEL RD
EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

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 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

⊠ DENOTES AREA TO BE REZONED RM30

JOB No. 162062

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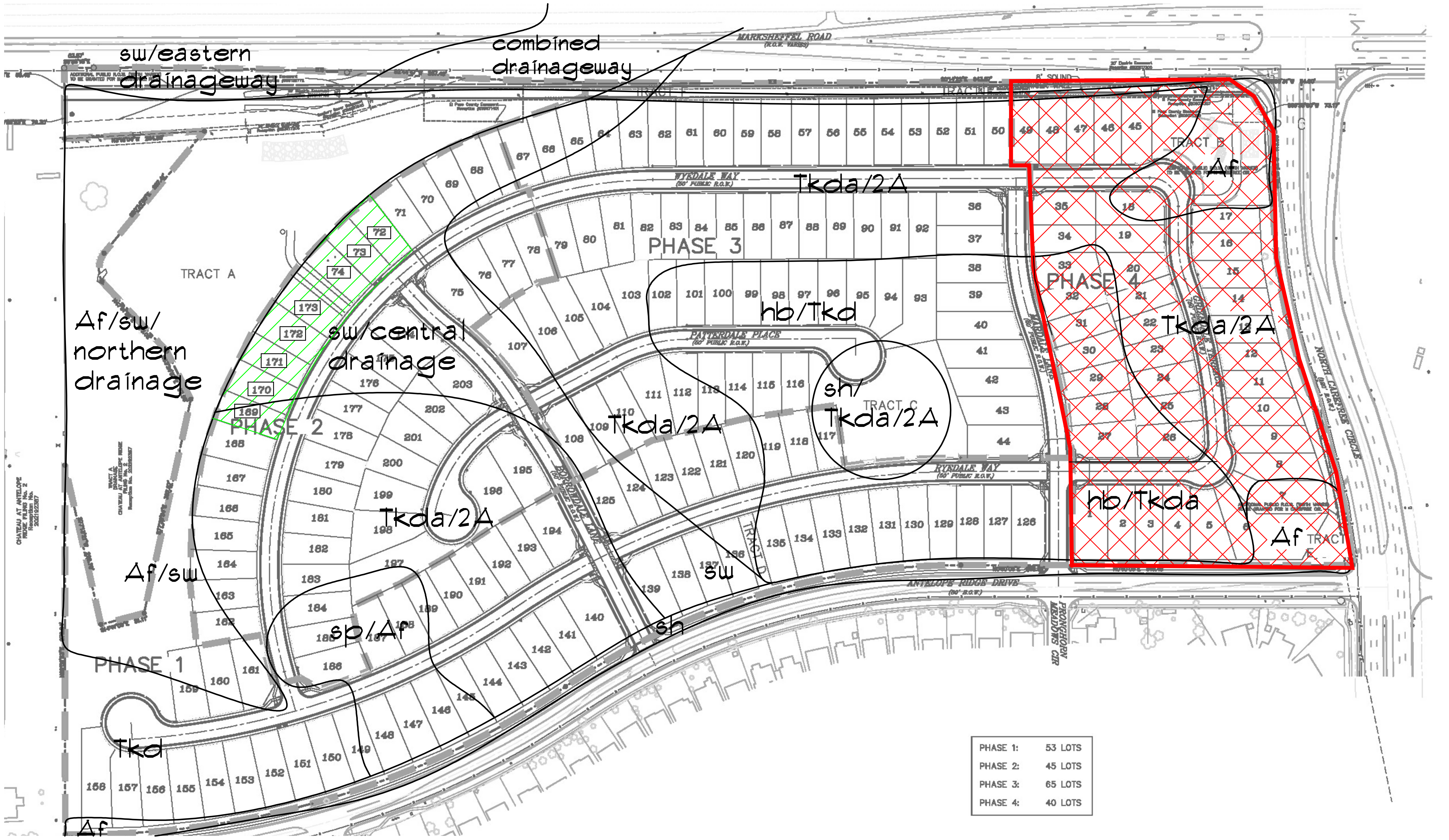
WINDERMERE SUBDIVISION
COLORADO SPRINGS, CO
WINDSOR RIDGE HOMES

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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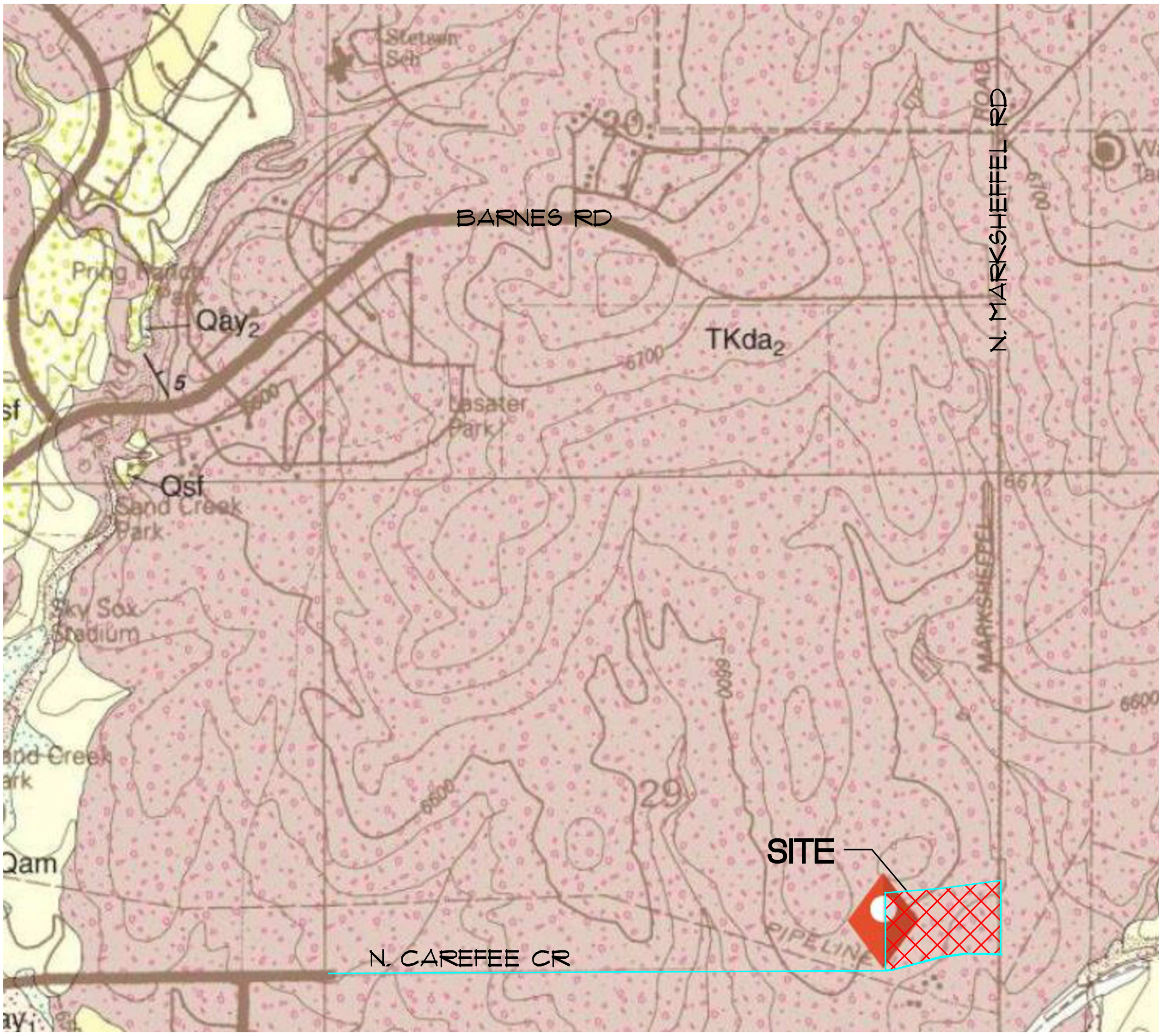
EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

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



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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

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BASE MAP PROVIDED BY: FEMA

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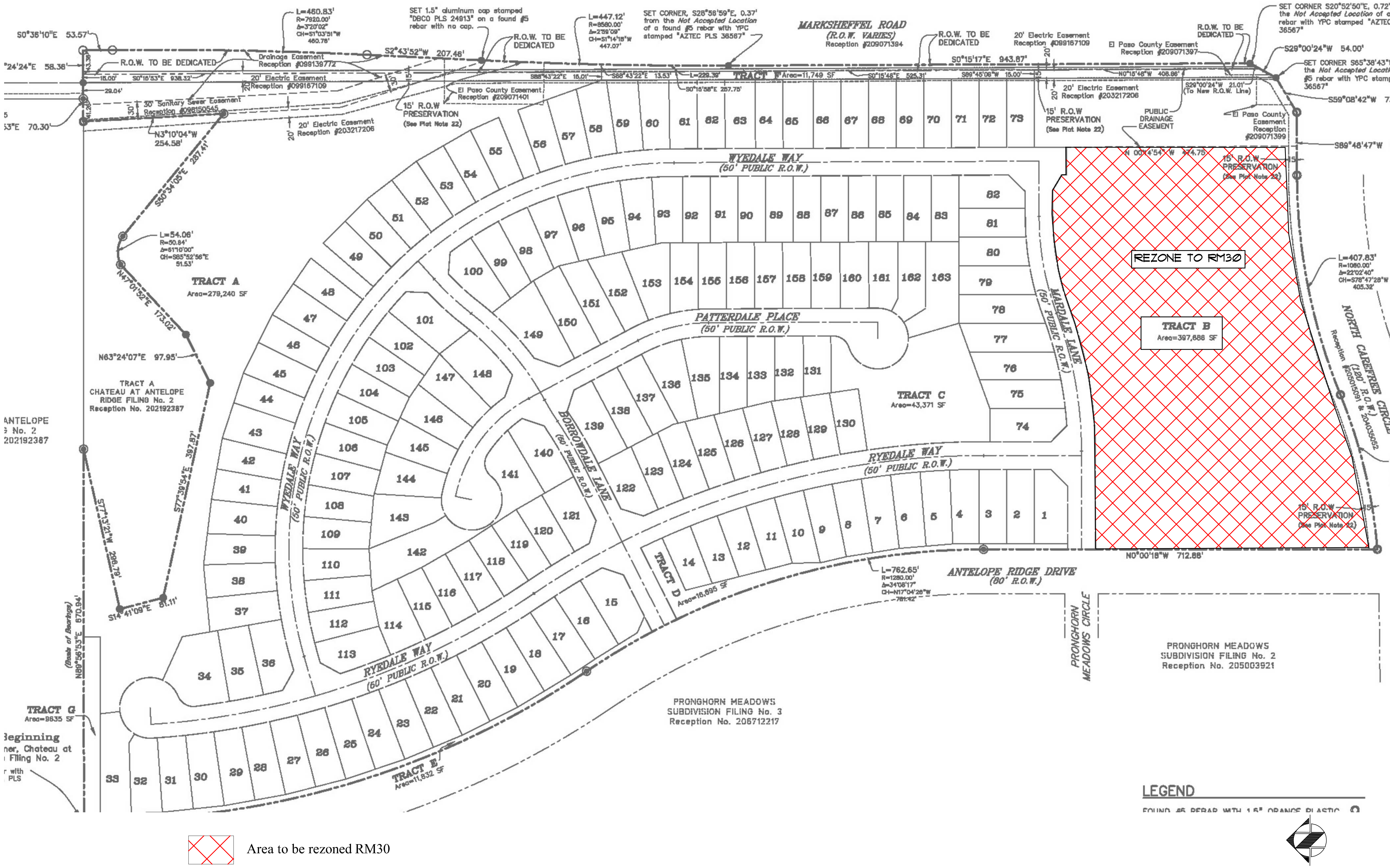
FEMA MAP

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

JOB No. 162062

FIG No. 6

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



▨ Area to be rezoned RM30

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BASE MAP PROVIDED BY: DREXEL, BARREL & CO.

JOB No. 162062

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EL PASO COUNTY, CO
WINDSOR RIDGE HOMES

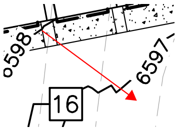
ENGINEER:	TPM
DRAWN BY:	KZ
CHECKED BY:	TPM
ISSUED:	3-30-2022

PROPOSED
REZONE

SHEET No.
FIG-7

V1_Drainage Report - Final.pdf Markup Summary

Arrow (4)



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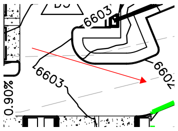

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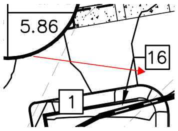

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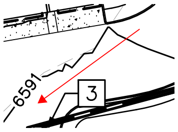

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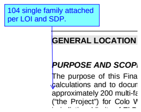
Callout (11)



104 single family attached per LOI and SDP.

GENERAL LOCATION

PURPOSE AND SCOP

The purpose of this Fina
calculations and to docur
approximately 200 multi-fa
("the Project") for Colo V

Subject: Callout
Page Label: 5
Author: Joseph Sandstrom
Date: 12/30/2024 3:02:33 PM
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Color: 🟦
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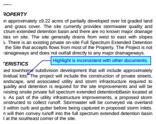
104 single family attached per LOI and SDP.



ROPERTY

n approximately ±9.22 acres of partially developed over lot graded land
and grass cover. The site currently provides stormwater quality and
ctrum extended detention basin and there are no known major drainage
ties on site. The site generally drains from west to east with slopes
. There is an existing private on-site Full Spectrum Extended Detention
the Site that accepts flows from most of the Property. The Project is not
ainageways and does not outfall directly to any major drainageways.

ERISTICS

Highlight is inconsistent with other documents.

sed townhome subdivision development that will include approximately
ividual lots. The project will include the construction of private streets,
ndscape, and associated utility and storm infrastructure required to
uaility and detention is required for the site improvements and will be
xisitng onsite private full spectrum extended detentionbBasin located at
. As part of the utility infrastructure improvements, a proposed storm
onstructed to collect runoff. Stormwater will be conveyed via overland
within curb and gutter before being captured in proposed storm inlets.
n will then convey runoff into the full spectrum extended detention basin
at the southeast corner of the site.

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Date: 12/30/2024 4:40:10 PM
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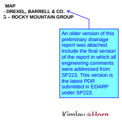

Subject: Callout
Page Label: 3
Author: Joseph Sandstrom
Date: 1/6/2025 1:32:54 PM
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Color: 🟦
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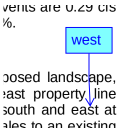
An older version of this preliminary drainage report was attached. Include the final version of the report in which all engineering comments were addressed from SP223. This version is the latest PDR submitted in EDARP under SP223.



Subject: Callout
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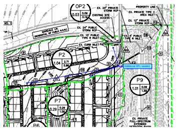
west



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Page Label: [1] E1 PROPOSED DRAINAGE MAP
Author: Joseph Sandstrom
Date: 1/6/2025 11:22:51 AM
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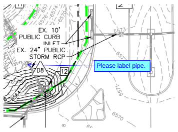
Additional DPs needed.



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Page Label: [1] E1 PROPOSED DRAINAGE MAP
Author: Joseph Sandstrom
Date: 1/6/2025 11:36:32 AM
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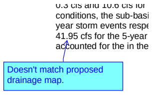
Please label pipe.



Subject: Callout
Page Label: 15
Author: Joseph Sandstrom
Date: 1/6/2025 11:44:04 AM
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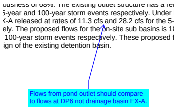
Color: 🟦
Layer:
Space:

Doesn't match proposed drainage map.



Subject: Callout
Page Label: 15
Author: Joseph Sandstrom
Date: 1/6/2025 1:37:25 PM
Status:
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Layer:
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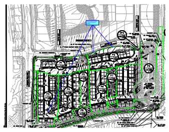
Flows from pond outlet should compare to flows at DP6 not drainage basin EX-A.



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Page Label: [1] E1 PROPOSED DRAINAGE MAP
Author: Joseph Sandstrom
Date: 1/6/2025 1:39:11 PM
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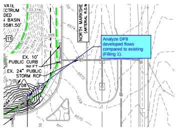
Please update basins to reflect proposed grading.



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Page Label: [1] E1 PROPOSED DRAINAGE MAP
Author: Joseph Sandstrom
Date: 1/6/2025 1:40:29 PM
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Color: 🟦
Layer:
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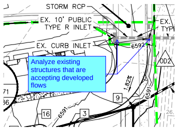
Analyze DP8 developed flows compared to existing (Filling 1).



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Page Label: [1] E1 PROPOSED DRAINAGE MAP
Author: Joseph Sandstrom
Date: 1/6/2025 1:41:36 PM
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Layer:
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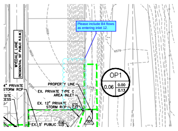
Analyze existing structures that are accepting developed flows

Cloud+ (2)



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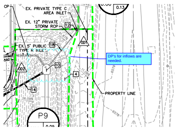
Page Label: [1] E1 PROPOSED DRAINAGE MAP
Author: Joseph Sandstrom
Date: 1/6/2025 11:06:56 AM
Status:
Color: 🟦
Layer:
Space:

Please include B4 flows as entering inlet 12.



Subject: Cloud+
Page Label: [1] E1 PROPOSED DRAINAGE MAP
Author: Joseph Sandstrom
Date: 1/6/2025 11:11:03 AM
Status:
Color: 🟦
Layer:
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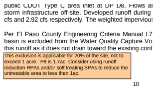
DP's for inflows are needed.

Contractor (4)



Subject: Contractor
Page Label: 11
Author: Christina Prete
Date: 12/30/2024 12:36:28 PM
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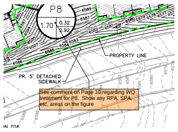
This exclusion is applicable for 20% of the site, not to exceed 1 acre. P8 is 1.7ac. Consider using runoff reduction RPAs and/or self treating SPAs to reduce the untreatable area to less than 1ac.



See comment on Page 10 regarding WQ treatment for P8. Show any RPA, SPA, etc, areas on the figure

Subject: Contractor
Page Label: [1] E1 PROPOSED DRAINAGE MAP
Author: Christina Prete
Date: 12/30/2024 12:52:27 PM
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Color: ■
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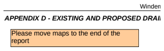
See comment on Page 10 regarding WQ treatment for P8. Show any RPA, SPA, etc, areas on the figure


APPENDIX D - EXISTING AND PROPOSED DRAI

Please move maps to the end of the report

Subject: Contractor
Page Label: 50
Author: Christina Prete
Date: 12/30/2024 12:52:34 PM
Status:
Color: ■
Layer:
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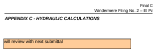
Please move maps to the end of the report


APPENDIX C - HYDRAULIC CALCULATIONS

will review with next submittal

Subject: Contractor
Page Label: 49
Author: Christina Prete
Date: 12/30/2024 12:55:40 PM
Status:
Color: ■
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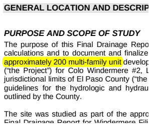
will review with next submittal

Highlight (8)


GENERAL LOCATION AND DESCRIP

PURPOSE AND SCOPE OF STUDY

The purpose of this Final Drainage Repo
calculations and to document and finalize
approximately 200 multi-family unit develop
("the Project") for Colo Windermere #2, L
jurisdictional limits of El Paso County ("the
guidelines for the hydrologic and hydrau
outlined by the County.

The site was studied as part of the appro

Subject: Highlight
Page Label: 5
Author: Joseph Sandstrom
Date: 12/30/2024 2:23:52 PM
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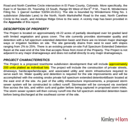
approximately 200 multi-family unit



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Page Label: 5
Author: Joseph Sandstrom
Date: 12/30/2024 3:02:45 PM
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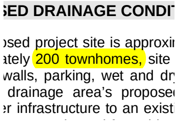
approximately
200 units platted as individual lots


SED DRAINAGE CONDI

osed project site is approxi
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walls, parking, wet and dr
drainage area's propose
r infrastructure to an exist

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Author: Joseph Sandstrom
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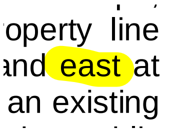
200 townhomes,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Author: Joseph Sandstrom
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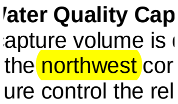
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Author: Joseph Sandstrom
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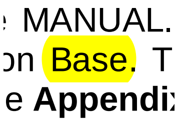
northwest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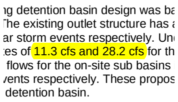
Base


g detention basin design was ba
The existing outlet structure has
ar storm events respectively. Un
es of 11.3 cfs and 28.2 cfs for th
flows for the on-site sub basins
vents respectively. These propos
detention basin.

Subject: Highlight
Page Label: 15
Author: Joseph Sandstrom
Date: 1/6/2025 11:42:35 AM
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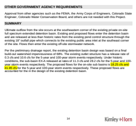
11.3 cfs and 28.2 cfs



Subject: Highlight
Page Label: 15
Author: Joseph Sandstrom
Date: 1/6/2025 11:43:43 AM
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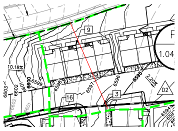
18.25 cfs and
41.95 cfs

Line (12)



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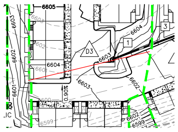

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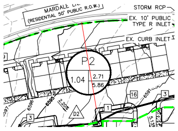

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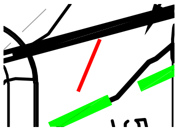

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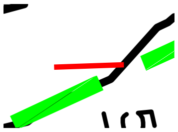

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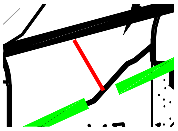

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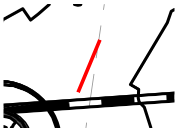

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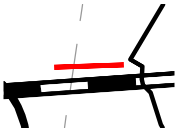

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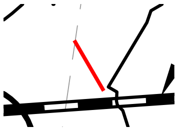

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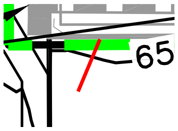

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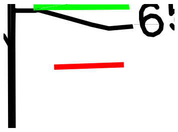

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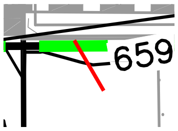

Subject: Line
Page Label: [1] E1 PROPOSED DRAINAGE MAP
Author: Joseph Sandstrom
Date: 1/6/2025 11:15:35 AM
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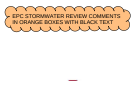
Stormwater Comments Color (1)



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Page Label: 1
Author: Christina Prete
Date: 12/30/2024 12:55:51 PM
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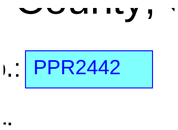
Text Box (16)


PPR2442

Subject: Text Box
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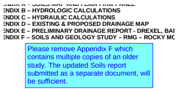
PPR2442


Please remove Appendix F which contains multiple copies of an older study. The updated Soils report submitted as a separate document, will be sufficient.

Subject: Text Box
Page Label: 3
Author: Joseph Sandstrom
Date: 12/31/2024 9:28:33 AM
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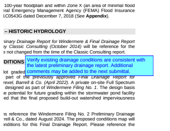
Please remove Appendix F which contains multiple copies of an older study. The updated Soils report submitted as a separate document, will be sufficient.



Subject: Text Box
Page Label: 7
Author: Joseph Sandstrom
Date: 12/31/2024 12:59:03 PM
Status:
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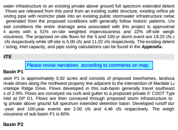
Verify existing drainage conditions are consistent with the latest preliminary drainage report. Additional comments may be added to the next submittal.



Subject: Text Box
Page Label: 10
Author: Joseph Sandstrom
Date: 1/6/2025 10:40:53 AM
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Color: 🟦
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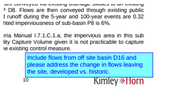
Please revise narratives according to comments on map.



Subject: Text Box
Page Label: 11
Author: Joseph Sandstrom
Date: 1/6/2025 10:45:19 AM
Status:
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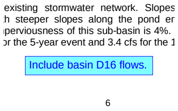
Include flows from off site basin D16 and please address the change in flows leaving the site, developed vs. historic.


Include basin D16 flows.

Subject: Text Box
Page Label: 7
Author: Joseph Sandstrom
Date: 1/6/2025 10:40:41 AM
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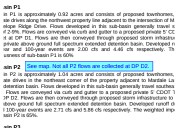
Include basin D16 flows.



Subject: Text Box
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Author: Joseph Sandstrom
Date: 1/6/2025 11:12:52 AM
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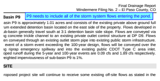
See map. Not all P2 flows are collected at DP D2.



Subject: Text Box
Page Label: 12
Author: Joseph Sandstrom
Date: 1/6/2025 11:18:53 AM
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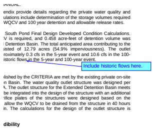
P9 needs to include all of the storm system flows entering the pond.



Subject: Text Box
Page Label: 14
Author: Joseph Sandstrom
Date: 1/6/2025 11:27:09 AM
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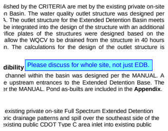
Include historic flows here.



Subject: Text Box
Page Label: 14
Author: Joseph Sandstrom
Date: 1/6/2025 11:30:13 AM
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Color: 🟦
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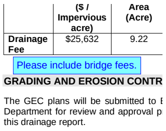
Space:

Please discuss for whole site, not just EDB.



Subject: Text Box
Page Label: 15
Author: Joseph Sandstrom
Date: 1/6/2025 11:33:21 AM
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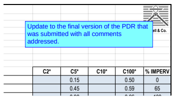
Please include bridge fees.



Subject: Text Box
Page Label: 39
Author: Joseph Sandstrom
Date: 1/6/2025 11:47:13 AM
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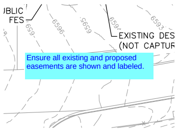
Update to the final version of the PDR that was submitted with all comments addressed.


Ensure all existing and proposed easements are shown and labeled.

Subject: Text Box
Page Label: [1] E1 PROPOSED DRAINAGE MAP
Author: CDurham
Date: 1/6/2025 1:28:35 PM
Status:
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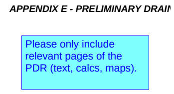
Ensure all existing and proposed easements are shown and labeled.


APPENDIX E - PRELIMINARY DRAI

Please only include relevant pages of the PDR (text, calcs, maps).

Subject: Text Box
Page Label: 53
Author: Joseph Sandstrom
Date: 1/6/2025 1:33:43 PM
Status:
Color: 🟦
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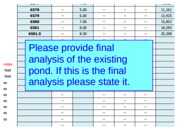
Please only include relevant pages of the PDR (text, calcs, maps).


Please provide final analysis of the existing pond. If this is the final analysis please state it.

Subject: Text Box
Page Label: 89
Author: Joseph Sandstrom
Date: 1/6/2025 1:35:04 PM
Status:
Color: 🟦
Layer:
Space:

Please provide final analysis of the existing pond. If this is the final analysis please state it.


Update to latest PDR submitted with all engineering comments addressed.

Subject: Text Box
Page Label: 51
Author: Joseph Sandstrom
Date: 1/6/2025 1:45:57 PM
Status:
Color: 🟦
Layer:
Space:

Update to latest PDR submitted with all engineering comments addressed.