FINAL DRAINAGE REPORT

FOR

Aura at Crossroads

Date: April 4, 2022

Prepared for:

Trinsic Acquisition Company, LLC
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Phone: 970-819-9968

Prepared by:

HARRIS KOCHER SMITH

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Harris Kocher Smith Project No.: 200823
PCD Project Number: PPR-21-041

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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 the city/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 r .

COLORADO LICENSED MARK A. WEST 38561 PROFESSIONAL ENGINEER

04-06-2022

________________________ ________________________

Mark A. West, P.E., C.F.M. Date
State Of Colorado Registration No. 38561
On Behalf of Harris Kocher Smith

Developer's Statement

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

____

Trinsic Acquisition Company, LLC

By: Allison Jones

Title: Vice President

Address: 8235 Douglas Ave Suite 950 Dallas, TX 75225

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.

________________________ ________________________

Jennifer Irvine, P.E. Date
County Engineer / ECM Administrator

Section I – General Location and Description

A. Location

The proposed Crossroads at Meadowbrook Apartments development (hereinafter referred to as "Site") is situated in the Southwest ¼ of Section8, Township 14, Range 65 West of the 6th Principle Meridian in the County of El Paso, State of Colorado. The Site is bounded by US Highway 24 to the South, undeveloped and soon to be commercial development to the east, Meadowbrook Parkway to the North, and undeveloped land and dirt roads to the west. The Site is essentially at the intersection of Highway 94 and Highway US 24.

B. Description of Property

The Site is approximately 12.70 acres comprised of paved areas, walks, and a large buildings, as well as undeveloped ground well vegetated by native grasses, weeds, and ferns. The Site generally flows from north to south, being collected in internal parking areas with grades ranging from 1% to 2%. There are no major drainageways located within or around the Site. An existing park/detention pond is located just south of the Site in Tract A of the Crossroads at Meadowbrook Mixed-Use subdivision that will capture and treat Site runoff. The proposed development of the Site includes multiple apartment buildings, a pool and clubhouse with facilities located on-Site, an amenity building, a dog park, walks, parking, and roadways.

The Site is almost entirely comprised of clean to silty sand at 20 to 30-foot depths, with NRCS hydrologic soil group A. The NRCS Custom Soil Resource Report for the Site can be found in Appendix A. According to the Geotechnical Investigation report prepared by CTL Thompson, dated May 18, 2021, the sand encountered was loose to very dense and tested samples contained 5 to 35 percent clay and silt-size particles (passing the No. 2000 sieve). Groundwater was not encountered in all of the borings on-site. There are soils that certify as collapsible-prone for the southern portion of the site and will require sub excavation and remediation up to four feet. A copy of the Geotechnical Investigation can be found in Appendix E.

Section II – Drainage Basins and Sub-Basins

A. Major Drainage Basins

The Site is shown on the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Map (FIRM) Community Panel Number 08041C0754G, effective as of December 07, 2018. Site is located in Zone X (areas determined to be outside of the 0.2% annual chance floodplain). Please refer to the FIRMette included in Appendix A for reference.

The Site lies within the Sand Creek FOFO4000 floodplain based on the El Paso County Drainage Basin Map. The Sand Creek East Fork Channel is located to the northwest of the adjacent Meadowbrook Crossing subdivision. There are currently no Master Drainageway Plans (MDP), Flood Hazard Area Delineations (FHAD), or Outfall Systems Plans (OSP) that affect development of the Site, nor are there any channels that impact or are impacted by development of the Site.

B. Sub-Drainage Basins

The historic drainage basins and conditions are described in the Preliminary Drainage Report for Crossroads Mixed Use that is included in Appendix D.

The final drainage basins are described below:

Sub-basin X-1 (0.42 acres) takes up a large area in the northwest portion of the Site. This basin contains primarily landscaped area with half of the rood flow from a residential building. Flow from this basin is collected through downspouts and area drains, with an emergency overflow pathway to the existing Type R 10’ inlet in Meadowbrook Parkway at DP 0.

Sub-basin X-2 (0.08 acres) is located at the northern entry of the site. A high point at the point of curb directs flow into Meadowbrook Parkway where it is conveyed to the existing Type R 10’ Inlet in Meadowbrook at DP 0.

Sub-basin X-3 (0.08 acres) is located at the northern entry of the Tract C roadway adjacent to the eastern property boundary of the Site. This basin contains mostly paved area with some landscaped area. Flow from this basin is conveyed through the existing Meadowbrook Parkway and collected at the existing Type R 10’ Inlet at DP 0.

Sub-basin A-1 (2.07 acres) is located in the northeast portion of the Site. This basin is fairly equal amounts of paved area, roofs, and landscape area. Flow from this basin is collected at a curb inlet designated DP 1, where it is then conveyed through the western storm system into the existing detention pond. This inlet is designed to capture all of the 95% of the minor storm and around 73% of the major storm. Carry-over flow will be collected at DP-7.

Sub-basin A-2 (0.43 acres) is located in the middle of the Site. This basin contains fairly equal amounts of paved area, roofs, and landscape area. Flow from this basin is directed to a curb inlet at DP 3 through curb and gutter or area and landscape drains. This inlet is designed to capture all of the minor storm and about 88% of the major storm to minimize bypass.

Sub-basin A-3 (0.42 acres) is located along the western property boundary of the Site. This basin is completely landscape area. Flow from this basin is collected via a grass swale to a landscape drain area inlet that is connected to a manhole at DP-5, and eventually conveyed through the western storm system to the detention pond. This area inlet is designed to capture all of the minor and major storm to prevent any flow from being bypassed to the adjacent property.

Sub-basin A-4 (0.76 acres) is located in the southern portion of the Site, just south of Basin A-5. This basin contains mostly paved areas and roofs. Flow from this basin is collected via streets and curb and gutter to a curb inlet at DP 6, and is then conveyed through the western storm system to the detention pond. This inlet is designed to capture all of the minor storm and 88% of the major storm to minimize bypass. The bypass flow will be directed to a curb inlet at DP 7.

Sub-basin A-5 (3.67 acres) is the largest sub-basin located in the eastern area of the Site. This basin contains primarily paved and landscape areas with some roof flows. Flows are conveyed through curb and gutter to a large Type R 15’ Inlet at DP 7 at the low point of the Site, just north of the existing detention pond. Storm sewer flows from Basin A-1, A-2, A-3, A-4, and A-5 are all routed to DP 7 and conveyed to the detention pond through a short storm run. This inlet is designed to capture 90% of the minor storm and 61% of the major storm. Bypassed flow will be conveyed directly into the adjacent detention pond to the south.

Sub-basin B-1 (0.75 acres) is located in the middle of the Site at the pool deck and open space amenity area. This basin contains roofs, paved areas, walks, landscaped areas, and open space. Flow from this basin is collected through area drains and at a Type C area inlet that is sitting in landscape area at DP 8. This inlet has been designed to capture all of the major and minor storm flows from this basin and route it through the eastern storm system.

Sub-basis B-2 (0.28 acres) is located in the middle portion of the Site. This basin contains mostly paved area with building roofs and a few private yards. Runoff from this basin will be collected through area drains or curb and gutter to a curb inlet at DP 9. It is then conveyed through the eastern storm sewer system in Tract C and eventually to the existing detention pond.

Sub-basin B-3 (1.91acres) is located along the eastern property boundary of the Site. This basin contains primarily paved area with some landscape and roof flows. The landscape and roof drainage will be collected with area drains and the paved area will be collected through curb and gutter to curb inlet at DP 10. This inlet is designed to capture 94% of the minor storm and 73% of the major storm. Bypassed flow will be directed to the downstream curb inlet D1.

Sub-basin C-1 (0.77 acres) is located adjacent to the eastern property boundary of Lot 11 and contains half of the Tract C limits along with the southeast corner of the Site. This basin contains mostly paved streets with a portion of a building roof and some landscape area. Flow is conveyed to a curb inlet at the south end of the street through curb and gutter. This inlet is designed to capture all of the minor storm and almost all of the major storm.

Sub-basin C-2 (0.44 acres) is located on the south half of the Tract C roadway and landscaping area. This basin contains primarily paved area with some landscape area. Flow is conveyed to a curb inlet at the south end of the street through curb and gutter. This inlet is designed to capture all of the minor storm and 86% of the major storm. Bypassed flow is conveyed over the crown of the street to other street inlet in Sub-Basin C-1.

Sub-basin D-1 (0.78 acres) is located at the southeast corner of the Site. This basin contains mostly paved streets and some roof and landscape areas. Flows are conveyed to a large curb inlet at DP 14 at another low point of the Site, and conveyed to the detention pond through the existing eastern storm sewer system in Tract A. This inlet is designed to capture all of the minor storm and 78% of the major storm. Bypassed will be conveyed directly into the adjacent detention pond to the south through overland flow.

Sub-basin Z-1 (0.37 acres) is located along the southern property boundary of the Site adjacent to the existing detention pond. This basin contains roofs and landscape/open space area that is collected through landscape drains. Any overflow from these area drains is conveyed overland to the adjacent existing detention pond.

Sub-basin Z-2 (0.56 acres) is located along the western property boundary of the Site. This basin contains roofs and landscape/open space area that is collected through landscape drains and/or a grass swale that conveys the flow south to the existing detention pond at DP 15.

The full final drainage plan can be found in Appendix G. A summary of the basin flows can be found in Appendix B.

Section III – Drainage Design Criteria

A. Development Criteria Reference and Constraints

The basis for design and analysis of the drainage system and drainage impacts for the Site were the studies noted above in Volume 1 of the County of El Paso, Colorado Drainage Criteria Manual (DCM), and the Mile High Flood District (MHFD, formerly known as Urban Drainage and Flood Control district [UDFCD]) Urban Storm Drainage Criteria Manual (USDCM), Volumes 1, 2 and 3 (2001-2019).

B. Hydrologic Criteria

The total area of the Site to be developed is approximately 13.67 acres. The Rational Method is appropriate and was used to calculate peak rates of stormwater runoff. The design storms analyzed for this Site include the 5-year and 100-year for the minor and major storms, respectively, per the El Paso County DCM. Rainfall intensities were determined using the following Rainfall Intensity Duration (IDF) equations, as applicable, excerpted from Figure 6-5 of the El Paso County DCM Volume 1 Update:

IDF Equations

$$I_{100} = -2.52 \ln(D) + 12.735$$

$$I_{50} = -2.25 \ln(D) + 11.375$$

$$I_{25} = -2.00 \ln(D) + 10.111$$

$$I_{10} = -1.75 \ln(D) + 8.847$$

$$I_{5} = -1.50 \ln(D) + 7.583$$

$$I_{2} = -1.19 \ln(D) + 6.035$$

The runoff coefficients from Table 6-6 of the Volume 1 Update of the El Paso County DCM reference the 2001-2008 UDFCD USDCM, and appear to have been computed using the corresponding equations from that same USDCM. Those equations were used to compute composite runoff coefficients for this study. Results of hydrologic analyses, in addition to pertinent charts, figures, and tables, are included in Appendix B of this report.

Data for the off-site flows and basins, particularly for and Design Points 0 and 11 and Offsite Basins A, B, and E presented in the Rational Calculations (Appendix B), is information pulled from highlighted excerpts presented in the Area Drainage Summary and the Proposed Conditions Drainage Map of the Preliminary Drainage Report for Crossroads Mixed Use (Appendix D). We are conforming to the text and calculations that are shown in this Preliminary Drainage Report.

C. Hydraulic Criteria

Hydraulic analyses generally conform to El Paso County DCM methodology. Inlet capture analyses were performed using UD-Inlet v5.01. The storm sewer system was analyzed using StormCAD. Manholes were modeled using HEC-22 Energy (2nd Edition), with "half" benching method; end inlets were modeled using Standard, with 1.25 for the headloss coefficient; in-line inlets were modeled using HEC-22

Energy (2nd Edition), with “flat” benching method. Results of hydraulic analyses are included in Appendix C of this report.

The minimum and maximum velocities in storm sewer pipe generally fall between 4.7 and 14.0 feet per second (fps) respectively during a minor or major storm. The hydraulic grade lines (HGLs) for the minor and major storm were calculated utilizing StormCAD CONNECT, a Bentley product. For the StormCAD model, the 100-year and 5-year event tail water for the proposed pond outfall was set to 6294.63 and 6290.51, respectively. These are the 100-year and WQCV water surface elevations presented in the Drainage Basin Outlet Structure Design of Preliminary Drainage Report for Crossroads Mixed Use (Appendix D). The hydraulic head loss method utilized in the StormCAD software was the HEC-22 energy method. Printouts from StormCAD are included in Appendix C.

D. Waivers from Criteria

There are no waivers from the criteria set by the El Paso County DCM or the USDCM. The project will abide by all criteria set by El Paso County DCM and Mile High Flood District’s USDCM.

Section IV – Drainage Facility Design

A. General Concept

No off-site surface flows are expected to affect the Site. Runoff from the Site area is planned to be captured in inlets and conveyed in pipes to the existing detention and water quality pond just south of the Site. Drainage patterns will remain virtually unchanged from current conditions. A Historic Conditions and Existing Conditions Drainage Map can be found in Appendix D.

The impervious percentage and Rational Method calculations for all basins are found in Appendix B. The inlet sizing and bypass calculations and StormCAD calculations are found in Appendix C. Detention Pond storage and release calculations as well as pond infrastructure design can be found in the Preliminary Drainage Report for Crossroads Mixed Use in Appendix D.

B. Specific Details

The Four Step Process will be implemented as follows:

Step 1: Proposed imperviousness is currently at 66.79% as indicated in Appendix B. Various landscaped areas are planned around the Site. Inlets and area drains are proposed in landscape areas where some stormwater will flow through grass swales and infiltrate. Where practical, openings are encouraged in curbs that are adjacent to landscape areas leading to area drains or inlets. Landscaping has been incorporated around the perimeter of the Site.

Step 2: Runoff from the Site will be collected and routed to the existing detention pond adjacent to the Site. The WQCV Calculations are included in Preliminary Drainage Report for Crossroads Mixed Use in Appendix D.

Step 3: The existing detention pond outfalls to a swale that is within the CDOT right of way (ROW). Analysis and stabilization may be required

Step 4: To mitigate potential sources of pollution due to construction practices, best management practices (BMPs), per the El Paso County DCM and MHFD manuals, are recommended.

All on-Site storm facilities will be owned and maintained by the owner of the property. Maintenance requirements for all best management practices shall be in accordance with the El Paso County DCM, USDCM, and CDOT.

Proposed inlet types include CDOT Type R and CDOT Type D. Junction structures for the proposed storm sewer lines are to be 5-to-6-foot diameter precast or cast –in-place slab base manholes. Modifications to some standard inlets will be needed to accommodate some pipe connections; details will be added to the construction plans. Inlet capture efficiencies have been determined using UD-Inlet v5.01. Printouts are included in Appendix C.

Section V - Drainage, Bridge, and Pond Fees

According to the 2021 El Paso County Drainage Basin Fees (Resolution No, 20-424), Sand Creek Drainage Basin (FOFO4000) has a drainage fee of $20,387 per impervious acre, and a drainage bridge fee of $8,339 per impervious acre. Based on the total disturbed area of 13.67 acres and a total imperviousness of 66.79 percent, a total drainage fee of $262,274 is required.

Section VI – Construction Cost Opinion

All on-site storm facilities will be private. The pipes and appurtenances within Tract C will be owned and maintained by El Paso County. The on-site storm facilities will be owned and maintained by the owner of the property. Maintenance requirements for all BMPs shall be in accordance with the El Paso County DCM and UDFCD/MHFD Criteria.

Opinion of probable costs for the public and remaining private drainage facilities are $81,178 and $282,730 respectively. See Appendix F for details.

Section VII – Other Government Agency Requirements

This Project may be subject to CDOT requirements due to the existing detention pond that outfalls to the swale in the CDOT right of way. Otherwise, the Project is not anticipated to be subject to requirements of other agencies (e.g. FEMA, COE, SEO, CWCB).

Section VIII – Conclusions

Currently, the Site is vacant and undeveloped; flows are undetained and only treated via the existing pervious cover or swales that will lead to the detention pond.

The proposed development includes on-site private and off-site public storm drainage systems to collect and convey runoff from the majority of the Site to the existing off-site regional water quality and detention facility directly south of the property. Site runoff that is not collected onsite will directly flow to the same surrounding storm sewer system that conveys the accumulated flows to existing detention pond to the south. No adverse impacts to the surrounding properties or drainage facilities are anticipated.

The proposed drainage design for the Aura at Crossroads development conforms with the Preliminary Drainage Report criteria dated February 2021. The Preliminary Drainage Report allows for 76.73% impervious cover for the site. The calculated impervious cover for the site is 66.79%; therefore, in general we are compliant with the Preliminary Drainage Report. See Appendix D for additional information. The facilities, if properly constructed and maintained, will effectively control stormwater runoff consistent with the criteria.

Per the County's Drainage Criteria Manual (DCM), a Grading and Erosion Control plan along with a County's Stormwater Management Plan is required and has been submitted.

Section IX – References

1. Drainage Criteria Manual, Volume 1, Volume 2, and Volume 1 Update, County of El Paso, Colorado, October 31, 2018.

2. Preliminary Drainage Report for Crossroads Mixed Use, El Paso County, Colorado, February 2021, MS Civil Consultants, Inc.

3. National Flood Hazard Layer FIRMette, El Paso County, Colorado, Map No. 08041C0752G, December 7, 2018, Federal Emergency Management Agency.

4. Custom Soil Resource Report, El Paso County Area, Colorado, April 5, 2021, Natural Resources Conservation Service.

5. Geotechnical Investigation, Crossroads Apartments. Colorado Springs, Colorado, CTL Thompson Inc., May, 18, 2021.

6. Urban Storm Drainage Criteria Manual Vol. 1, Mile High Flood District, revised August 2018.

7. Urban Storm Drainage Criteria Manual Vol. 2, Mile High Flood District, revised September 2017.

8. Urban Storm Drainage Criteria Manual Vol. 3, Mile High Flood District, revised October 2019.

Section X – Appendices

Appendix A Vicinity Map, FIRMette, NRCS Custom Soil Resource Report

Appendix B Hydrologic Computations

Appendix C Hydraulic Computations

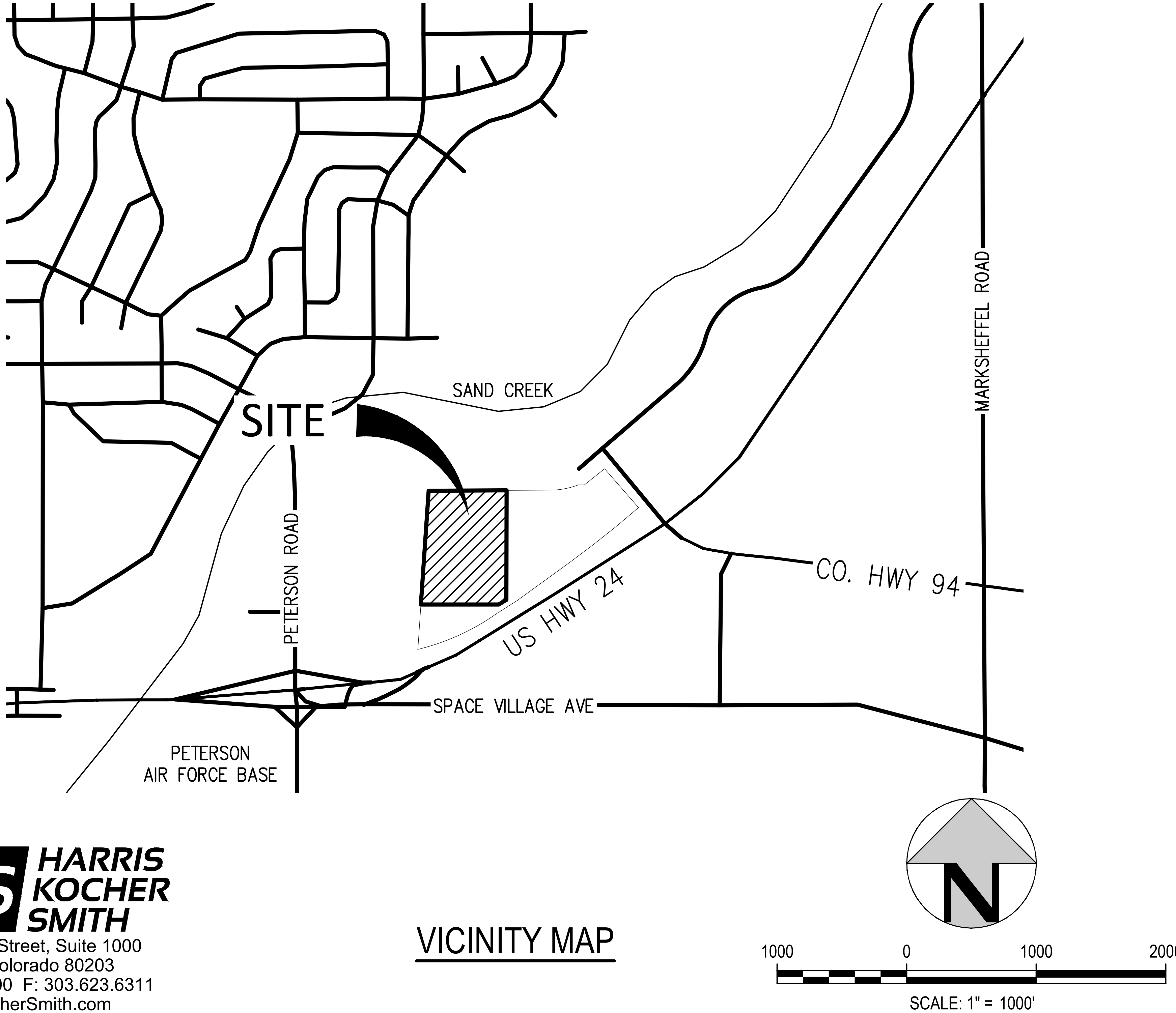
Appendix D Preliminary Drainage Report for Crossroads Mixed Use

Appendix E Geotechnical Engineering and Geologic Report

Appendix F Cost Estimate

Appendix G Drainage Maps

Appendix A – Vicinity Map, FIRMette, NRCS Custom Soil Resource Report



VICINITY MAP

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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

Crossroads at Meadowbrook

April 5, 2021

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 alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

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: 1:1,950 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 25, 50, 100, 150

Feet: 0, 50, 100, 200, 300

N

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 18, Jun 5, 2020

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
8	Blakeland loamy sand, 1 to 9 percent slopes	16.7	96.6%
10	Blendon sandy loam, 0 to 3 percent slopes	0.6	3.4%
Totals for Area of Interest		**17.2**	**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

8—Blakeland loamy sand, 1 to 9 percent slopes

Map Unit Setting

National map unit symbol: 369v
Elevation: 4,600 to 5,800 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

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

Description of Blakeland

Setting

Landform: Hills, flats
Landform position (three-dimensional): Side slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sedimentary rock and/or eolian deposits derived from sedimentary rock

Typical profile

A - 0 to 11 inches: loamy sand
AC - 11 to 27 inches: loamy sand
C - 27 to 60 inches: sand

Properties and qualities

Slope: 1 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water capacity: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Pleasant

Percent of map unit: 1 percent

Landform: Depressions
Hydric soil rating: Yes

Other soils

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

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 capacity: 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

Pleasant

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

Other soils

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

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National Flood Hazard Layer FIRMette

FEMA

104°42'5"W 38°50'47"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

104°41'28"W 38°50'19"N

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

N

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 4/6/2021 at 12:22 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.

Appendix B – Hydrologic Computations

IMPERVIOUSNESS AND RUNOFF COEFFICIENTS CALCULATIONS, POST DEVELOPMENT

CALC'D BY: EEM
DATE: 10/29/21
NRCS Hydrologic Soil Group: A/B

PROJECT: Aura at Crossroads
PROJ. NO: 200823

LAND USE TYPES (per Table 6-6 of Volume 1 Update of El Paso County DCM) :

Land Use or Surface Characteristics	Imperviousness	Runoff Coefficients, C											
		2-year		5-year		10-year		25-yr		50-yr		100-yr	
		A/B	C/D	A/B	C/D	A/B	C/D	A/B	C/D	A/B	C/D	A/B	C/D
Paved Streets, Drives, Parking, Walks	100%	0.89	0.89	0.90	0.90	0.92	0.92	0.94	0.94	0.95	0.95	0.96	0.96
Building Roofs	90%	0.71	0.73	0.73	0.75	0.75	0.77	0.78	0.80	0.80	0.82	0.81	0.83
Lawns, Landscape Areas	2%	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

Subbasin	Areas	ACRES: Paved Streets, Drives, Parking, Walks	ACRES: Building Roofs	ACRES: Lawns, Landscape Areas	Imperviousness	Imperv. Acres	COMPOSITE RUNOFF COEFFICIENTS (Eq. 6-6): C_2=	C_5=	C_{10}=	C_{25}=	C_{50}=	C_{100}=
X-1	0.42	0.00	0.18	0.24	39.42%	0.16	0.31	0.36	0.41	0.48	0.51	0.55
X-2	0.01	0.01	0.00	0.00	77.91%	0.01	0.69	0.72	0.75	0.78	0.80	0.82
X-3	0.08	0.07	0.00	0.01	83.16%	0.07	0.74	0.76	0.79	0.82	0.84	0.86
A-1	2.07	0.87	0.59	0.61	68.37%	1.42	0.58	0.61	0.65	0.69	0.72	0.74
A-2	0.43	0.13	0.12	0.18	57.23%	0.25	0.48	0.52	0.56	0.61	0.64	0.67
A-3	0.42	0.00	0.00	0.42	2.00%	0.01	0.02	0.08	0.15	0.25	0.30	0.35
A-4	0.76	0.46	0.19	0.11	83.16%	0.63	0.72	0.74	0.76	0.80	0.82	0.83
A-5	3.67	1.92	0.94	0.81	75.80%	2.78	0.65	0.68	0.71	0.75	0.77	0.79
B-1	0.75	0.27	0.09	0.39	48.53%	0.37	0.42	0.46	0.50	0.57	0.60	0.63
B-2	0.28	0.12	0.10	0.06	74.95%	0.21	0.63	0.66	0.69	0.73	0.75	0.77
B-3	1.91	1.17	0.31	0.43	76.49%	1.46	0.67	0.69	0.72	0.76	0.78	0.80
D-1	0.78	0.39	0.15	0.23	68.64%	0.53	0.59	0.62	0.66	0.70	0.73	0.75
C-1	0.77	0.34	0.17	0.26	64.66%	0.50	0.56	0.59	0.62	0.67	0.70	0.72
C-2	0.44	0.36	0.00	0.08	81.51%	0.36	0.73	0.75	0.77	0.81	0.83	0.84
Z-1	0.37	0.00	0.14	0.23	35.36%	0.13	0.28	0.33	0.38	0.45	0.49	0.52
Z-2	0.38	0.01	0.17	0.21	42.47%	0.16	0.34	0.38	0.43	0.50	0.53	0.56
Total/Composite	13.55	6.13	3.15	4.27	66.79%	9.05	0.57	0.60	0.64	0.69	0.71	0.73

When multiple sub-basins are delineated, the composite C value calculation is:

$$C_c = (C_1A_1 + C_2A_2 + C_3A_3 + \ldots C_iA_i) / A_t \quad \text{(Eq. 6-6)}$$

Where:

C_c = composite runoff coefficient for total area

C_i = runoff coefficient for subarea corresponding to surface type or land use

A_i = area of surface type corresponding to C_i (units must be the same as those used for total area)

A_t = total area of all subareas for which composite runoff coefficient applies

i = number of surface types in the drainage area

CALCULATED BY: EEM
CHECKED BY: MW
DATE: 10/29/2021

Standard Form SF-1 (Modified)

Time of Concentration, Post-Development

JOB NO: 200823
PROJECT: Aura at Crossroads
REVISED: 10/29/2021

SUB-BASIN DATA			INITIAL/OVERLAND TIME (T_i)			TRAVEL TIME (T_t)					T_c CHECK (URBANIZED BASINS)				FINAL T_c	REMARKS
BASIN	AREA (AC)	C_5	LENGTH (FT)	SLOPE %	T_i (MIN)	LENGTH (FT)	SLOPE %	C_v	VELOCITY (FPS)	T_t (MIN)	COMPOS. $T_c = T_i + T_t$ (MIN)	L_t, TOTAL LENGTH	AVG SLOPE	Tc = (L/180) + 10 (MIN)	(MIN)	
X-1	0.42	0.36	243.0	1.26	19.7	16.0	1.00	15	1.50	0.2	19.8	259	1.25	11.4	11.4	to proposed area/landscape drains
X-2	0.01	0.72	28.9	5.29	2.2	285.0	1.30	20	2.28	2.1	5.0	313.9	1.67	11.7	5.0	to existing off-site inlet
X-3	0.08	0.76	87.5	1.41	5.2	613.6	1.10	20	2.10	4.9	10.1	701.1	1.14	13.9	10.1	to existing off-site inlet
A-1	2.07	0.61	362.0	1.13	16.4	318.0	1.18	20	2.17	2.4	18.8	680	1.15	13.8	13.8	to proposed curb inlet
A-2	0.43	0.52	203.0	1.10	14.7	67.4	1.96	20	2.80	0.4	15.1	270.4	1.32	11.5	11.5	to proposed curb inlet
A-3	0.42	0.08	70.2	3.59	10.2	378.0	2.00	15	2.12	3.0	13.2	448.16	2.25	12.5	12.5	to proposed area inlet
A-4	0.76	0.74	52.4	2.18	3.7	282.0	1.10	20	2.10	2.2	6.0	334.4	1.27	11.9	6.0	to proposed modified curb inlet
A-5	3.67	0.68	198.0	1.06	10.7	701.0	1.03	20	2.03	5.8	16.5	899	1.04	15.0	15.0	to proposed curb inlet
B-1	0.75	0.46	180.0	2.11	12.3	5.0	1.00	10	1.00	0.1	12.4	185	2.08	11.0	11.0	to proposed area inlet
B-2	0.28	0.66	182.5	1.28	10.1	76.0	1.70	20	2.61	0.5	10.5	258.5	1.40	11.4	10.5	to proposed curb inlet
B-3	1.91	0.69	210.3	1.54	9.5	451.0	1.00	20	2.00	3.8	13.2	661.3	1.17	13.7	13.2	to proposed curb inlet
D-1	0.78	0.62	125.0	1.48	8.6	40.0	2.60	20	3.22	0.2	8.8	165	1.75	10.9	8.8	to proposed curb inlet
C-1	0.77	0.59	50.0	2.14	5.2	706.0	1.46	20	2.42	4.9	10.0	756	1.51	14.2	10.0	to proposed curb inlet
C-2	0.44	0.75	13.0	0.15	4.4	754.0	1.48	20	2.43	5.2	9.5	767	1.45	14.3	9.5	to proposed curb inlet
Z-1	0.37	0.33	90.0	0.24	21.5	277.4	1.06	20	2.06	2.2	23.8	367.4	0.86	12.0	12.0	to proposed area/landscape drains
Z-2	0.38	0.38	126.0	2.25	11.3	67.0	1.22	7	0.77	1.4	12.7	193	1.89	11.1	11.1	to landsacpe drains/grass swale to detention pond

Estimating Time of Concentration (T_c):

$$t_c = t_i + t_t \quad \text{(RO-2)}$$

in which:

t_c = time of concentration (minutes)

t_i = initial or overland flow time (minutes)

t_t = travel time in the ditch, channel, gutter, storm sewer, etc. (minutes)

2.4.1 Initial Flow Time

The initial or overland flow time, t_i, may be calculated using equation RO-3:

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \quad \text{(RO-3)}$$

in which:

t_i = initial or overland flow time (minutes)

C_5 = runoff coefficient for 5-year frequency (from Table RO-5)

L = length of overland flow (500 ft maximum for non-urban land uses, 300 ft maximum for urban land uses)

S = average basin slope (ft/ft)

Estimating Overland Travel Time (T_t):

$$V = C_v S_w^{0.5} \quad \text{(RO-4)}$$

in which:

V = velocity (ft/sec)

C_v = conveyance coefficient (from Table RO-2)

S_w = watercourse slope (ft/ft)

Table RO-2—Conveyance Coefficient, C_v

Type of Land Surface	Conveyance Coefficient, C_v
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

The time of concentration, t_c, is then the sum of the initial flow time, t_i, and the travel time, t_t, as per Equation RO-2.

1-HR Rainfall

Rainfall Depths for Colorado Springs, DCM Vol 1 Upd., Table 6-2

Return Interval (YR)	1-hour Rainfall	
WQ	0.6	(WQ per MHFD USDCM Vol 3, p 1-9 [29 of 577])
1	unknown	
2	1.19	
5	1.50	
10	1.75	
25	2.00	
50	2.25	
100	2.52	
500	unknown	

FOR COMPARISON INFORMATION ONLY, NOAA Atlas 14 - point on map

Return Interval (YR)	1-hour Rainfall	
WQ	0.6	(WQ per MHFD USDCM Vol 3, p 1-9 [29 of 577])
1	0.863	
2	1.020	
5	1.30	
10	1.57	
25	1.99	
50	2.35	
100	2.74	
500	3.79	

Intensity (per Vol. 1 Update of the El Paso County DCM):

IDF Equations

$I_{100} = -2.52 \ln(D) + 12.735$

$I_{50} = -2.25 \ln(D) + 11.375$

$I_{25} = -2.00 \ln(D) + 10.111$

$I_{10} = -1.75 \ln(D) + 8.847$

$I_{5} = -1.50 \ln(D) + 7.583$

$I_{2} = -1.19 \ln(D) + 6.035$

POINT PRECIPITATION FREQUENCY (PF) ESTIMATES

WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION

NOAA Atlas 14, Volume 8, Version 2

PF tabular | PF graphical | Supplementary information | Print page

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.238 (0.200-0.286)	0.289 (0.242-0.348)	0.378 (0.315-0.456)	0.457 (0.379-0.554)	0.573 (0.461-0.728)	0.669 (0.523-0.860)	0.771 (0.579-1.02)	0.880 (0.631-1.19)	1.03 (0.708-1.44)	1.15 (0.767-1.62)
10-min	0.349 (0.292-0.419)	0.423 (0.354-0.509)	0.553 (0.461-0.667)	0.669 (0.554-0.811)	0.839 (0.675-1.07)	0.980 (0.766-1.26)	1.13 (0.848-1.49)	1.29 (0.924-1.75)	1.51 (1.04-2.11)	1.69 (1.12-2.38)
15-min	0.425 (0.357-0.511)	0.516 (0.432-0.621)	0.674 (0.563-0.814)	0.815 (0.676-0.989)	1.02 (0.823-1.30)	1.20 (0.934-1.54)	1.38 (1.03-1.81)	1.57 (1.13-2.13)	1.84 (1.26-2.57)	2.06 (1.37-2.90)
30-min	0.647 (0.543-0.778)	0.783 (0.656-0.943)	1.02 (0.852-1.23)	1.23 (1.02-1.50)	1.55 (1.24-1.97)	1.81 (1.41-2.32)	2.08 (1.56-2.74)	2.37 (1.70-3.21)	2.78 (1.91-3.88)	3.11 (2.07-4.38)
60-min	0.863 (0.724-1.04)	1.02 (0.853-1.23)	1.30 (1.09-1.58)	1.57 (1.31-1.91)	1.99 (1.61-2.55)	2.35 (1.84-3.04)	2.74 (2.07-3.64)	3.17 (2.28-4.32)	3.79 (2.61-5.30)	4.30 (2.86-6.04)
2-hr	1.08 (0.912-1.29)	1.25 (1.06-1.50)	1.59 (1.34-1.91)	1.92 (1.60-2.31)	2.44 (2.00-3.12)	2.90 (2.30-3.74)	3.40 (2.59-4.50)	3.97 (2.88-5.39)	4.80 (3.33-6.68)	5.48 (3.67-7.66)
[illegible]	1.19	1.36	1.71	2.06	2.64	3.16	3.74	4.41	5.39	6.21

CALCULATED BY: EEM

DATE: 3/24/2022

CHECKED BY: MW

PROJECT MANAGER: JDO

Standard Form SF-2 (Modified)

Storm Drainage System Design

(Rational Method Procedure) **Post Development**

JOB NO: 200823

PROJECT: Aura at Crossroads

DESIGN STORM: 5 YR

		DIRECT RUNOFF						TOTAL RUNOFF				INLET		PIPE							
SUBBASIN(s)	DESIGN POINT (DP)	AREA (AC)	RUNOFF COEFF	T_c (min)	C x A (AC)	I (IN/HR)	Q (CFS)	T_c (MIN)	Σ(C x A) (AC)	I (IN/HR)	Q (CFS)	INLET INTERCEPTION (CFS)	BYPASS (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE (IN)	CAPACITY AT 80% (CFS)	LENGTH (FT)	VELOCITY (FPS)	T_t (min)	REMARKS
Offsite Basin A		1.68	0.96	8.9	1.50	4.30	6.46														data per FDR for Crossroads Mixed Use (M&S Civil, August 2021)
Offsite Basin B		1.49	0.96	8.8	2.28	4.32	9.85														data per FDR for Crossroads Mixed Use (M&S Civil, August 2021)
								8.9	3.78	4.30	16.27										
X-1		0.42	0.36	11.4	0.15	3.93	0.58														Flows offsite to Meadowbrook Curb Inlet
X-2		0.01	0.72	5.0	0.01	5.17	0.05														Flows offsite to Meadowbrook Curb Inlet
X-3		0.08	0.76	10.1	0.06	4.12	0.26														Flows offsite to Meadowbrook Curb Inlet
Offsite + X-1 + X-2 + X-3	0							10.1	4.00	4.12	16.48			16.48	0.75	30	32.23	246.75	6.6	0.63	
A-1	1	2.07	0.61	13.8	1.26	3.65	4.61					4.40	0.21	4.61	2.00	18	13.48	38.51	7.6	0.08	
DP0+DP1	2							13.9	5.27	3.64	19.17			19.17	0.93	36	58.35	331.00	8.3	0.67	
A-2	3	0.43	0.52	11.5	0.22	3.92	0.88							0.88	1.50	15	7.18	103.00	5.8	0.29	
DP2+DP3	4							14.5	5.49	3.57	19.60			19.60	2.00	36	85.57	65.00	12.1	0.09	
A-3		0.42	0.08	12.5	0.03	3.80	0.13														Landscape Area Drain to DP-5
DP4+DP5	5							14.8	5.53	3.54	19.55			19.55	0.55	36	44.87	406.00	6.3	1.07	
A-4	6	0.76	0.74	6.0	0.56	4.91	2.76														
														0.00	2.00	24	29.02	132.06	9.2	0.24	
A-5		3.67	0.68	15.0	2.48	3.52	8.72														
A-5+DP6	7						8.93	15.0	8.56	3.52	30.16	6.80	2.13	30.16	0.50	48	4.14	131.29	3.4	0.65	
B-1	8	0.75	0.46	11.0	0.35	3.98	1.38							1.38	0.50	15	4.14	35.33	3.4	0.17	
B-2		0.28	0.66	10.5	0.18	4.05	0.74							0.74	0.50	24	14.51	215.10	4.6	0.78	
B-2+DP8	9							11.7	0.53	3.90	2.06										
B-3		1.91	0.69	13.2	1.32	3.71	4.89														
B-3+DP8	10							13.2	1.85	3.71	6.85	4.60	0.29	6.85	0.50	30	26.31	110.00	5.4	0.34	
Offsite Basin E		1.36	0.89	6.9	1.21	4.69	5.65														
	11							14.2			35.00			35.00	1.10	36	63.46	226.00	9.0	0.42	
DP10 + DP11	12							14.2	1.85	3.60	41.65			41.65	0.60	48	100.94	213.00	8.0	0.44	1/2 of Basin E in Crossroads Mixed Use PDR
C-1		0.77	0.59	10.0	0.45	4.12	1.86							1.86	2.00	18	13.48	16.16	7.6	0.04	Flow and Time of Travel is from Crossroads PDR
							1.86														
C-2		0.44	0.75	9.5	0.33	4.20	1.39							1.39	2.00	30	52.62	16.16	10.7	0.03	
OS-1+OS-2+DP12	13							14.2	0.78	3.60	44.47			44.47	1.00	48	130.31	30.49	10.4	0.05	
D-1	14	0.78	0.62	8.8	0.48	4.32	2.08														
							2.08							0.00	3.50	30		87.00			
Z-1	15	0.37	0.33	12.0	0.12	3.85	0.47														Landscape drains and overflow into detention pond
Z-2	16	0.38	0.38	11.1	0.14	3.98	0.57														Swale that flows existing detention pond

CALCULATED BY: EEM

DATE: 3/24/2022

CHECKED BY: MW

PROJECT MANAGER: JDO

Standard Form SF-2 (Modified)

Storm Drainage System Design

(Rational Method Procedure) **Post Development**

JOB NO: 200823

PROJECT: Aura at Crossroads

DESIGN STORM: 100 YR

		DIRECT RUNOFF						TOTAL RUNOFF				INLET		PIPE							
SUBBASIN(s)	DESIGN POINT (DP)	AREA (AC)	RUNOFF COEFF	T_c (min)	C x A (AC)	I (IN/HR)	Q (CFS)	T_c (MIN)	Σ(C x A) (AC)	I (IN/HR)	Q (CFS)	INLET INTERCEPTION (CFS)	BYPASS (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE (IN)	QFULL (CFS)	LENGTH (FT)	VELOCITY (FPS)	T_t (min)	REMARKS
Offsite Basin A		1.67	0.96	8.9	1.71	7.23	12.36														data per FDR for Crossroads Mixed Use (M&S Civil, August 2021)
Offsite Basin B		1.48	0.96	8.8	3.56	7.25	25.83														data per FDR for Crossroads Mixed Use (M&S Civil, August 2021)
								8.9	5.27	7.23	38.08										
X-1		0.42	0.55	11.4	0.23	6.59	1.50														Flows offsite to Meadowbrook Curb Inlet
X-2		0.01	0.82	5.0	0.01	8.68	0.10														Flows offsite to Meadowbrook Curb Inlet
X-3		0.08	0.86	10.1	0.07	6.91	0.50														Flows offsite to Meadowbrook Curb Inlet
Offsite + X-1 + X-2 + X-3	0							10.1	5.58	6.91	38.58			38.58	0.75	30	35.52	246.75	7.2	0.57	
A-1	1	2.07	0.74	13.8	1.53	6.12	9.36					6.80	2.56	9.36	2.00	18	14.86	38.51	8.4	0.08	
DP0+DP1	2							13.9	7.11	6.11	43.45			43.45	0.93	36	64.32	331.00	9.1	0.61	
A-2	3	0.43	0.67	11.5	0.29	6.58	1.90					1.70	0.20	1.90	1.50	15	7.91	103.00	6.4	0.27	
DP2+DP3	4							14.5	7.40	6.00	44.42			44.42	2.00	36	94.33	65.00	13.3	0.08	
A-3		0.42	0.35	12.5	0.15	6.37	0.94														
DP4+DP5	5							14.5	7.55	5.99	45.20			45.20	0.55	36	49.46	406.00	7.0	0.97	
A-4	6	0.76	0.83	6.0	0.64	8.24	5.24					4.80	0.44								
														4.80	2.00	24	31.99	132.06	10.2	0.22	
A-5		3.67	0.79	15.0	2.89	5.91	17.06														
A-5+DP6	7						20.26	15.0	11.07	5.91	65.43	11.60	8.66	65.43	0.50	48	101.57	131.29	8.1	0.27	
B-1	8	0.75	0.63	11.0	0.47	6.69	3.17							3.17	0.50	15	4.57	35.33	3.7	0.16	
B-2		0.28	0.77	10.5	0.21	6.80	1.45							1.45	0.50	24	16.00	215.10	5.1	0.70	
B-2+DP8	9							11.2	0.69	6.65	4.57										
B-3		1.91	0.80	13.2	1.53	6.23	9.52					6.90	2.62								
B-3+DP8	10							13.2	2.22	6.23	13.80			13.80	0.50	30	29.00	110.00	5.9	0.31	
Offsite Basin E		1.36	0.89	6.9	1.21	7.87	9.49														
	11							14.2			60.50			60.50	1.10	36	69.95	226.00	9.9	0.38	
DP10 + DP11	12							14.6	2.22	5.98	73.75			73.75	0.50	48	101.57	213.00	8.1	0.44	
C-1		0.77	0.72	10.0	0.56	6.92	3.84							3.84	2.00	18	14.86	16.16	8.4	0.03	1/2 of Basin E in Crossroads Mixed Use PDR
							4.79					4.00	0.79								Flow and Time of Travel is from Crossroads PDR
C-2		0.44	0.84	9.5	0.37	7.05	2.64					1.70	0.94	2.64	2.00	30	58.01	16.16	11.8	0.02	
OS-1+OS-2+DP12	13							15.0	0.93	5.91	79.25			79.25	1.00	48	143.64	30.49	11.4	0.04	
D-1	14	0.78	0.75	8.8	0.58	7.25	4.20					4.60	2.23								
							6.83							0.00	3.50	30	76.74	87.00	15.6	0.09	
Z-1	15	0.37	0.52	12.0	0.20	6.46	1.27														Landscape drains and overflow into detention pond
Z-2	16	0.38	0.56	11.1	0.21	6.68	1.43														Swale that flows existing detention pond

Appendix C – Hydraulic Computations

MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	A3	A4	B1	A9	A8	B2	B4	D1
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	AREA	STREET	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	Swale	On Grade	On Grade	On Grade	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type C	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows								
Minor Q_{Known} (cfs)	4.6	0.9	1.4	2.8	8.7	0.7	4.9	2.1
Major Q_{Known} (cfs)	9.4	1.9	3.2	5.2	17.1	1.5	9.5	4.2
Bypass (Carry-Over) Flow from Upstream								
Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	User-Defined	No Bypass Flow Received	User-Defined	No Bypass Flow Received	No Bypass Flow Received	User-Defined
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.3
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.1	0.0	3.2	0.0	0.0	2.6
Watershed Characteristics								
Subcatchment Area (acres)	2.07	0.43						
Percent Impervious	68.37	57.23						
NRCS Soil Type	A	A						
Watershed Profile								
Overland Slope (ft/ft)	0.011	0.011						
Overland Length (ft)	300	203						
Channel Slope (ft/ft)	0.012	0.020						
Channel Length (ft)	318	67.4						
Minor Storm Rainfall Input								
Design Storm Return Period, T_r (years)								
One-Hour Precipitation, P_1 (inches)								
Major Storm Rainfall Input								
Design Storm Return Period, T_r (years)								
One-Hour Precipitation, P_1 (inches)								

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**4.6**	**0.9**	**1.4**	**2.8**	**8.9**	**0.7**	**4.9**	**2.4**
Major Total Design Peak Flow, Q (cfs)	**9.4**	**1.9**	**3.3**	**5.2**	**20.3**	**1.5**	**9.5**	**6.8**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.2	0.0	0.0	0.0	0.9	0.0	0.3	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	2.6	0.2	0.0	0.4	7.8	0.1	2.6	1.5
Minor Storm (Calculated) Analysis of Flow Time								
C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C_5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Velocity, Vi	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Channel Flow Velocity, Vt	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Time, Ti	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Channel Travel Time, Tt	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Regional T_c	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Recommended T_c	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
T_c selected by User	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Major Storm (Calculated) Analysis of Flow Time								
C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C_5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Velocity, Vi	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Channel Flow Velocity, Vt	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Time, Ti	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Channel Travel Time, Tt	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Regional T_c	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Recommended T_c	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
T_c selected by User	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	C3	C4	Existing Inlet at DP 0
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.9	1.0	9.8
Major Q_{Known} (cfs)	3.8	2.0	25.8

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	User-Defined	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.3	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

Overland Slope (ft/ft)			
Overland Length (ft)			
Channel Slope (ft/ft)			
Channel Length (ft)			

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)			
One-Hour Precipitation, P_1 (inches)			

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.9**	**1.0**	**9.8**
Major Total Design Peak Flow, Q (cfs)	**4.1**	**2.0**	**25.8**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	0.1	0.3	N/A

Minor Storm (Calculated) Analysis of Flow

C	N/A	N/A	N/A
C_5	N/A	N/A	N/A
Overland Flow Velocity, Vi	N/A	N/A	N/A
Channel Flow Velocity, Vt	N/A	N/A	N/A
Overland Flow Time, Ti	N/A	N/A	N/A
Channel Travel Time, Tt	N/A	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A	N/A
Regional T_c	N/A	N/A	N/A
Recommended T_c	N/A	N/A	N/A
T_c selected by User	N/A	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A	N/A

Major Storm (Calculated) Analysis of Flow

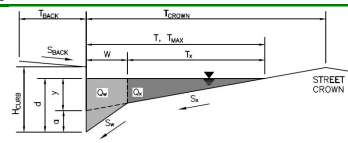
C	N/A	N/A	N/A
C_5	N/A	N/A	N/A
Overland Flow Velocity, Vi	N/A	N/A	N/A
Channel Flow Velocity, Vt	N/A	N/A	N/A
Overland Flow Time, Ti	N/A	N/A	N/A
Channel Travel Time, Tt	N/A	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A	N/A
Regional T_c	N/A	N/A	N/A
Recommended T_c	N/A	N/A	N/A
T_c selected by User	N/A	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A	N/A

MHFD-Inlet, Version 5.01 (April 2021)

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Crossroads
Inlet ID: Existing Inlet at DP 0



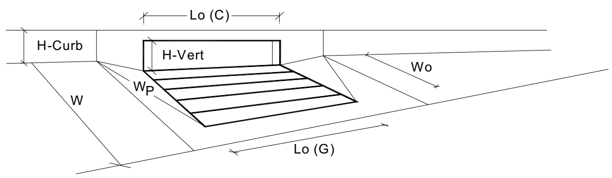
Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	26.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	16.5	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.3	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.2	8.9	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

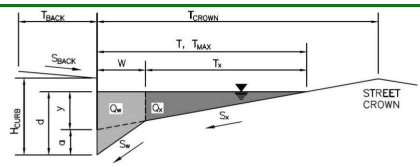
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.35	0.58	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.58	0.84	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.80	0.93	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**10.6**	**26.0**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	9.8	25.8	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Crossroads
Inlet ID: A3

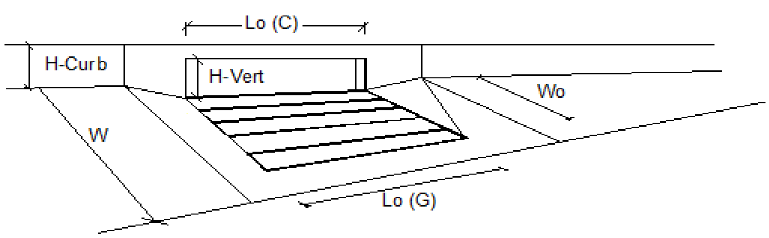


Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	6.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.100		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	42.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	42.0	42.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**13.8**	**115.4**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)

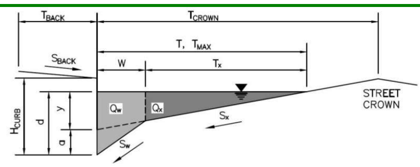


Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.4**	**6.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.2**	**2.6**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**95**	**73**	**%**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Crossroads
Inlet ID: A4



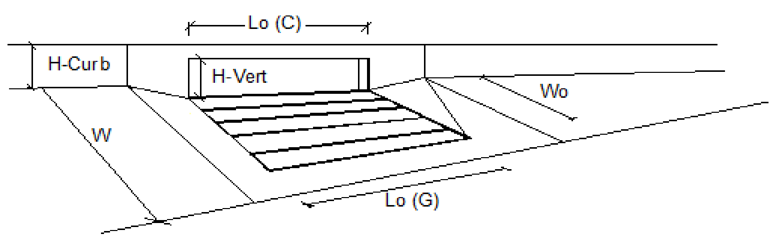
Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.028		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =			
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	24.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	24.0	24.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.2	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**13.8**	**25.1**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

0.369509995 0.369509995

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)

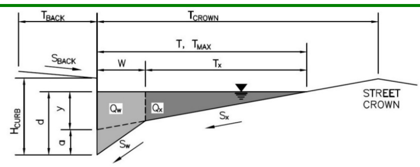


Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.9**	**1.7**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.2**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**88**	**%**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Crossroads
Inlet ID: A8

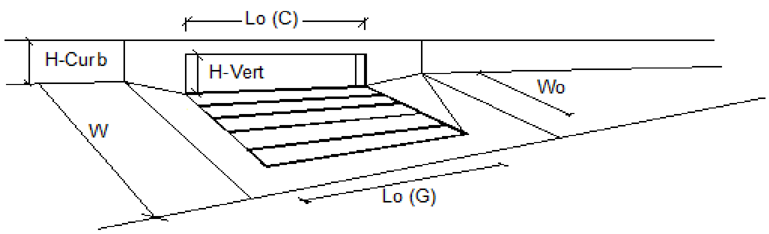


Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.150		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	30.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.010		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.020		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	30.0	30.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**21.5**	**21.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)

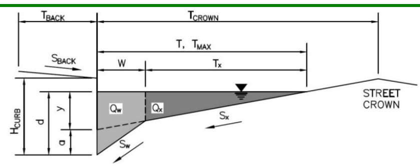


Design Information (Input) — CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**8.1**	**12.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.9**	**7.8**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**90**	**61**	**%**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Crossroads
Inlet ID: A9

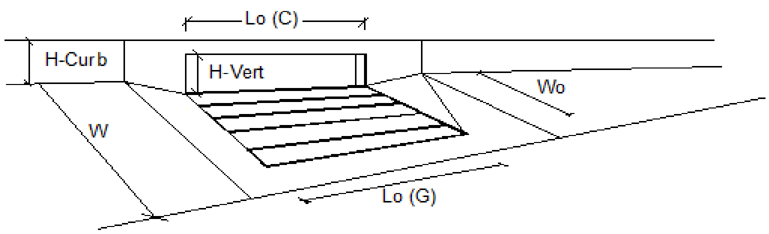


Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.015		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	60.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	20.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**13.8**	**13.8**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)

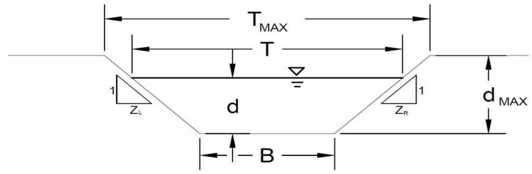


Design Information (Input)		MINOR	MAJOR	
Type of Inlet [CDOT Type R Curb Opening]	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.8**	**4.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.4**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**92**	**%**

AREA INLET IN A SWALE

Crossroads

B1



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

	NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =	A	
	Manning's n (Leave cell D16 blank to manually enter an n value)	n =	see details below	
	Channel Invert Slope	S_O =	0.0200	ft/ft
	Bottom Width	B =	0.00	ft
Warning 01	Left Side Slope	Z1 =	2.00	ft/ft
Warning 01	Right Side Sloe	Z2 =	2.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

Choose One:
- Non-Cohesive
- Cohesive (selected)
- Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**20.00**	**20.00**	**ft**
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**2.00**	**2.00**	**ft**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**4.3**	**4.3**	**cfs**
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	**2.00**	**2.00**	**ft**

Water Depth in Channel Based On Design Peak Flow

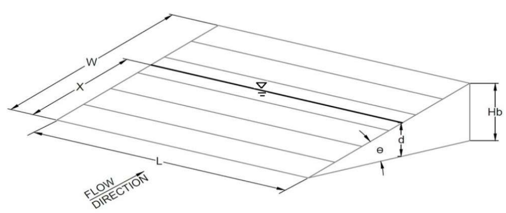
Design Peak Flow	Q_o =	**1.4**	**3.3**	**cfs**
Water Depth	d =	**1.27**	**1.82**	**ft**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

Inlet Design Information (Input)

Type of Inlet: CDOT Type C — Inlet Type = CDOT Type C

Angle of Inclined Grate (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grate	W =	3.00	ft
Length of Grate	L =	3.00	ft
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grate	H_B =	0.00	ft
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	0.96	
Orifice Coefficient	C_o =	0.64	
Weir Coefficient	C_w =	2.05	



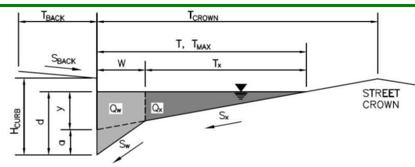
		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	1.27	1.82	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**18.2**	**21.8**	**cfs**
Bypassed Flow	Q_b =	**0.0**	**0.0**	**cfs**
Capture Percentage = Qa/Qo	C% =	**100**	**100**	**%**

Warning 01: Sideslope steepness exceeds USDCM Volume I recommendation.

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Crossroads
Inlet ID: B2

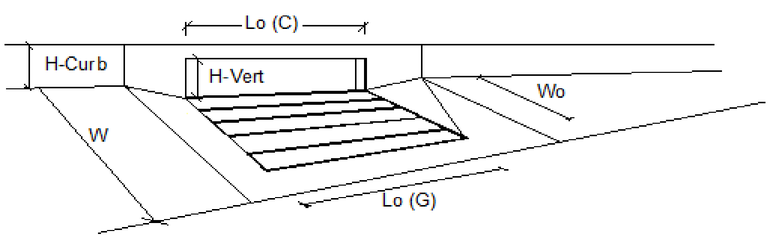


Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	26.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.040		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	86.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.020		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	20.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**19.5**	**19.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)

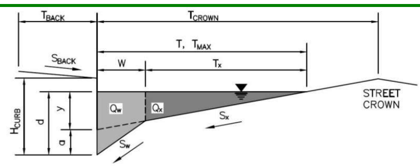


Design Information (Input)		MINOR	MAJOR	
Type of Inlet — CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.7**	**1.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**96**	**%**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Crossroads
Inlet ID: B4



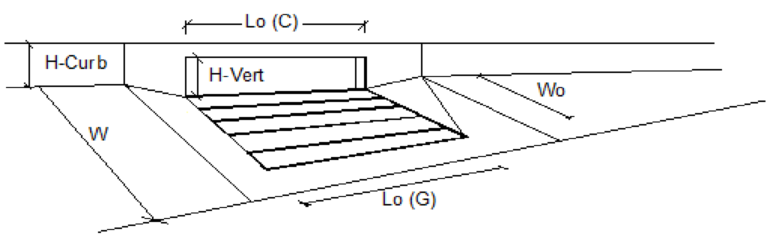
Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.000		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	26.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.020		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	11.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**5.5**	**9.6**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)

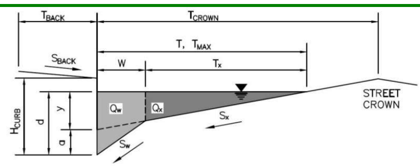


Design Information (Input) — CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**4.6**	**6.9**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.3**	**2.6**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**94**	**73**	**%**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Crossroads
Inlet ID: C3

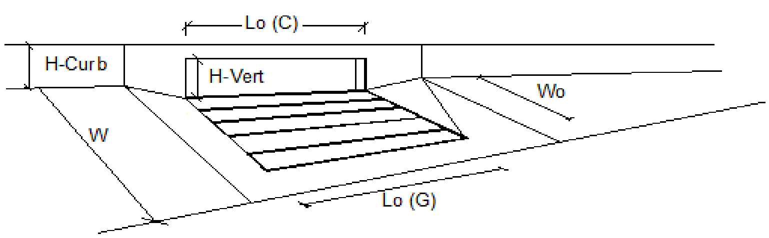


Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.000		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.0	5.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**6.8**	**6.8**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)

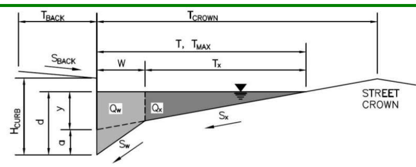


Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**1.9**	**4.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**0.1**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**98**	**%**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Crossroads
Inlet ID: C4

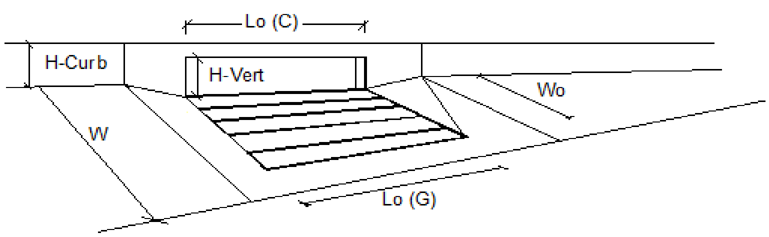


Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.220		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	14.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.010		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	14.0	14.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.0	5.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**6.8**	**6.8**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)

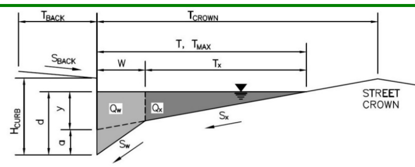


Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**0.9**	**1.7**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.3**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**86**	**%**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Crossroads
Inlet ID: D1

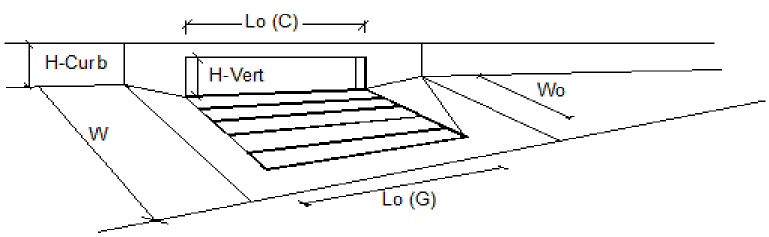


Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	15.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.060		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	30.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.010		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.020		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	30.0	30.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**21.5**	**21.5**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**2.4**	**5.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**1.5**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**78**	**%**

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. — Wednesday, Sep 29 2021

100-YR A3 LANDSCAPE PIPE

Circular

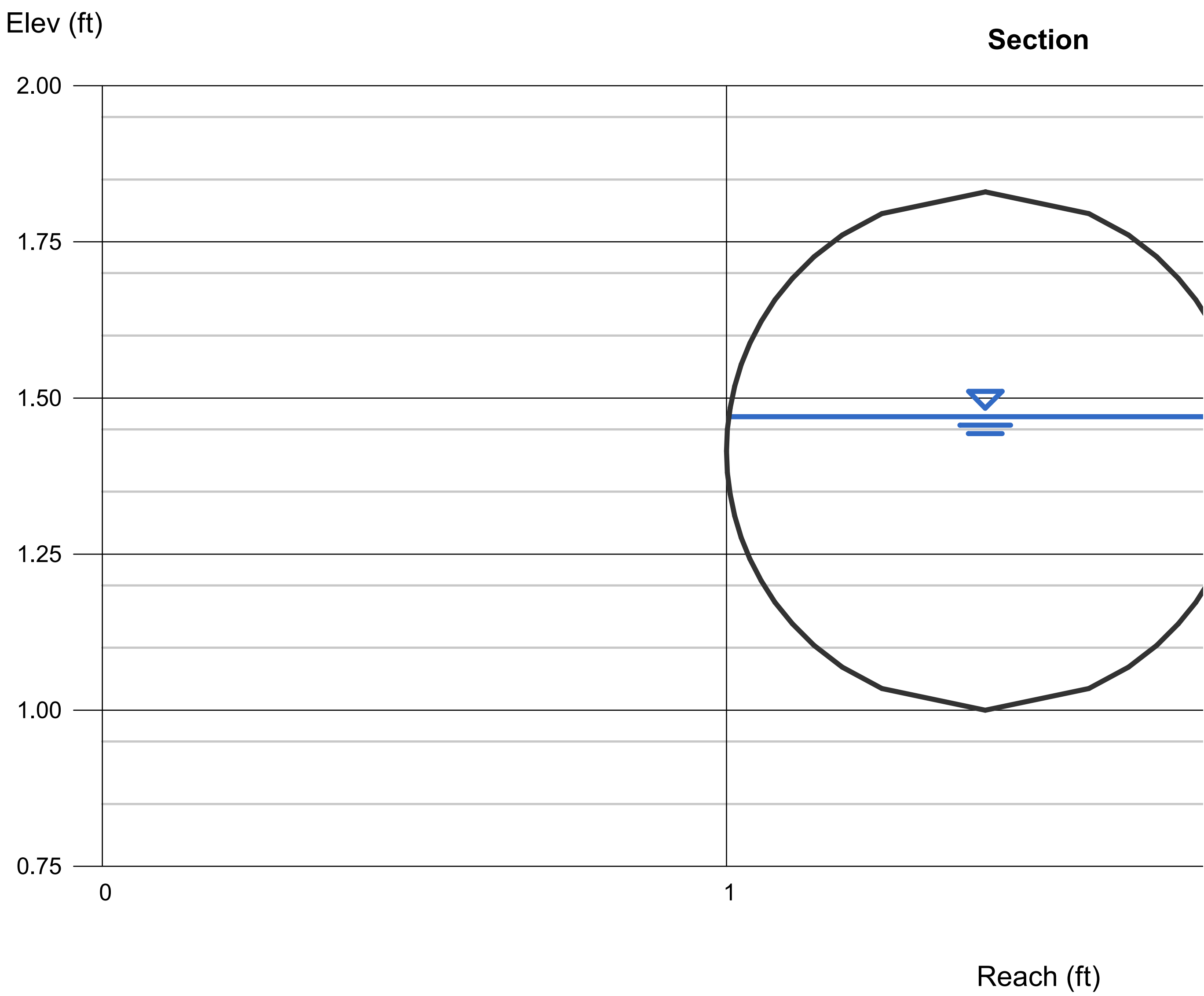
Diameter (ft)	= 0.83
Invert Elev (ft)	= 1.00
Slope (%)	= 0.50
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.94

Highlighted

Depth (ft)	= 0.47
Q (cfs)	= 0.940
Area (sqft)	= 0.32
Velocity (ft/s)	= 2.97
Wetted Perim (ft)	= 1.42
Crit Depth, Yc (ft)	= 0.43
Top Width (ft)	= 0.82
EGL (ft)	= 0.61



Inlet Report

100 YR - A-3 AREA INLET CAPACITY

Drop Grate Inlet

Location	= Sag
Curb Length (ft)	= -0-
Throat Height (in)	= -0-
Grate Area (sqft)	= 1.00
Grate Width (ft)	= 1.00
Grate Length (ft)	= 1.00

Gutter

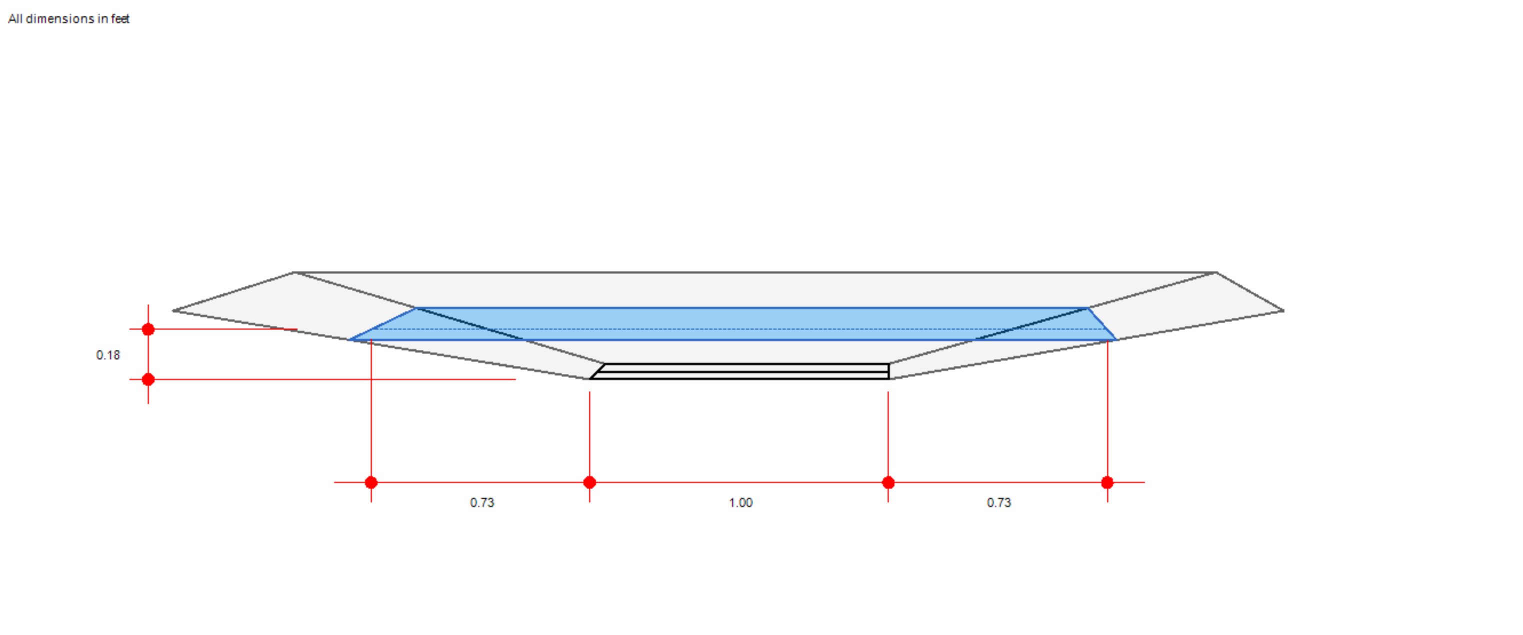
Slope, Sw (ft/ft)	= 0.250
Slope, Sx (ft/ft)	= 0.250
Local Depr (in)	= -0-
Gutter Width (ft)	= 1.00
Gutter Slope (%)	= -0-
Gutter n-value	= -0-

Calculations

Compute by:	Known Q
Q (cfs)	= 0.94

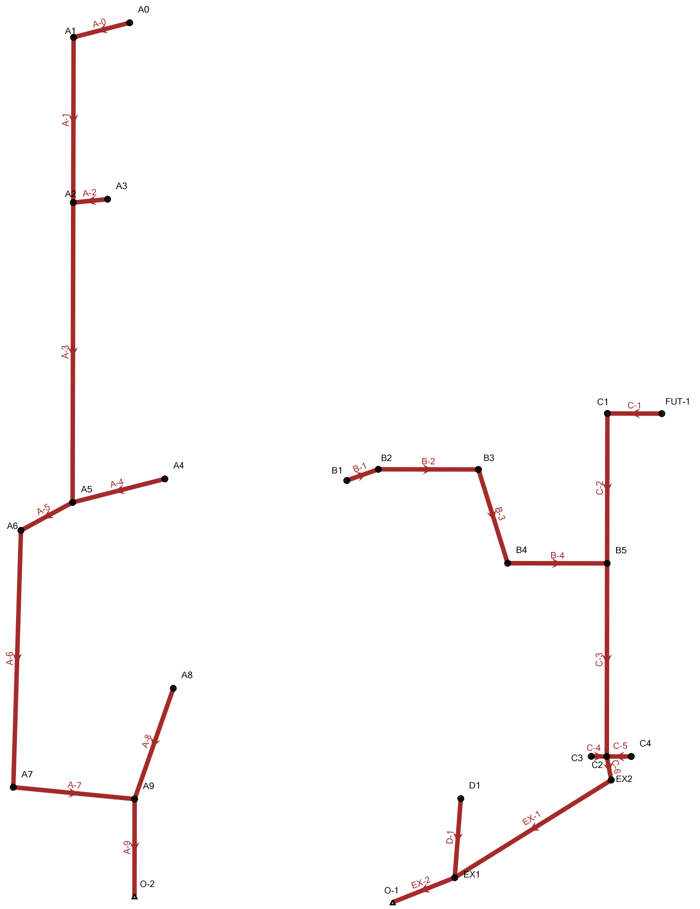
Highlighted

Q Total (cfs)	= 0.94
Q Capt (cfs)	= 0.94
Q Bypass (cfs)	= -0-
Depth at Inlet (in)	= 2.20
Efficiency (%)	= 100
Gutter Spread (ft)	= 2.46
Gutter Vel (ft/s)	= -0-
Bypass Spread (ft)	= -0-
Bypass Depth (in)	= -0-



Aura at Crossroads

Network Schematic



Aura at Crossroads

FlexTable: Conduit Table

Active Scenario: 5 YR

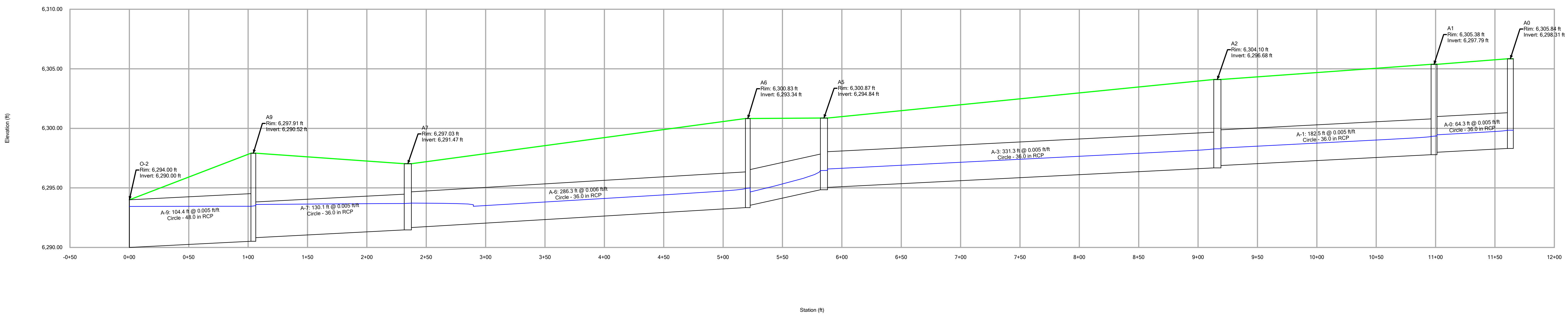
Label	Start Node	Stop Node	Length (Unified) (ft)	Rise (Unified) (ft)	Notes	Invert (Start) (ft)	Invert (Stop) (ft)	Slope (Calculated) (ft/ft)	System Known Flow (cfs)	Capacity (Full Flow) (cfs)	Velocity (ft/s)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)
A-0	A0	A1	64.3	3.00	36" RCP	6,298.31	6,297.99	0.005	22.65	47.06	6.59	6,299.84	6,299.46	6,305.84	6,305.38
A-1	A1	A2	182.5	3.00	36" RCP	6,297.79	6,296.88	0.005	22.65	47.10	6.60	6,299.32	6,298.35	6,305.38	6,304.10
A-2	A3	A2	38.3	1.50	18" RCP	6,299.84	6,298.18	0.043	4.61	21.88	9.81	6,300.66	6,298.67	6,302.56	6,304.10
A-3	A2	A5	331.3	3.00	36" RCP	6,296.68	6,295.04	0.005	24.63	46.92	6.72	6,298.28	6,296.58	6,304.10	6,300.87
A-4	A4	A5	102.9	1.25	15" RCP	6,298.13	6,296.59	0.015	0.88	7.90	4.25	6,298.50	6,296.87	6,302.89	6,300.87
A-5	A5	A6	64.1	3.00	36" RCP	6,294.84	6,293.54	0.020	24.95	94.98	11.32	6,296.45	6,294.66	6,300.87	6,300.83
A-6	A6	A7	286.3	3.00	36" RCP	6,293.34	6,291.67	0.006	24.86	50.94	7.16	6,294.95	6,293.72	6,300.83	6,297.03
A-7	A7	A9	130.1	3.00	36" RCP	6,291.47	6,290.82	0.005	24.86	47.14	6.76	6,293.69	6,293.61	6,297.03	6,297.91
A-8	A8	A9	125.8	2.00	24" RCP	6,293.78	6,292.52	0.010	2.76	22.64	4.88	6,294.36	6,293.51	6,299.57	6,297.91
A-9	A9	O-2	104.4	4.00	48" RCP	6,290.50	6,290.00	0.005	35.44	99.40	7.25	6,293.46	6,293.44	6,297.91	6,294.00
B-1	B1	B2	35.7	1.25	15" RCP	6,299.37	6,299.19	0.005	1.38	4.59	3.27	6,299.84	6,299.65	6,302.34	6,303.02
B-2	B2	B3	109.4	1.50	18" RCP	6,298.99	6,298.44	0.005	2.06	7.45	3.60	6,299.53	6,298.98	6,303.02	6,304.77
B-3	B3	B4	107.9	1.50	18" RCP	6,298.24	6,297.70	0.005	2.06	7.43	3.60	6,298.84	6,298.82	6,304.77	6,303.81
B-4	B4	B5	110.3	2.00	24" RCP	6,297.50	6,296.95	0.005	6.85	15.97	4.89	6,298.43	6,297.87	6,303.81	6,304.53
C-1	FUT-1	C1	60.3	3.00	36" RCP	6,300.45	6,298.11	0.039	35.00	131.40	15.73	6,302.37	6,299.29	6,308.24	6,307.03
C-2	C1	B5	165.7	3.50	42" RCP	6,297.61	6,295.45	0.013	35.00	114.88	10.48	6,299.44	6,296.78	6,307.03	6,304.53
C-3	B5	C2	213.2	4.00	48" RCP	6,294.95	6,293.67	0.006	41.65	111.28	8.22	6,296.88	6,295.37	6,304.53	6,302.67
C-4	C3	C2	15.7	1.50	18" RCP	6,296.65	6,295.87	0.050	1.86	23.41	7.92	6,297.16	6,296.18	6,299.96	6,302.67
C-5	C4	C2	25.7	2.50	30" RCP	6,296.15	6,294.87	0.050	3.60	91.53	9.05	6,296.77	6,295.23	6,300.16	6,302.67
C-6	C2	EX2	26.5	4.00	48" RCP	6,293.37	6,293.21	0.006	46.67	111.56	8.48	6,295.42	6,295.32	6,302.67	6,304.40
D-1	D1	EX1	87.7	2.50	30" RCP	6,295.49	6,292.40	0.035	2.08	77.00	6.80	6,295.96	6,293.49	6,301.22	6,298.00
EX-1	EX2	EX1	204.3	4.00	48" RCP	6,292.91	6,290.90	0.010	57.47	142.47	10.73	6,295.19	6,293.46	6,304.40	6,298.00
EX-2	EX1	O-1	99.4	4.00	48" RCP	6,290.60	6,290.00	0.006	59.55	111.59	9.03	6,293.44	6,293.44	6,298.00	6,295.00

Aura at Crossroads

Profile Report

Engineering Profile - Storm Sewer A (Crossroads - StormCAD - 2021-09-24.stsw)

Active Scenario: 5 YR

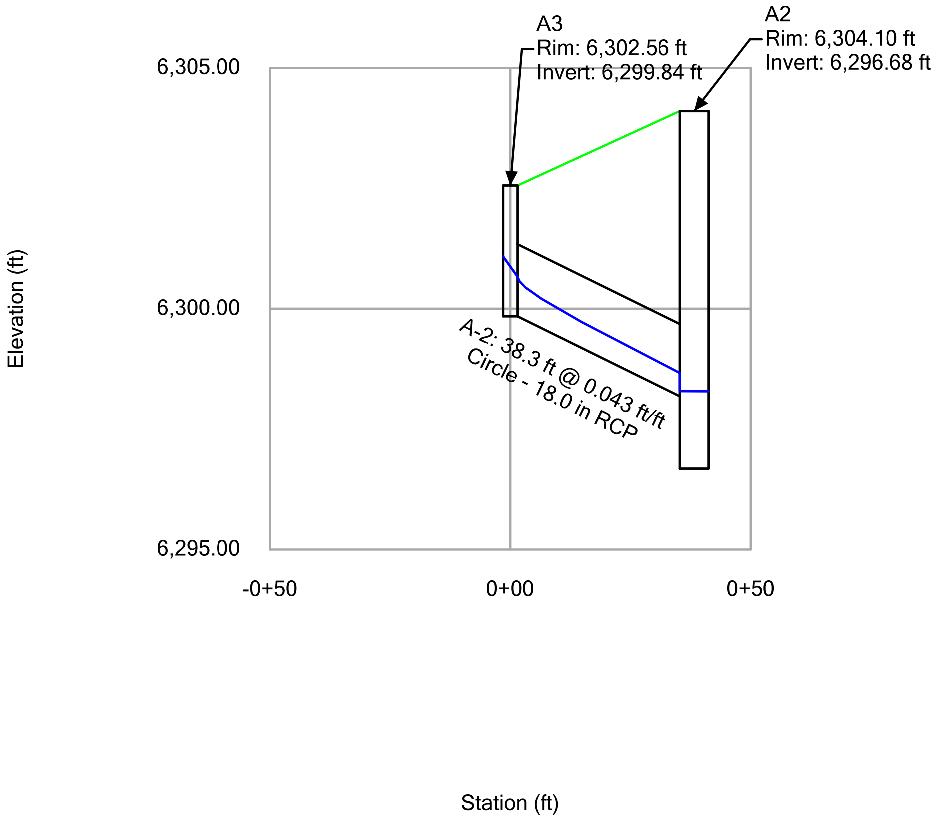


Aura at Crossroads

Profile Report

Engineering Profile - Storm Sewer AA (Crossroads - StormCAD - 2021-09-24.stsw)

Active Scenario: 5 YR

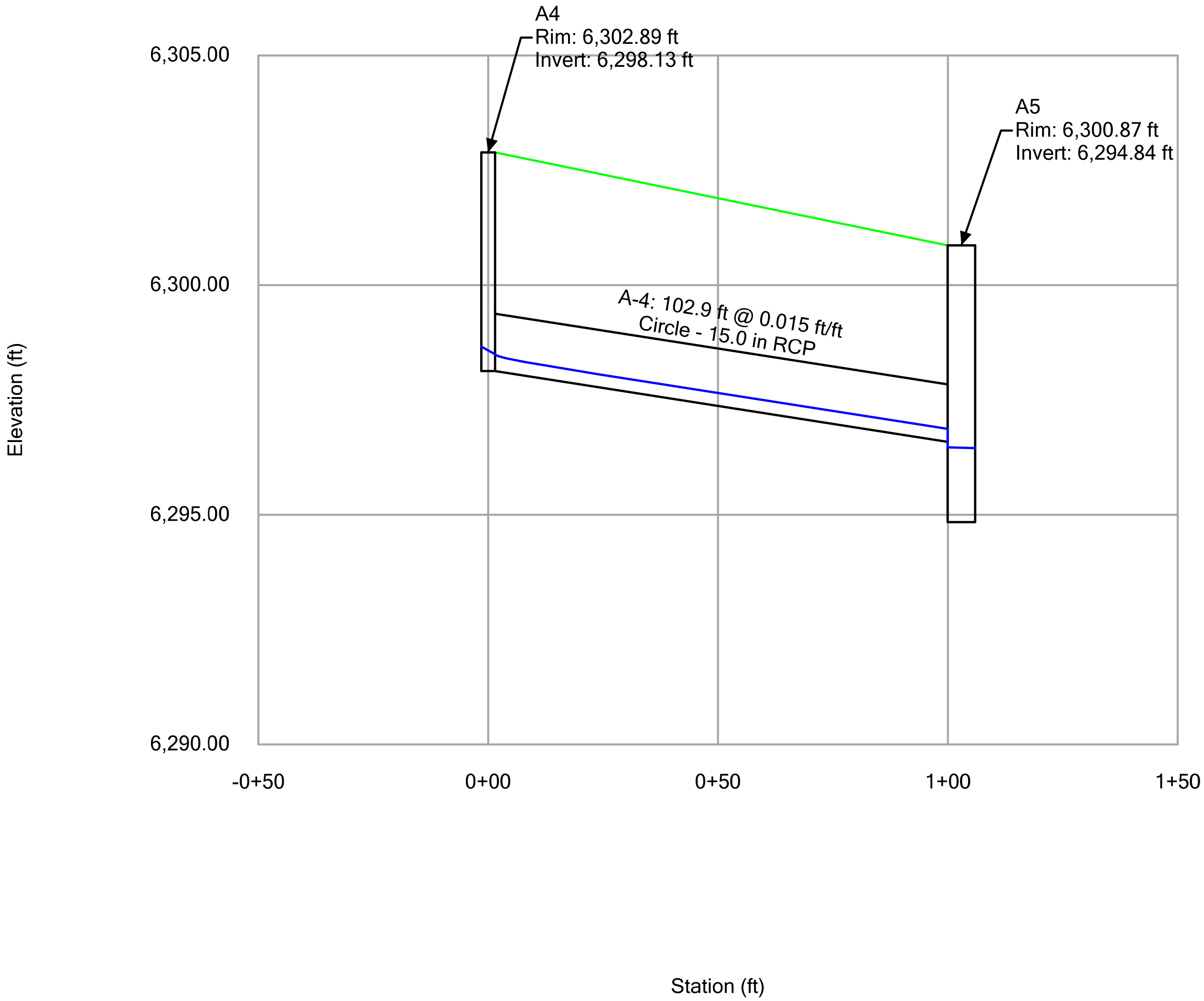


Aura at Crossroads

Profile Report

Engineering Profile - Storm Sewer AB (Crossroads - StormCAD - 2021-09-24.stsw)

Active Scenario: 5 YR

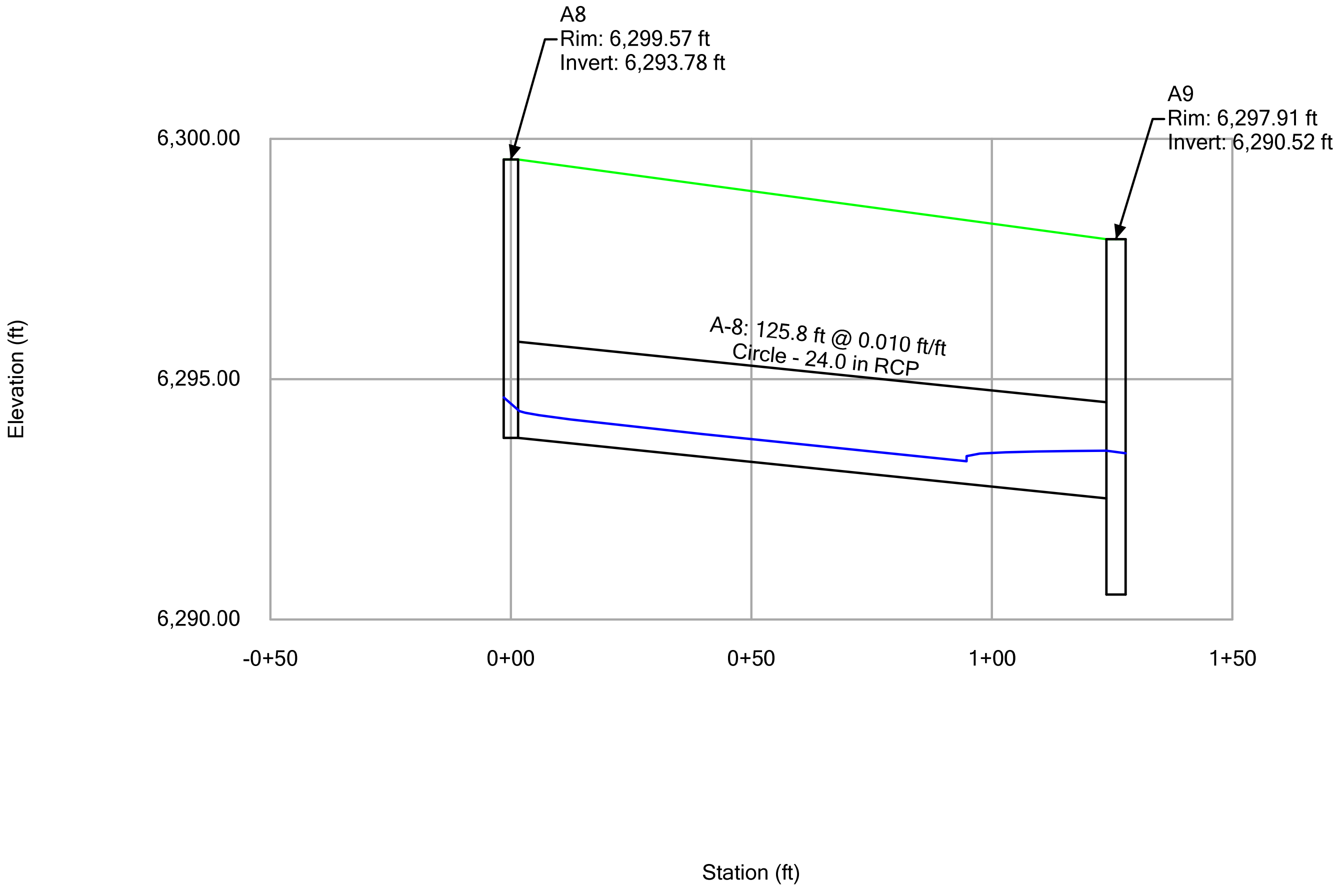


Aura at Crossroads

Profile Report

Engineering Profile - Storm Sewer AC (Crossroads - StormCAD - 2021-09-24.stsw)

Active Scenario: 5 YR

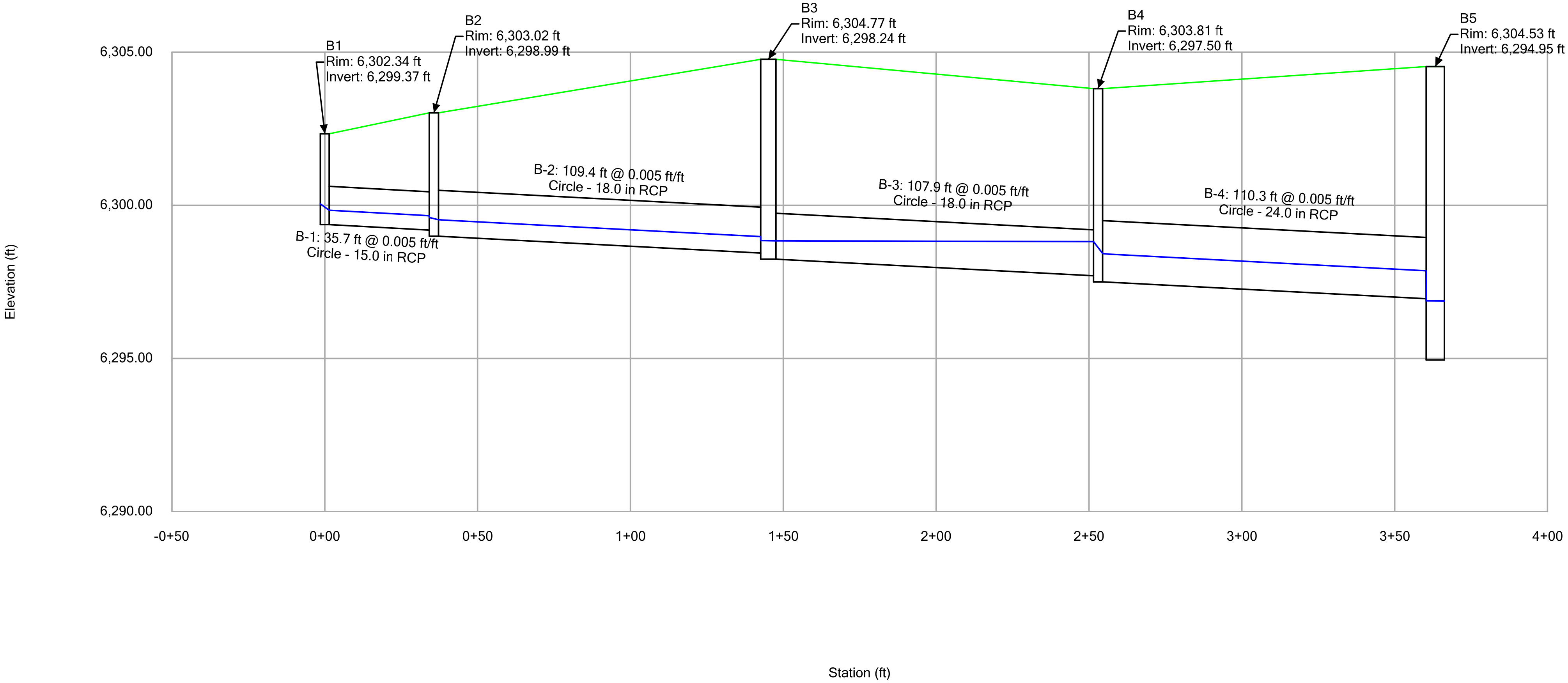


Aura at Crossroads

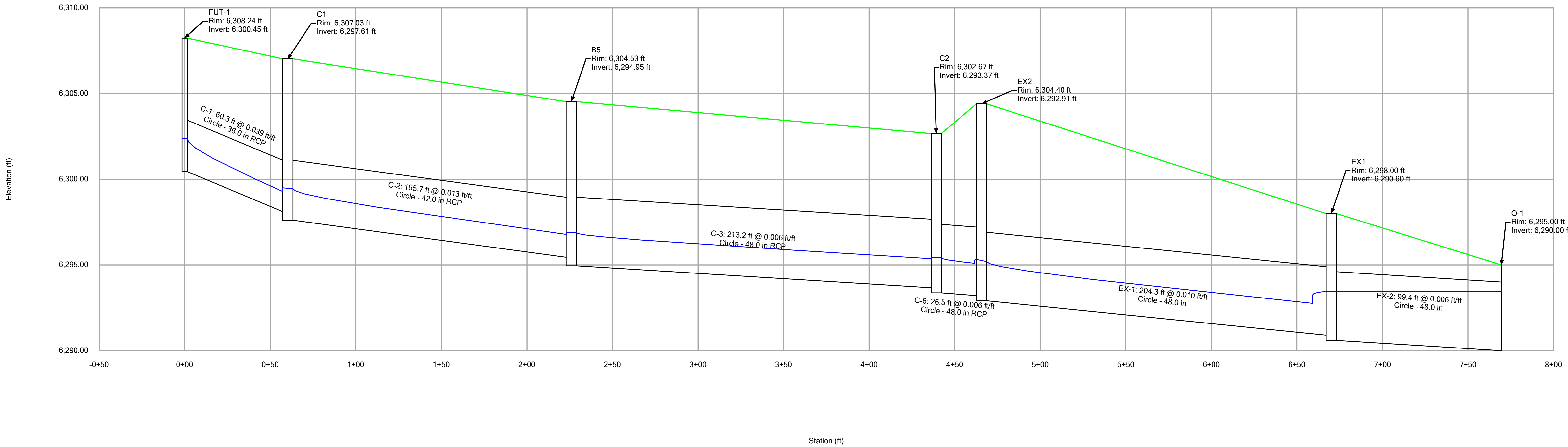
Profile Report

Engineering Profile - Storm Sewer B (Crossroads - StormCAD - 2021-09-24.stsw)

Active Scenario: 5 YR



Aura at Crossroads
Profile Report
Engineering Profile - Storm Sewer C (Crossroads - StormCAD - 2021-09-24.stsw)
Active Scenario: 5 YR

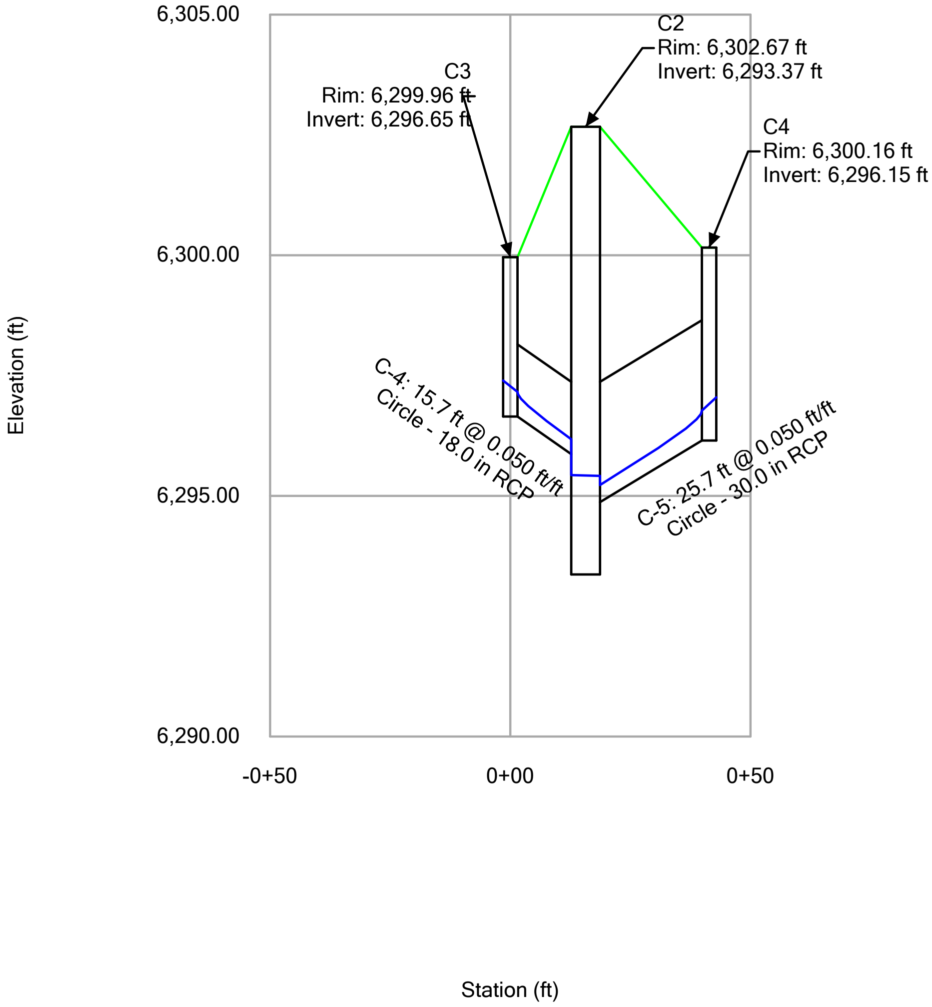


Aura at Crossroads

Profile Report

Engineering Profile - Storm Sewer CA (Crossroads - StormCAD - 2021-09-24.stsw)

Active Scenario: 5 YR

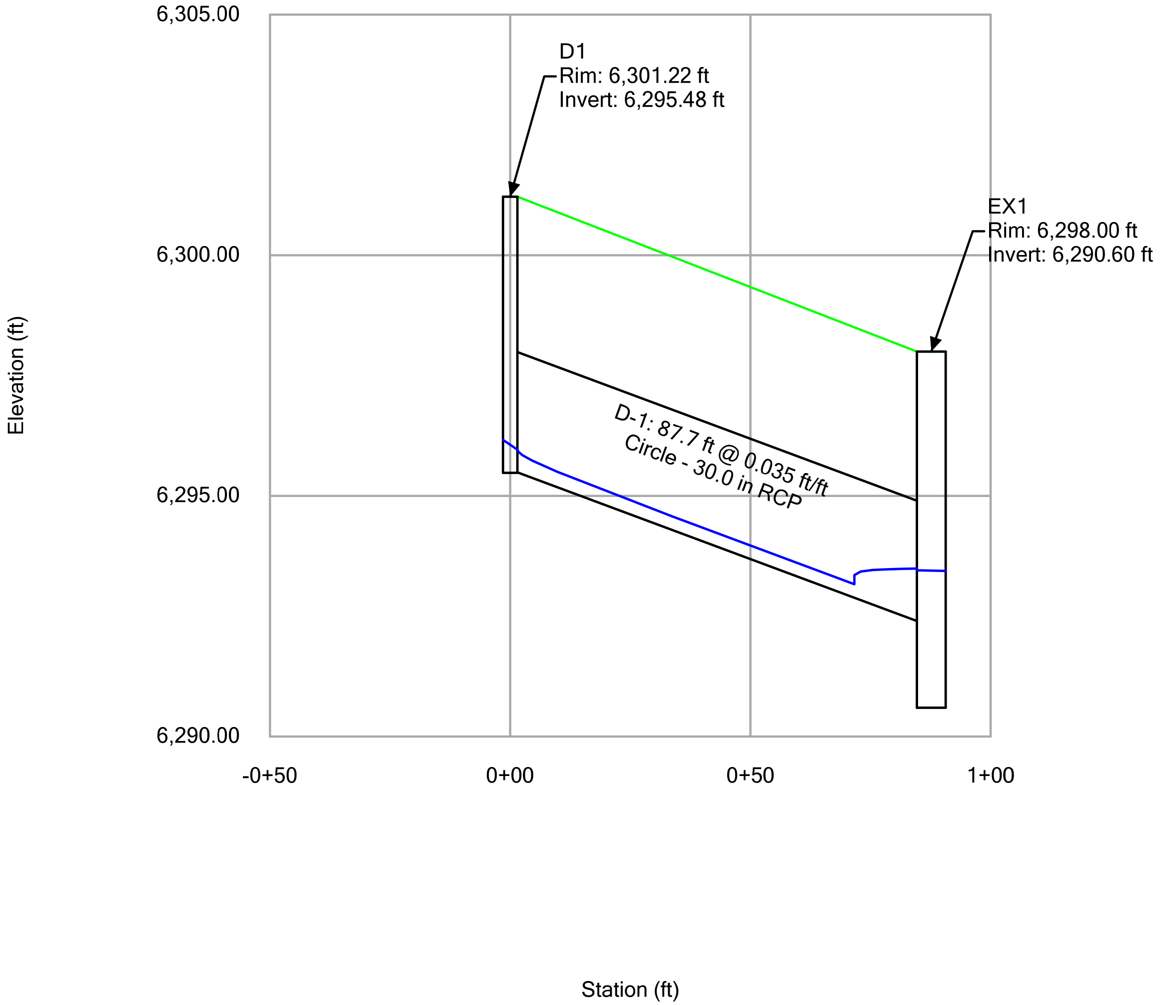


Aura at Crossroads

Profile Report

Engineering Profile - Storm Sewer D (Crossroads - StormCAD - 2021-09-24.stsw)

Active Scenario: 5 YR



Aura at Crossroads

FlexTable: Conduit Table

Active Scenario: 100 YR

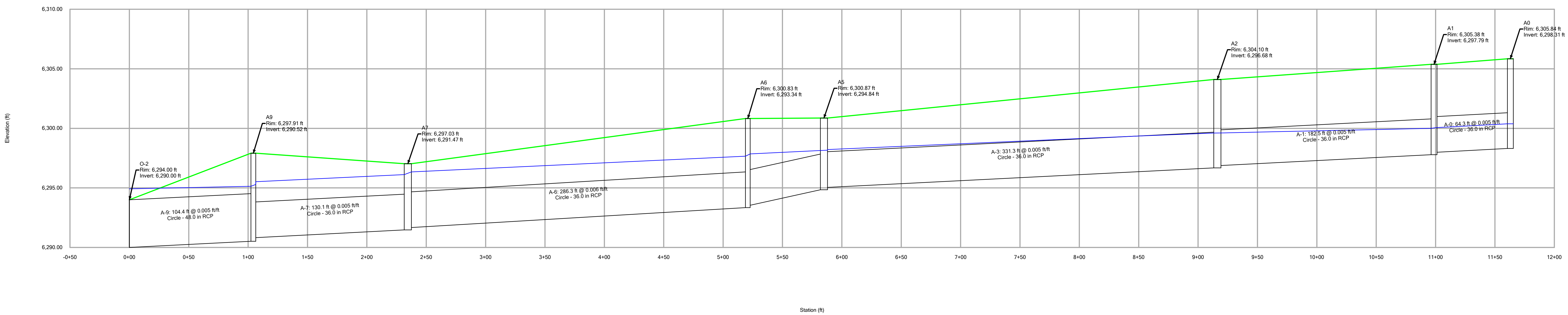
Label	Start Node	Stop Node	Length (Unified) (ft)	Rise (Unified) (ft)	Notes	Invert (Start) (ft)	Invert (Stop) (ft)	Slope (Calculated) (ft/ft)	System Known Flow (cfs)	Capacity (Full Flow) (cfs)	Velocity (ft/s)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)
A-0	A0	A1	64.3	3.00	36" RCP	6,298.31	6,297.99	0.005	38.65	47.06	7.43	6,300.38	6,300.15	6,305.84	6,305.38
A-1	A1	A2	182.5	3.00	36" RCP	6,297.79	6,296.88	0.005	38.65	47.10	7.44	6,300.08	6,299.69	6,305.38	6,304.10
A-2	A3	A2	38.3	1.50	18" RCP	6,299.84	6,298.18	0.043	9.36	21.88	11.89	6,301.02	6,299.75	6,302.56	6,304.10
A-3	A2	A5	331.3	3.00	36" RCP	6,296.68	6,295.04	0.005	43.51	46.92	6.16	6,299.68	6,298.27	6,304.10	6,300.87
A-4	A4	A5	102.9	1.25	15" RCP	6,298.13	6,296.59	0.015	1.90	7.90	5.29	6,298.68	6,298.22	6,302.89	6,300.87
A-5	A5	A6	64.1	3.00	36" RCP	6,294.84	6,293.54	0.020	44.48	94.98	6.29	6,298.19	6,297.90	6,300.87	6,300.83
A-6	A6	A7	286.3	3.00	36" RCP	6,293.34	6,291.67	0.006	45.26	50.94	6.40	6,297.71	6,296.39	6,300.83	6,297.03
A-7	A7	A9	130.1	3.00	36" RCP	6,291.47	6,290.82	0.005	45.26	47.14	6.40	6,296.16	6,295.56	6,297.03	6,297.91
A-8	A8	A9	125.8	2.00	24" RCP	6,293.78	6,292.52	0.010	5.24	22.64	5.86	6,295.38	6,295.33	6,299.57	6,297.91
A-9	A9	O-2	104.4	4.00	48" RCP	6,290.50	6,290.00	0.005	65.49	99.40	5.21	6,295.18	6,294.96	6,297.91	6,294.00
B-1	B1	B2	35.7	1.25	15" RCP	6,299.37	6,299.19	0.005	3.17	4.59	4.03	6,300.16	6,300.07	6,302.34	6,303.02
B-2	B2	B3	109.4	1.50	18" RCP	6,298.99	6,298.44	0.005	4.57	7.45	4.43	6,299.96	6,299.83	6,303.02	6,304.77
B-3	B3	B4	107.9	1.50	18" RCP	6,298.24	6,297.70	0.005	4.57	7.43	2.59	6,299.81	6,299.61	6,304.77	6,303.81
B-4	B4	B5	110.3	2.00	24" RCP	6,297.50	6,296.95	0.005	13.80	15.97	5.72	6,298.93	6,298.29	6,303.81	6,304.53
C-1	FUT-1	C1	60.3	3.00	36" RCP	6,300.45	6,298.11	0.039	60.50	131.40	18.20	6,302.96	6,299.76	6,308.24	6,307.03
C-2	C1	B5	165.7	3.50	42" RCP	6,297.61	6,295.45	0.013	60.50	114.88	12.10	6,300.05	6,297.29	6,307.03	6,304.53
C-3	B5	C2	213.2	4.00	48" RCP	6,294.95	6,293.67	0.006	73.75	111.28	9.47	6,297.55	6,297.34	6,304.53	6,302.67
C-4	C3	C2	15.7	1.50	18" RCP	6,296.65	6,295.87	0.050	3.84	23.41	9.78	6,297.40	6,297.41	6,299.96	6,302.67
C-5	C4	C2	25.7	2.50	30" RCP	6,296.15	6,294.87	0.050	17.30	91.53	14.33	6,297.56	6,297.41	6,300.16	6,302.67
C-6	C2	EX2	26.5	4.00	48" RCP	6,293.37	6,293.21	0.006	93.89	111.56	9.95	6,297.32	6,297.21	6,302.67	6,304.40
D-1	D1	EX1	87.7	2.50	30" RCP	6,295.49	6,292.40	0.035	4.20	77.00	8.39	6,296.16	6,295.89	6,301.22	6,298.00
EX-1	EX2	EX1	204.3	4.00	48" RCP	6,292.91	6,290.90	0.010	113.49	142.47	9.03	6,296.98	6,295.71	6,304.40	6,298.00
EX-2	EX1	O-1	99.4	4.00	48" RCP	6,290.60	6,290.00	0.006	117.96	111.59	9.39	6,295.63	6,294.96	6,298.00	6,295.00

Aura at Crossroads

Profile Report

Engineering Profile - Storm Sewer A (Crossroads - StormCAD - 2021-09-24.stsw)

Active Scenario: 100 YR

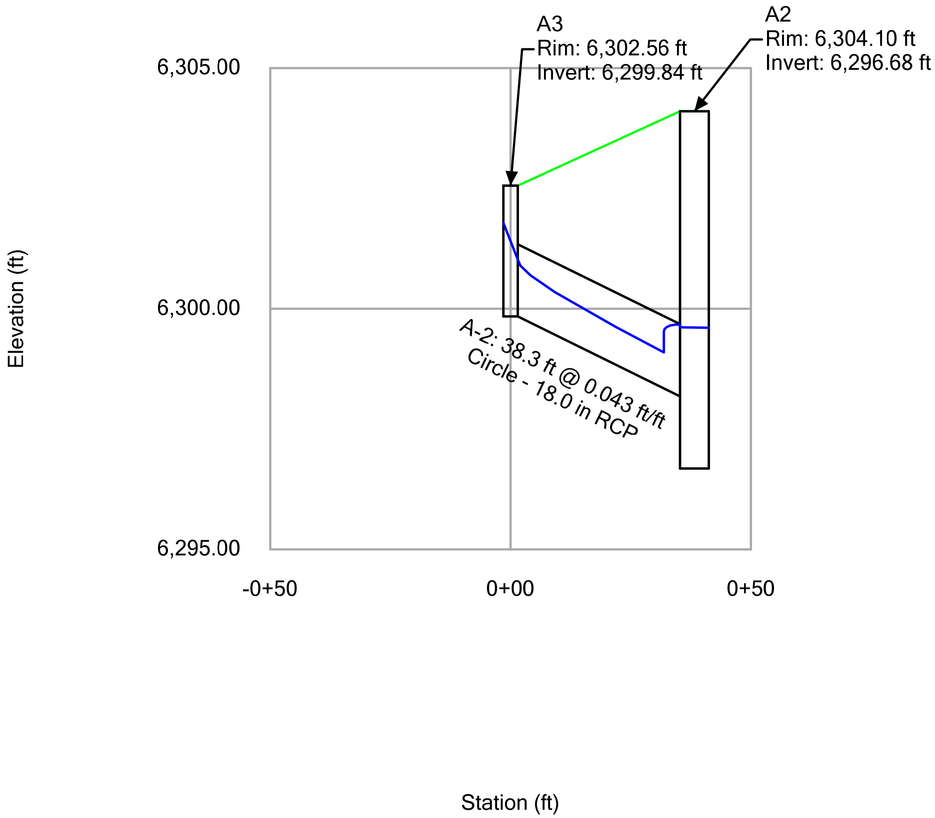


Aura at Crossroads

Profile Report

Engineering Profile - Storm Sewer AA (Crossroads - StormCAD - 2021-09-24.stsw)

Active Scenario: 100 YR

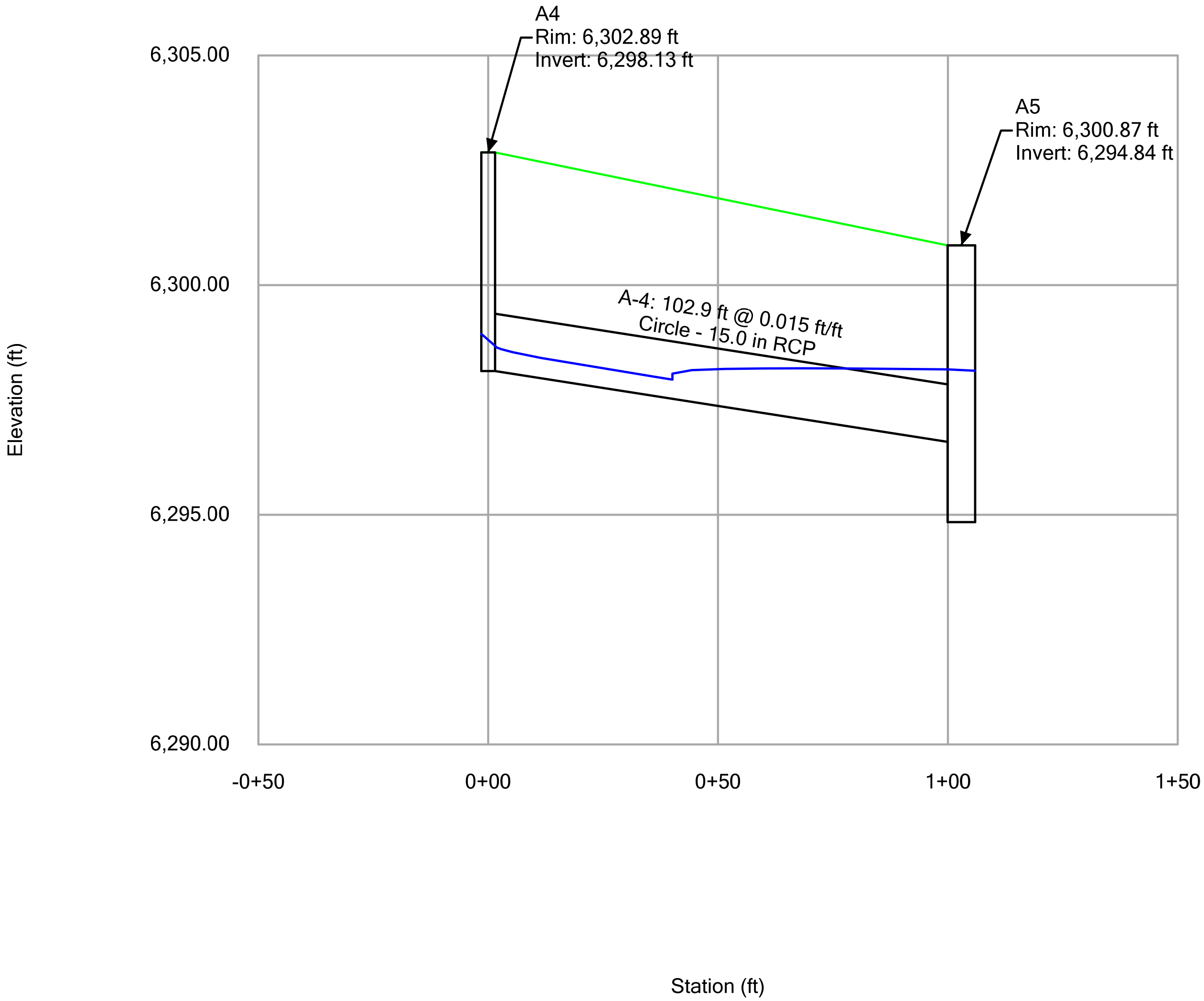


Aura at Crossroads

Profile Report

Engineering Profile - Storm Sewer AB (Crossroads - StormCAD - 2021-09-24.stsw)

Active Scenario: 100 YR

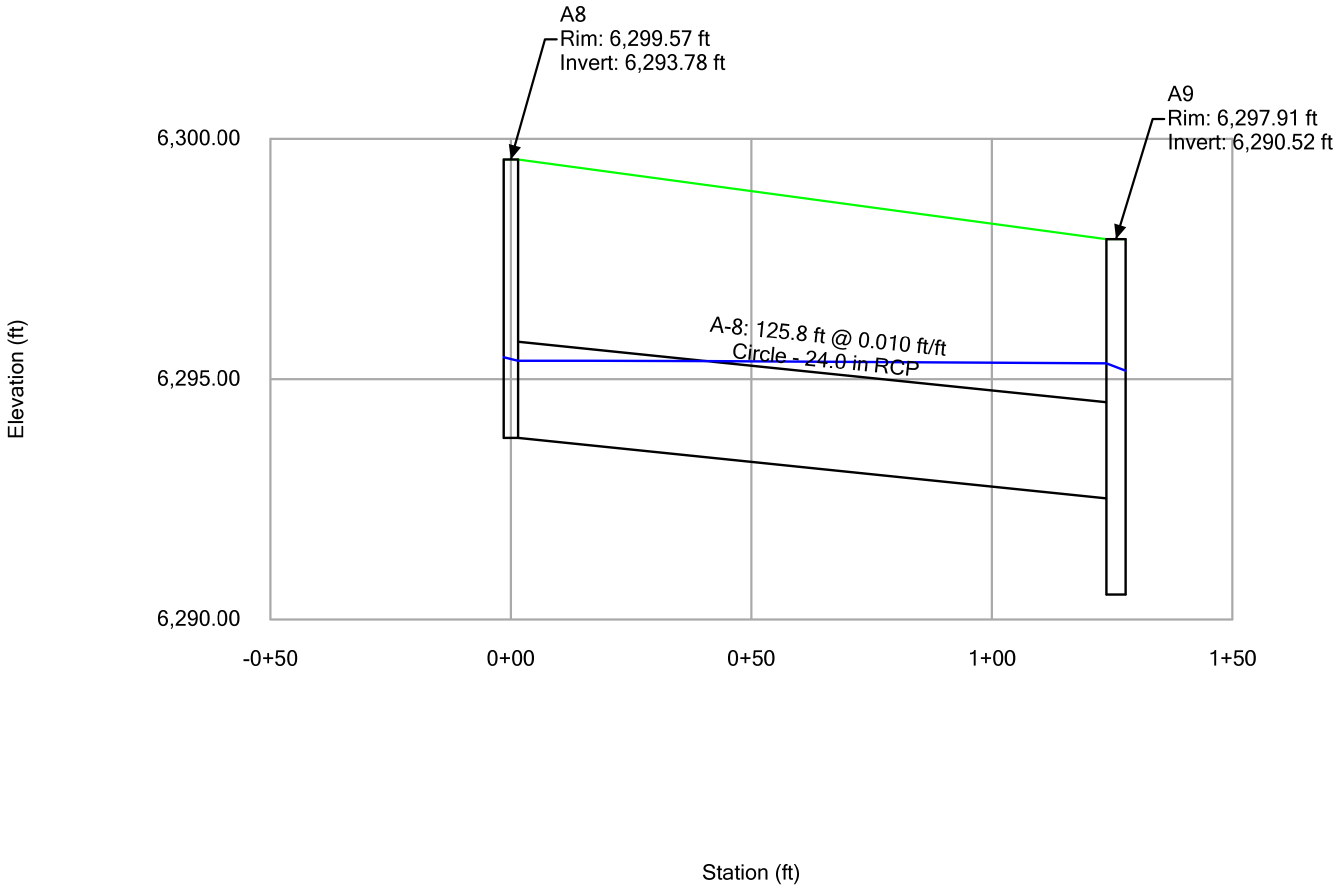


Aura at Crossroads

Profile Report

Engineering Profile - Storm Sewer AC (Crossroads - StormCAD - 2021-09-24.stsw)

Active Scenario: 100 YR

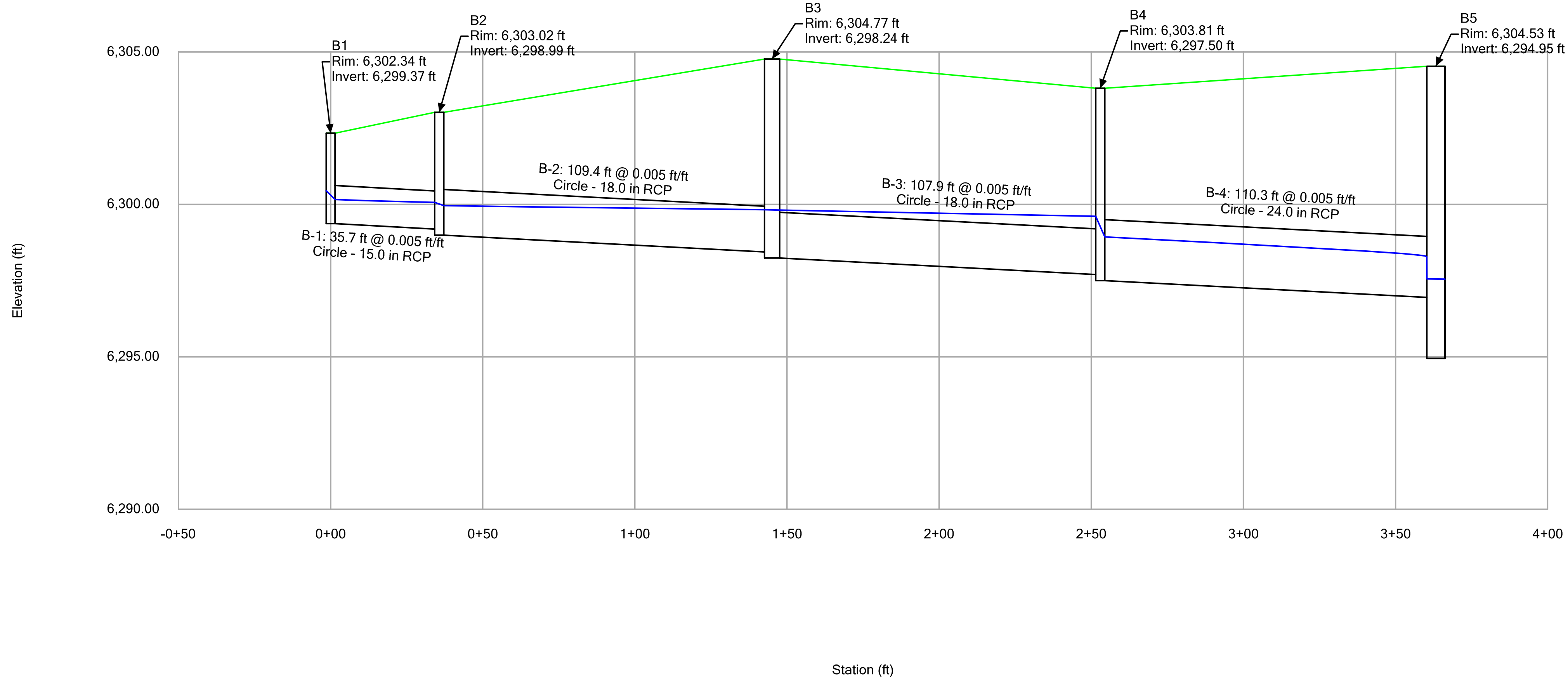


Aura at Crossroads

Profile Report

Engineering Profile - Storm Sewer B (Crossroads - StormCAD - 2021-09-24.stsw)

Active Scenario: 100 YR

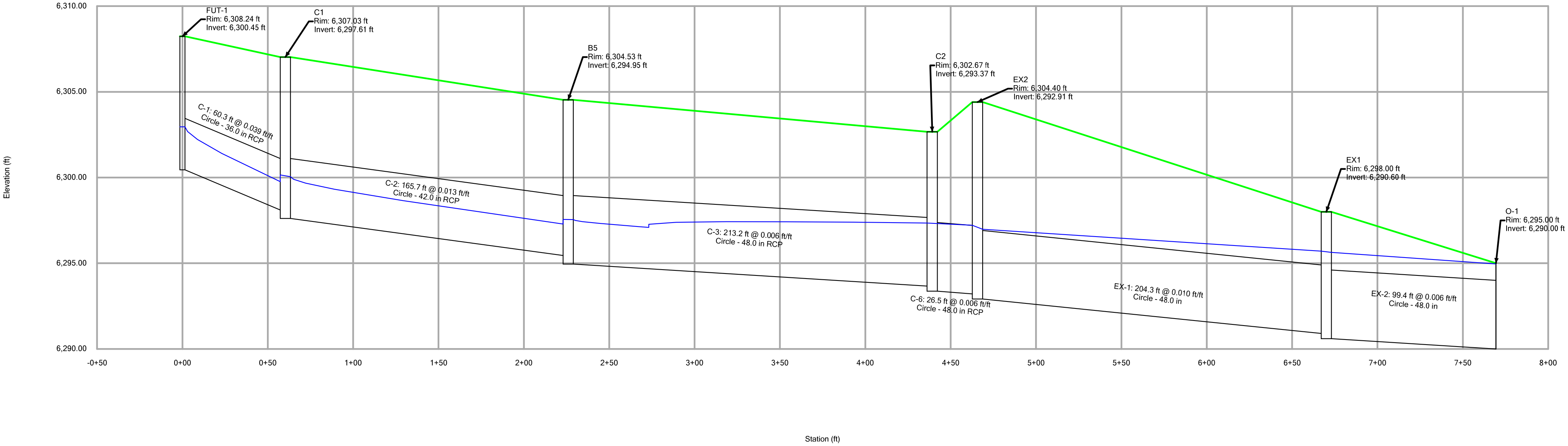


Aura at Crossroads

Profile Report

Engineering Profile - Storm Sewer C (Crossroads - StormCAD - 2021-09-24.stsw)

Active Scenario: 100 YR

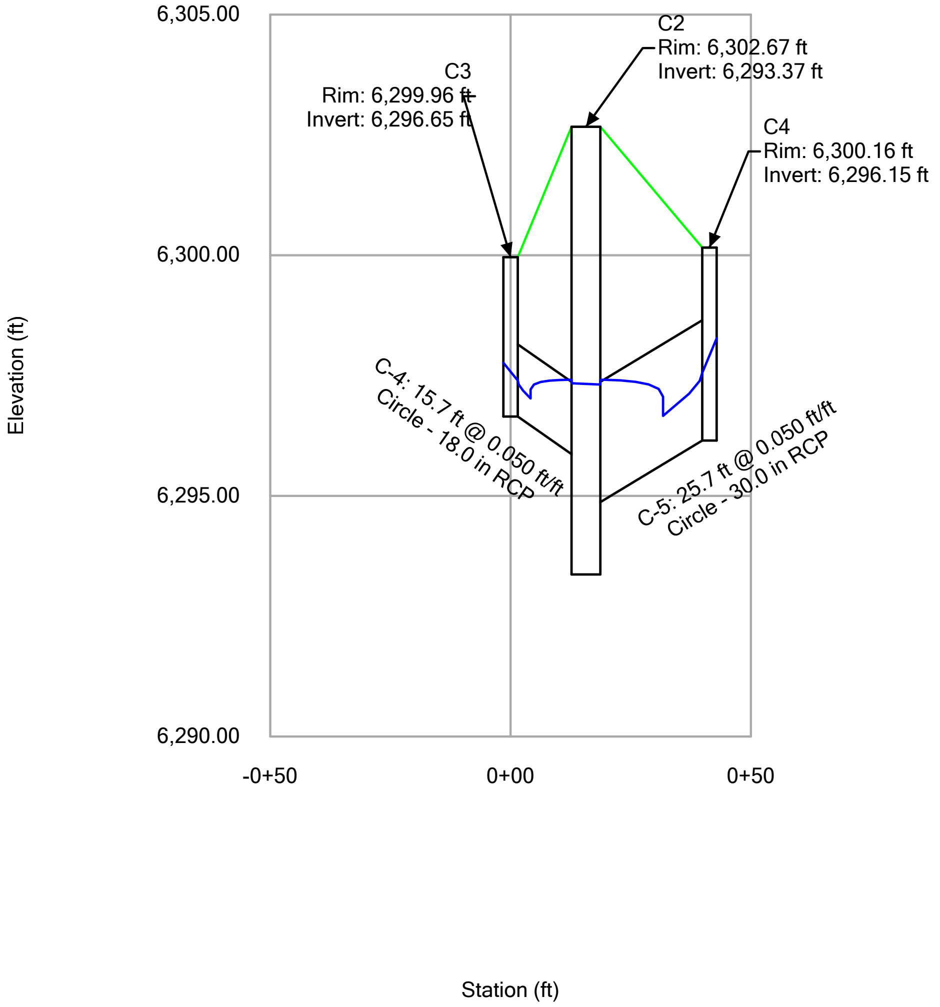


Aura at Crossroads

Profile Report

Engineering Profile - Storm Sewer CA (Crossroads - StormCAD - 2021-09-24.stsw)

Active Scenario: 100 YR

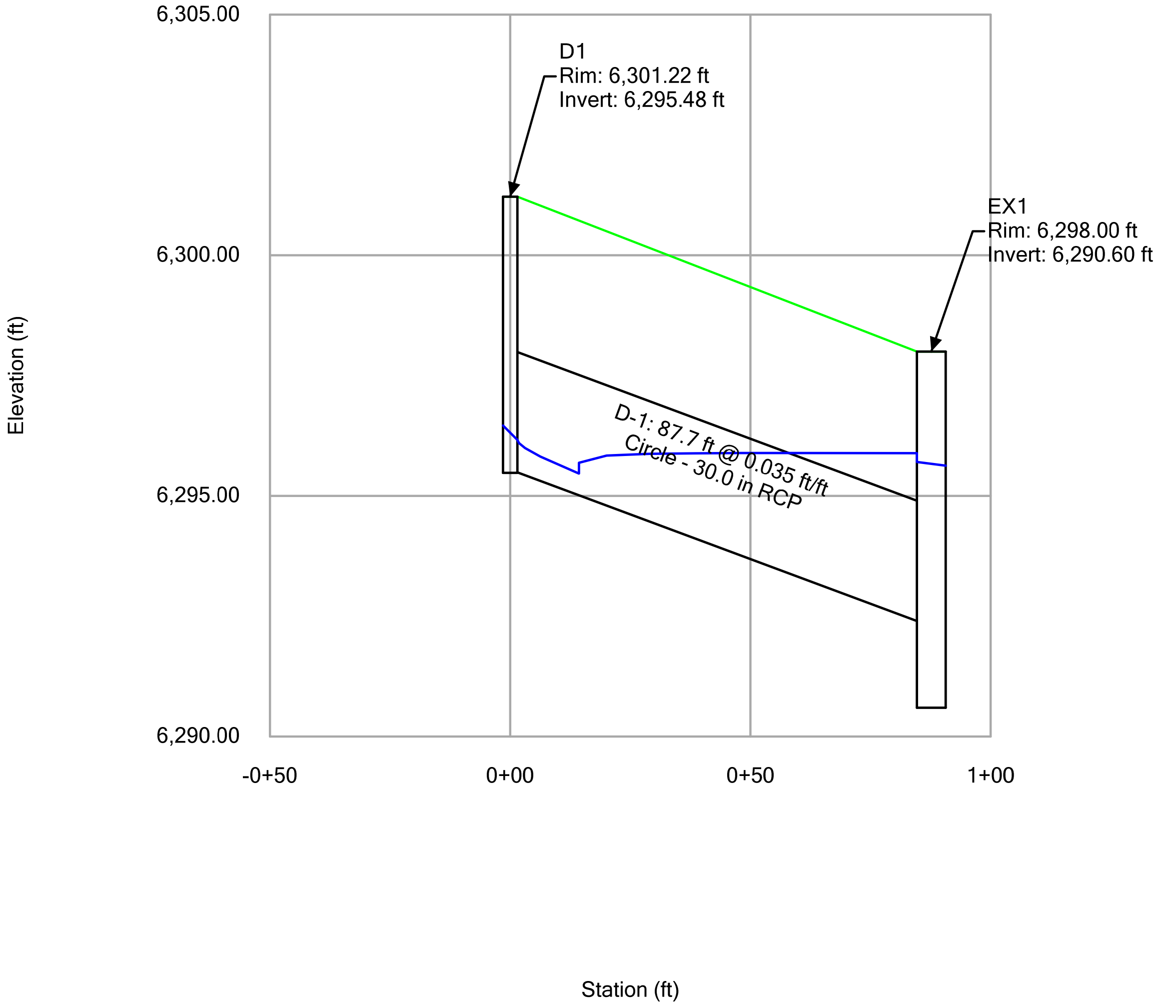


Aura at Crossroads

Profile Report

Engineering Profile - Storm Sewer D (Crossroads - StormCAD - 2021-09-24.stsw)

Active Scenario: 100 YR



Appendix D – Final Drainage Report for Crossroads Mixed Use

FINAL DRAINAGE REPORT

FOR

CROSSROADS MIXED USE FILING NO. 1
EL PASO COUNTY, COLORADO

FEBRUARY 2022

Prepared for:
Crossroads Metropolitan District No. 1
Mr. Danny Mientka
90 South Cascade Avenue, Suite 1500
Colorado Springs, Colorado Springs 80903

Prepared by:

CIVIL CONSULTANTS, INC.
212 N. Wahsatch Avenue, Suite 305
Colorado Springs, CO 80903
(719) 955-5485

Project #18-003A
PCD Filing No.: SF 21-029

FINAL DRAINAGE REPORT
FOR
CROSSROADS MIXED USE FILING NO. 1

DRAINAGE PLAN STATEMENTS

ENGINEERS STATEMENT

The attached drainage plan and report was 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.

____
Virgil A. Sanchez, P.E. #37160
For and on Behalf of M&S Civil Consultants, Inc

DEVELOPER'S STATEMENT

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

BY:____________________________________
Danny Mientka –Owner

DATE:____________________________

ADDRESS: The Equity Group LLC
90 South Cascade Avenue, Suite 1500
Colorado Springs, CO 80903

EL PASO COUNTY'S STATEMENT

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

BY:________________________________ DATE:____________________
Jennifer Irvine, P.E.
County Engineer / ECM Administrator

CONDITIONS:

FINAL DRAINAGE REPORT
FOR
CROSSROADS MIXED USE FILING NO. 1

TABLE OF CONTENTS

APPENDIX

FINAL DRAINAGE REPORT
FOR
CROSSROADS MIXED USE FILING NO. 1

Purpose

This Final Drainage Report for Crossroads Mixed Use Filing No. 1 is in support of the Final Plat, Preliminary Plan, and Construction Drawings of the subject site. This report functions to identify the existing and proposed runoff patterns and recommend proposed drainage improvements which are intended to safely convey runoff through the proposed development, while minimizing impacts to downstream facilities and adjacent properties.

The Final Plat and Construction Drawings for this site will be submitted concurrently with this report. Individual drainage letters and/or reports shall be required with the development of each lot not otherwise clearly analyzed by this report for Crossroads Mixed Use Filing No. 1. This report is subject to changes dependent upon future lot development. In such case, an updated report and accompanying drawings shall be submitted.

Project Location and Description

The subject site is located at 0 Meadowbrook Parkway in the southwestern quarter of Section 8, Township 14 South, Range 65 West of the 6th P.M. in El Paso County, Colorado. The 29.049 Acre site is currently undeveloped. The site is bound to the west by undeveloped Softball West Subdivision Filing No.2, to the north by Meadowbrook Crossing Subdivision, south by Highway 24, and to the east by Newt Drive.

The proposed site is will be developed into ten (10) commercial lots, one (1) multifamily residential lot, and three (3) tracts for detention and roadway use. The development will extend Meadowbrook Parkway to the west and will include a single lane roundabout to be constructed at the intersection of the Meadowbrook Parkway and Newt Drive. The property is within the commercial aviation district overlay. A rezone application has been approved to rezone 12.703 acres from CR to the RM-30 Zone.

The majority of the existing site is covered with native grasses with fair to good cover, the exception being portions of the future Meadowbrook Parkway corridor where exposed soils are present. Known earthwork operations for "borrow material" have occurred over a small area of the eastern portion of the site in early to mid 2019, but have since stabilized. A few dirt paths/trails are present along the far west end of the site, likely from recreational vehicles. Generally, the site slopes from east to west slightly greater than 1% with some localized depressions and general terrain undulations near the west boundary that have slopes ranging from 1- 20%. Some of these may be the results of previous earthwork activities. The site lies within the Sand Creek Drainage

Basin. No existing drainage facilities or improvements are onsite. No known irrigation systems or wells are present.

Soils

Soils in the project area have been determined to be Blakeland Loamy Sand (8) and Blendon Sandy Loam (10), which are characterized to be part of Hydrologic Soil Types "A" & "B" as determined from the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) "Web Soils Survey". A soils map illustrating the site location and soil types is provided in the appendix of this report.

Floodplain Statement

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Nos. 08041C0754 G & 08041C0752 G, effective date December 7th, 2018, none of the site lies within a designated floodplain. A copy of these annotated maps can be found in the appendix. The Sand Creek East Fork Channel is located to the northwest of the adjacent Meadowbrook Crossing subdivision.

Previous Studies

The area which encompasses Crossroads Mixed Use Filing No. 1 has been previously studied. Below is a short outline of the assumptions regarding the lands of the subject site and those based upon the previously assembled and approved drainage reports and how the assumptions within them impact the subject site.

"Sand Creek Drainage Basin Planning Study, Preliminary Design Report", prepared by Kiowa Engineering Corporation, dated January 1993, revised March 1996.

- Establishes that the subject site falls within the East Fork Sand Creek Drainage Basin, a portion of the larger Sand Creek Watershed
- Establishes that there are no requirements for major infrastructure improvements and subsequently no drainage-improvement related reimbursements with the development of this parcel
- Drainage fees shall be required to plat the subdivision

"Claremont Business Park Filing No.2 prepared by Matrix Design Group, revised November 2006

- Establishes the drainage patterns of offsite Basins 0S-4 and E2 which are to be conveyed within the Meadowbrook Rights of Way
- Established up-gradient offsite drainage to be directed under Meadowbrook north to offsite East Fork Sand Creek Channel, and away from the subject site

"Final Drainage Report, Lot 1 24/94 Business Park Filing No.1 prepared by Core Engineering Group, dated July 14, 2016

- The development of the 24/94 Business Park FDR shows future curb inlets along the future Meadowbrook Parkway extension on the south and west corners of the intersection to capture runoff from up-gradient watersheds in addition to a proposed inlet which was to be located above the intersection at the northwest corner of the subject site.
- Establishes that flows from the parcel upstream of the convenience store (29/94 FDR Basin OS4) EX-B now to be collected by the extension of a 36" RCP along the south side of Meadowbrook Parkway. Runoff within the right of way/roadway separated out as Basin EX-A2.
- Continues assumption that flows from Newt Drive be conveyed north to East Fork Sand Creek.
- Evaluated pre-development drainage patterns for subject site including direct discharge flow rates to the CDOT rights of way of 1.9 and 14.5 cfs for the 5 and 100 year events, respectively. (Basin EX-E).

"Preliminary and Final Drainage Report Meadowbrook Crossing Filing No. 1 and Filing 2, El Paso County, Colorado prepared by Kiowa Engineering Corporation, dated July 25, 2017

- Proposed the installation of a future 10' Type R inlet at the southeast corner of Newt Drive and Meadowbrook Parkway with the extension of Meadowbrook Parkway to the west (along the northern boundary of the subject site). The inlet was to function to collect offsite runoff from a portion of the south half of Meadowbrook Parkway and Newt Drive north of Hwy 24. Intercepted runoff would be conveyed via a proposed 24" storm sewer to the existing storm sewer system within the Meadowbrook Crossings development.
- Proposed the installation of a 10' Type R inlet at the west end of future Meadowbrook Parkway. The inlet was to collect runoff from the north half of the future roadway. An 18" storm drain was proposed to convey collected runoff to the existing water quality pond located within the Meadowbrook Crossings Development. The report indicates a separate forebay or the modification of an existing forebay would be required.
- Shifted the location of the existing 10' Type R curb inlet to be installed upstream of the intersection of Newt Drive (as shown with the 24/94 Business Park FDR), flows in excess of the inlet capacity are to continue within the future Meadowbrook.

"Final Drainage Report for Meadowbrook Dirt Borrow Site, El Paso County Colorado, prepared by M&S Civil Consultants, November 2018.

- Evaluated onsite drainage patterns
- Excluded offsite runoff impacts from areas to the east of site.
- Allowed site to be utilized as a "borrow site" for offsite earthwork activities.

Hydrologic Calculations

Hydrologic calculations were performed using the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual and where applicable the Urban Storm Drainage Criteria

Manual. The Rational Method was used to estimate stormwater runoff anticipated from design storms with 5-year and 100-year recurrence intervals.

Hydraulic Calculations

Hydraulic calculations were estimated using the Manning's Formula and the methods described in the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual. Grassed swale cross sections were analyzed using an open channel flow calculator with parameters such as a surface roughness coefficient of 0.025 (good condition w/ little to no stones or weeds). Topographical information was used to define swale geometry, and design point flows were used to obtain channel flow depths and velocities at their maximum design capacity for flood and erosion control considerations. Storm drains were designed using parameters and criteria summarized in Chapter 8 of El Paso County's Drainage Criteria Manual Vol. 1 and the City of Colorado Springs Drainage Criteria Manuals. Parameters such as Manning's values of 0.13 were used for concrete pipe flow, and design considerations for minimum freeboard and maximum velocities were applied. The relevant data sheets are included in the appendix of this report. Hydraulic grade line calculations for the storm system in the ultimate (future) condition are provided in the Appendix of this Final Drainage report.

Drainage Criteria

This drainage analysis has been prepared in accordance with current El Paso County Drainage Criteria Manual and, where applicable, City of Colorado Springs and Mile High Flood District Criteria Manuals. Calculations were performed to determine runoff quantities for the 5-year and 100-year frequency storms for developed conditions using the Rational Method as required for basins having areas less than 100 acres. See Appendix for supporting calculations.

Historic (Pre-Grading) Drainage Characteristics

The historic drainage patterns discussed within this report reflect the site conditions prior to the approval of the 2018 Meadowbrook Dirt Borrow Site Grading and Erosion Control Plan. This 'historic condition' generally coincides with the existing condition analysis and mapping that accompanied that project's hydrologic analysis.

The following excerpt is from the existing Drainage Characteristics section of the Final Drainage Report for Meadowbrook Dirt Borrow Site, El Paso County, Colorado, by M&S Civil Consultants and adequately describes the general site characteristics prior to grading.

"Site vegetation is sparse, consisting primarily of native grasses and weeds. The parcel possesses a ridgeline that bisects the parcel, directing runoff to the south and west boundaries, with slopes varying from 1% to 20%. A few small depressions are located on site, near the west boundary. For the purposes of hydrologic analysis, the small depressions are not considered to detain runoff."

Given the increase in breadth and scope of this study, significant consideration of the impacts of offsite drainage from the adjacent developments will be evaluated. This includes drainage from a small portion of Hwy 24 which combines with flows within existing from portions of Newt Drive. Runoff from this offsite area combines with by-pass flows from two inlets located within existing Meadowbrook Drive, prior to entering the site at its northeast corner. Runoff from these locations ultimately combines with onsite flows within the proposed Meadowbrook Parkway corridor, prior to discharging to downstream properties.

The detailed description of the historic (pre-grading) condition is as follows. Please refer to the historic conditions drainage map which is provided within the appendix of this report.

Historic Conditions - Detailed Drainage Discussion

Design Point 1

Basins E2 and EX-A2 geometry were derived from their respective reports. Flow velocity equations, conveyance coefficients, and time of concentration equations have been modified since these reports were approved, therefore, these parameters were remodeled with El Paso's hydrologic criteria current to this report's date. Excerpts of reported calculations for these basins are provided in the Appendix for comparison. **Basin E2 (Claremont Business Park Filing No.2)** consists of a reported 3.86 developed acres of development located along the southeastern half of existing Meadowbrook Parkway, some 1200' northeast of the subject site. Runoff produced by the offsite development (CBPF2 Lot 46) is conveyed to Meadowbrook Parkway at flow rates of Q5=15.1 and Q100=28.6 cfs in the 5 and 100-year storm events respectively. The collected flows combine with runoff from **Basin EX-A2 (Lot 1 24/94 Business Park Filing No.1)** (Q5=2.5, Q100=4.5 cfs) which consists of 0.59 acres of the southeastern half of Meadowbrook Parkway, and is located immediately east of existing Newt Drive. The collected flows from the two basins culminate at **Design Point 1** at peak rates of Q5=14.2 and Q100=26.5 cfs. An existing 10' CDOT Type R at-grade inlet (**Inlet 1**) intercepts flows of Q5=8.4 and Q100=11.1 cfs, with subsequent by-pass flows of 5.8 and 15.4 cfs in the 5 and 100 year events. Surface flows continue west within the south half of existing Meadowbrook Parkway.

Design Point 2

Basin OS-A (Meadowbrook Crossing Filing 1 and 2) consists of 1.29 acres of the northern half of existing Meadowbrook Parkway located immediately east of Newt Drive. Runoff produced within this basin totals Q5=3.1 and Q100=6.0 cfs. These calculated flows differ 0.1 cfs from reported flows due to the significant digits used for the basin acreage in the flow calculation, yet can be viewed as conservative values since they are higher. An existing 10' CDOT Type R at grade inlet (**Inlet 2**) collects runoff of Q5=3.1 and Q100=5.3 cfs, with subsequent by-pass flows in only the 100 year event of 0.7 cfs. Runoff leaving the design point continuing west within the north half of existing Meadowbrook Parkway.

Design Point 3

Basin OS-1 consists of approximately 1.28 developed acres of existing Newt Drive located along the eastern boundary of the site. Runoff produced within the basin (Q5=5.8 cfs, Q100=10.5 cfs) combine with flow-by from **DP1** in the intersection at peak flow rates of 9.8 cfs, and 22.5 cfs in the 5 and 100-year storm events.

Surface runoff and by-pass flows from both **DP2** and **DP3** enter **Basin A** in the undeveloped rights of way of future Meadowbrook Parkway, at the northeast corner of the site.

<u>Design Point 4</u>

Basin A consists of 12.88 undeveloped acres located along the northern boundary that drains from east to west across the subject site. Runoff produced by this basin (Q5=1.9 cfs, Q100=14.2 cfs) combine with flowby from **DP2** and flows from **DP3.** The cumulative runoff at **DP4** of Q5=7.4 cfs and Q100=27.7 cfs discharges onto the adjacent property (Lot 1, Softball West Subdivision 2) along the western boundary of the site, approximately 250' to south of the northern property line.

<u>Design Point 5</u>

Basin B consists of 13.63 undeveloped acres located along the western side of the subject site. Runoff produced by the basin generally flows from northeast to southwest, discharging onto the adjacent property (Lot 2, Softball West Subdivision 2) approximately 200' north of the southern property line. Runoff reaching the boundary at **DP5** are calculated at 2.5 cfs and 18.2 cfs in the 5 year and 100 year events, respectively.

<u>Design Point 6</u>

Basin C currently consists of 5.89 undeveloped acres located along the southern boundary of the site. Runoff produced within the basin travels east to west as sheet flow before eventually discharging into the existing barrow ditch which travels along the US HWY 24 CDOT right of way**.** Peak runoff rates reaching the subdivision boundary at **DP6** are calculated at 1.2 cfs and 8.5 cfs in the 5 year and 100 year events respectively.

<u>Design Point 7</u>

Basin OS-2 consists of 4.98 acres of a portion of the northern half of the US HWY 24 roadway and the adjoining, native, grass-lined barrow ditch. Runoff produced within the basin (Q5=8.7, Q100=19.6 cfs) combines with flows from **DP6** at cumulative peak runoff rates of 10.4 and 31.9 cfs in the 5 and 100 year storm events at **DP7**. A modeled hydraulic cross section of the ditch section at **DP7** calculates flow depths of 0.59 feet traveling at a velocity of approximately 4.02 feet per second. Input parameters for this analysis can be found in the Hydraulics section of the Appendix. The roadside ditch at this design point was selected as the suitable downstream outfall, therefore, intermediate events have been routed through the site to compare predevelopment to post development flows at this point. Calculations are provided in the Roadside Ditch Intermediate Events Routing Summary in the appendix.

Runoff from **Design Points 4 and 5** ultimately combine with the flows from **DP7** within the barrow ditch of US Hwy 24 several hundred feet downstream of the subject site. An existing 36" RCP culvert located at the interchange of HWY 24 and Peterson Road aids in conveying a portion of the runoff from the subject site and adjacent offsite areas under the roadway. Flows in excess of the culverts carrying capacity, overtop the roadway before rejoining within a subsequent drainage swale that parallels the west bound HWY 24 on-ramp. Ultimately flows discharge into the East Fork of the Sand Creek via an existing riprap rundown. Site visits conducted by M&S Civil at the time of the writing of this report, found no significant signs of erosion or deposition along the aforementioned corridor.

A Drainageway Exhibit in the appendix of this report provides an aerial illustration of the aforementioned conveyance route to the channel, which will also serve to function as the emergency overflow path for the proposed site development.

Existing Drainage Characteristics

The subject site has been utilized as a "borrow site" to provide surplus earthwork to offsite developments in the area. This recent grading effort occurred during the spring and summer of 2019. At the request of El Paso County, an existing conditions drainage analysis has been provided to show the changes to the topography and drainage patterns as a result of this effort. As the only changes between the two conditions are onsite, the offsite drainage patterns calculations and assumptions determined within the historical analysis will remain the same. Specifically, basins **E2**, **EX-A2**, and **OS-2** remained the same. This correlates to **DP1**, **DP2**, and **DP3** remaining the same. It should be noted that the subject site was not disturbed to the full extent of the approved plan, with limited excavation primarily occurring within the eastern side of the site.

In the existing condition, vegetation remains sparse, consisting primarily of native grasses and weeds with good to fair cover. Areas disturbed by grading activities were reseeded and have since stabilized. With regards to historic versus existing drainage basin delineation, the bisecting parcel ridgeline has been relocated further to the south, which results in redirecting more of the runoff to the southwestern part of the site and less to the CDOT rights of way. The few small depressions remain on site, near the west boundary. For the purposes of hydrologic analysis, these small depressions will continue to not be evaluated for their ability to detain runoff. Ultimately, all runoff from the parcel is conveyed to the west towards existing drainage facilities located under Peterson Road and ultimately the East Fork of Sand Creek as in the historic condition.

This section only discusses the changes in basin geometry and drainage pattern and provides a direct comparison of the historic versus existing conditions, utilizing the same outfall (design) points, which have remained undisturbed.

Design Point 4

Basin A (Q5=1.5, Q100=11.1 cfs) currently consists of 11.02 acres which continues to drain from east to west eventually discharging along the western boundary of the site, approximately 250' south of the northern property line. Peak runoff, post-grading, has decreased to 7.1 and 25.5 cfs as compared to the historic condition flow rates of 7.4 and 27.7 cfs in the 5-year and 100-year events respectively.

Design Point 5

Basin B (Q5=2.0, Q100=14.5 cfs) consists of 17.31 acres that drains from northeast to southwest, eventually discharging along the western boundary of the site, approximately 200' north of the southern property line. Peak runoff rates at this location are also than lower than the historic conditions with post grading flows of 2.0 cfs and 14.5 cfs, as compared to 2.5 cfs and 18.2cfs in the 5-year and 100-year events respectively. Despite the basin currently being larger in area than in the historic condition, a decrease in the peak flow rates occurs as a result of a longer flow path to the given design point.

Design Point 6

Basin C consists of 3.99 undeveloped acres that drains from east to west into the US HWY 24 Right of Way at the southern boundary of the site. The peak runoff at this location is less than the historic condition at an estimated 0.9 and 6.3 cfs, as compared to 1.2 and 8.5 cfs in the 5-year and 100-year events, respectively.

Design Point 7

Basin OS-2 (Q5=8.7, Q100=19.6 cfs) consists of 4.98 acres of the northern half of the US HWY 24 roadway and adjoining native grass lined barrow ditch. Runoff produced within the basin combines with runoff from the subject site at lower cumulative peak runoff rates of 9.9 and 28.0 cfs in the 5 and 100-year storm events at **DP7** as compared to 10.4 and 31.9 cfs in the historic condition. A cross section of the ditch at this location was analyzed in the 100 yr event for comparison purposes and is provided in the appendix.

Four Step Process

Step 1 **Employ Runoff Reduction Practices** – Approx. 2.54 acres of the proposed development is being set aside for a Full Spectrum Detention (FSD) Pond. Whenever possible, runoff produced within developable area containing impervious surfaces will be routed through landscaped areas or earthen swales (grass-lined where slope exceeds 2%) to minimize direct connection of impervious surfaces. In the interim, runoff will be reduced through the use of (4) temporary sediments ponds until the ground has been stabilized with vegetation or permanently developed.

Step 2 **Stabilize Drainageways** – The development of this site is not anticipated to have negative effects on downstream drainage ways since flows released will be below historic rates. In the interim, the site proposes four temporary sedimentation ponds, before discharging at the southwest property corner of the site and onto an adjacent undeveloped property via riprap-lined spillways. This ensures that in this stage of the development negative effects on the downstream drainage ways will be avoided.

In the proposed and future conditions, the flow is discharged to the same location offsite through an RCP pipe outfall lined with rip rap. From here it continues southwest in CDOT's man-made roadside ditch until it reaches Peterson Road. It is then conveyed to the other side of the road, into a similar earthen channel, via a 36" CMP culvert. The drainage continues southwest in the right of way, until it reaches the East Fork Sand Creek Channel. Existing rip rap barriers are lined throughout this portion of the pathway approximately every 90-100 feet within the ditch to the channel bank. The Drainageway Exhibit provided in the Drainage Maps section of the Appendix provides a visual representation of this information. Roadside ditch calculations for various storm events are provided for the selected suitable downstream outfall (project site's discharge location) to ensure the facility can adequately contain and convey the flows.

Step 3 Provide Water Quality Capture Volume (WQCV)– The site will use a Full Spectrum Detention (FSD) Pond to control developed runoff that is discharging into an existing CDOT ROW roadside ditch and ultimately into Sand Creek. The FSD pond's outlet structure will be designed to drain the water quality event storm in 40 hours, while reducing the 100 year peak discharge to approximately 90% of the predevelopment conditions.

Step 4 Consider Need For Selecting Industrial And Commercial BMP's – The proposed development will implement a Stormwater Management Plan including property housekeeping practices, spill containment procedures, and coverage of storage/handling areas. Specialized BMP's are not required since the vertical development of the commercial areas are unknown at this time.

Future Drainage Characteristics

The future site will be developed into ten (10) commercial lots, one (1) multifamily residential lot, and three (3) tracts for detention and roadway use. The proposed development will extend Meadowbrook Parkway to the west and will include a single lane roundabout to be constructed at the intersection of the Meadowbrook Parkway and Newt Drive to aid in traffic control. A proposed private looped roadway, consisting of Southern Rail Point and Pacific Rail Point will extend into the site to provide access and a utility corridor to both the commercial and residential developments. At this time, it is anticipated that the development and design of Lot 11 (by others) is planned to occur concurrently with the construction of the proposed utilities and infrastructure provided by this plan. A separate drainage letter or report will be required for that portion of the development.

The following summary generalizes the proposed drainage patterns and drainage improvements required to safely route developed runoff to downstream facilities.

A storm sewer pipe and inlet will be constructed at the southwest corner of the newly constructed roundabout to aid in collecting runoff reaching the site from offsite watersheds. These facilities will connect to the existing system located inside the existing Meadowbrook Subdivision. Bypassed flows and developed flows within the newly constructed Meadowbrook Parkway will be collected by a pair of sump inlets located at the west end of the roadway. The drainage facilities located with the rights of way will be public and all remaining onsite storm sewer and drainage improvements shall be private. A future, private, looped roadway will provide access and utility corridors for development. Private storm sewer mains, stubs, and inlets will be extended along these corridors to serve the development. The extension of these facilities beyond what is shown by this plan is likely with future development. Runoff collected by the infrastructure will be conveyed to a single full spectrum detention pond located in the southwest corner of the subdivision. The proposed outfall from the pond is planned to discharge into the existing barrow ditch located with the north half of the existing CDOT Right of Way. A drainage easement will be required from CDOT for the outfall and slope protection facilities that fall within the corridor. It should be noted that the storm outfall will be shaped into the existing hillside and any soil riprap protection will be buried. Runoff leaving the site and entering the CDOT corridor will discharge at less than historic rates. The previous discharge points along the west boundary of the subject site, which also previously contributed to the barrow ditch will be virtually eliminated, further reducing the peak flow rates to downstream facilities.

Future Detailed Drainage Discussion

Design Point 1

Basin E2 (Claremont Business Park Filing No.2) consists of a reported 3.86 developed acres of development located along the southeastern half of existing Meadowbrook Parkway some 1200' northeast of the subject site. Runoff produced by the offsite development (CBPF2 Lot 46) is conveyed to Meadowbrook Parkway at flow rates of Q5=15.1 and Q100=28.6 cfs in the 5 and 100-year storm events respectively. The collected flows combine with runoff from **Basin EX-A2 (Lot 1 24/94 Business Park Filing No.1)** (Q5=2.5, Q100=4.5 cfs) which consists of 0.59 acres of the southeastern half of Meadowbrook Parkway located immediately east of existing Newt Drive. The collected flows from the two basins culminate at **Design Point 1** at peak rates of Q5=14.2 and Q100=26.5 cfs. An existing 10' CDOT Type R at-grade inlet (**Inlet 1**) intercepts flows of Q5=8.4 and Q100=11.1 cfs, with subsequent by-pass flows of 5.8 and 15.4 cfs in the 5 and 100 year events. Surface flows continue west within the south half of existing Meadowbrook Parkway.

Design Point 2

Basin OS-A (Meadowbrook Crossing Filing 1 and 2) consists of 1.29 acres of the northern half of existing Meadowbrook Parkway located immediately east of Newt Drive. Runoff produced within this basin totals Q5=3.1 and Q100=6.0 cfs. An existing 10' CDOT Type R at grade inlet (**Inlet 2**) collects runoff of Q5=3.1 and Q100=5.3 cfs, with subsequent by-pass flows in only the 100 year event of 0.7 cfs. Runoff leaving the design point continuing west within the north half of existing Meadowbrook Parkway.

Design Point 3

In accordance with the assumptions outlined within the Meadowbrook Subdivision Final Drainage Report, an offsite public storm sewer pipe and inlet will be constructed at the southwest corner of the proposed roundabout to aid in collecting runoff from a portion of the offsite watershed located to the east of the site. A new manhole is not anticipated to be required to connect the outfall to the existing pipe located inside the existing Meadowbrook Subdivision. As this area is already paved, increases to the imperviousness of this area are not anticipated.

Basin OS-1 consists of approximately 1.40 acres of existing Newt Drive that will be retrofitted with new raised median as part of an intersection conversion to a roundabout. Runoff produced within the basin (Q5=6.4 and Q100=11.5 cfs) will combine with flow-by from **DP1** at peak rates of Q5=10.2 and Q100=23.3 cfs at a proposed public 10' at-grade inlet (**Inlet 3**: Q5=6.7, Q100=9.8 cfs intercepted; Q5=3.5, Q100=13.5 cfs flowby) located at **DP3**. A proposed public 24" storm sewer (**PR1**) will convey water across the intersection to the existing 42" storm sewer with Meadowbrook Crossings in accordance with that subdivision's drainage report. The existing manhole connection has been determined to be sufficient following construction of this proposed inlet and storm sewer. It is important to note that this connection also remains feasible as the roundabout is not anticipated to significantly increase the overall imperviousness of the area above that of the existing condition. Runoff in excess of the inlet capacity will continue westward via the curb and gutter of Proposed Meadowbrook Parkway.

<u>Design Point 4</u>

Basin A consists of 1.67 acres of the north half of proposed Meadowbrook. Runoff within this basin (Q5=6.5 and Q100=11.6 cfs) combines with flow by from **DP2** for total flows of 6.5 and 12.4 cfs in the 5 year and 100 year events, respectively. A proposed 15’ at-grade inlet (**Inlet 4:** Q5=6.5, Q100=10.6 cfs intercepted; Q5=0.0, Q100=1.8 cfs flowby) is located at the west end of the roadway just before the proposed temporary cul-de-sac. This inlet conveys intercepted flows to **PR1.5**, a proposed 24” RCP public storm sewer. Flowby from the 100 year event continues west to downstream infrastructure.

<u>Design Point 4.5</u>

1.8 cfs of flowby in the 100 year event continues west from **DP4** towards **Inlet 4.5**, a **NEENAH R-2501 Type C Grate** lid and frame at the low point of the cul-de-sac. Supporting calculations for this non-standard inlet are provided in the Appendix. This inlet is anticipated to reach a maximum depth of 0.5’ in order to convey this flow underneath the roadway via a proposed public 24” storm sewer (**PR2**). The NEENAH inlet is to be removed and replaced with a standard CDOT 5’ Type R inlet when the roadway cul de sac is removed and the roadway is extended to the west with future development. In the case of inlet clogging, overflow will collect at **DP5**, which has an additional 13.3 cfs capacity.

<u>Design Point 5</u>

Basin B consists of 1.48 acres of the south half of proposed Meadowbrook Parkway. Runoff produced within this basin (Q5=5.8 and Q100=10.3 cfs) combines with flow-by leaving **DP3** at peak flowrates of Q5=9.8, Q100=25.8 cfs. A proposed public 15’ sump inlet (**Inlet 5:** Q5=9.8, Q100=25.8 cfs intercepted; no flowby) located at west end of the roadway will prevent developed flows from leaving exiting the roadway corridor. The intercepted runoff will combine with **PR2** flows in a 36” private storm sewer system (**PR3, by others**). Combined flows within the proposed system are calculated to reach peak rates of 16.2 and 37.9 cfs. The storm sewer system is to be planned by others through the multi-family site (Lot 11) but ultimately will tie back into the system at **DP15**. In case of inlet clogging, overflows will overtop the curb on the southern side onto the apartment site and be conveyed to the swale on the west side of the site.

<u>Design Point 6</u>

Basin C (Q5=18.7, Q100=34.5 cfs) consists of 4.61 acres of commercial lots (1-5 and portions of lot 6) located along the east side of the site. Earthen swales are proposed to convey flows along the basin edge to the proposed depression. Rip rap (Type H, D50=1.5 ft, 3’ thickness) is proposed at the terminus and will protect the slopes of the depression. A future private 30” storm sewer (**PR4-PR7**) is provided to collect and convey flows of Q5=18.7 and Q100=34.5 cfs in the 5 and 100-year storm event, respectively. **PR4.5** is a 30” private stub provided to assist in intercepting flows from future development of the commercial lots, and therefore does not receive any flows in this condition.

Intercepted flows are conveyed west underground within the roadway tract. Rip rap sizing was determined with the use of the Steep Slope Rip Rap Design charts from the Surface Mining Water Diversion Manual and is provided in the appendix. Flow to the depression considered the 2:1 longitudinal slope into the depression, 2:1 side slopes in the depression, and was assumed to spread and encompass a 6' base width at the entry point of the depression from the swale. The rip rap sizing at this design point was conservatively used at other depressions around the site due to having the largest flow accumulation.

Design Point 7

Basin D consists of 2.22 acres of commercial lots located between Meadowbrook Parkway and the looped roadway. **Basin D**, which includes portions of Lots 9 and 10, will require a private 24" storm drain (**PR8**) to collect peak flows of Q5=9.3 and Q100=17.0 cfs from this basin in the 5 and 100 year storm events, respectively. Earthen swales are proposed to convey flows along the basin edge to the proposed depression. Rip rap (Type H, D50=1.5 ft, 3' thickness) is proposed at the terminus of the swale and will protect the slopes of the depression. Rip rap was conservatively sized using **DP6's** analysis.

Design Point 8

Basin E (Q5=4.1, Q100=7.4 cfs) consists of 1.04 acres of commercial lots and roadway located in the central portion of the site. A private 10' CDOT Type R at-grade inlet (**Inlet 6:** Q5=4.0, Q100=6.0 cfs intercepted; Q5=0.1, Q100=1.4 cfs flowby) is located on the north side of the roadway to intercept flows. Runoff bypassing this inlet continues to downstream infrastructure. Flows collected from the inlet combined with **PR8** and are conveyed to a box base manhole in the middle of the planned roadway via a private 30" (**PR9**) storm drain.

Design Point 9

Basin E1 (Q5=6.4, Q100=11.7 cfs) consists of 1.67 acres of commercial lots and roadway located in the central portion of the site. A private 10' CDOT Type R at-grade inlet (**Inlet 7:** Q5=5.5, Q100=7.7 cfs intercepted; Q5=0.9, Q100=4.0 cfs flowby) is located on the south side of the roadway to intercept flows. Runoff bypassing this inlet continues to downstream infrastructure. Flows collected from the inlet are conveyed to a box base manhole in the middle of the planned roadway via a private 18" (**PR10**) storm drain. **PR7** and **PR9** also collect at this junction. A proposed 36" private storm sewer (**PR11**) will then convey flows west underground at peak flow rates of 35.0 and 60.5 cfs in the 5 and 100-year events. **PR12**, a 42" private storm sewer, then directs the system south from another manhole. Pipe flows from the proposed apartment site (**PR11.5**, private 30" RCP) combine with **PR12** in **PR12.5**, a proposed private 48" storm drain.

Design Point 10

Basin G (Q5=2.1, Q100=3.8 cfs) consists of 0.46 acres of multi-family lots and roadway located in the central portion of the site. A private 10' CDOT Type R sump inlet (**Inlet 8**: Q5=2.1, Q100=3.8 cfs; no flowby) located on the west side of the street functions to collect the runoff from **Basin G. PR13**, a proposed 18" private storm sewer, will direct runoff east to a box base manhole at peak flow rates of 2.1 cfs and 3.8 cfs in the minor and major storm events, respectively. In the case of inlet clogging, overflow is directed to the swale at **DP13**.

<u>Design Point 11</u>
Basin G1 (Q5=2.8, Q100=5.0 cfs) consists of 0.60 acres of commercial lots and roadway located in the central portion of the site. A private 15' CDOT Type R sump inlet (**Inlet 9:** Q5=3.7, Q100=15.3 cfs intercepted; no flowby), located on the east side of the street functions to collect the runoff from **Basin G1** as well as bypass flows from **DP8 and DP9**, totaling Q5=3.7 and Q100=15.3 cfs. **PR14**, a proposed 30" private storm sewer, will direct runoff west to an underground box base manhole at peak flow rates of 3.7 cfs and 15.3 cfs in the minor and major storm events, respectively. From the junction, flows from **PR12.5**, **PR13**, and **PR14** combine at **PR15** (Q5=48.0, Q100=93.7 cfs), a 48" private storm sewer, and are directed south. In the case of inlet clogging, overflows will overtop the curb and collect in the rip rap protected depression at **DP12**.

<u>Design Point 12</u>
Basin F consists of 2.57 acres of commercial lots (Lot 8 and portions of Lot 7) located along the southern boundary of the site. An earthen swale is proposed to convey flows to the depression. Rip rap (Type M, D50=1.5 ft, 3' thickness) is proposed at the terminus of the swale and will protect the slopes of the depression. Rip rap was conservatively sized using **DP6's** analysis. A private 24" storm drain (**PR16**) is provided to collect the basin flows of Q5=10.8 and Q100=19.6 cfs at **DP12** in the 5 and 100 year events, respectively. Intercepted flows are conveyed west underground to the main line where they combine with flows from **PR15** at a manhole junction. **PR17,** a private 48" RCP storm sewer directs the collected runoff to a manhole which joins with **PR21** (private 48" RCP) at peak flow rates of Q5=57.9 and Q100=112.1 cfs. The collected flows are conveyed southwest in **PR18** (Private 48" RCP) until discharging into the proposed forebay at **DP15**.

<u>Design Point 13</u>
DP13 consists of a 2' bottom earthen swale that is designed to convey overflow runoff from the proposed apartment site (**Basin A-5 Overflow**: Q5=0.9, Q100=7.8 cfs, **Basin Z-1**: Q5=0.47, Q100=1.27 cfs, and **Basin D-1 Overflow**: Q5=0.0, Q100=1.5 cfs) to the northwest corner of the pond. This swale joins another on the west end of the property (**DP14**) that ultimately conveys flows into the pond. Overflows from the apartment site were obtained by using flowby from the "Final Drainage Report for Aura at Crossroads" MHFD inlet sheets, which are provided in the appendix. The maximum runoff expected at **DP13** is 1.3 and 10.9 cfs in the 5 and 100 year events, respectively. Calculations for this swale (Section C-C') are included in the appendix of this report.

<u>Design Point 14</u>
DP14 represents the on-site portion of a proposed, v-shaped, earthen swale that collects flows not anticipated to be collected by the apartment site's storm sewer (**Basin Z-2**: Q5=0.57, Q100=1.43 cfs), and combines with flows from **Design Point 13**. Runoff collected within this swale (maximum Q5=2.0 cfs, Q100=9.7 cfs) is conveyed from north to south to the proposed FSD pond at **DP15**. Calculations for this swale before (Section B-B') and after (Section D-D') the junction are provided in the appendix of this report. Anticipated flows for **Basin Z-2** from "Final Drainage Report for Aura at Crossroads" were used to determine swale cross section prior to the junction location, and combined flows with **DP13** were used for after. <u>North American Green SC-250</u> erosion control blanketing or approved equal shall be used as swale protection and was selected based on flow velocity.

<u>Design Point 15</u>

Basin J consists of 3.21 acres of the proposed Tract for the full spectrum detention pond. Runoff produced within this basin reaches peak runoff rates (Q5=2.3 and Q100=10.0 cfs) combines with flows from **DP14** and **PR18** (proposed 48" private RCP) in the pond. **PR19** (proposed 48" private RCP) represents the tie in point for the apartment site storm sewer, and conveys collected flows into the proposed forebay. The cumulative flows at **FSD Pond 1** are Q5=116.7 and Q100=235.0 cfs. Flow exiting the pond will be routed to the existing 5' bottom earthen swale (Proposed Section A-A' Analyses) in CDOT's Right of Way at **DP16** via 18" private **PR20** (Q5=1.2 and Q100=11.4 cfs). A rip rap pad (Type L, D50=9") is provided as outlet protection. Refer to the Appendix for rip rap sizing calculations.

<u>Design Point 16</u>

Basin OS-2 consists of 4.98 acres. Approximately half of this basin is comprised of the paved surface of U.S. Highway 24, while the other half is comprised of the 5 foot bottom earthen swale in CDOT's Right of Way. Runoff produced within this basin (Q5=8.7 and Q100=19.6 cfs) flows from northeast to southwest, combining with outfall flows from **DP15**. This combination of runoff collects in the existing swale in the right of way. The cumulative flows at **DP16** are Q5=9.9 and Q100=31.0 cfs, which are lower than the historic and existing rates. Calculations for the 5, 10, 25, 50, and 100 year events for this swale are provided in the Appendix. All except the 25 and 50 year events are lower than the historic condition, but the difference of about 2 cfs is considered negligible in terms of effects in the ditch. Flows from this design point continue to downstream infrastructure. A rip rap pad is located at the terminus of the storm sewer, as previously mentioned in **DP15's** discussion.

Proposed Drainage Characteristics

In the proposed condition Lot 11, (apartment site), Tract C, and Meadowbrook Parkway infrastructure will be constructed and Tract D (future 10 commercial lots) will remain undeveloped. Since the future (full-buildout) condition was used to size this infrastructure and has been shown to adequately convey site drainage to the downstream facilities, the undeveloped characteristics of Tract D cause lower contributions to overall flows that are conveyed to downstream facilities. Calculations have been provided in the appendix notating these characteristics. Parks and cemeteries runoff coefficients were used to analyze the undeveloped area drainage. Surface flows at **DP's 1-5**, **DP10**, **DP11**, **DP13**, and **DP14** remain the same as the future condition. Pipe flow analysis was simplified to a comparison of the affected upstream storm sewer (**PR11**) to the manhole junction at **PR17** for this condition since it has been shown that the entire system sufficiently serves the future condition. A detailed drainage discussion for the undeveloped portion of the site (Tract D) in the proposed condition is provided below that highlights and summarizes the results of this analysis.

<u>Design Point 7</u>

Basin P1 consists of 8.97 undeveloped acres. Runoff produced within this basin (Q5=3.8 and Q100=20.7 cfs) flows from northeast to southwest and collects in a proposed swale parallel to Tract C that discharges into a temporary sediment basin (**SB2**). Flows from the sediment basin discharge into a proposed swale to the south to continue to downstream infrastructure. In the case of clogging, overflow will be directed to the swale to the south. Since no flows at this location enter the storm system, **PR11** and **PR12** convey no flow in the proposed condition. **PR11.5** conveys flows from the apartment site into the trunk main at **PR12.5** (Q5=6.9, Q100=13.8 cfs). Inlets 8 and 9 function as they do in the future condition and combine with **PR12.5** at cumulative flow rates of Q5=10.8 and Q100=27.0 cfs at **PR15** in the proposed condition. See below for continued discussion of the pipe conveyance to and from **DP12**.

Design Point 12

Basin P2 consists of 3.04 undeveloped acres. Runoff produced within this basin (Q5=1.3 and Q100=7.2 cfs) flows from northeast to southwest, combining with outfall flows from **DP7**. Detention effects from the sediment basin was not considered, therefore, inflow was considered equal to outflow as a conservative analysis. This combination of runoff collects in a proposed swale parallel to Tract C that discharges into a proposed sediment basin (**SB3**). The sediment basin outfall discharges onto a rip rap protected depression at the design point. In the case of overflow, flows will be directed to this same location. Runoff then enters the storm drain system at proposed 24" private RCP **PR16** (Q5=5.1, Q100=27.9 cfs). A manhole junction joins flows from **PR15** and **PR16** in **PR17** (Q5=15.9, Q100=54.7 cfs). The storm system at this location is considerably less than the future condition (Q5=57.0, Q100=110.1 cfs). Flows continue through the storm drain system until discharging in the eastern forebay of the FSD pond. Backwater effects in the storm system are considered negligible and were not analyzed due to the reduction in flows at the aforementioned entry points and sheer volumetric reduction in flow. An assumption was also made that the system (**PR11-PR18**) in this condition will not be pressurized from the results of this analysis.

Water Quality Provisions and Maintenance

The proposed full spectrum detention (FSD) pond functions to provide detention and water quality for the proposed development. This full spectrum detention pond will function to treat approximately 32.20 acres of 78.67% impervious, tributary area by providing 0.863 acre-feet of storage for the water quality event, 3.295 acre feet of storage at the EURV storm event, and 4.668 acre-feet of storage in the 100-year event. The 33' wide emergency spillway is designed with a foot of freeboard in the 100-year event. This spillway safely conveys flows to CDOT's Right of Way in the event of outlet clogging or failure, and will be armored with permanent erosion control fabric and Type M (D50=12") soil rip rap. Rip Rap sizing calculations for the embankment protection are provided in the appendix. The results show that the FSD pond remains functional in the 100-year event and the outlet structure is able to discharge flows to an existing swale and ultimately to Sand Creek. The sizing for the full spectrum detention facility has been determined using the guidelines set forth in the Urban Drainage and Flood Control District Criteria Manual. Refer to the UDFCD MHFD-Detention, Version 4.03, Excel Workbook located within the appendix of this report for calculations.

The proposed FSD pond will be privately owned and maintained by Crossroads Metropolitan District No. 1. Access to the pond shall be granted to the owner/district and El Paso County for access and maintenance of the private facility. A private maintenance agreement document shall accompany this report submittal.

Erosion Control

It is the policy of the El Paso County that M&S Civil Consultants submit a grading and erosion control plan with the drainage report. The plan includes proposed silt fence, vehicle tracking control, (4) temporary sediment basins, and straw bale barriers as proposed erosion control measures. The plan also includes provisions for stockpiling, staging, and concrete washout areas. A stormwater management plan is provided to accompany the plans.

2022 Drainage & Bridge Fees:

Drainage Fees:	17.033	x	78.67%	x	$21,814.00	=	$	292304.57
Bridge Fees:	17.033	x	78.67%	x	$8,923.00	=	$	119,566.96
						Total	**$**	**411,871.53**

Drainage fees shall be paid at the time of platting. Tract D drainage fees are not included and will be paid at the time of platting. Future development of these lots shall require individual drainage reports.

Construction Cost Estimate (Non-Reimbursable)

Item	Amount	Unit	Unit Cost	Total Cost
10’ CDOT Type R Inlet	4	EA	$ 9,890.00	$ 39,560.00
15’ CDOT Type R Inlet	3	EA	$ 13,002.00	$ 39,006.00
Custom Grate Inlet	1	EA	$ 5,000.00	$ 5,000.00
Type I MH	8	EA	$ 9,800.00	$ 78,400.00
Type II MH	1	EA	$ 6,000.00	$ 6,000.00
Rip Rap Aprons	84.5	CY	$ 65.00	$ 5,492.50
18” SD	113	LF	$ 45.00	$ 5,085.00
24” SD	232	LF	$ 81.00	$ 18,792.00
30" SD	432	LF	$ 100.00	$ 35,800.00
36" SD	16	LF	$ 124.00	$ 1,984.00
42" SD	396	LF	$ 166.00	$ 65,736.00
48" SD	395	LF	$ 202.00	$ 79,790.00
Concrete Channel	2,416	SF	$ 5.00	$ 12,080.00
Outlet Structure	1	EA	$ 15,000.00	$ 15,000.00
Forebay	2	EA	$ 8,000.00	$ 16,000.00
Gravel (Access)	629	CY	$ 52.00	$ 32,708.00
Spillway	1	EA	$ 20,000.00	$ 20,000.00
TOTAL COST:	**$**			**476,433.50**

M & S Civil Consultants, Inc. (M & S) cannot and does not guarantee the construction cost will not vary from these opinions of probable costs. These opinions represent our best judgment as design professionals familiar with the construction industry and this development in particular. The above is only an estimate of the facility cost and drainage basin fee amounts in 2022.

Summary:

The construction of this site is for the purposes of creating a commercial tract, detention tract, and an apartment site in the proposed condition. In the future condition, the commercial tract is proposed to be platted into ten lots. This condition was analyzed to appropriately size the infrastructure for full buildout of the site. The site will be graded and all disturbed areas will be seeded. Post construction runoff will be discharged to downstream property at rates that are below historic discharge rates. In the historic condition, the total flows leaving the site that reach the East Fork Sand Creek Channel are 10.4 cfs and 31.9 cfs in the 5 year and 100 year storm events, respectively. Through the strategic design and placement of storm sewer infrastructure components, the overall discharge rates are reduced to 9.9 and 31.0 cfs in the future condition. Negligible impacts are concluded from the minor increase in flows in the 25 and 50 year events at the discharge location, and the ditch is being adequately protected with rip rap and a toe wall to prevent erosion and scouring at the discharge point. Erosion control measures will be implemented to prevent sediment migration. The construction of Crossroads Mixed Use Filing No. 1 shall not adversely affect adjacent or downstream property. Subsequent drainage reports will be required when the site is developed behind the uses defined within this report.

References

1.) "El Paso County and City of Colorado Springs Drainage Criteria Manual".

2.) "Urban Storm Drainage Criteria Manual"

3.) SCS Soils Map for El Paso County.

4.) Flood Insurance Rate Map (FIRM), Federal Emergency Management Agency, Revised date December 7th, 2018.

5.) "Final Drainage Report for Claremont Business Park Filing No. 2", dated November 2006, by Matrix Design Group, Inc.

6.) "Preliminary and Final Drainage Report Meadowbrook Crossing Filing 1 and Filing 2", dated July 25, 2017, by Kiowa Engineering Corporation.

7.) "Final Drainage Report Lot 1 24/94 Business Park Filing No. 1 on Platte Avenue and Meadowbrook Parkway", dated April 28, 2016 and revised July 14, 2016, by Core Engineering Group, LLC.

8.) "Final Drainage Report for Meadowbrook Dirt Borrow Site ", dated November 2018, by M&S Civil Consultants, Inc.

9.) "Sand Creek Drainage Basin Planning Study", revised March 1996, by Kiowa Engineering Corporation.

APPENDIX

FIRM PANELS

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, City of Fountain, Bureau of Land Management, National Oceanic and Atmospheric Administration, United States Geological Survey, and Anderson Consulting Engineers, Inc. These data are current as of 2006.

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.

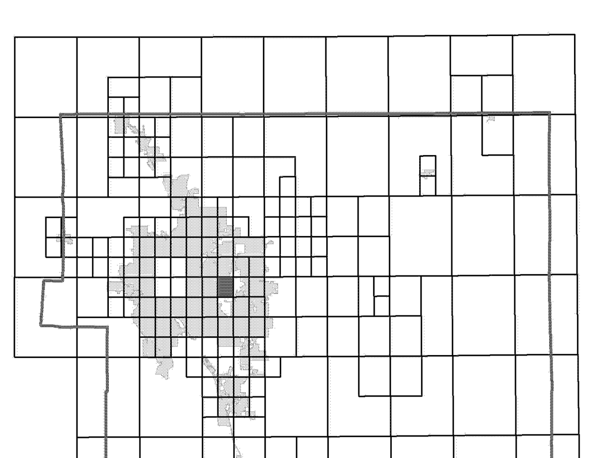
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this 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

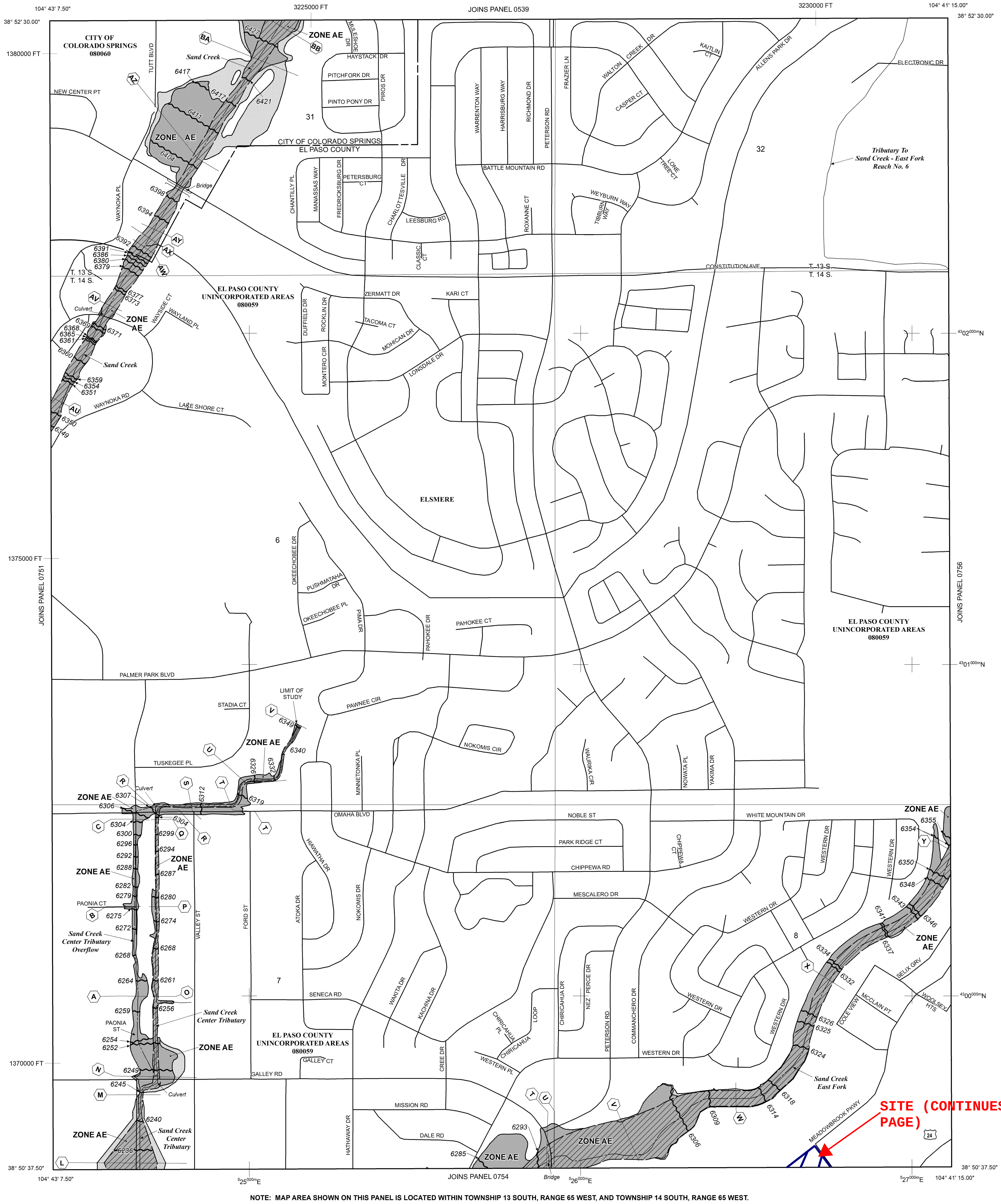
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

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.



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.

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MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP — NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0752G

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

PANEL 752 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0752	G
EL PASO COUNTY	080059	0752	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 08041C0752G

MAP REVISED DECEMBER 7, 2018

Federal Emergency Management Agency

NOTES TO USERS

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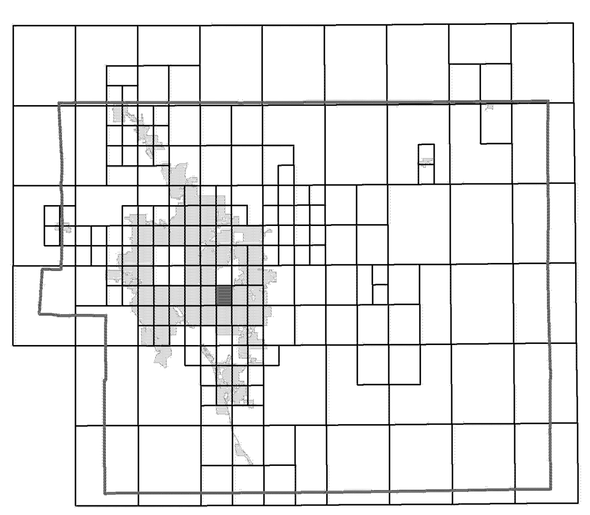
Panel Location Map



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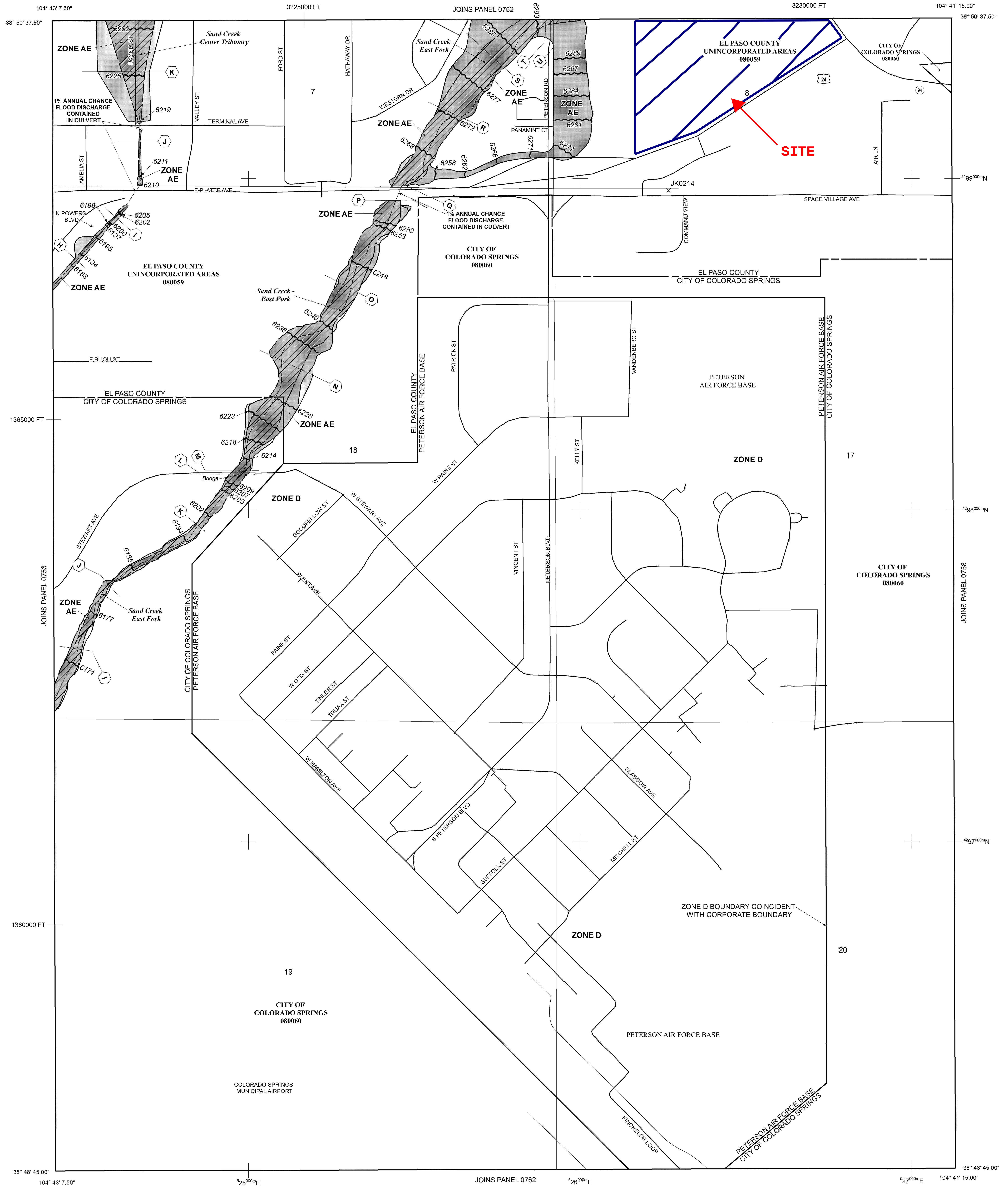

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 14 SOUTH, RANGE 65 WEST.

LEGEND

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

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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

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- Floodway boundary
- Zone D Boundary
- CBRS and OPA boundary
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- ~~ 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)

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- 23- - - -23 Transect line
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- 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.

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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 0754G

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

PANEL 754 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0754	G
EL PASO COUNTY	080059	0754	G

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MAP NUMBER
08041C0754G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

HYDROLOGIC CALCULATIONS

Crossroads Mixed Use Filing No. 1
FINAL DRAINAGE REPORT
(Historic Area Runoff Coefficient Summary)

			STREETS / DEVELOPED			***OVERLAND / DEVELOPED***			***WEIGHTED***	
BASIN	**TOTAL AREA** *(SF)*	**TOTAL AREA** *(Acres)*	**AREA** *(Acres)*	C_5	C_{100}	**AREA** *(Acres)*	C_5	C_{100}	C_5	C_{100}
C	256383.3	5.89	0.00	0.90	0.96	5.89	0.08	0.35	***0.08***	***0.35***
A	561176.6	12.88	0.00	0.90	0.96	12.88	0.08	0.35	***0.08***	***0.35***
B	593693.4	13.63	0.00	0.90	0.96	13.63	0.08	0.35	***0.08***	***0.35***
OS-1	55560.16	1.28	1.28	0.90	0.96	0.00	0.08	0.35	***0.90***	***0.96***
OS-2	216993.7	4.98	2.49	0.90	0.96	2.49	0.08	0.35	***0.49***	***0.66***
EX-A2***		0.59	0.59	0.90	0.96	0.00	0.08	0.35	***0.90***	***0.96***
OS-A**		1.29	1.29	0.62	0.72	0.00	0.08	0.35	***0.62***	***0.72***
E2*		3.86	3.86	0.80	0.90	0.00	0.08	0.35	***0.80***	***0.90***

*FROM FDR FOR CLAREMONT BUSINESS PARK FILING NO. 2

**FROM FDR FOR MEADOWBROOK CROSSING FILING 1 AND FILING 2

***FROM FDR FOR LOT 1 24/94 BUSINESS PARK FILING NO. 1 ON PLATTE AVENUE AND MEADOWBROOK PARKWAY

Crossroads Mixed Use Filing No. 1
FINAL DRAINAGE REPORT
(Historic Area Drainage Summary)

From Area Runoff Coefficient Summary				***OVERLAND***				***STREET / CHANNEL FLOW***				***Time of Travel (T_t)***		***INTENSITY ^***		***TOTAL FLOWS***	
BASIN	**AREA TOTAL** *(Acres)*	C_5 *From DCM Table 5-1*	C_{100}	C_5	**Length** *(ft)*	**Height** *(ft)*	T_C *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	T_t *(min)*	**TOTAL** *(min)*	**CHECK** *(min)*	I_5 *(in/hr)*	I_{100} *(in/hr)*	Q_5 *(c.f.s.)*	Q_{100} *(c.f.s.)*
C	5.89	0.08	0.35	0.08	300	9	22.2	500	2.0%	1.0	8.4	30.6	14.4	2.5	4.1	***1.2***	***8.5***
A	12.88	0.08	0.35	0.08	300	13	19.7	1350	1.6%	0.9	25.2	44.8	19.2	1.9	3.2	***1.9***	***14.2***
B	13.63	0.08	0.35	0.08	300	11	20.8	750	1.7%	0.9	13.7	34.5	15.8	2.3	3.8	***2.5***	***18.2***
OS-1	1.28	0.90	0.96	0.90	100	3	2.5	490	2.2%	3.0	2.8	5.3	13.3	5.1	8.5	***5.8***	***10.5***
OS-2	4.98	0.49	0.66	0.49	85	8	4.8	1165	1.8%	2.0	9.6	14.5	16.9	3.6	6.0	***8.7***	***19.6***
EX-A2*	0.59	0.90	0.96	0.90	10	0.2	0.9	916	1.9%	2.7	5.6	6.5	15.1	4.8	8.0	***2.5***	***4.5***
OS-A	1.29	0.62	0.72	0.62	40	0.8	4.4	1310	1.9%	2.8	7.9	12.3	17.5	3.8	6.4	***3.1***	***6.0***
E2*	3.86	0.80	0.90	0.80	50	1	3.0	400	1.3%	2.3	2.9	6.0	12.5	4.9	8.2	***15.1***	***28.6***

^ Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: CVW
Date: 1/31/2022
Checked by: DLM

*VALUES DERIVED USING DATA FROM FDR FOR CLAREMONT BUSINESS PARK FILING NO. 2

**VALUES DERIVED USING DATA FROM FDR FOR MEADOWBROOK CROSSING FILING 1 AND FILING 2 PAGE 31

***VALUES DERIVED USING DATA FROM FDR FOR LOT 1 24/94 BUSINESS PARK FILING NO. 1 ON PLATTE AVENUE AND MEADOWBROOK PARKWAY

Crossroads Mixed Use Filing No. 1
FINAL DRAINAGE REPORT
(Historic Basin Routing Summary)

From Area Runoff Coefficient Summary				***OVERLAND***				***PIPE / CHANNEL FLOW***				***Time of Travel (T_t)***	***INTENSITY ****		***TOTAL FLOWS***		
DESIGN POINT	**CONTRIBUTING BASINS**	**CA_5**	**CA_{100}**	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**I_5** *(in/hr)*	**I_{100}** *(in/hr)*	**Q_5** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*	COMMENTS
1	**E2**	3.09	3.47				6.0	916	1.9%	2.7	5.6	11.6	3.9	6.6	***14.2***	***26.5***	
	EX-A2	0.53	0.57														
		3.62	4.04	Tc for E2 Used													EXISTING 10' CDOT TYPE R AT GRADE INLET
2	**OS-A**	0.80	0.93									12.3	3.8	6.4	***3.1***	***6.0***	
				See Area Drainage Sheet for Input													EXISTING 10' CDOT TYPE R AT GRADE INLET
3	**OS-1**	1.15	1.22				11.6	150	1.0%	2.0	1.3	12.8	3.8	6.3	***9.8***	***22.5***	
	FB-DP1	1.47	2.35														
		2.62	3.57	Tc for DP1 Used													END OF PAVEMENT
4	**A**	1.03	4.51				12.8	1470	1.6%	0.9	28.0	40.8	2.0	3.4	***7.4***	***27.7***	
	FB-DP2	0.00	0.10														
	DP3	2.62	3.57														
		3.65	8.19	Tc for DP3 Used													ADJACENT PARCEL (LOT 1)
5	**B**	1.09	4.77									34.5	2.3	3.8	***2.5***	***18.2***	
				See Area Drainage Sheet for Input													ADJACENT PARCEL (LOT 2)
6	**C**	0.47	2.06									30.6	2.5	4.1	***1.2***	***8.5***	
				See Area Drainage Sheet for Input													DISCHARGE TO CDOT ROW
7	**OS2**	2.44	3.26									14.5	3.6	6.0	***10.4***	***31.9***	
	DP6	0.47	2.06														BARROW DITCH
		2.91	5.32	Tc for OS2 Used													SW CORNER OF SITE/CDOT ROW

Calculated by: CVW
Date: 1/31/2022
Checked by: DLM

Crossroads Mixed Use Filing No. 1
FINAL DRAINAGE REPORT
(Existing Area Runoff Coefficient Summary)

			STREETS / DEVELOPED			*OVERLAND / DEVELOPED*			*WEIGHTED*	
BASIN	**TOTAL AREA** *(SF)*	**TOTAL AREA** *(Acres)*	**AREA** *(Acres)*	C_5	C_{100}	**AREA** *(Acres)*	C_5	C_{100}	C_5	C_{100}
C	173960	3.99	0.00	0.90	0.96	5.89	0.08	0.35	***0.08***	***0.35***
A	480166.8	11.02	0.00	0.90	0.96	11.02	0.08	0.35	***0.08***	***0.35***
B	754121.6	17.31	0.00	0.90	0.96	17.31	0.08	0.35	***0.08***	***0.35***
OS-1	55560.16	1.28	1.28	0.90	0.96	0.00	0.08	0.35	***0.90***	***0.96***
OS-2	216993.7	4.98	2.49	0.90	0.96	2.49	0.08	0.35	***0.49***	***0.66***
EX-A2*		0.59	0.59	0.90	0.96	0.00	0.08	0.35	***0.90***	***0.96***
OS-A*		1.29	1.29	0.62	0.72	0.00	0.08	0.35	***0.62***	***0.72***
E2*		3.86	3.86	0.80	0.90	0.00	0.08	0.35	***0.80***	***0.90***

*FROM FDR FOR CLAREMONT BUSINESS PARK FILING NO. 2

**FROM TO FDR MEADOWBROOK CROSSING FILING 1 AND FILING 2

***FROM FDR LOT 1 24/94 BUSINESS PARK FILING NO. 1 ON PLATTE AVENUE AND MEADOWBROOK PARKWAY

Crossroads Mixed Use Filing No. 1
FINAL DRAINAGE REPORT
(Existing Area Drainage Summary)

From Area Runoff Coefficient Summary				OVERLAND				STREET / CHANNEL FLOW				Time of Travel (T_t)		INTENSITY ^		TOTAL FLOWS	
BASIN	AREA TOTAL	C_5	C_{100}	C_5	Length	Height	T_C	Length	Slope	Velocity	T_t	TOTAL	CHECK	I_5	I_{100}	Q_5	Q_{100}
	(Acres)	From DCM Table 5-1			(ft)	(ft)	(min)	(ft)	(%)	(fps)	(min)	(min)	(min)	(in/hr)	(in/hr)	(c.f.s.)	(c.f.s.)
C	3.99	0.08	0.35	0.08	120	2.8	15.3	555	1.5%	0.9	10.6	25.9	13.8	2.7	4.5	0.9	6.3
A	11.02	0.08	0.35	0.08	165	8	13.8	1730	1.3%	0.8	36.3	50.1	20.5	1.7	2.9	1.5	11.1
B	17.31	0.08	0.35	0.08	300	3	30.9	1390	1.2%	0.8	29.7	60.6	19.4	1.4	2.4	2.0	14.5
OS-1	1.28	0.90	0.96	0.90	100	3	2.5	490	2.2%	3.0	2.8	5.3	13.3	5.1	8.5	5.8	10.5
OS-2	4.98	0.49	0.66	0.49	85	8	4.8	1165	1.8%	2.0	9.6	14.5	16.9	3.6	6.0	8.7	19.6
EX-A2***	0.59	0.90	0.96	0.90	10	0.2	0.9	916	1.9%	2.7	5.6	6.5	15.1	4.8	8.0	2.5	4.5
OS-A**	1.29	0.62	0.72	0.62	40	0.8	4.4	1310	1.9%	2.8	7.9	12.3	17.5	3.8	6.4	3.1	6.0
E2*	3.86	0.80	0.90	0.80	50	1	3.0	400	1.3%	2.3	2.9	6.0	12.5	4.9	8.2	15.1	28.6

^ Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: CVW
Date: 1/31/2022
Checked by: DLM

*VALUES DERIVED USING DATA FROM FDR FOR CLAREMONT BUSINESS PARK FILING NO. 2

**VALUES DERIVED USING DATA FROM FDR FOR MEADOWBROOK CROSSING FILING 1 AND FILING 2 PAGE 31

***VALUES DERIVED USING DATA FROM FDR FOR LOT 1 24/94 BUSINESS PARK FILING NO. 1 ON PLATTE AVENUE AND MEADOWBROOK PARKWAY

Crossroads Mixed Use Filing No. 1
FINAL DRAINAGE REPORT
(Existing Basin Routing Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*PIPE / CHANNEL FLOW*				*Time of Travel (T_t)*	*INTENSITY **		*TOTAL FLOWS*		
DESIGN POINT	**CONTRIBUTING BASINS**	**CA_5**	**CA_{100}**	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**I_5** *(in/hr)*	**I_{100}** *(in/hr)*	**Q_5** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*	COMMENTS
1	**E2**	3.09	3.47				6.0	916	1.9%	2.7	5.6	11.6	3.9	6.6	***14.2***	***26.5***	
	EX-A2	0.53	0.57														
		3.62	4.04	Tc for E2 Used													EXISTING 10' CDOT TYPE R AT GRADE INLET
2	**OS-A**	0.80	0.93									12.3	3.8	6.4	***3.1***	***6.0***	
				See Area Drainage Sheet for Input													EXISTING 10' CDOT TYPE R AT GRADE INLET
3	**OS-1**	1.15	1.22				11.6	150	1.0%	2.0	1.3	12.8	3.8	6.3	***9.8***	***22.5***	
	FB-DP1	1.47	2.35														
		2.62	3.57	Tc for DP1 Used													END OF PAVEMENT
4	**A**	0.88	3.86				12.8	1470	1.6%	0.9	28.0	40.8	2.0	3.4	***7.1***	***25.5***	
	FB-DP2	0.00	0.10														
	DP3	2.62	3.57														
		3.50	7.54	Tc for DP3 Used													ADJACENT PARCEL (LOT 1)
5	**B**	1.38	6.06									60.6	1.4	2.4	***2.0***	***14.5***	
				See Area Drainage Sheet for Input													ADJACENT PARCEL (LOT 2)
6	**C**	0.32	1.40									25.9	2.7	4.5	***0.9***	***6.3***	
				See Area Drainage Sheet for Input													DISCHARGE TO CDOT ROW
7	**OS2**	2.44	3.26									14.5	3.6	6.0	***9.9***	***28.0***	
	DP6	0.32	1.40														BARROW DITCH
		2.76	4.66	Tc for OS2 Used													SW CORNER OF SITE/CDOT ROW

Calculated by: CVW
Date: 1/31/2022
Checked by: DLM

CROSSROADS MIXED USE FILING NO. 1
FINAL DRAINAGE CALCULATIONS
(Future Area Runoff Coefficient Summary)

			STREETS / COMMERC.			MULTI-FAMILY/PARKLAND			OVERLAND / UNDEVELOPED			WEIGHTED	
BASIN	TOTAL AREA (Sq Ft)	TOTAL AREA (Acres)	AREA (Acres)	C_5	C_{100}	AREA (Acres)	C_5	C_{100}	AREA (Acres)	C_5	C_{100}	C_5	C_{100}
FUTURE BASINS													
OS-A**		1.29	1.29	0.62	0.72	0.00	0.49	0.62	0.00	0.08	0.35	0.62	0.72
E2*		3.86	3.86	0.80	0.90	0.00	0.49	0.62	0.00	0.08	0.35	0.80	0.90
EX-A2***		0.59	0.59	0.90	0.96	0.00	0.49	0.62	0.00	0.08	0.35	0.90	0.96
OS-1	60793.3017	1.40	1.40	0.90	0.96	0.00	0.49	0.62	0.00	0.08	0.35	0.90	0.96
OS-2	216993.7096	4.98	2.49	0.90	0.96	0.00	0.49	0.62	2.49	0.08	0.35	0.49	0.66
A	72787.0873	1.67	1.67	0.90	0.96	0.00	0.49	0.62	0.00	0.08	0.35	0.90	0.96
B	64490.3787	1.48	1.48	0.90	0.96	0.00	0.49	0.62	0.00	0.08	0.35	0.90	0.96
C	200631.5748	4.61	4.46	0.81	0.88	0.00	0.49	0.62	0.15	0.08	0.35	0.79	0.86
D	96773.7602	2.22	2.22	0.81	0.88	0.00	0.49	0.62	0.00	0.08	0.35	0.81	0.88
E	45497.7355	1.04	0.24	0.90	0.96	0.80	0.81	0.88	0.00	0.08	0.35	0.83	0.90
E1	72636.2925	1.67	0.24	0.90	0.96	1.43	0.81	0.88	0.00	0.08	0.35	0.82	0.89
F	112036.6061	2.57	2.57	0.81	0.88	0.00	0.49	0.62	0.00	0.08	0.35	0.81	0.88
G	20057.4496	0.46	0.46	0.90	0.96	0.00	0.49	0.62	0.00	0.08	0.35	0.90	0.96
J	139924.2472	3.21	0.00	0.90	0.96	3.21	0.16	0.41	0.00	0.08	0.35	0.16	0.41
A-5****	159865.2	3.67	0.00	0.90	0.96	3.67	0.68	0.79	0.00	0.08	0.35	0.68	0.79
Z-1****	16117.2	0.37	0.00	0.90	0.96	0.37	0.33	0.52	0.00	0.08	0.35	0.33	0.52
D-1****	33976.8	0.78	0.00	0.90	0.96	0.78	0.62	0.75	0.00	0.08	0.35	0.62	0.75
Z-2****	16552.8	0.38	0.00	0.90	0.96	0.38	0.38	0.56	0.00	0.08	0.35	0.38	0.56
G1	25962.0179	0.60	0.60	0.90	0.96	0.00	0.16	0.41	0.00	0.08	0.35	0.90	0.96

*FROM FDR FOR CLAREMONT BUSINESS PARK FILING NO. 2
**FROM FDR FOR MEADOWBROOK CROSSING FILING 1 AND FILING 2
***FROM FDR FOR LOT 1 24/94 BUSINESS PARK FILING NO. 1 ON PLATTE AVENUE AND MEADOWBROOK PARKWAY
****FROM FDR FOR AURA AT CROSSROADS, DATED OCTOBER 29TH, 2021

Calculated by: CVW
Date: 1/31/2022
Checked by: DLM

CROSSROADS MIXED USE FILING NO. 1
FINAL DRAINAGE REPORT
(Future Drainage Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*STREET / CHANNEL FLOW*				*Time of Travel (T_t)*		*INTENSITY #*		*TOTAL FLOWS*	
BASIN	**AREA TOTAL** *(Acres)*	**C_5**	**C_{100}**	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**CHECK** *(min)*	**I_5** *(in/hr)*	**I_{100}** *(in/hr)*	**Q_5** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*
		From DCM Table 5-1															
Future Area Drainage Summary																	
OS-A**	1.29	0.62	0.72	0.62	40	0.8	4.4	1310	1.9%	2.8	7.9	12.3	17.5	3.8	6.4	***3.1***	***6.0***
E2*	3.86	0.80	0.90	0.80	50	1	3.0	400	1.3%	2.3	2.9	6.0	12.5	4.9	8.2	***15.1***	***28.6***
EX-A2***	0.59	0.90	0.96	0.90	10	0.2	0.9	916	1.9%	2.7	5.6	6.5	15.1	4.8	8.0	***2.5***	***4.5***
OS-1	1.40	0.90	0.96	0.90	100	3	2.5	490	2.2%	3.0	2.7	5.2	13.3	5.1	8.6	***6.4***	***11.5***
OS-2	4.98	0.49	0.66	0.49	85	8	4.8	1165	1.8%	2.0	9.6	14.5	16.9	3.6	6.0	***8.7***	***19.6***
A	1.67	0.90	0.96	0.90	30	0.6	1.6	1325	0.7%	1.7	7.3	8.9	17.5	4.3	7.2	***6.5***	***11.6***
B	1.48	0.90	0.96	0.90	25	0.5	1.4	1335	0.7%	1.7	7.3	8.8	17.6	4.3	7.3	***5.8***	***10.3***
C	4.61	0.79	0.86	0.79	50	1	3.2	260	1.5%	2.4	1.4	5.0	11.7	5.2	8.7	***18.7***	***34.5***
D	2.22	0.81	0.88	0.81	50	1	2.9	200	1.5%	2.4	1.1	5.0	11.4	5.2	8.7	***9.3***	***17.0***
E	1.04	0.83	0.90	0.83	60	1.2	3.0	700	1.0%	2.0	3.8	6.8	14.2	4.7	7.9	***4.1***	***7.4***
E1	1.67	0.82	0.89	0.82	60	1.2	3.0	700	1.0%	2.0	3.8	6.8	14.2	4.7	7.9	***6.4***	***11.7***
F	2.57	0.81	0.88	0.81	50	0.8	3.2	300	1.3%	2.3	1.6	5.0	11.9	5.2	8.7	***10.8***	***19.6***
G	0.46	0.90	0.96	0.90	50	1	2.0	466	1.1%	2.1	2.6	5.0	12.9	5.2	8.7	***2.1***	***3.8***
J	3.21	0.16	0.41	0.16	50	2	7.6	0	0.0%	0.0	0.0	7.6	10.3	4.5	7.6	***2.3***	***10.0***
A-5****	3.67	0.68	0.79	0.68	REFER TO "FDR FOR AURA AT CROSSROADS" FOR DETAILS											***8.72***	***17.06***
Z-1****	0.37	0.33	0.52	0.33	REFER TO "FDR FOR AURA AT CROSSROADS" FOR DETAILS											***0.47***	***1.27***
D-1****	0.78	0.62	0.75	0.62	REFER TO "FDR FOR AURA AT CROSSROADS" FOR DETAILS											***2.08***	***4.20***
Z-2****	0.38	0.38	0.56	0.38	REFER TO "FDR FOR AURA AT CROSSROADS" FOR DETAILS											***0.57***	***1.43***
G1	0.60	0.90	0.96	0.90	50	1	2.0	466	1.1%	2.1	2.6	5.0	12.9	5.2	8.7	***2.8***	***5.0***

Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: CVW
Date: 1/31/2022
Checked by: DLM

*VALUES DERIVED USING DATA FROM FDR FOR CLAREMONT BUSINESS PARK FILING NO. 2

**VALUES DERIVED USING DATA FROM FDR MEADOWBROOK CROSSING FILING 1 AND FILING 2 PAGE 31

***VALUES DERIVED USING DATA FROM FDR LOT 1 24/94 BUSINESS PARK FILING NO. 1 ON PLATTE AVENUE AND MEADOWBROOK PARKWAY

****FROM FDR FOR AURA AT CROSSROADS, DATED OCTOBER 29th, 2021

CROSSROADS MIXED USE FILING NO. 1
FINAL DRAINAGE REPORT
(Future Basin Routing Summary)

From Area Runoff Coefficient Summary				OVERLAND				PIPE / CHANNEL FLOW				Time of Travel (T_t)	INTENSITY *		TOTAL FLOWS		
DESIGN POINT	CONTRIBUTING BASINS	CA_5	CA_{100}	C_5	Length (ft)	Height (ft)	T_C (min)	Length (ft)	Slope (%)	Velocity (fps)	T_t (min)	TOTAL (min)	I_5 (in/hr)	I_{100} (in/hr)	Q_5 (c.f.s.)	Q_{100} (c.f.s.)	COMMENTS
FUTURE DRAINAGE BASIN ROUTING SUMMARY																	
1	E2, EX-A2	3.62	4.04	Tc for E2 Used			6.0	916	1.9%	2.7	5.6	11.6	3.9	6.6	*14.2*	*26.5*	Existing 10' CDOT Type R At-Grade Inlet (Public)
2	OS-A	0.80	0.93	See Area Drainage Sheet for Input								12.3	3.8	6.4	*3.1*	*6.0*	Existing 10' CDOT Type R At-Grade Inlet (Public)
3	OS-1, FB-DP1	2.73	3.69	Tc for DP1 Used			11.6	150	1.0%	2.0	1.3	12.8	3.8	6.3	*10.2*	*23.3*	Proposed 10' CDOT Type R At-Grade Inlet (Public)
4	A, FB-DP2	1.50	1.71	Tc for Basin A used								8.9	4.3	7.2	*6.5*	*12.4*	Proposed 15' CDOT Type R At-Grade Inlet (Public)
4.5	FB-DP4	0.00	0.25	Tc for DP4 used								8.9	4.3	7.2	*0.0*	*1.8*	Proposed NEENAH R-2501 MH Lid and Frame (Public)
5	B, FB-DP3	2.28	3.56	Tc for Basin B Used								8.8	4.3	7.3	*9.8*	*25.8*	Proposed 15' CDOT Type R Sump Inlet (Public)
6	C	3.62	3.98	See Area Drainage Sheet for Input								5.0	5.2	8.7	*18.7*	*34.5*	Future 30" RCP or PP Storm Sewer, Rip Rap Pad (Private)
7	D	1.80	1.96	See Area Drainage Sheet for Input								5.0	5.2	8.7	*9.3*	*17.0*	Future 24" RCP or PP Storm Sewer, Rip Rap Pad (Private)
8	E	0.87	0.94	See Area Drainage Sheet for Input								6.8	4.7	7.9	*4.1*	*7.4*	Future 10' CDOT Type R At-Grate Inlet (Private)
9	E1	1.37	1.49	See Area Drainage Sheet for Input								6.8	4.7	7.9	*6.4*	*11.7*	Future 10' CDOT Type R At-Grade Inlet (Private)
10	G	0.41	0.44	Tc for Basin G Used								5.0	5.2	8.7	*2.1*	*3.8*	Proposed 10' CDOT Type R Sump Inlet (Private)
11	G1 FB-DP8 FB-DP9	0.51 0.02 0.20 **0.73**	1.32 0.18 0.51 **1.83**	Weighted Tc Used								5.6	5.0	8.4	*3.7*	*15.3*	Proposed 15' CDOT Type R Sump Inlet (Private)
12	F	2.08	2.26	See Area Drainage Sheet for Input								5.0	5.2	8.7	*10.8*	*19.6*	Proposed 24" RCP or PP Storm Sewer (Private)
13	Basin A-5 (Overflow) Basin Z-1 Basin D-1 (Overflow)	0.23 0.12 0.00 **0.36**	1.32 0.20 0.21 **1.72**	Weighted Tc Used								12.8	3.8	6.3	*1.3*	*10.9*	Proposed 2' Bottom Earthen Swale, Rip Rap Rundown
14	Basin Z-2 DP 13	0.14 0.36 **0.50**	0.03 1.43 **1.46**	Tc for Basin Z-2 Used								11.1	4.0	6.7	*2.0*	*9.7*	Proposed Triangular Earthen Swale (Private)
15	J, DP14, PR19, PR18	24.15	28.95	Weighted Tc Used								6.3	4.8	8.1	*116.7*	*235.0*	Full Spectrum Extended Detention Basin (Private)
16	POND OUTFALL OS-2	2.77	5.16	Tc for Basin OS-2 Used								14.5	3.6	6.0	*9.9*	*31.0*	HISTORIC FLOW IN CDOT BARROW DITCH Q5= 10.4 CFS, Q100 = 31.9 CFS PER HISTORIC DRAINAGE ANALYSIS

* Intensity equations assume a minimum travel time of 5 minutes.

Overflow- obtain flows from inlet sheets provided in Background Information Section of Appendix

CVW
Date: 1/31/2022
Checked by: DLM

CROSSROADS MIXED USE FILING NO. 1
FINAL DRAINAGE CALCULATIONS
(Future Storm Sewer Routing Summary)

PIPE RUN	Contributing Pipes/Design Points	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	Intensity* I_5	I_{100}	Flow Q_5	Q_{100}	PIPE SIZE
1	DP3 (INLET 3)	1.78	1.55	12.8	3.8	6.3	6.7	9.8	24" SD
1.5	DP4 (INLET 4)	1.50	1.46	8.9	4.3	7.2	6.5	10.6	24" SD
2	PR1.5, DP4.5 (INLET 4.5)	1.50	1.71	9.0	4.3	7.2	6.4	12.3	24" SD
3	PR2, DP5 (INLET 5)	3.78	5.27	9.0	4.3	7.2	16.2	37.9	36" SD
4	DP6	3.62	3.98	5.0	5.2	8.7	18.7	34.5	30" SD
4.5	Future Commercial Lot	0.00	0.00	0.0	0.0	0.0	0.0	0.0	30" SD
5	PR4, PR4.5	3.62	3.98	5.0	5.2	8.7	18.7	34.5	30" SD
6	PR5	3.62	3.98	5.0	5.2	8.7	18.7	34.5	30" SD
7	PR6	3.62	3.98	5.0	5.2	8.7	18.7	34.5	30" SD
8	DP7	1.80	1.96	5.0	5.2	8.7	9.3	17.0	24" SD
9	PR8, DP8 (Inlet 6)	2.65	2.72	6.8	4.7	7.9	12.5	21.4	30" SD
10	DP9 (Inlet 7)	1.17	0.98	6.8	4.7	7.9	5.5	7.7	18" SD
11	PR7, PR9, PR10	7.45	7.67	6.8	4.7	7.9	35.0	60.5	36" SD
11.5*	SEE FDR FOR AURA AT CROSSROADS	1.93	2.30	14.6	3.6	6.0	6.9	13.8	30" SD
12	PR11	7.45	7.67	7.0	4.7	7.8	34.7	60.0	42" SD
12.5	PR12, PR11.5	9.38	9.97	7.2	4.6	7.8	43.3	77.4	48" SD
13	DP10 (Inlet 8)	0.41	0.44	5.0	5.2	8.7	2.1	3.8	18" SD
14	DP11 (Inlet 9)	0.73	1.83	5.6	5.0	8.4	3.7	15.3	30" SD
15	PR12.5, PR13, PR14	10.52	12.24	7.5	4.6	7.7	48.0	93.7	48" SD
16	DP12	2.08	2.26	5.0	5.2	8.7	10.8	19.6	24" SD
17	PR15, PR16	12.61	14.50	7.7	4.5	7.6	57.0	110.1	48" SD
18	PR17, PR21	13.09	15.08	8.2	4.4	7.4	57.9	112.1	48" SD
19*	SEE FDR FOR AURA AT CROSSROADS	10.05	11.09	15.0	3.5	5.9	35.4	65.5	48" SD
20	POND OUTFALL	PER	MHFD	WKSHT			1.2	11.4	18" SD
21*	SEE FDR FOR AURA AT CROSSROADS	0.48	0.58	8.8	4.3	7.3	2.1	4.2	30" SD

*REFER TO FDR FOR AURA AT CROSSROADS FOR CONTRIBUTING PIPE FLOW DETAILS

DP - Design Point
EX - Existing Design Point
FB- Flow By from Design Point
INT- Intercepted Flow from Design Point

Calculated by: CVW
Date: 1/31/2022
Checked by: DLM

CROSSROADS MIXED USE FILING NO. 1
FINAL DRAINAGE CALCULATIONS
(Proposed Area Runoff Coefficient Summary)

			STREETS / COMMERC.			*MULTI-FAMILY/PARKLAND*			*DISTURBED & UNDEVELOPED*			*WEIGHTED*	
BASIN	**TOTAL AREA** *(Sq Ft)*	**TOTAL AREA** *(Acres)*	**AREA** *(Acres)*	C_5	C_{100}	**AREA** *(Acres)*	C_5	C_{100}	**AREA** *(Acres)*	C_5	C_{100}	C_5	C_{100}
TRACT D PROPOSED BASINS													
P1	***390703.7678***	8.97	0.00	0.90	0.96	0.00	0.38	0.56	8.97	0.12	0.39	***0.12***	***0.39***
P2	***132430.7607***	3.04	0.00	0.90	0.96	0.00	0.16	0.41	3.04	0.12	0.39	***0.12***	***0.39***

Calculated by: CVW
Date: 2/7/2022
Checked by: DLM

CROSSROADS MIXED USE FILING NO. 1
FINAL DRAINAGE REPORT
(Proposed Drainage Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*STREET / CHANNEL FLOW*				*Time of Travel (T_t)*		*INTENSITY #*		*TOTAL FLOWS*	
BASIN	**AREA TOTAL** *(Acres)*	**C_5**	**C_{100}** *From DCM Table 5-1*	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**CHECK** *(min)*	**I_5** *(in/hr)*	**I_{100}** *(in/hr)*	**Q_5** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*
Proposed Area Drainage Summary																	
P1	8.97	0.12	0.39	0.12	173	2	22.2	728	1.1%	1.6	7.7	29.9	15.0	3.5	5.9	***3.8***	***20.7***
P2	3.04	0.12	0.39	0.12	175	2	22.4	525	1.5%	1.9	4.7	27.1	13.9	3.6	6.1	***1.3***	***7.2***

Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: CVW
Date: 2/7/2022
Checked by: DLM

CROSSROADS MIXED USE FILING NO. 1
FINAL DRAINAGE REPORT
(Proposed Basin Routing Summary)

From Area Runoff Coefficient Summary				OVERLAND				PIPE / CHANNEL FLOW				Time of Travel (T_t)	INTENSITY *		TOTAL FLOWS		
DESIGN POINT	CONTRIBUTING BASINS	CA_5	CA_{100}	C_5	Length (ft)	Height (ft)	T_C (min)	Length (ft)	Slope (%)	Velocity (fps)	T_t (min)	TOTAL (min)	I_5 (in/hr)	I_{100} (in/hr)	Q_5 (c.f.s.)	Q_{100} (c.f.s.)	COMMENTS
PROPOSED DRAINAGE BASIN ROUTING SUMMARY																	
7	**P1**	1.08	3.50				15.0					15.0	3.5	5.9	***3.8***	***20.7***	Proposed Sediment Basin (SB2)
				Tc for P1 Used													
12	**P2, DP7**	1.44	4.68				14.7					14.7	3.6	6.0	***5.1***	***27.9***	Proposed Sediment Basin (SB3)
				Weighted Tc Used													

* Intensity equations assume a minimum travel time of 5 minutes.

CVW
Date: 2/7/2022
Checked by: DLM

CROSSROADS MIXED USE FILING NO. 1
FINAL DRAINAGE CALCULATIONS
(Proposed Storm Sewer Routing Summary)

PIPE RUN	Contributing Pipes/Design Points	Equivalent CA_5	Equivalent CA_{100}	Maximum T_C	Intensity*		Flow		PIPE SIZE
					I_5	I_{100}	Q_5	Q_{100}	
11	N/A	0.00	0.00	0.0	0.0	0.0	0.0	0.0	36" SD
11.5*	SEE FDR FOR AURA AT CROSSROADS	1.93	2.30	14.6	3.6	6.0	6.9	13.8	30" SD
12	PR11	0.00	0.00	0.0	0.0	0.0	0.0	0.0	42" SD
12.5	PR12, PR11.5	1.93	2.30	14.6	3.6	6.0	6.9	13.8	48" SD
13	Inlet 8 (See Future Drainage)	0.41	0.44	5.0	5.2	8.7	2.1	3.8	18" SD
14	Inlet 9 (See Future Drainage)	0.73	1.83	5.6	5.0	8.4	3.7	15.3	30" SD
15	PR12.5 PR13, PR14	3.07	4.57	15.0	3.5	5.9	10.8	27.0	48" SD
16	DP12	1.44	4.68	14.7	3.6	6.0	5.1	27.9	24" SD
17	PR15, PR16	4.51	9.25	15.0	3.5	5.9	15.9	54.7	48" SD

*REFER TO FDR FOR AURA AT CROSSROADS FOR CONTRIBUTING PIPE FLOW DETAILS

DP - Design Point
EX - Existing Design Point
FB- Flow By from Design Point
INT- Intercepted Flow from Design Point

Calculated by: CVW
Date: 2/7/2022
Checked by: DLM

Crossroads Mixed Use Filing No. 1
FINAL DRAINAGE REPORT
(Roadside Ditch Intermediate Events Drainage Summary)

From Area Runoff Coefficient Summary							***OVERLAND***				***STREET / CHANNEL FLOW***				***Time of Travel (T_t)***		***INTENSITY ^***					***TOTAL FLOWS***				
BASIN	**AREA TOTAL** *(Acres)*	C_5	C_{10}	C_{25}	C_{50}	C_{100}	C_5	**Length** *(ft)*	**Height** *(ft)*	T_C *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	T_t *(min)*	**TOTAL** *(min)*	**CHECK** *(min)*	I_5 *(in/hr)*	I_{10} *(in/hr)*	I_{25} *(in/hr)*	I_{50} *(in/hr)*	I_{100} *(in/hr)*	Q_5 *(c.f.s.)*	Q_{10} *(c.f.s.)*	Q_{25} *(c.f.s.)*	Q_{50} *(c.f.s.)*	Q_{100} *(c.f.s.)*
		From DCM Table 5-1																								
C	5.89	0.08	0.15	0.25	0.30	0.35	0.1	300	9.0	22.2	300	2%	1.0	8.4	30.6	14.4	2.9	3.6	4.2	4.8	5.4	***1.3***	***3.2***	***6.2***	***8.4***	***11.1***
OS-2	4.98	0.49	0.54	0.60	0.63	0.66	0.5	85	8.0	4.8	1165	1.8%	2.0	9.6	14.5	16.9	3.6	4.2	4.8	5.4	6.0	***8.7***	***11.1***	***14.1***	***16.7***	***19.6***

^ Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: CVW
Date: 1/31/2022
Checked by: DLM

Crossroads Mixed Use Filing No. 1
FINAL DRAINAGE REPORT
(Roadside Ditch Intermediate Events: Routing Summary)

From Area Runoff Coefficient Summary							***OVERLAND***				***PIPE / CHANNEL FLOW***				***T_t***	***INTENSITY ****					***TOTAL FLOWS***				
DESIGN POINT *(CONDITION)*	**CONTRIBUTING BASINS**	**CA_5**	**CA10**	**CA25**	**CA50**	**CA_{100}**	**C_5**	**Length** *(ft)*	**Height** *(ft)*	**T_C** *(min)*	**Length** *(ft)*	**Slope** *(%)*	**Velocity** *(fps)*	**T_t** *(min)*	**TOTAL** *(min)*	**I_5** *(in/hr)*	**I_{10}** *(in/hr)*	**I_{25}** *(in/hr)*	**I_{50}** *(in/hr)*	**I_{100}** *(in/hr)*	**Q_5** *(c.f.s.)*	**Q10** *(c.f.s.)*	**Q25** *(c.f.s.)*	**Q50** *(c.f.s.)*	**Q_{100}** *(c.f.s.)*
7	**OS2**	2.44	2.67	2.96	3.11	3.26				14.5					14.5	3.6	4.2	4.8	5.4	6.0	***10.4***	***14.8***	***21.1***	***26.2***	***31.9***
(Historic)	**DP6 (Basin C)**	0.47	0.88	1.47	1.77	2.06																			
		2.91	3.55	4.44	4.88	5.32	Tc for OS2 Used																		
16	**OS2**	2.44	2.67	2.96	3.11	3.26				14.5					14.5	3.6	4.2	4.8	5.4	6.0	***9.9***	***13.7***	***23.2***	***27.7***	***31.0***
(Future)	**POND OUTFALL**	0.34	0.62	1.91	2.05	1.90																			
	(SEE MHFD POND SHEET)	2.78	3.29	4.87	5.17	5.16	Tc for OS2 Used																		

Calculated by: CVW
Date: 1/31/2022
Checked by: DLM

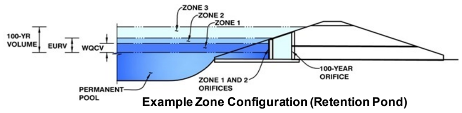
HYDRAULIC CALCULATIONS

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

Project: **CROSSROADS MIXED USE**

Basin ID: **POND 1**



Example Zone Configuration (Retention Pond)

Watershed Information

- Selected BMP Type = **EDB**
- Watershed Area = 32.20 acres
- Watershed Length = 1,725 ft
- Watershed Length to Centroid = 1,000 ft
- Watershed Slope = 0.006 ft/ft
- Watershed Imperviousness = 78.67% percent
- Percentage Hydrologic Soil Group A = 95.4% percent
- Percentage Hydrologic Soil Group B = 4.6% 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) = 0.859 acre-feet | (override) acre-feet
- Excess Urban Runoff Volume (EURV) = 3.293 acre-feet | (override) acre-feet
- 2-yr Runoff Volume (P1 = 1.19 in.) = 2.407 acre-feet | 1.19 inches
- 5-yr Runoff Volume (P1 = 1.5 in.) = 3.122 acre-feet | 1.50 inches
- 10-yr Runoff Volume (P1 = 1.75 in.) = 3.696 acre-feet | 1.75 inches
- 25-yr Runoff Volume (P1 = 2 in.) = 4.394 acre-feet | 2.00 inches
- 50-yr Runoff Volume (P1 = 2.25 in.) = 5.058 acre-feet | 2.25 inches
- 100-yr Runoff Volume (P1 = 2.52 in.) = 5.833 acre-feet | 2.52 inches
- 500-yr Runoff Volume (P1 = 3.14 in.) = 7.551 acre-feet | inches
- Approximate 2-yr Detention Volume = 2.178 acre-feet
- Approximate 5-yr Detention Volume = 2.835 acre-feet
- Approximate 10-yr Detention Volume = 3.393 acre-feet
- Approximate 25-yr Detention Volume = 4.014 acre-feet
- Approximate 50-yr Detention Volume = 4.379 acre-feet
- Approximate 100-yr Detention Volume = 4.723 acre-feet

Define Zones and Basin Geometry

- Zone 1 Volume (WQCV) = 0.859 acre-feet
- Zone 2 Volume (EURV - Zone 1) = 2.433 acre-feet
- Zone 3 Volume (100-year - Zones 1 & 2) = 1.430 acre-feet
- Total Detention Basin Volume = 4.723 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 Increment = 2.00 ft

6287.68

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	--	--	--	125	0.003		
88	--	0.40	--	--	--	240	0.006	73	0.002
90	--	2.40	--	--	--	17,342	0.398	16,784	0.385
92	--	4.40	--	--	--	39,263	0.901	72,518	1.665
94	--	6.40	--	--	--	47,710	1.095	159,490	3.661
96	--	8.40	--	--	--	60,034	1.378	267,234	6.135
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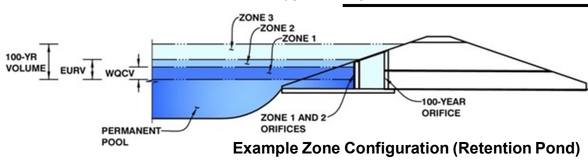
DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

Project: **CROSSROADS MIXED USE**
Basin ID: **POND 1**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.35	0.859	Orifice Plate
Zone 2 (EURV)	6.06	2.433	Orifice Plate
Zone 3 (100-year)	7.32	1.430	Weir&Pipe (Restrict)
Total (all zones)		4.723	

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

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

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	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 =	6.08	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	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	2.03	4.05					
Orifice Area (sq. inches)	3.77	6.25	12.60					

	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 =	6.09	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	5.70	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	2.91	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 =	6.09	N/A	feet
Overflow Weir Slope Length =	2.91	N/A	feet
Grate Open Area / 100-yr Orifice Area =	13.14	N/A	
Overflow Grate Open Area w/o Debris =	11.61	N/A	ft^2
Overflow Grate Open Area w/ Debris =	5.81	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 =	0.33	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 =	9.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.88	N/A	ft^2
Outlet Orifice Centroid =	0.43	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.57	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.30	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	33.00	feet
Spillway End Slopes =	3.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

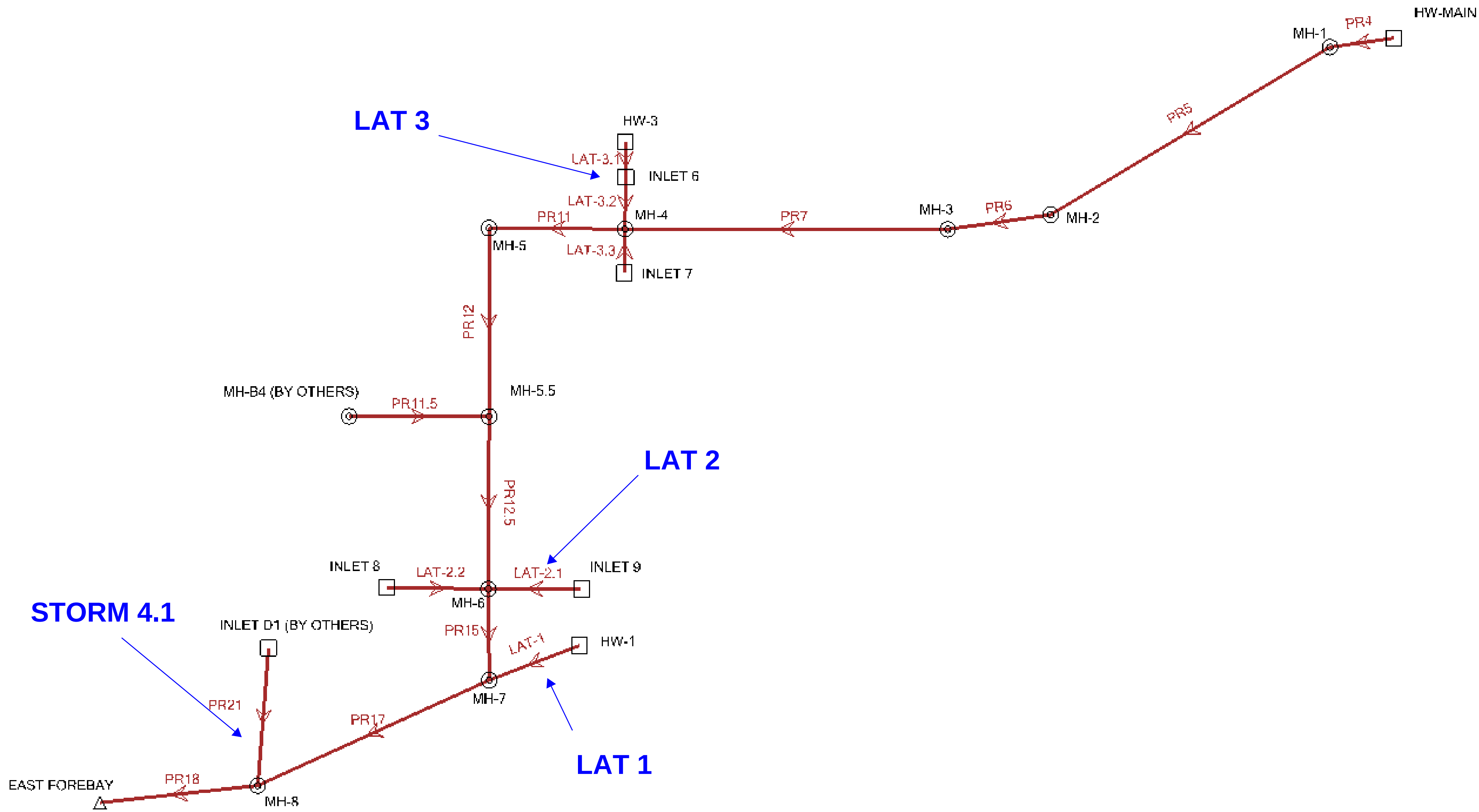
Spillway Design Flow Depth=	0.85	feet
Stage at Top of Freeboard =	9.15	feet
Basin Area at Top of Freeboard =	1.38	acres
Basin Volume at Top of Freeboard =	6.13	acre-ft

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	3.14
CUHP Runoff Volume (acre-ft) =	0.859	3.293	2.407	3.122	3.696	4.394	5.058	5.833	7.551
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	2.407	3.122	3.696	4.394	5.058	5.833	7.551
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.2	0.3	0.5	5.1	9.2	14.8	26.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.01	0.01	0.16	0.29	0.46	0.82
Peak Inflow Q (cfs) =	N/A	N/A	33.3	42.7	49.7	61.8	71.7	83.5	108.3
Peak Outflow Q (cfs) =	0.5	1.3	1.1	1.2	2.6	9.1	11.0	11.4	40.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	3.7	5.6	1.8	1.2	0.8	1.5
Structure Controlling Flow =	Plate	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.1	0.7	0.8	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	67	61	66	69	68	67	66	62
Time to Drain 99% of Inflow Volume (hours) =	**40**	72	65	72	76	75	75	75	74
Maximum Ponding Depth (ft) =	3.35	6.06	5.02	5.70	6.19	6.44	6.75	7.28	7.72
Area at Maximum Ponding Depth (acres) =	0.63	1.06	0.96	1.03	1.07	1.10	1.14	1.22	1.28
Maximum Volume Stored (acre-ft) =	0.863	3.295	2.242	2.918	3.434	3.705	4.042	4.668	5.230

STORM MAIN NETWORK LAYOUT



STORM MAIN: 100 YR FLEXTABLE

FlexTable: Conduit Table

Label	ID	Upstream Structure	Flow (cfs)	Flow / Capacity (Design) (%)	Length (Unified) (ft)	Velocity (ft/s)	Froude Number (Normal)	Depth (Normal) (ft)	Depth (Critical) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss (ft)
PR18	32	MH-8	112.10	108.1	95.9	8.92	0.786	(N/A)	3.20	6,296.78	6,296.20	6,295.54	6,294.96	0.58
PR17	36	MH-7	110.10	76.3	199.1	8.76	1.474	2.62	3.17	6,299.02	6,297.85	6,297.83	6,296.66	1.17
PR15	38	MH-6	93.70	84.0	26.5	7.46	1.093	2.81	2.93	6,299.88	6,299.76	6,299.01	6,298.90	0.11
LAT-2.1	46	INLET 9	15.30	14.8	25.7	3.12	3.910	0.65	1.32	6,300.51	6,300.48	6,300.36	6,300.33	0.04
PR11	68	MH-4	60.50	45.3	58.4	8.56	3.102	1.42	2.51	6,305.00	6,304.51	6,303.86	6,303.38	0.48
LAT-2.2	73	INLET 8	3.80	12.9	15.7	2.15	3.981	0.36	0.75	6,300.42	6,300.40	6,300.35	6,300.33	0.02
LAT-3.3	84	INLET 7	7.70	15.6	2.5	4.36	6.691	0.40	1.08	6,305.90	6,305.88	6,305.60	6,305.59	0.01
LAT-3.2	86	INLET 6	21.40	41.0	27.8	4.36	1.932	1.11	1.57	6,305.96	6,305.88	6,305.66	6,305.59	0.08
PR7	88	MH-3	34.50	63.8	175.7	7.03	1.880	1.45	2.00	6,307.60	6,306.35	6,306.83	6,305.59	1.24
PR6	90	MH-2	34.50	75.3	60.1	10.25	1.522	1.62	2.00	6,308.29	6,307.69	6,307.25	6,306.91	0.34
PR5	92	MH-1	34.50	78.2	125.3	9.95	1.446	1.66	2.00	6,310.04	6,308.74	6,309.00	6,307.22	1.77
PR4	94	HW-MAIN	34.50	47.7	22.5	14.56	2.635	1.22	2.00	6,311.04	6,310.76	6,310.00	6,308.80	1.20
LAT-3.1	104	HW-3	17.00	20.2	15.1	5.41	5.583	0.61	1.49	6,306.50	6,306.42	6,306.05	6,305.96	0.09
LAT-1	118	HW-1	19.60	40.1	38.4	6.24	3.161	0.88	1.59	6,299.79	6,299.51	6,299.19	6,298.90	0.29
PR21	129	INLET D1 (BY OTHERS)	4.20	5.4	87.6	8.49	2.873	0.39	0.67	6,296.68	6,296.67	6,296.60	6,296.66	-0.05
PR12	135	MH-5	60.00	52.2	165.6	6.24	1.786	1.80	2.43	6,303.18	6,302.59	6,302.58	6,301.99	0.59
PR12.5	136	MH-5.5	77.40	69.5	213.2	6.16	1.171	2.46	2.66	6,301.54	6,300.92	6,300.95	6,300.33	0.62
PR11.5	138	MH-B4 (BY OTHERS)	13.80	47.7	110.3	2.81	1.055	1.22	1.25	6,302.24	6,302.11	6,302.11	6,301.99	0.13

Upstream Structure Hydraulic Grade Line (In) (ft)	Upstream Structure Velocity (In-Governing) (ft/s)	Upstream Structure Headloss Coefficient	Upstream Structure Headloss (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Conduit Description
6,296.66	8.76	0.900	1.11	6,295.00	6,301.41	6,290.10	6,290.60	Circle - 48.0 in
6,298.90	6.24	0.900	1.07	6,301.41	6,304.40	6,290.90	6,292.91	Circle - 48.0 in
6,300.33	2.15	1.520	1.31	6,304.40	6,302.67	6,293.21	6,293.37	Circle - 48.0 in
6,300.59	3.12	1.500	0.23	6,302.67	6,302.41	6,295.17	6,296.80	Circle - 30.0 in
6,305.59	4.36	1.520	1.73	6,306.99	6,308.27	6,298.11	6,300.45	Circle - 36.0 in
6,300.46	2.15	1.500	0.11	6,302.67	6,302.32	6,296.17	6,297.40	Circle - 18.0 in
6,306.04	4.36	1.500	0.44	6,308.27	6,307.05	6,301.95	6,302.50	Circle - 18.0 in
6,305.96	5.41	1.020	0.30	6,308.27	6,307.77	6,300.95	6,301.40	Circle - 30.0 in
6,306.91	7.11	0.100	0.08	6,308.27	6,310.70	6,300.95	6,304.00	Circle - 30.0 in
6,307.35	9.89	0.100	0.10	6,310.70	6,312.53	6,304.50	6,305.25	Circle - 30.0 in
6,309.10	11.25	0.100	0.10	6,312.53	6,313.79	6,305.55	6,307.00	Circle - 30.0 in
6,311.06	8.21	1.020	1.07	6,313.79	6,311.00	6,307.30	6,308.00	Circle - 30.0 in
6,306.46	5.41	1.020	0.46	6,307.77	6,306.00	6,301.90	6,304.00	Circle - 24.0 in
6,299.62	6.24	1.020	0.62	6,304.40	6,299.00	6,295.21	6,297.00	Circle - 24.0 in
6,296.72	2.28	1.500	0.12	6,301.41	6,301.20	6,292.40	6,295.60	Circle - 30.0 in
6,303.38	8.56	1.320	0.80	6,306.99	6,304.52	6,297.61	6,295.45	Circle - 42.0 in
6,301.99	2.81	1.770	1.04	6,304.52	6,302.67	6,294.95	6,293.67	Circle - 48.0 in
6,302.18	2.81	0.500	0.06	6,304.52	6,303.80	6,296.45	6,297.00	Circle - 30.0 in

Appendix E – Geotechnical Engineering and Geologic Report

CTL | THOMPSON
INCORPORATED

GEOTECHNICAL INVESTIGATION
CROSSROADS APARTMENTS
MEADOWBROOK PARKWAY AND US HIGHWAY 24
COLORADO SPRINGS, COLORADO

Prepared for:

TRINSIC RESIDENTIAL GROUP
1801 Wewatta Street, Floor 11
Denver, Colorado 80202

Attention: Allison Jones

CTL|T Project No. CS19308-125

May 18, 2021

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SCOPE

This report presents the results of our Geotechnical Investigation for the Crossroads Apartments to be located west of the intersection of Highway 24 and Highway 94 in Colorado Springs, Colorado. The investigated parcel is planned for development of multi-family, apartment buildings. The purpose of our investigation was to evaluate the subsurface conditions at the site and provide geotechnical recommendations and criteria for design and construction of foundations, floor systems, and pavement section alternatives, as well as surface drainage precautions. The scope of our services is described in our proposal (CS-20-0127) dated February 10, 2010.

The report was prepared based on conditions interpreted from field reconnaissance of the site, review of previous information, conditions found in our exploratory borings, results of laboratory tests, engineering analysis, and our experience. Observations made during grading or construction may indicate conditions that require revision or re-evaluation of some of the criteria presented in this report. The criteria presented are for the development as described. Revision in the scope of the project could influence our recommendations. If changes occur, we should review the development plans and the effect of the changes on our preliminary design criteria. Evaluation of the property for the possible presence of potentially hazardous materials (Environmental Site Assessment) was beyond the scope of this investigation.

The following section summarizes the report. A more complete description of the conditions found at the site, our interpretations, and our recommendations are included in the report.

SUMMARY

1. The near-surface soils encountered in the twenty-two (22) borings drilled during this investigation consisted of 20 to 30 feet of sand and silty sand soils.
2. At the time of drilling, groundwater was not encountered. Groundwater levels will vary with seasonal precipitation and landscaping irrigation.

3. We understand both post-tensioned slabs-on-grade (PTS) and spread footing foundations are being considered. Foundation design and construction criteria are presented in the report.
4. If spread footings are used for the apartment buildings, the potential for differential movement between the spread footings and slabs-on-grade would need to be accommodated during design. Post-tensioned slab foundations are structurally integrated and should exhibit more reliable, long-term performance than conventional slabs-on-grade and isolated shallow foundations.
5. Full-depth asphalt concrete and composite asphalt and aggregate base course pavement section alternatives are presented in the report for the planned parking lots and access driveways.
6. Surface drainage should be designed, constructed, and maintained to provide rapid removal of runoff away from the proposed buildings. Conservative irrigation practices should be followed to avoid excessive wetting.
7. The design and construction criteria for foundations and slabs-on-grade included in this report were compiled with the expectation that all recommendations will be incorporated into the project and that the property manager will maintain the structures, use prudent irrigation practices, and maintain surface drainage. It is critical that all recommendations in this report are followed.

SITE CONDITIONS

The investigated parcel of land is situated west of the intersection of Highway 24 and Highway 94 in Colorado Springs, Colorado. The overall ground surface gently slopes downward to the south. Vegetation on the site consists of a slight to moderate stand of mostly grasses and weeds and scattered trees. The parcel is crisscrossed by several narrow, dirt paths. The surficial soils on the site were very loose in areas, generally on the southern side of the lot, and may cause issues with vehicles traversing the site. We had difficulties accessing these areas with the drill rig.

To the south of the site is Highway 24, to the north is a residential development. An abandoned sports complex that once had baseball diamonds is to the west. The parcel directly to the east is vacant.

PROPOSED DEVELOPMENT

We understand the proposed development will include an apartment complex consisting of eight apartment buildings, a clubhouse, and a pool. The apartments are anticipated to be two to three-story, wood-frame structures. Foundation loads are expected to be light to moderate. No habitable, below-grade construction is expected. The complex will include paved access roads and automobile parking stalls.

PREVIOUS INVESTIGATION

We previously reviewed the Soils and Geology Study performed by RMG Engineers, CTL|T Project No. CS19308-115, report dated November 13, 2020. This report was reviewed as part of this investigation.

SUBSURFACE INVESTIGATION

Subsurface conditions at the site were investigated by drilling twenty-two borings at the locations shown in Fig. 1. Graphical logs of the conditions found in our exploratory borings, the results of field penetration resistance tests, and some laboratory data are presented in Appendix A. Swell-consolidation and gradation test results are presented in Appendix B. Laboratory test data are summarized in Table B-1. Summary logs from our previous investigation are shown in Appendix D.

Soil samples obtained during this study were returned to our laboratory and visually classified. Laboratory testing was then assigned to representative samples. Testing included moisture content and dry density, gradation analysis, Atterberg limits, and water-soluble sulfate content tests.

SUBSURFACE CONDITIONS

The soils encountered in the twenty-two borings drilled during this investigation consisted of 20 to 30-feet of sand and silty sand soils. Sandstone bedrock was encountered in one boring at a depth of 29-feet. Some of the pertinent engineering characteristics of the soils and bedrock encountered and groundwater conditions are discussed in the following paragraphs.

Sand Soils

The soils encountered consisted of clean to silty sand. The sand encountered in the borings extended to the maximum depth explored of 30-feet below the existing ground surface. The sand was loose to very dense based on the results of field penetration resistance tests. Samples of the sand tested in our laboratory contained 5 to 35 percent clay and silt-sized particles (passing the No. 200 sieve). Our experience indicates the clean to silty sands are non-expansive when wetted.

Sand fill was logged in one boring (TH-2) to a depth of 7-feet below the existing ground surface. The material was identified as fill based on the color variation of the sample, however the lab testing indicates that the material properties are consistent with the native sand soil.

Bedrock

Sandstone bedrock was encountered in one boring (TH-10) at a depth of 29 feet. The sandstone was very hard based on the results of field penetration resistance tests. Our experience indicates the bedrock is non-expansive when wetted.

Groundwater

At the time of drilling, groundwater was not encountered. Due to the nature of the onsite materials, we were not able to check water levels several days after the completion of drilling operations as the boring holes had collapsed. Groundwater levels will vary with seasonal precipitation and landscaping irrigation.

Seismicity

This area, like most of central Colorado, is subject to a degree of seismic activity. Geologic evidence has been interpreted to indicate that movement along some Front

Range faults has occurred during the last two million years (Quaternary). This includes the Rampart Range Fault, which is located several miles west of the site. We believe the soils on the property classify as Site Class D (stiff soil profile) according to the 2015 International Building Code (2015 IBC).

SITE DEVELOPMENT

We do not expect significant issues due to geotechnical considerations to impact the development of the site. The most significant geotechnical constraint identified is the presence of collapse-prone soils. The following sections provide considerations and recommendations as they relate to site development

Grading plans prepared by Civil Consultants, Inc. dated February 16, 2021 were provided. The plans suggest cuts up to about 6-feet and fills up to about 8-feet will be necessary to achieve the desired building pad elevations. We believe site grading can be accomplished using conventional, heavy-duty earthmoving equipment. We recommend grading plans consider long-term cut and fill slopes no steeper than 3:1 (horizontal to vertical). This ratio considers that no seepage of groundwater occurs. If groundwater seepage does occur, a drain system and flatter slopes may be appropriate.

Collapse-Prone Soils

Collapse-prone soils are present at this site. Collapse-prone soils may be susceptible to hydro-collapse, a phenomenon where soils undergo a decrease in volume upon an increase in moisture content, with or without an increase in external loads. The presence of collapse-prone soils implies risk that slabs-on-grade and foundations will settle and be damaged. The risks associated with collapse-prone soils can be mitigated by careful design, construction, and maintenance procedures. We believe the recommendations in this report will help to control risk of foundation and/or slab damage; they will not eliminate that risk. The owner should understand that slabs-on-grade and, in some instances, foundations may be affected by these soils. Maintenance will be required to control risk. We believe the collapse-prone soils at this site present a moderate to low risk without mitigation, with the risk being lower on the northern side of the property and increasing to the south.

In general, the soils identified as collapse-prone are on the southern half of the site. The RMG report discussed in the Previous Investigation section, indicated that the northern half of this parcel has a circular, bulbus feature that they mapped as an area that has been "disturbed from past activity on the site and/or from historical overflow of sediment and water from EFSC from the north." Our testing indicates the soils in this area more consolidated.

Sub-Excavation

Sub-excavation will reduce the risk of excessive differential movement and create a more uniform bearing layer for support of the proposed structures. The northern buildings and the swimming pool should be constructed on at least a 2-foot-thick layer of new or sub-excavation backfill and the southern buildings should be constructed on at least a 4-foot-thick layer of new or sub-excavation backfill. The thickness of fill should be measured from the lowest member of the foundation system, or the swimming pool subgrade. The recommended depth of sub-excavation for each building is shown in Fig. 2.

The sub-excavation zone should extend laterally at least 5 feet beyond the outer edges of the structures and should have a uniform bottom elevation throughout the structure footprint. After the existing material is removed, the on-site existing fill materials, or imported granular fill can be used as excavation backfill. The sub-excavation zone should be backfilled to the bottom of foundation elevations with densely compacted fill that has been properly moisture conditioned and compacted as described in the Fill Placement section.

Our representative should observe the completed excavation prior to any backfill placement to verify the conditions exposed in the excavation are as expected. The placement and compaction of fill below foundations and foundation subgrade preparation should be observed and tested by a representative of our firm during construction.

Excavation

We believe the soils encountered in our exploratory borings can be excavated with conventional, heavy-duty excavation equipment. We recommend the contractor become familiar with applicable local, state, and federal safety regulations, including the current Occupational Safety and Health Administration (OSHA) Excavation and Trench Safety Standards, to determine appropriate excavation slopes. We anticipate the grading fill (existing and new) and the near-surface, natural soils will classify as Type C materials. Temporary excavations in Type C soils require a maximum slope inclination of 1.5:1 (horizontal to vertical), unless the excavation is shored or braced. If groundwater seepage occurs, flatter slopes will likely be required. The contractor's "competent person" should review excavation conditions and refer to OSHA standards when worker exposure is anticipated. Stockpiles and equipment should not be placed within a horizontal distance equal to one-half the excavation depth, from the edge of the excavation. Excavations deeper than 20 feet should be designed by a registered professional engineer.

Fill Placement

The properties of the fill will affect the performance of foundations, slabs-on-grade, and pavements. The on-site soils, when free of debris, can be used as site grading fill. We anticipate most of the grading fill will consist of silty sand soils that are generated from cuts into the near surface. If import materials will be used, the import should preferably consist of granular soils, similar to the on-site soils. Import fill materials should exhibit liquid limits of less than 30 and plasticity indices of less than 10. A sample of the import fill should be submitted to our office for testing before transporting to the site.

Vegetation, topsoil, and organic materials should be removed from the ground surface where fill will be placed at the site. Soft or loose soils, if encountered, should be stabilized or removed to stable material prior to placement of grading fill. Organic soils should be wasted in landscaped areas. The ground surface in areas to receive fill should be scarified, moisture conditioned to near optimum moisture contents, and compacted to a high density to provide a firm base.

We recommend the fill be placed at relatively uniform moisture contents within 2 percent of optimum moisture content and compacted in thin lifts to at least 95 percent of maximum modified Proctor dry density (ASTM D 1557) for granular materials. Placement and compaction of the grading fill should be observed and tested by our representative during construction.

Water and sewer lines are often constructed beneath slabs and pavements. Compaction of utility trench backfill can have a significant effect on the life and serviceability of floor slabs, pavements, and exterior flatwork. We recommend utility trench backfill be placed in compliance with City of Colorado Springs specifications. Personnel from our firm should periodically observe utility trench backfill placement and test the density of the backfill materials during construction.

FOUNDATIONS

Based on the conditions encountered in our exploratory borings and the planned site grading cuts and fills, we anticipate the near-surface soils found at or near shallow foundation levels for the proposed apartment buildings and clubhouse will consist predominantly of clean to silty sand and new, sand grading fill. These granular materials are non-expansive when wetted.

Based on the results of our borings, laboratory testing, and understanding of the planned construction, we believe the proposed apartment buildings can be constructed with shallow foundations consisting of post-tensioned, slab-on-grade (PTS) foundations or spread footing foundations. If spread footings are used for the apartment buildings, the potential for differential movement for this type of building, between the spread footings and slabs-on-grade would need to be accommodated during design. Post-tensioned slab foundations are structurally integrated and should exhibit more reliable, long-term performance than conventional slabs-on-grade and isolated shallow foundations. Criteria for post-tensioned, slabs-on-grade are presented in the Post-Tensioned, Slabs-on-Grade section. Criteria for spread footings are presented in the Spread Footings section. We are available to discuss foundation alternatives, as desired.

Post-Tensioned, Slabs-On-Grade (PTS)

We understand post-tensioned, slab-on-ground (PTS) foundations are being considered for the proposed apartment buildings and the clubhouse. In our opinion, the on-site soils are suitable for construction of the planned PTS foundations. Conditions encountered in our borings suggest that the complex can be considered a “Non-Active Site” as defined in Section 3.2.3 of the “Design of Post-Tensioned Slabs-on-Ground” manual developed by the Post-Tensioning Institute (PTI, 3rd Edition, 2004). The design of a PTS foundation for a non-active site requires that the foundation need only be checked for bearing and lightly reinforced against shrinkage and temperature cracking.

1. PTS foundations should be constructed on newly placed fill, and/or reprocessed fill, as described previously.
2. The PTS foundations should be designed for a maximum allowable soil pressure of 2,000 psf.
3. Perimeter stiffening beams may be poured “neat” into trenches excavated in the building pads. The on-site sands may cave or slough during trench excavation for the stiffening beams. Disturbed soils should be removed from trench bottoms prior to placement of concrete. Formwork or other methods may be required for proper beam installation.
4. For slab tensioning design, a coefficient of friction value of 0.75 or 1.0 can be used for slab construction on polyethylene sheeting or a sand layer, respectively. A coefficient of friction of 2 should be used for slabs on fill or native soil.
5. Exterior stiffening beams must be protected from frost action. Normally, 30 inches of frost cover is provided in this area.
6. A representative of our firm should observe the completed excavations. We should also observe the placement of the reinforcing tendons and reinforcement prior to placing the slabs and beams, as well as observe the tensioning of the tendons.

Spread Footing Foundations

1. We recommend the spread footing foundations be constructed on newly placed fill, and/or reprocessed fill, as described previously.
2. Spread footings can be designed for a maximum allowable soil pressure of 2,000 psf.
3. Spread footings beneath continuous foundation walls should be at least 16 inches wide. Footings beneath isolated column pads should be at least 24 inches square. Larger footing sizes could be required to accommodate the anticipated foundation loads.
4. We recommend designs consider total settlement of 1-inch and differential settlement of 1/2-inch.
5. Continuous foundation stem walls should be reinforced, top and bottom, to span local anomalies in the subsoils. We recommend the reinforcement required to simply span an unsupported distance of at least 10 feet.
6. Exterior spread footings within the garages must be protected from frost action. Typically, at least 30 inches of soil cover is provided in this area.
7. A representative of our firm should observe the completed foundation excavations to confirm the exposed conditions are similar to those encountered in our exploratory borings. The placement and compaction of below-foundation fill and foundation subgrade preparation should be observed and tested by a representative of our firm during construction.

FLOOR SYSTEMS AND SLABS-ON-GRADE

As previously discussed, soils below the foundations will consist of a layer of granular fill over the existing granular soils. Considering a 15-foot depth of wetting, our calculations indicate potential ground settlement within the building footprint of less than 1 inch to about 2 inches. Granular material settles more quickly than clay and clayey materials, and some of the internal settlement may occur during construction.

For the PTS system, the foundation is structurally integrated with the floor slab and should exhibit more reliable long-term performance, as compared to conventional slab-on-grade floors. Under-slab utilities such as water and sewer lines should be pressure tested prior to installing slabs. Utilities that penetrate slabs should be provided with sleeves and flexible connections that allow for independent movement of the slab and that reduce the likelihood of damaging buried pipes. We recommend these details allow at least 2 inches of differential movement between the slabs and pipes.

For the post-tensioned slabs-on-grade system, the foundation is structurally integrated with the floor slab and should exhibit more reliable long-term performance, as compared to conventional slab-on-grade floors. Where slab-on-grade construction is used, we recommend the following precautions.

Fill placed below the slabs should be constructed per the Fill Placement section of this report. Building foundations underlain by granular soils will settle relative to more lightly loaded slab-on-grade floors. The settlement can cause cosmetic cracking of drywall. We recommend slab-on-grade floors be separated from exterior walls and interior bearing members with joints that allow for independent vertical movements of the slab relative to the foundation. Provision of a 1-1/2 inch thick slip joint in slab-bearing partitions can reduce the risk of cracking of drywall resulting from movement of structural elements. If the “float” is provided at the tops of partitions, the connection between interior, slab-supported partitions and exterior, foundation-supported walls should be detailed to allow differential movement. These architectural connections are critical to help reduce cosmetic damage when foundations and floor slabs move relative to each other. We have seen instances where these architectural connections were not designed and constructed properly and resulted in moderate cosmetic damage, even though the movement experienced was well within the anticipated range. The architect should pay special attention to these issues and detail the connections accordingly.

From a geotechnical viewpoint, we believe the floor slabs can be placed directly on the subgrade soils. The 2015 International Building Code (IBC) requires a vapor retarder be placed between base course or subgrade soils and the concrete slab-on-grade floor, unless the designer of the floor (structural engineer) waives this requirement. The merits of installation of a vapor retarder below a floor slab depend on the sensitivity of floor coverings and building use to moisture. A properly installed vapor retarder (10 mil minimum) is more beneficial below concrete slab-on-grade floors where floor coverings, painted floor surfaces or products stored on the floor will be sensitive to moisture. The vapor retarder is most effective when concrete is placed directly on top of it, rather than placing a sand or gravel leveling course between the vapor retarder and the floor slab. The placement of concrete on the vapor retarder may increase the risk of shrinkage cracking and curling. Use of concrete with reduced shrinkage characteristics including minimized water content, maximized coarse aggregate content, and reasonably low slump will reduce the risk of shrinkage cracking and curling. Considerations and recommendations for the installation of vapor retarders below concrete slabs are outlined in Section 3.2.3 of the 2006 report of the American Concrete Institute (ACI) Committee 302, “Guide for Concrete Floor and Slab Construction (ACI 302.R-96)”.

Underslab plumbing should be avoided as much as possible. If underslab plumbing is necessary, service lines should be pressure tested for leaks during construction. Any utility lines that penetrate the slabs should be isolated from the slabs with joints to allow for free vertical movement. Slab-supported mechanical systems should have flexible connections to allow for vertical movement without rupturing supply lines.

Frequent control joints should be provided in the slabs to reduce the effects of curling and help reduce shrinkage cracking. Our experience indicates joint spacing of not greater than 30 times the slab thickness is effective in this area.

Exterior Flatwork

Exterior flatwork is normally constructed as a slab-on-grade. Performance of conventional slabs-on-grade is erratic. Various properties of the soils and environmental conditions influence magnitude of settlement and other performance characteristics. Increases in the moisture content in the underlying soils can result in settlement and possible cracking of slabs-on-grade. Backfill below slabs should be moisture conditioned and compacted to reduce settlement, as discussed in the Fill Placement section. Driveways and exterior slabs founded on backfill may settle and crack if the backfill is not properly moisture treated and compacted.

SWIMMING POOL AND POOL DECK

We understand a swimming pool is planned in association with the proposed clubhouse. No plans were available at the time of this investigation. We anticipate the pool structure may consist of spray-applied gunite against natural soil, or possibly a steel or a fiberglass shell. Because of the granular nature of the on-site soils, vertical excavation of the pool walls required for gunite pool construction may not be possible. A fiberglass or steel shell placed in an enlarged excavation may then be the more feasible option. If gunite methods are used, the cement slurry should be properly reinforced.

We recommend the pool be underlain by a drain system that collects water leakage and provides for discharge of the water to a sump or gravity outfall. The drain system should consist of free-draining gravel covering the bottom of the pool excavation. The excavation should slope to a 3 to 4-inch diameter, perforated or slotted pipe placed within the gravel layer. The drain should lead to a positive gravity outlet, such as a subdrain located beneath the sewer, or to a sump where water can be removed by pumping. A conceptual pool drain system is presented in Fig. 3. Overall surface drainage patterns should be planned to provide for the rapid removal of storm runoff and water that splashes over the edges of the pool.

The swimming pool structure may settle more than the flatwork surrounding the pool. To avoid damage to the pool structure, a slip joint should be used around the perimeter of the pool structure and adjacent to any other structural elements. Utility lines that penetrate the pool structure should be separated and isolated with joints to allow for free vertical movement. All ducts with connections between the pool structure and surrounding soil should be flexible or “crushable,” to allow some relative movement.

Pool decking should be constructed directly on the newly moisture conditioned and densely compacted sub-excavation backfill and be isolated from the swimming pool. Movement of the deck should not be transmitted to the swimming pool. The deck slab should be reinforced to function as an independent unit. Frequent control joints should be provided to reduce problems associated with potential soil movements. Panels that are approximately square generally perform better than rectangular areas.

PAVEMENTS

Our exploratory borings and understanding of the proposed construction suggest the subgrade soils within the planned access driveways and parking lots will consist of silty sand and new grading fill. The anticipated subgrade soil sample tested in our laboratory classified as A-1-b to A-2-4 material, according to the American Association of State Highway Transportation Officials (AASHTO) classification system. These group classifications generally exhibit good pavement support characteristics. Based on our laboratory classification testing (Atterberg Limits and sieve analysis) and experience with similar soils in the area a Hveem Stabilometer ("R") value of 50 was assigned to the subgrade materials for design purposes.

We anticipate the access driveways could be subjected to occasional heavy vehicle loads such as trash trucks and moving vans. We considered daily traffic numbers (DTN) of 2 for the parking stalls and 10 for the access driveways, which correspond to 18-kip Equivalent Single-Axle Loads (ESAL) of 14,600 and 73,000, respectively, for a 20-year pavement design life. We believe the parking stalls can be paved with 4 inches of asphalt concrete or 3 inches of asphalt concrete over 4 inches of aggregate base course. The access driveways and other portions of the proposed paved areas subjected to occasional truck traffic should be paved with 6 inches of asphalt concrete or 4 inches of asphalt underlain by 6 inches of aggregate base course.

We recommend a concrete pad be provided at the trash dumpster sites. The pads should be at least 6 inches thick and long enough to support the entire length of the trash truck and dumpster. The concrete pad should extend at least 5 feet outside of the anticipated truck dimensions. Joints between concrete and asphalt pavements should be sealed with a flexible compound.

Our design considers pavement construction will be completed in accordance with the City of Colorado Springs "Standard Specifications" and the Pikes Peak Region Asphalt Paving Specifications. The specifications contain requirements for the pavement materials (asphalt, base course, and concrete) as well as the construction practices used (compaction, materials sampling, and proof-rolling). Of particular importance are those recommendations directed toward subgrade and base course compaction and proof-rolling. During proof-rolling, particular attention should be directed toward the areas of confined backfill compaction. Soft or loose subgrade or areas that pump excessively should be stabilized prior to pavement construction. A representative of our office should be present at the site during placement of fill and construction of pavements to perform density testing.

CONCRETE

Concrete in contact with soils can be subject to sulfate attack. We measured the water-soluble sulfate concentration in three samples from the site at less than 0.1 percent. Sulfate concentrations of less than 0.1 percent indicate Class 0 exposure to sulfate attack for concrete in contact with the subsoils, according to ACI 201.2R-01, as published in the 2008 American Concrete Institute (ACI) Manual of Concrete Practice. For this level of sulfate concentration, the ACI indicates Type I cement can be used for concrete in contact with the subsoils. Superficial damage may occur to the exposed surfaces of highly permeable concrete, even though sulfate levels are relatively low. To control this risk and to resist freeze-thaw deterioration, the water-to-cementitious material ratio should not exceed 0.50 for concrete in contact with soils that are likely to stay moist due to surface drainage or high-water tables. Concrete subjected to freeze-thaw cycles should be air entrained.

LIMITATIONS

The recommendations and conclusions presented in this report were prepared based on conditions disclosed by our exploratory borings, geologic reconnaissance, engineering analyses, and our experience. Variations in the subsurface conditions not indicated by the borings are possible and should be expected.

We believe this report was prepared with that level of skill and care ordinarily used by geologists and geotechnical engineers practicing under similar conditions. No warranty, express or implied, is made.

Should you have any questions regarding the contents of this report or the project from a geotechnical engineering point-of-view, please call.

CTL | THOMPSON, INC.

COLORADO LICENSED GWENDOLYN ELIZABETH EBERHART 45929 05/18/2021 PROFESSIONAL ENGINEER

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Reviewed by:

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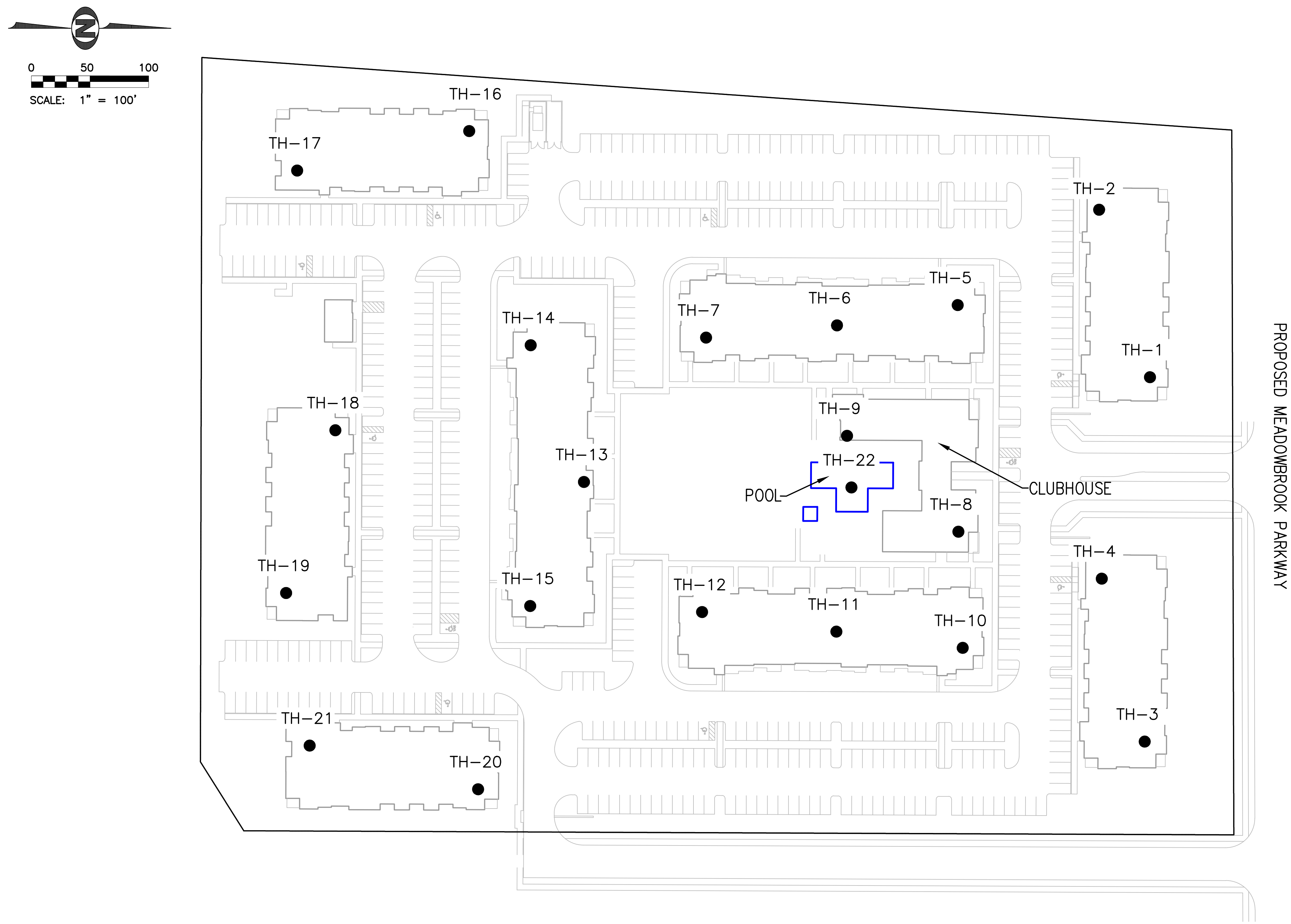

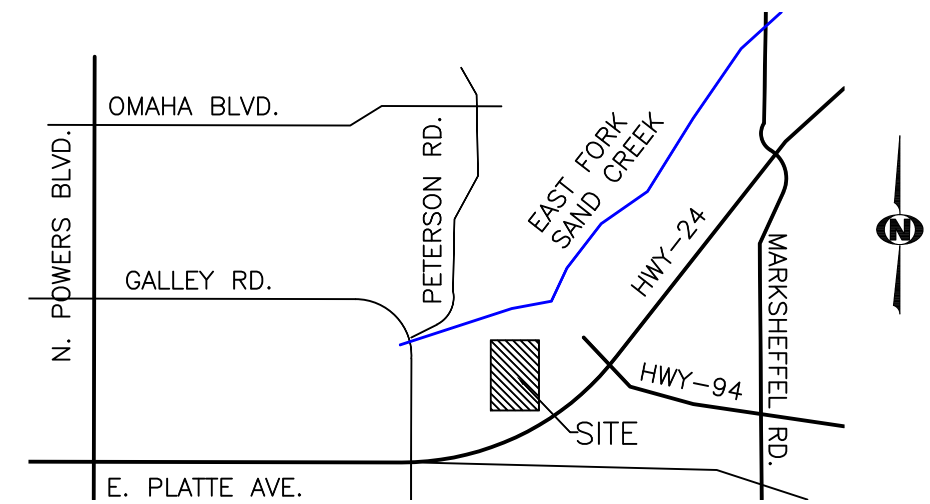

VICINITY MAP
NOT TO SCALE

LEGEND:

TH-1 ● APPROXIMATE LOCATION OF EXPLORATORY BORING

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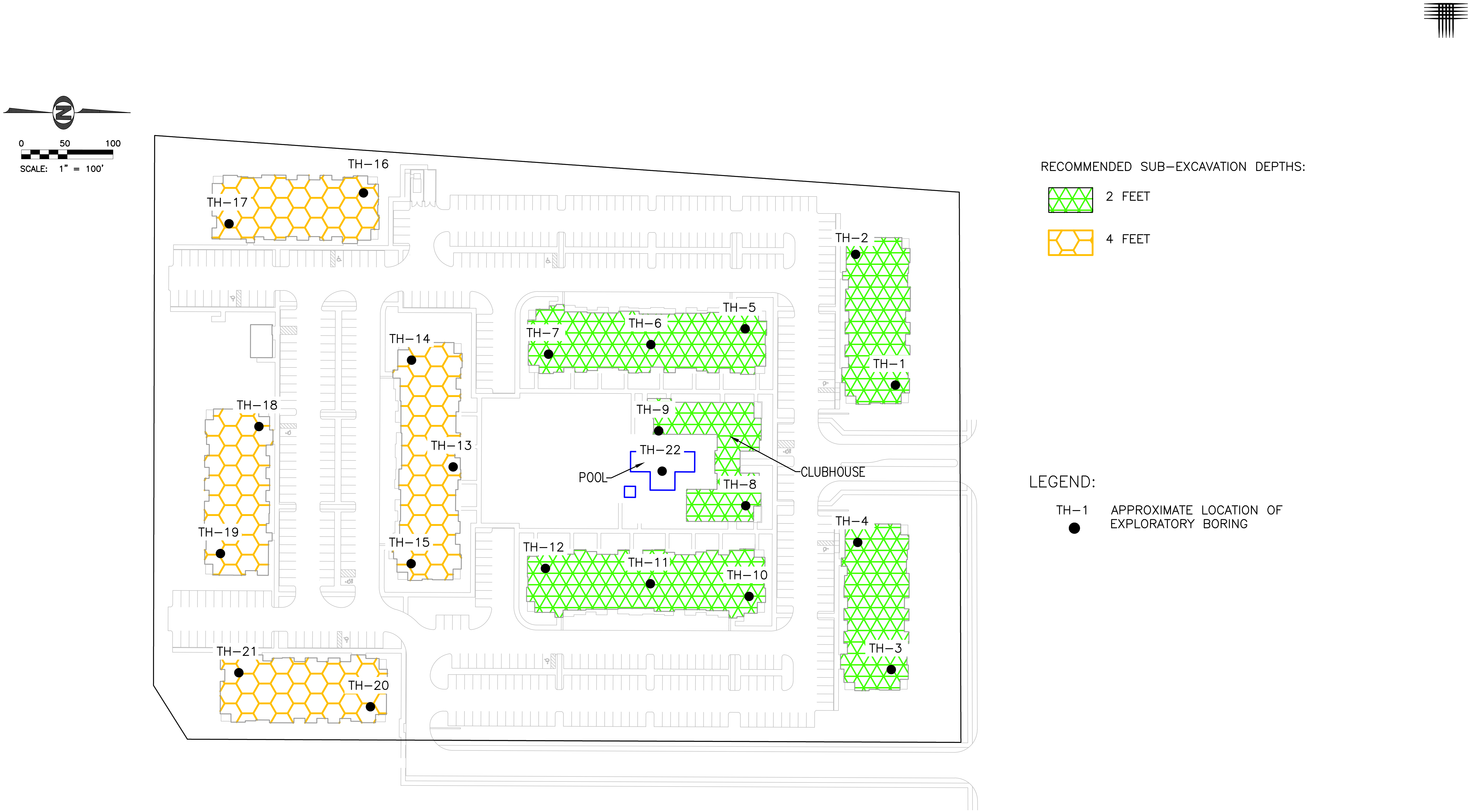
Locations of Exploratory Borings

Fig. 1



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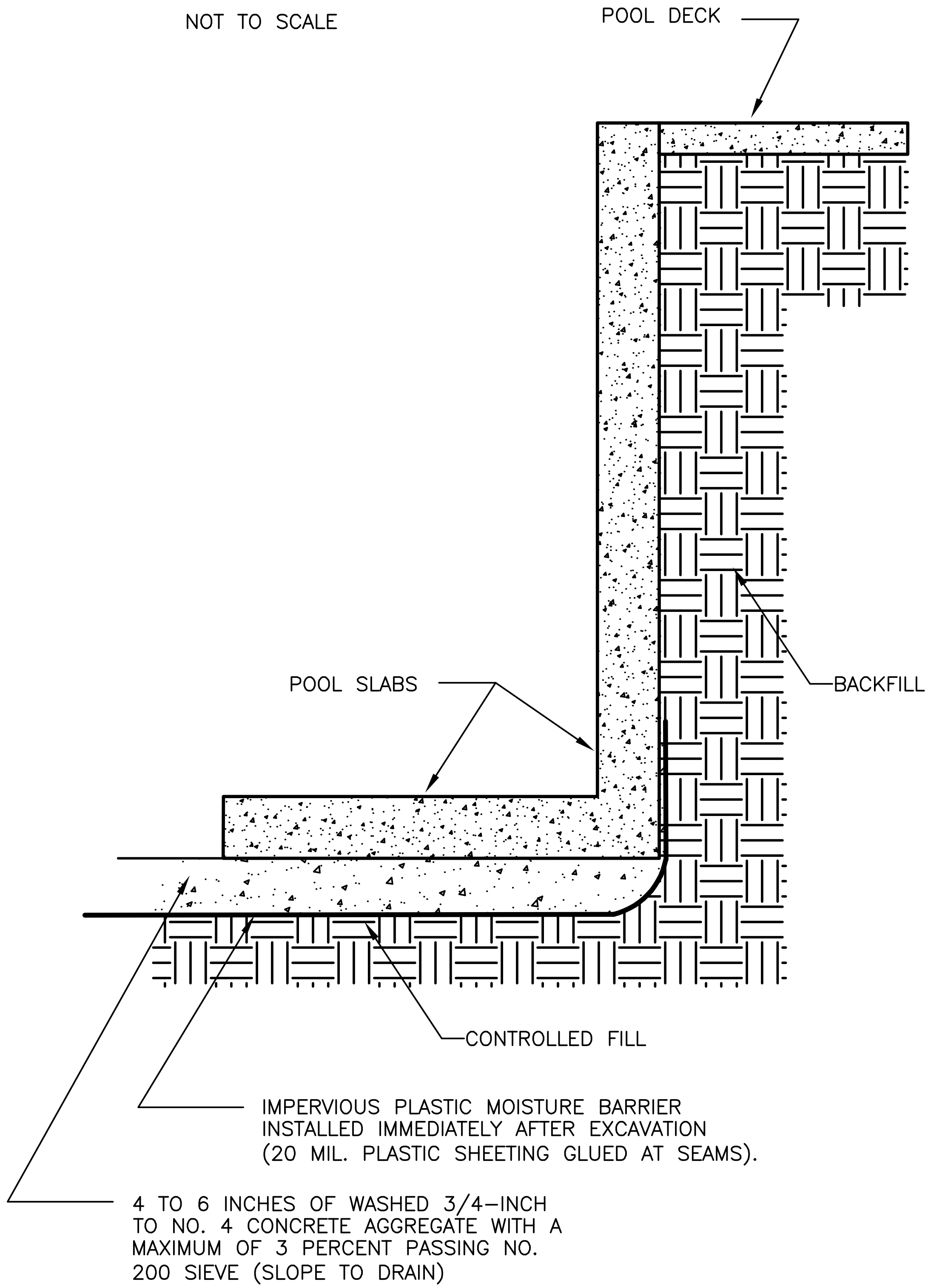
CTL|T Project No. CS19308-125

Recommended Sub-Excavation Depths

Fig. 2



NOTE:
DRAIN PIPE SHOULD CONSIST OF A 3 OR 4–INCH DRAIN PIPE WITH A MINIMUM SLOPE OF 1/8 INCH DROP PER FOOT, TO A POSITIVE GRAVITY OUTLET OR TO A SUMP WHERE WATER CAN BE REMOVED BY PUMPING.

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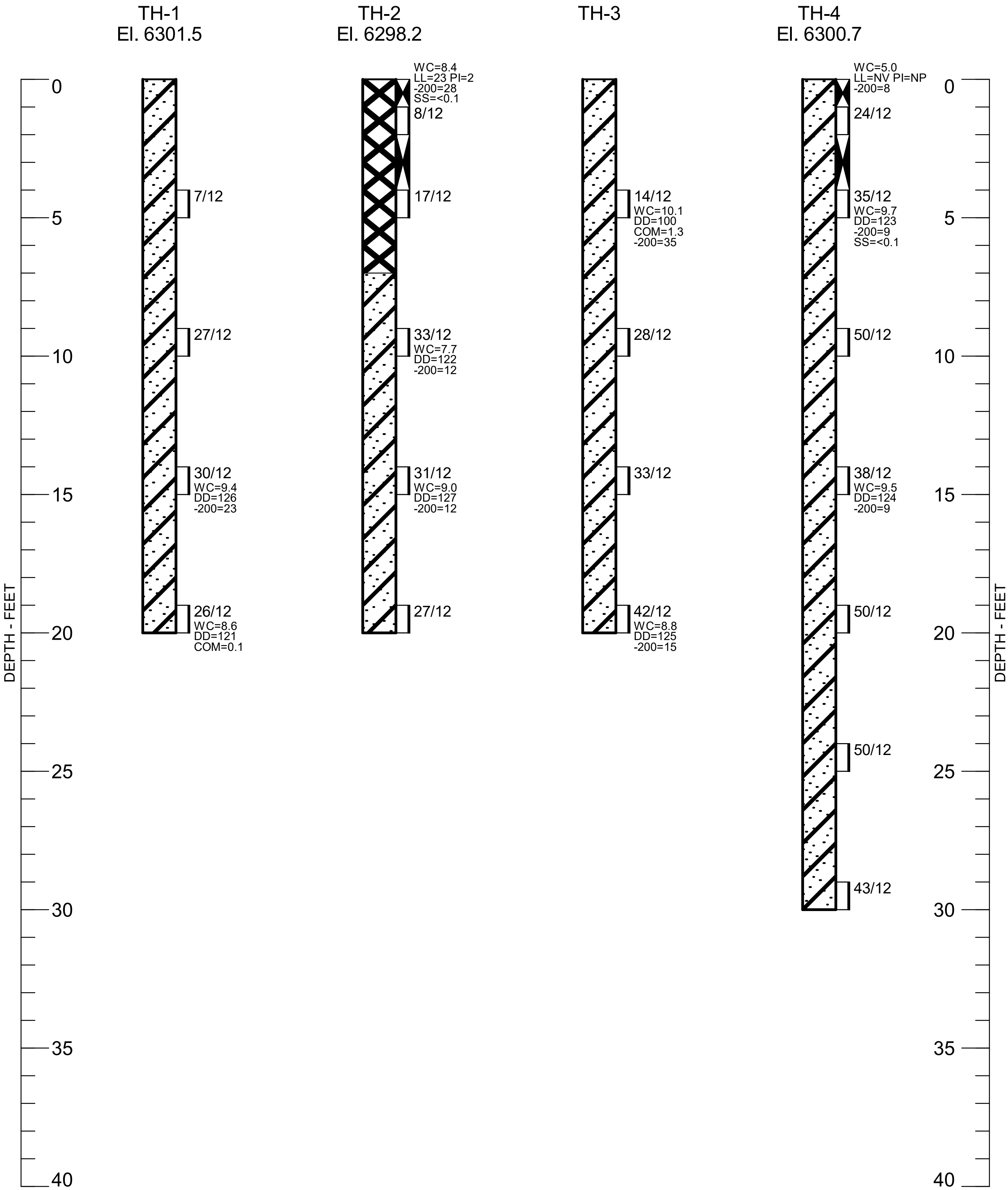
Recommended Pool Drain Detail

Fig. 3

APPENDIX A

SUMMARY LOGS OF EXPLORATORY BORINGS



SUMMARY LOGS OF EXPLORATORY BORINGS

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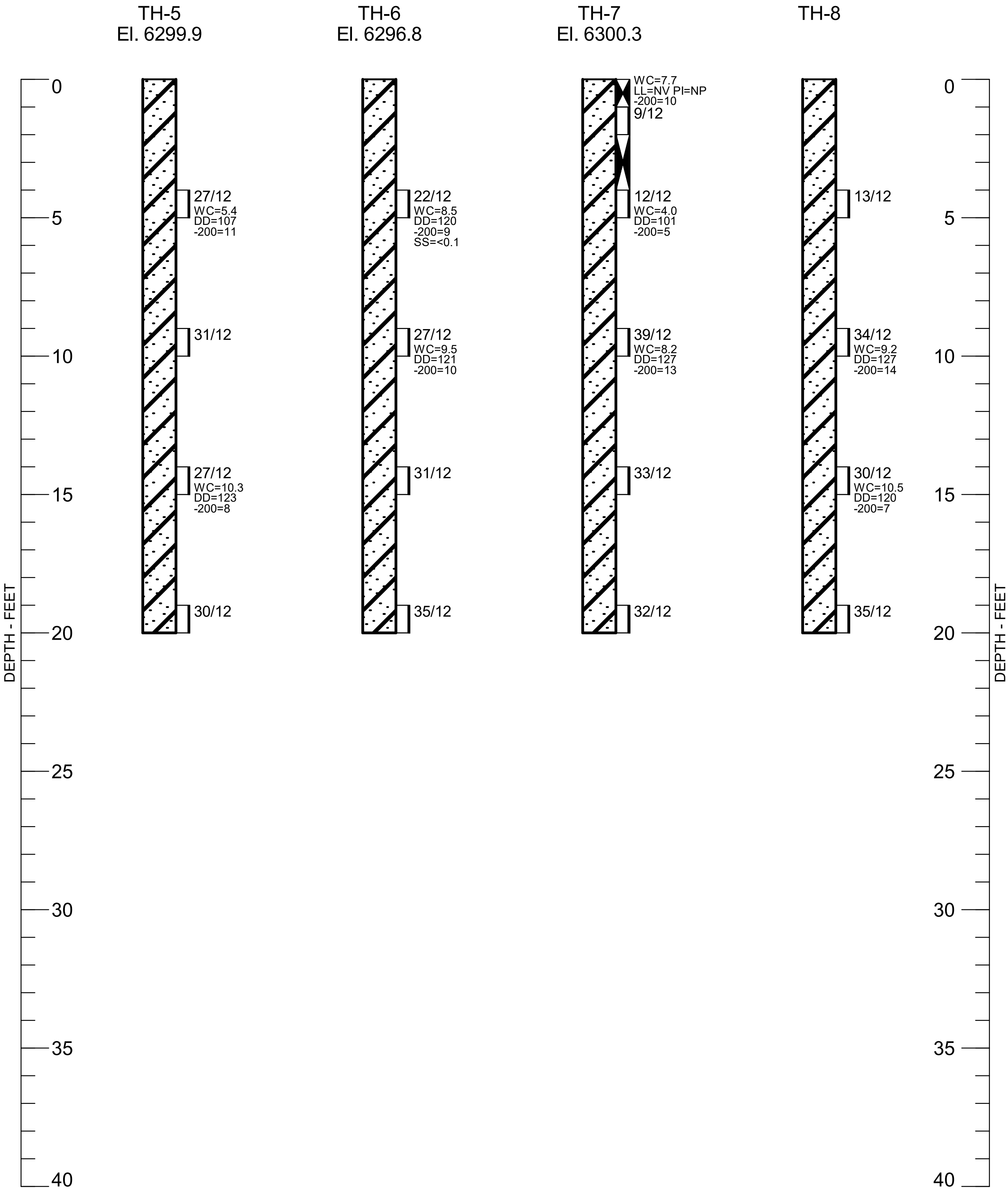
CROSSROADS APARTMENTS
CTL|T PROJECT NO. CS19308-125

FIG. A- 1



SUMMARY LOGS OF EXPLORATORY BORINGS

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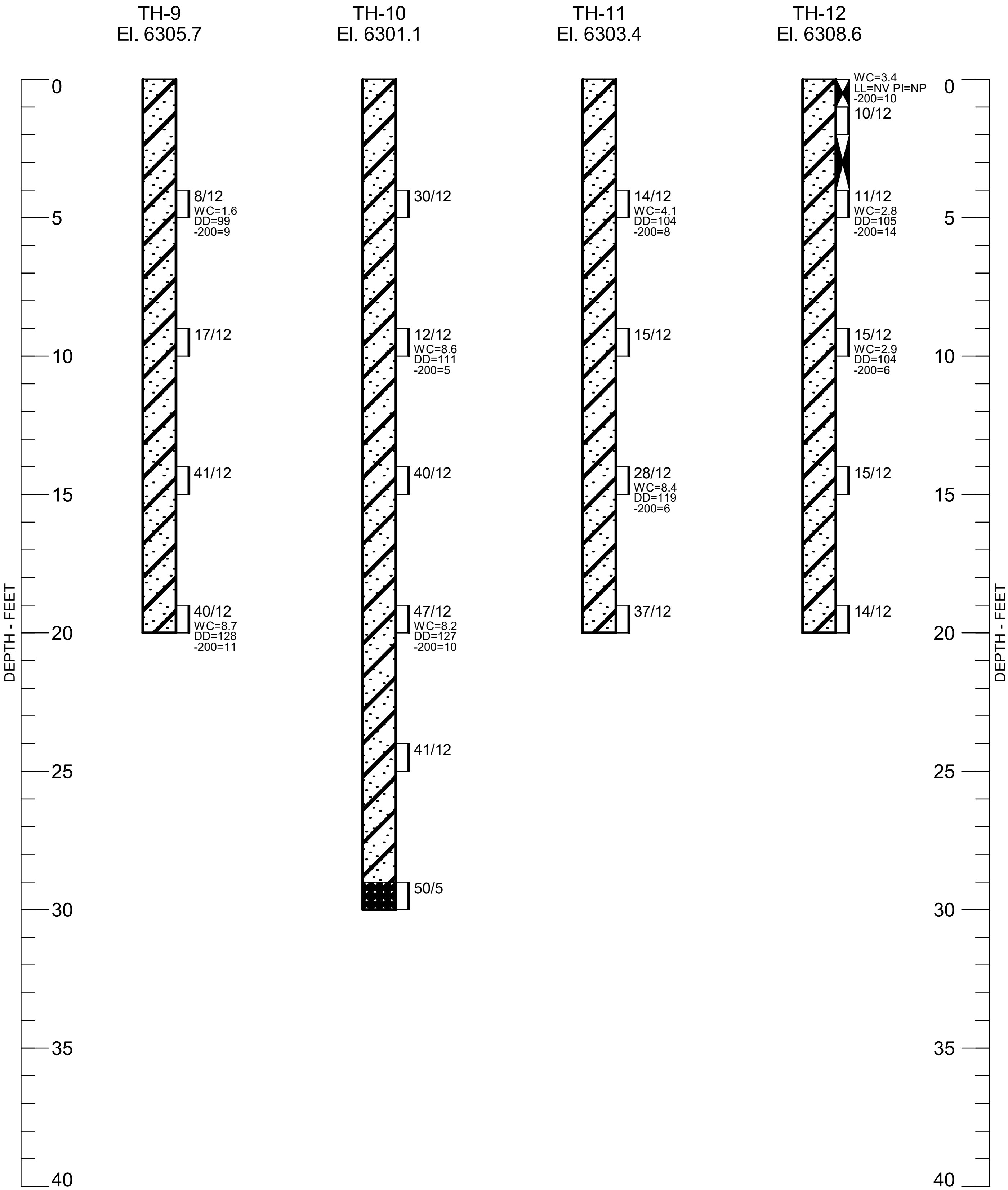
CTL|T PROJECT NO. CS19308-125

FIG. A- 2



SUMMARY LOGS OF EXPLORATORY BORINGS

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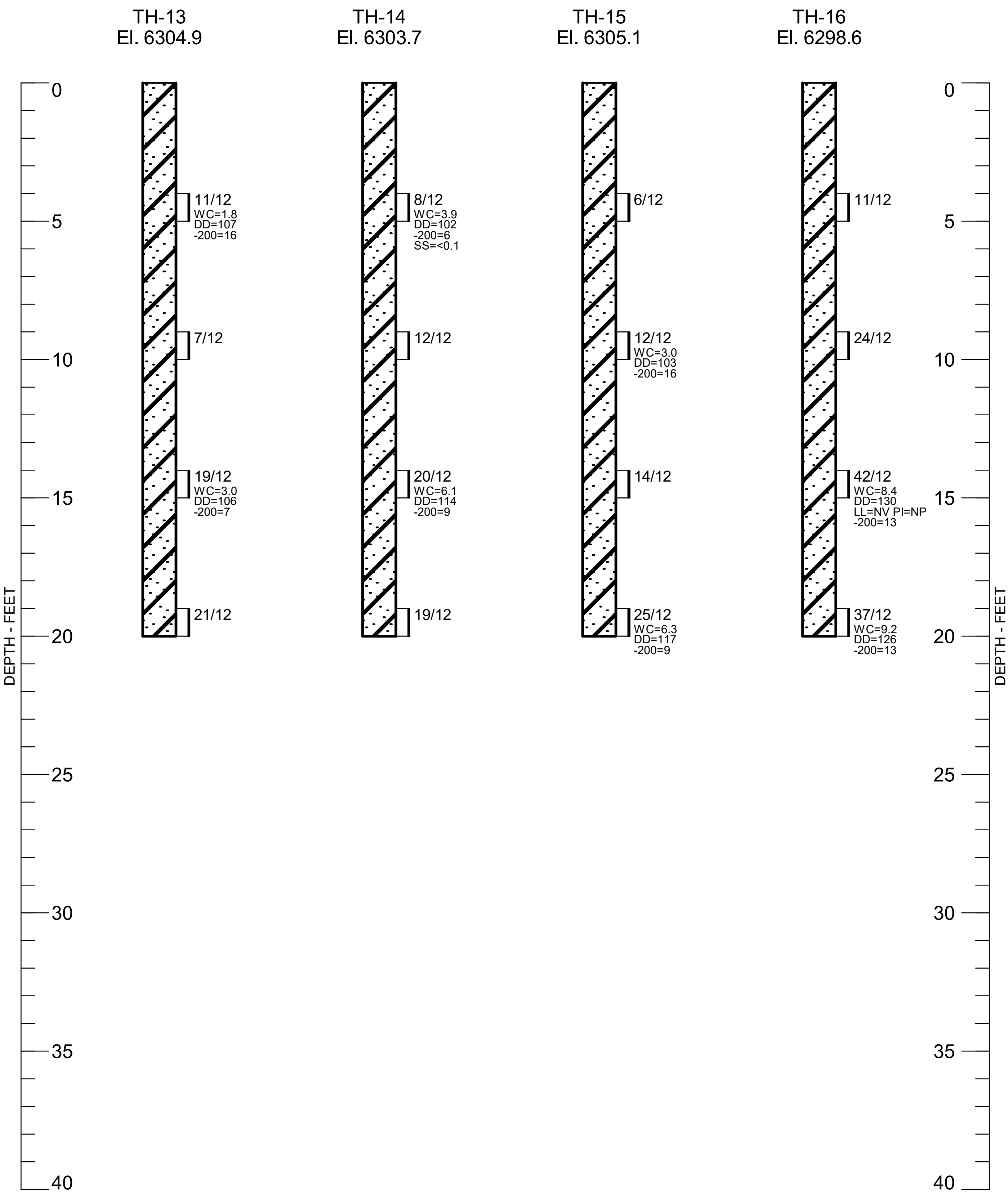
FIG. A- 3



SUMMARY LOGS OF EXPLORATORY BORINGS

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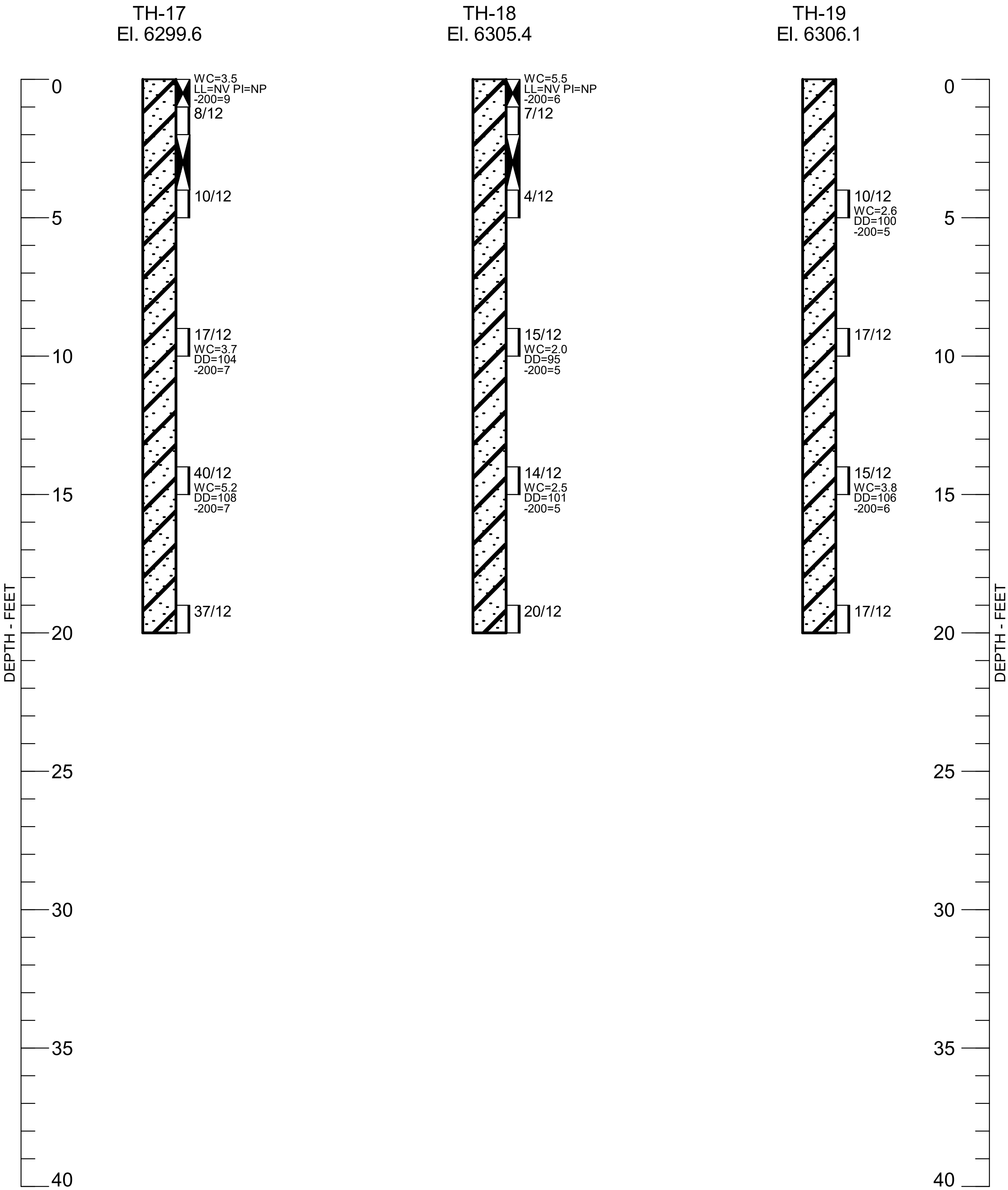
CTL|T PROJECT NO. CS19308-125

FIG. A- 4



SUMMARY LOGS OF EXPLORATORY BORINGS

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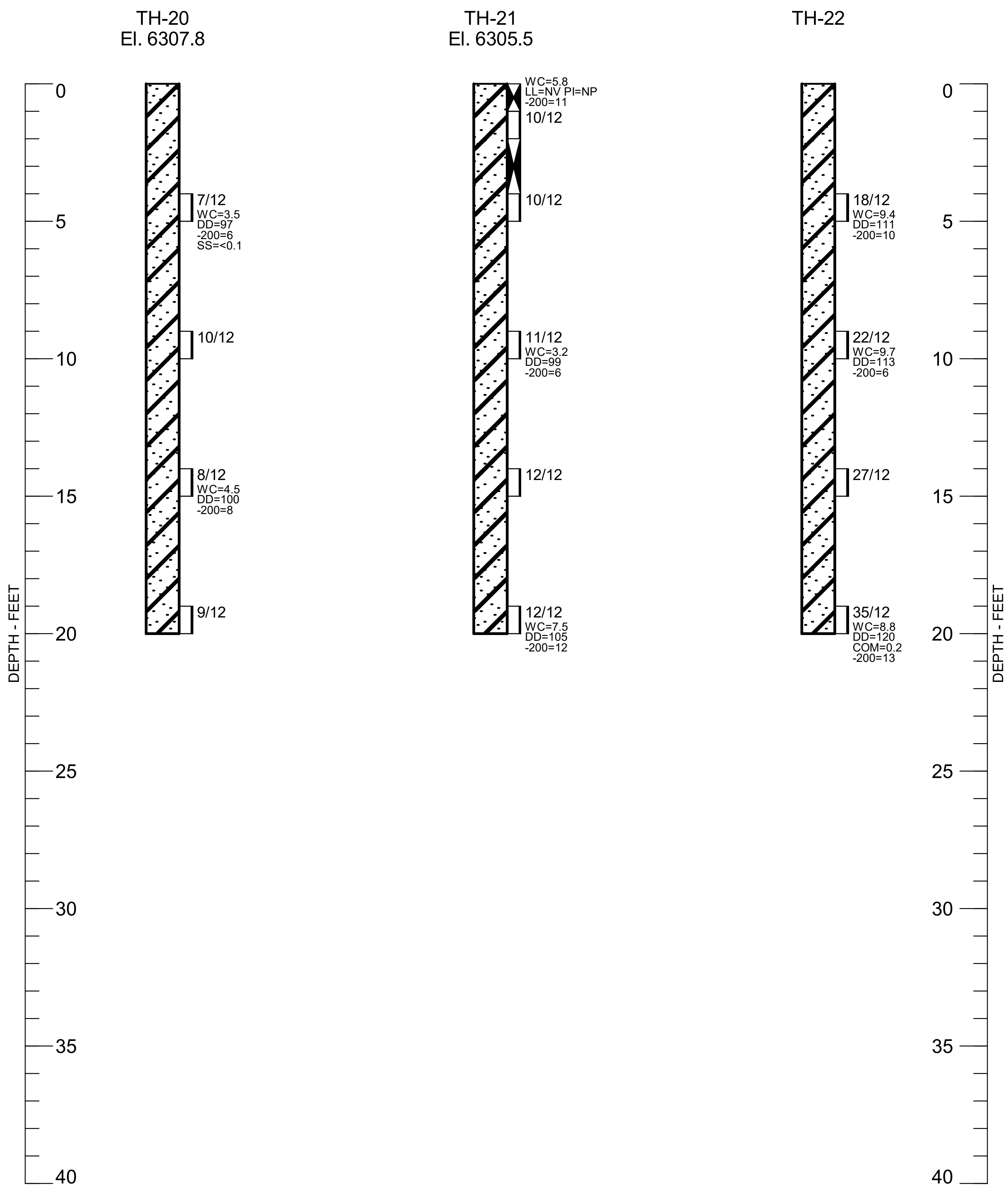
FIG. A- 5



SUMMARY LOGS OF EXPLORATORY BORINGS

LEGEND:

FILL, SAND, SILTY, LOOSE TO MEDIUM DENSE, SLIGHTLY MOIST, DARK BROWN.

SAND, CLEAN TO SILTY, LOOSE TO DENSE, DRY TO SLIGHTLY MOIST, LIGHT TO MEDIUM BROWN (SP-SM, SM).

BEDROCK, SANDSTONE, SLIGHTLY CLAYEY, VERY HARD, MOIST, MEDIUM BROWN, RUST.

DRIVE SAMPLE. THE SYMBOL 7/12 INDICATES 7 BLOWS OF AN AUTOMATIC 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.5-INCH O.D. SAMPLER 12 INCHES.

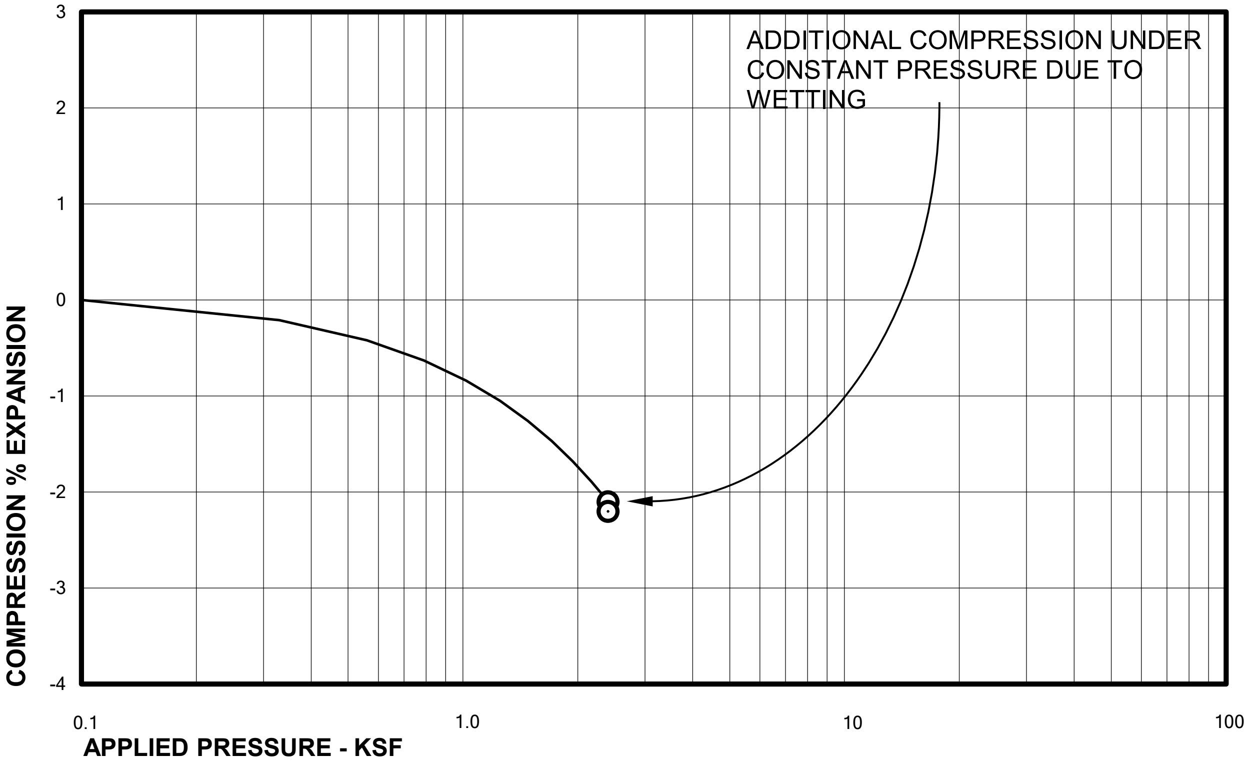
BULK SAMPLE COLLECTED FROM AUGER CUTTINGS.

NOTES:

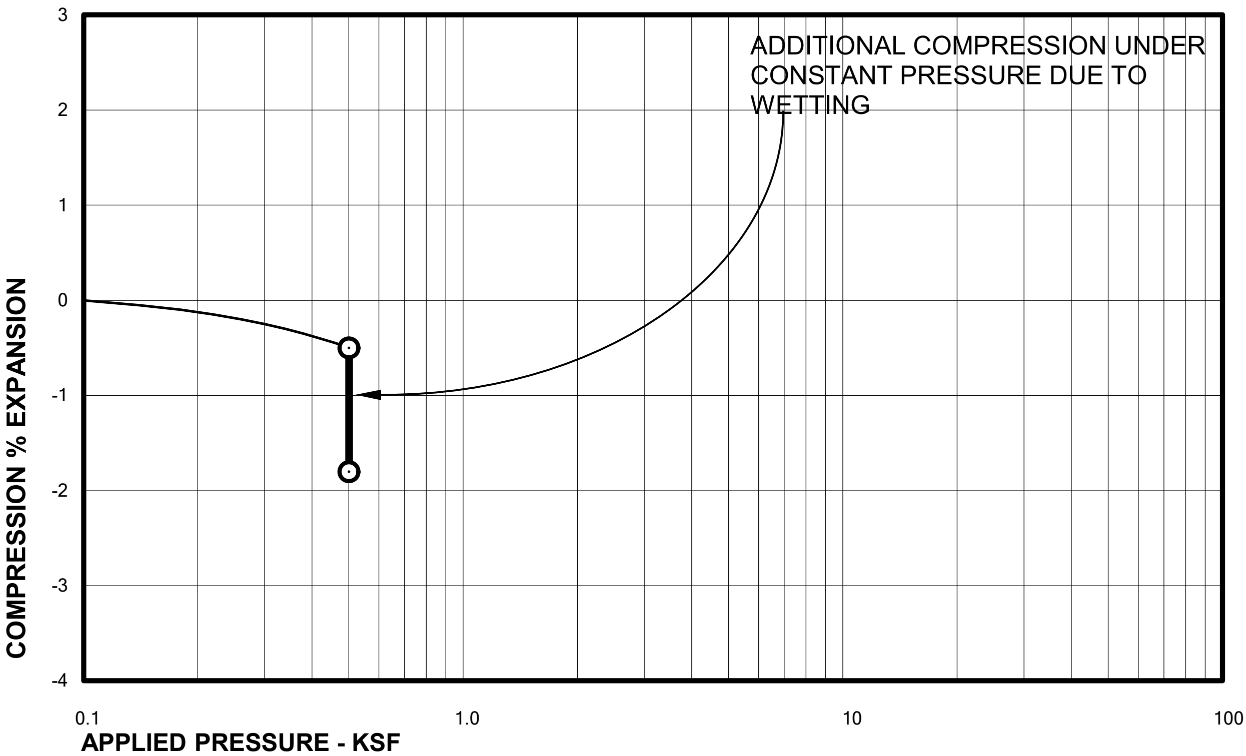
1. THE BORINGS WERE DRILLED ON MARCH 11, 12, 19, 25 AND 29, 2021 USING 4-INCH DIAMETER, CONTINUOUS-FLIGHT SOLID-STEM AUGER AND TRUCK-MOUNTED CME-45 DRILL RIG.
2. GROUNDWATER WAS NOT ENCOUNTERED DURING THIS INVESTIGATION.
3. WC - INDICATES MOISTURE CONTENT (%).
   DD - INDICATES DRY DENSITY (PCF).
   SW - INDICATES SWELL WHEN WETTED UNDER APPROXIMATE OVERBURDEN PRESSURE (%).
   COM - INDICATES COMPRESSION WHEN WETTED UNDER APPROXIMATE OVERBURDEN PRESSURE (%).
   LL - INDICATES LIQUID LIMIT.
   PI - INDICATES PLASTICITY INDEX.
   -200 - INDICATES PASSING NO. 200 SIEVE (%).
   SS - INDICATES WATER-SOLUBLE SULFATE CONTENT (%).
4. THESE LOGS ARE SUBJECT TO THE EXPLANATIONS, LIMITATIONS AND CONCLUSIONS CONTAINED IN THIS REPORT.

APPENDIX B

LABORATORY TEST RESULTS
TABLE B-1: SUMMARY OF LABORATORY TESTING



Sample of SAND, SILTY (SM) DRY UNIT WEIGHT= 121 PCF
From TH-1 AT 19 FEET MOISTURE CONTENT= 8.6 %



Sample of SAND, SILTY (SM) DRY UNIT WEIGHT= 100 PCF
From TH-3 AT 4 FEET MOISTURE CONTENT= 10.1 %

Swell Consolidation Test Results

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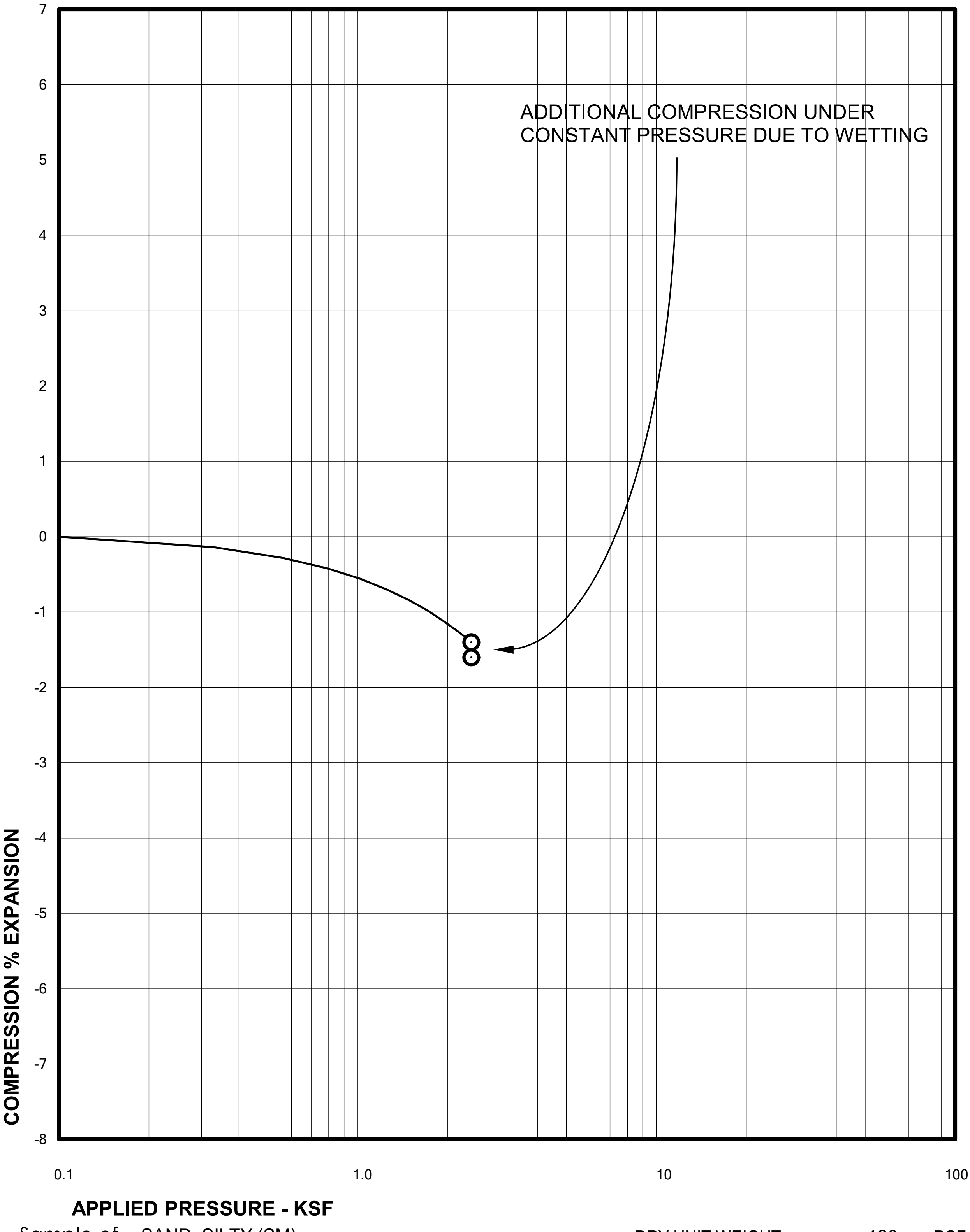
FIG. B-1



Sample of SAND, SILTY (SM)

From TH-22 AT 19 FEET

DRY UNIT WEIGHT= 120 PCF

MOISTURE CONTENT= 8.8 %

Swell Consolidation Test Results

FIG. B-2

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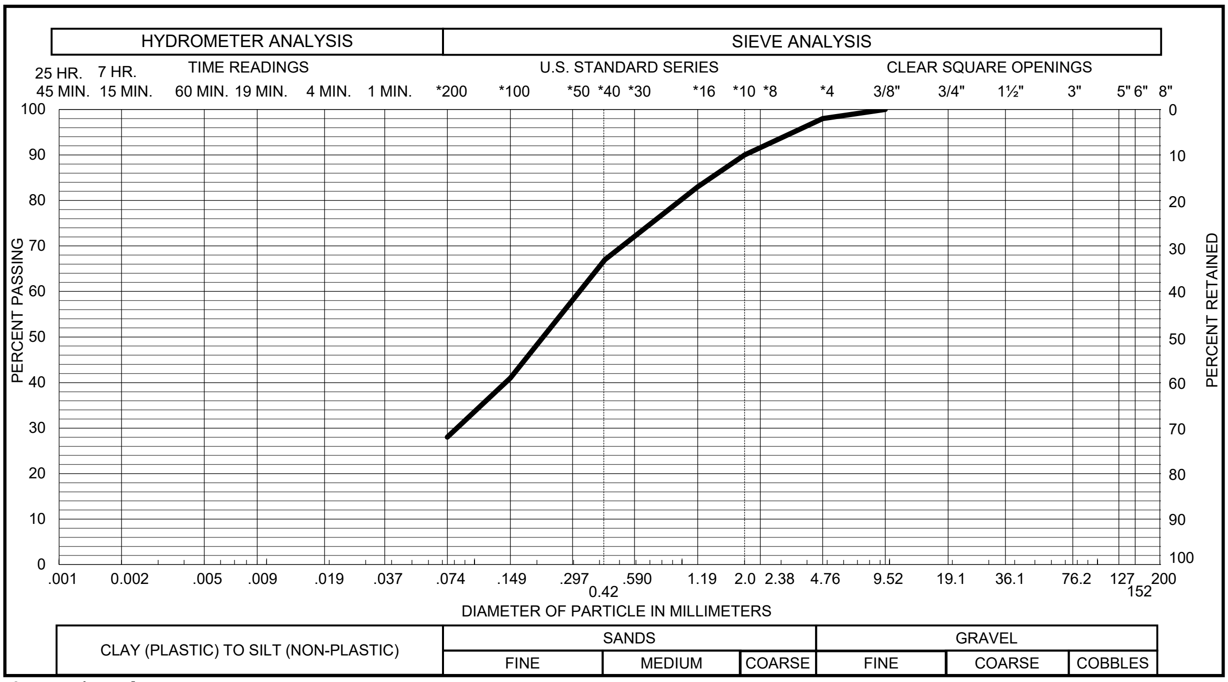


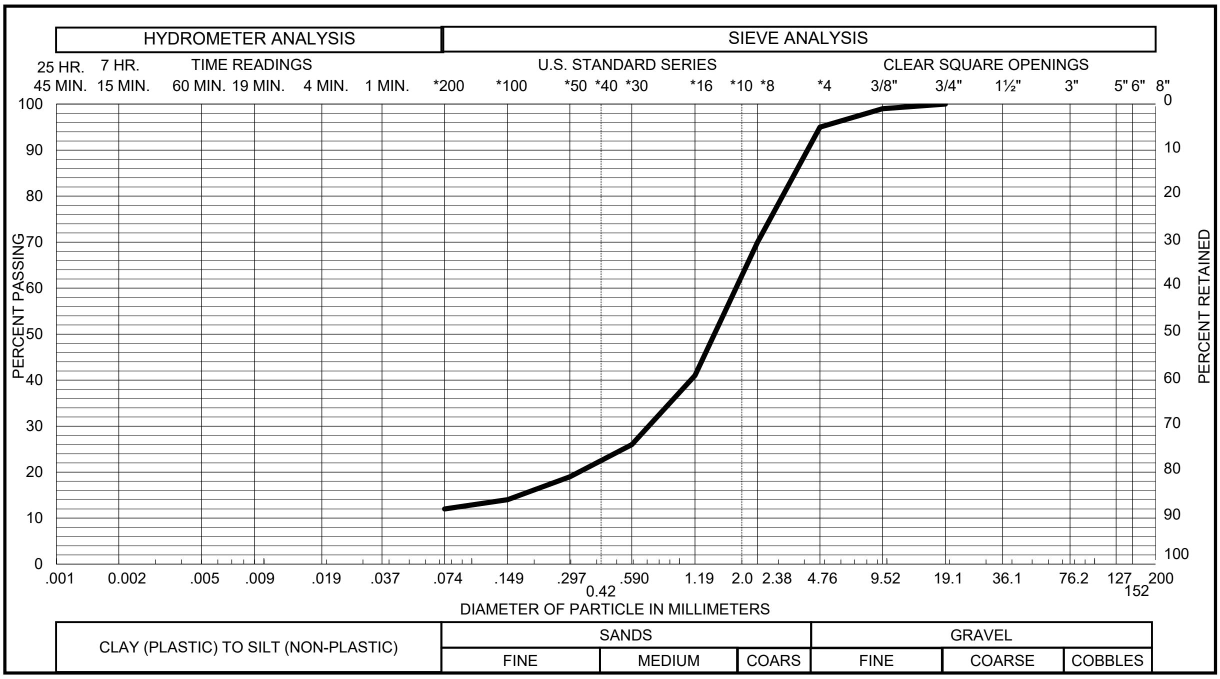
Sample of FILL, SAND, SILTY

From TH - 2 AT 0-4 FEET

GRAVEL 2 % SAND 70 %

SILT & CLAY 28 % LIQUID LIMIT %

PLASTICITY INDEX %



Sample of SAND, SLIGHTLY SILTY (SP-SM)

From TH - 2 AT 14 FEET

GRAVEL 5 % SAND 83 %

SILT & CLAY 12 % LIQUID LIMIT %

PLASTICITY INDEX %

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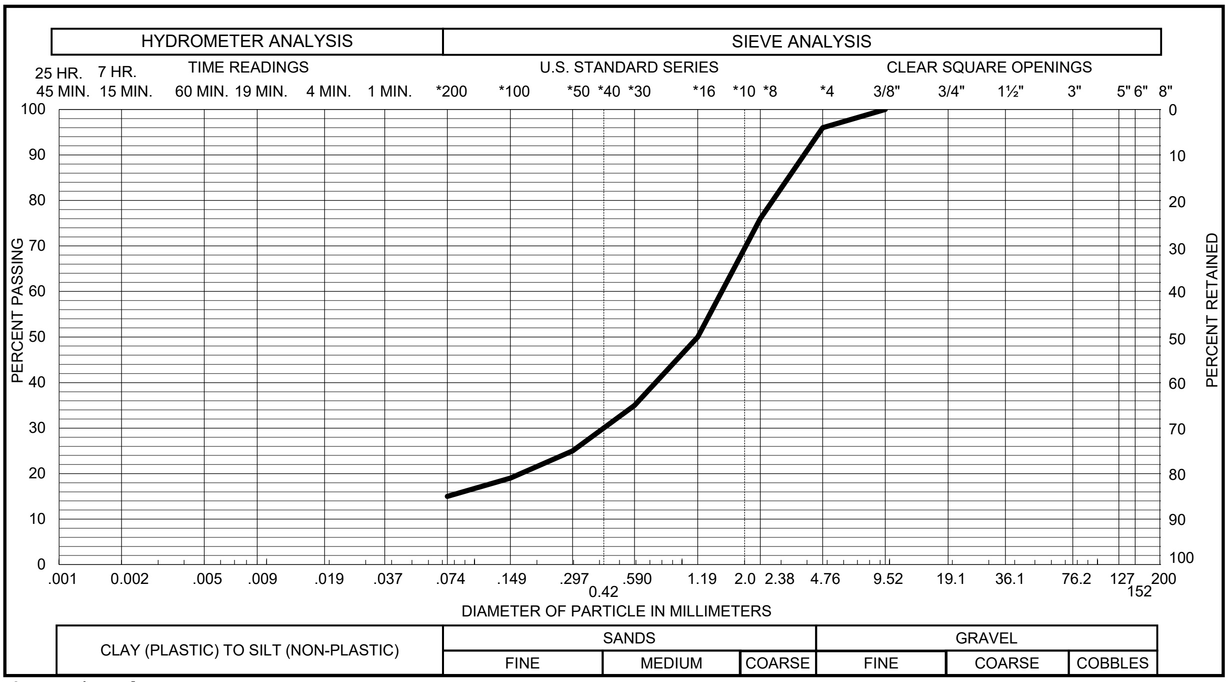
Gradation Test Results

FIG. B-3



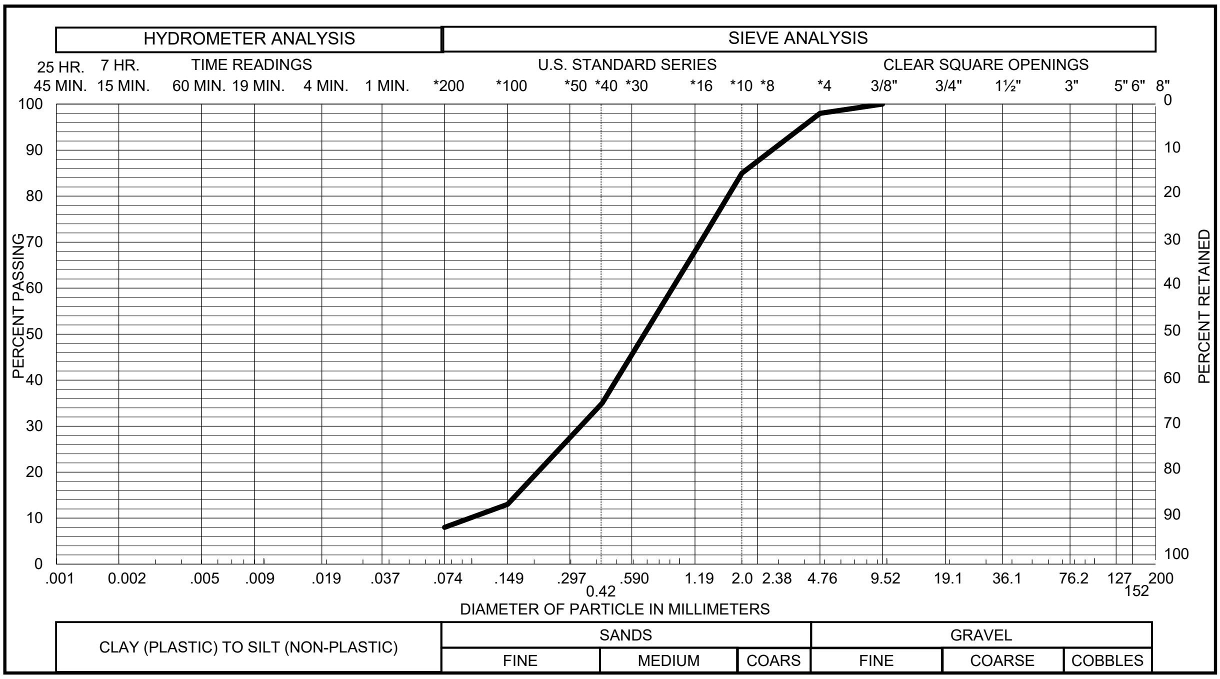
Sample of SAND, SILTY (SM)

From TH - 3 AT 19 FEET

GRAVEL 4 % SAND 81 %

SILT & CLAY 15 % LIQUID LIMIT %

PLASTICITY INDEX %



Sample of SAND, SLIGHTLY SILTY (SP-SM)

From TH - 4 AT 0-4 FEET

GRAVEL 2 % SAND 90 %

SILT & CLAY 8 % LIQUID LIMIT %

PLASTICITY INDEX %

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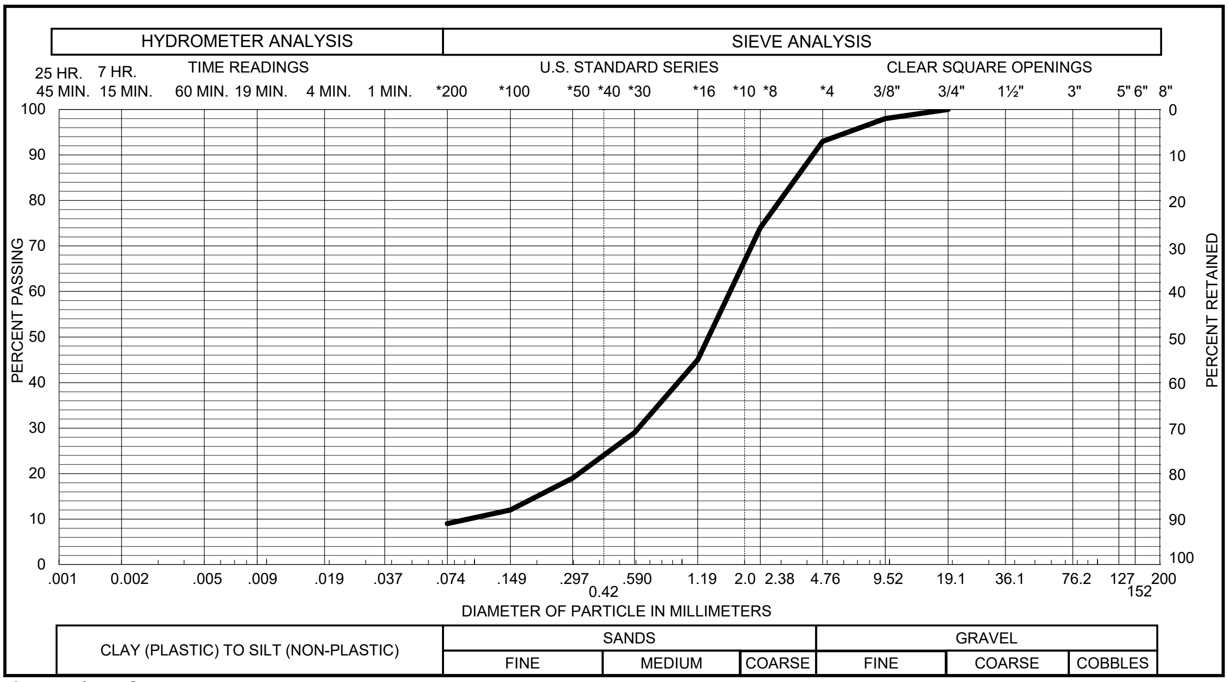
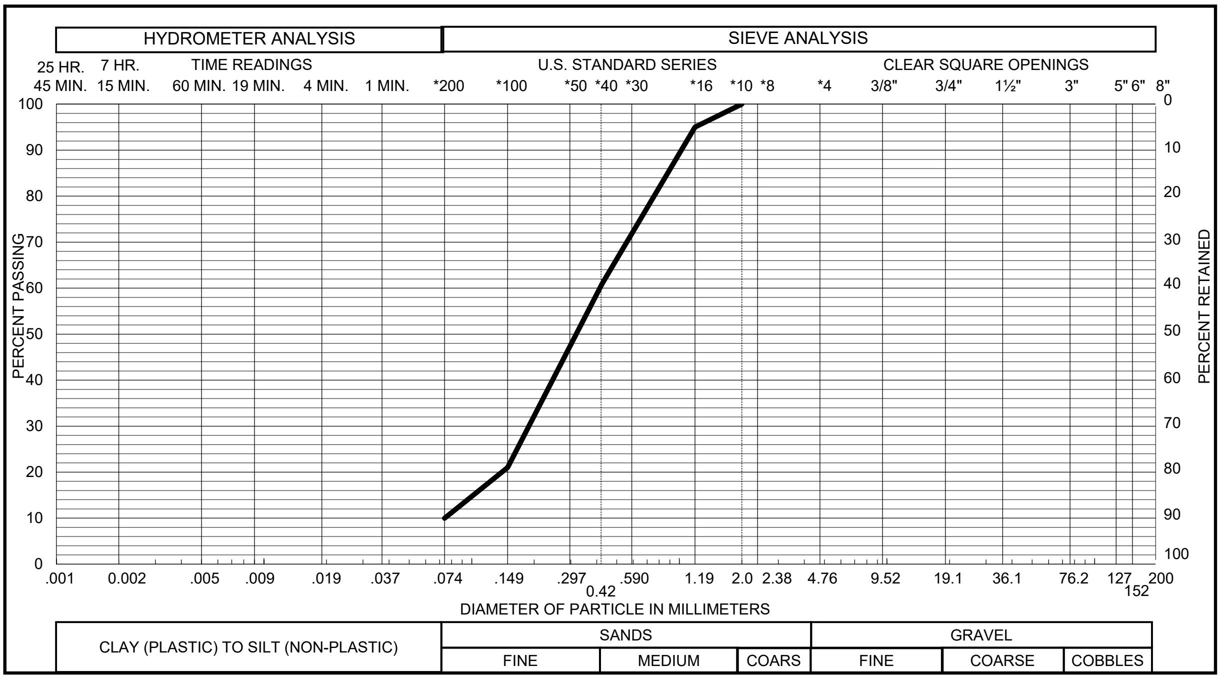
Gradation Test Results

FIG. B-4



Sample of SAND, SLIGHTLY SILTY (SP-SM)
From TH - 6 AT 4 FEET

GRAVEL 7 % SAND 84 %
SILT & CLAY 9 % LIQUID LIMIT %
PLASTICITY INDEX %



Sample of SAND, SLIGHTLY SILTY (SP-SM)
From TH - 7 AT 0-4 FEET

GRAVEL 0 % SAND 90 %
SILT & CLAY 10 % LIQUID LIMIT %
PLASTICITY INDEX %

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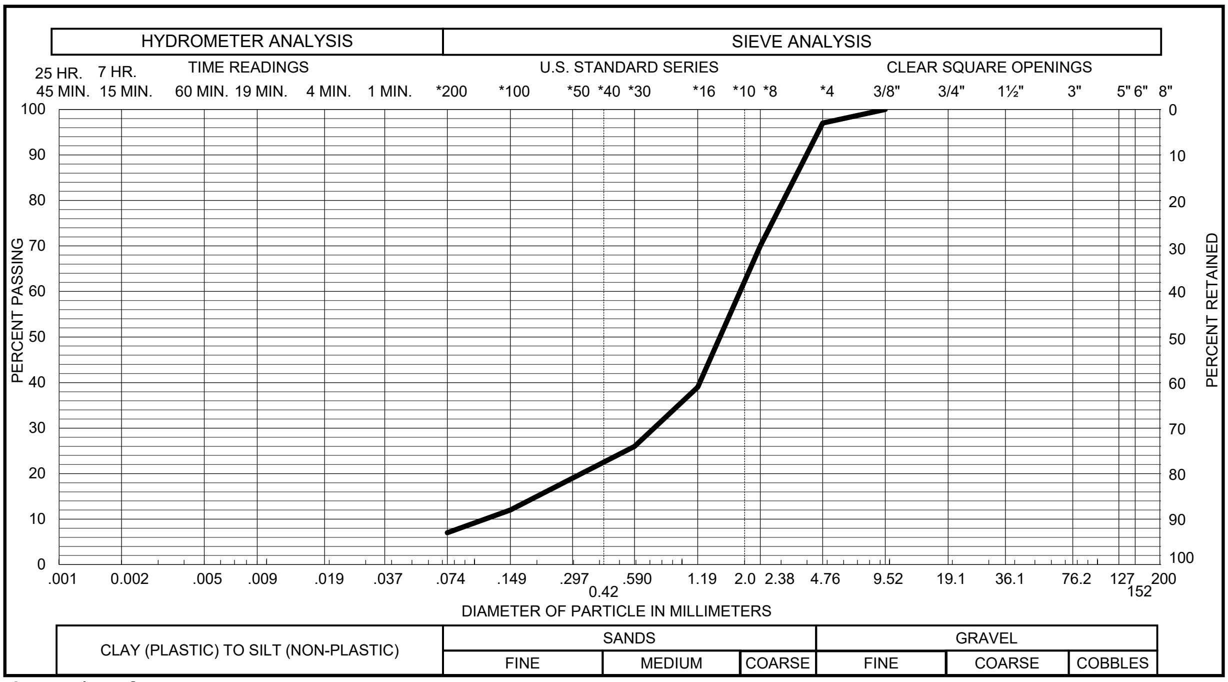
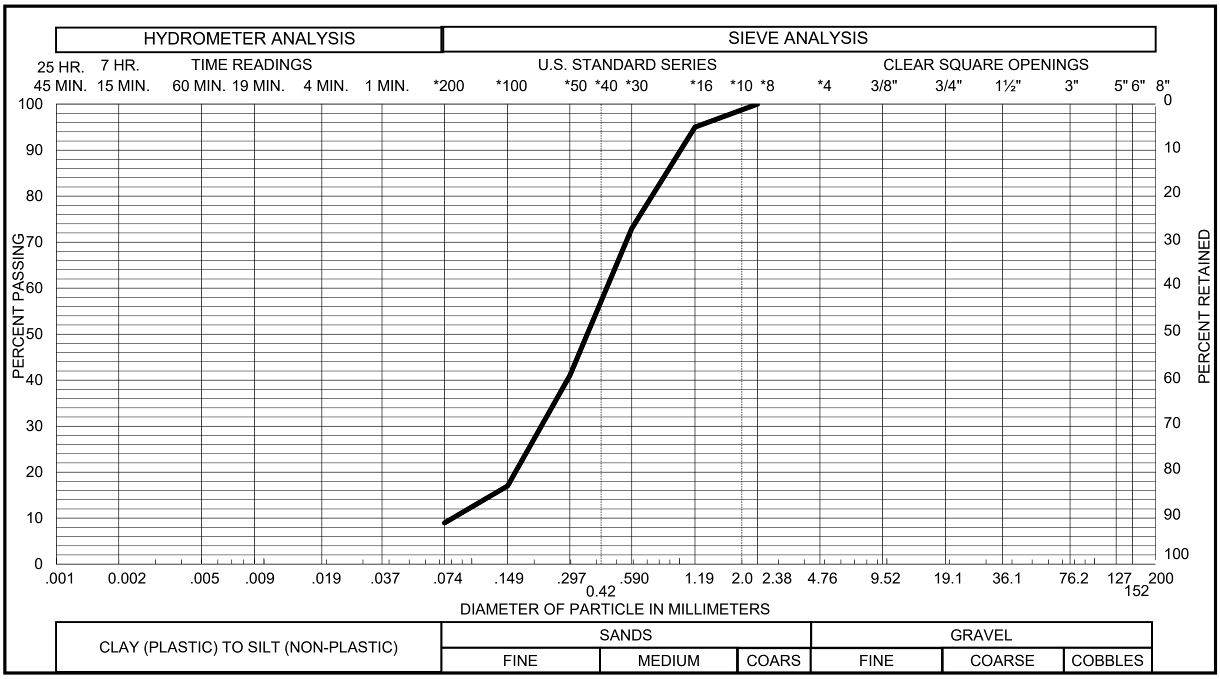
Gradation Test Results

FIG. B-5



Sample of SAND, SLIGHTLY SILTY (SP-SM)
From TH - 8 AT 14 FEET

GRAVEL 3 % SAND 90 %
SILT & CLAY 7 % LIQUID LIMIT %
PLASTICITY INDEX %



Sample of SAND, SLIGHTLY SILTY (SP-SM)
From TH - 9 AT 4 FEET

GRAVEL 0 % SAND 91 %
SILT & CLAY 9 % LIQUID LIMIT %
PLASTICITY INDEX %

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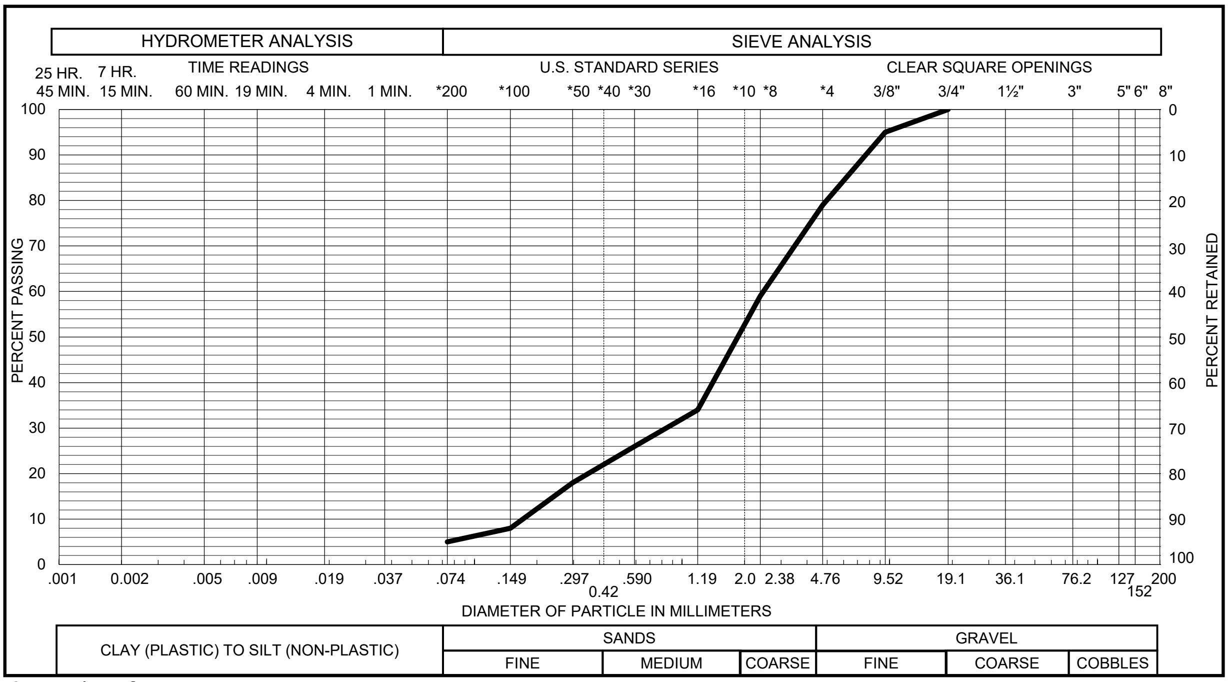
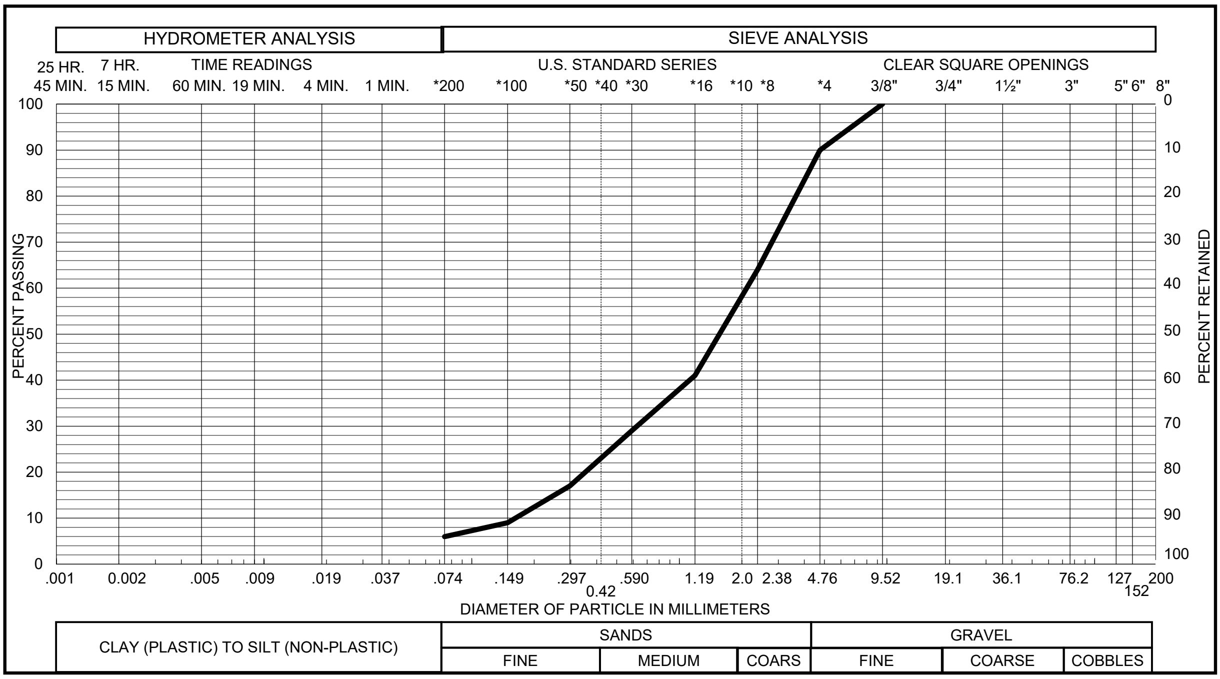
Gradation Test Results

FIG. B-6



Sample of SAND, SLIGHTLY SILTY (SP-SM)
From TH - 10 AT 9 FEET

GRAVEL	21 %	SAND	74 %
SILT & CLAY	5 %	LIQUID LIMIT	%
PLASTICITY INDEX	%		



Sample of SAND, SLIGHTLY SILTY (SP-SM)
From TH - 11 AT 14 FEET

GRAVEL	10 %	SAND	84 %
SILT & CLAY	6 %	LIQUID LIMIT	%
PLASTICITY INDEX	%		

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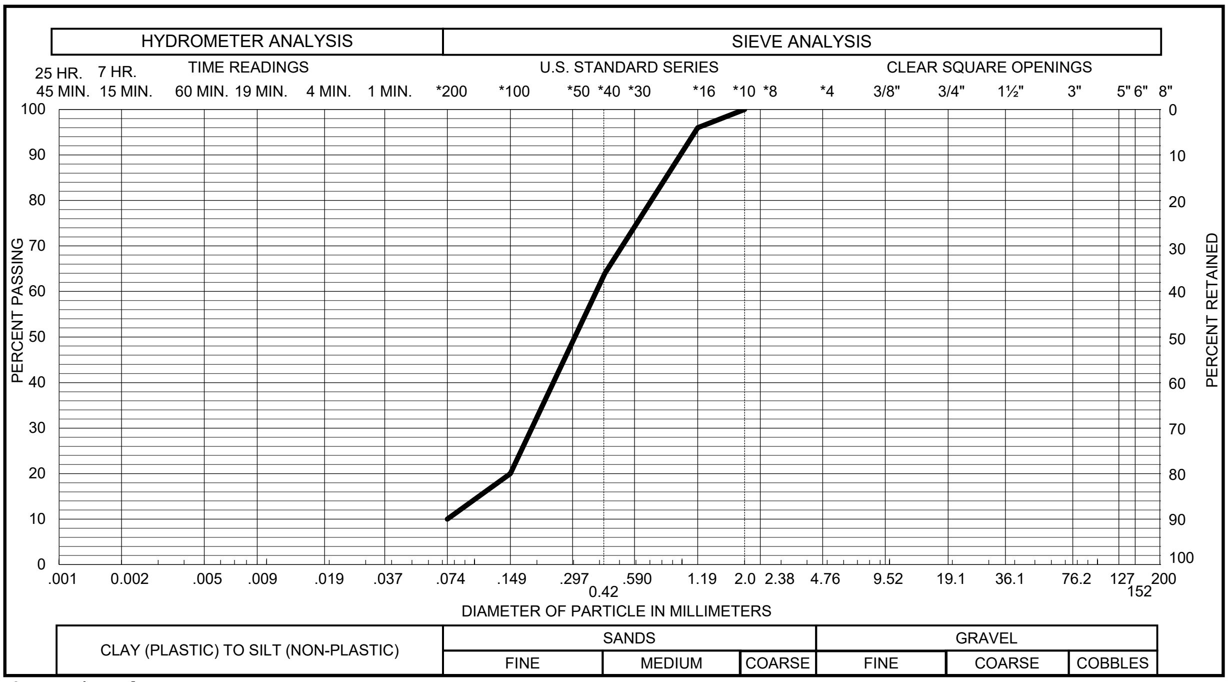
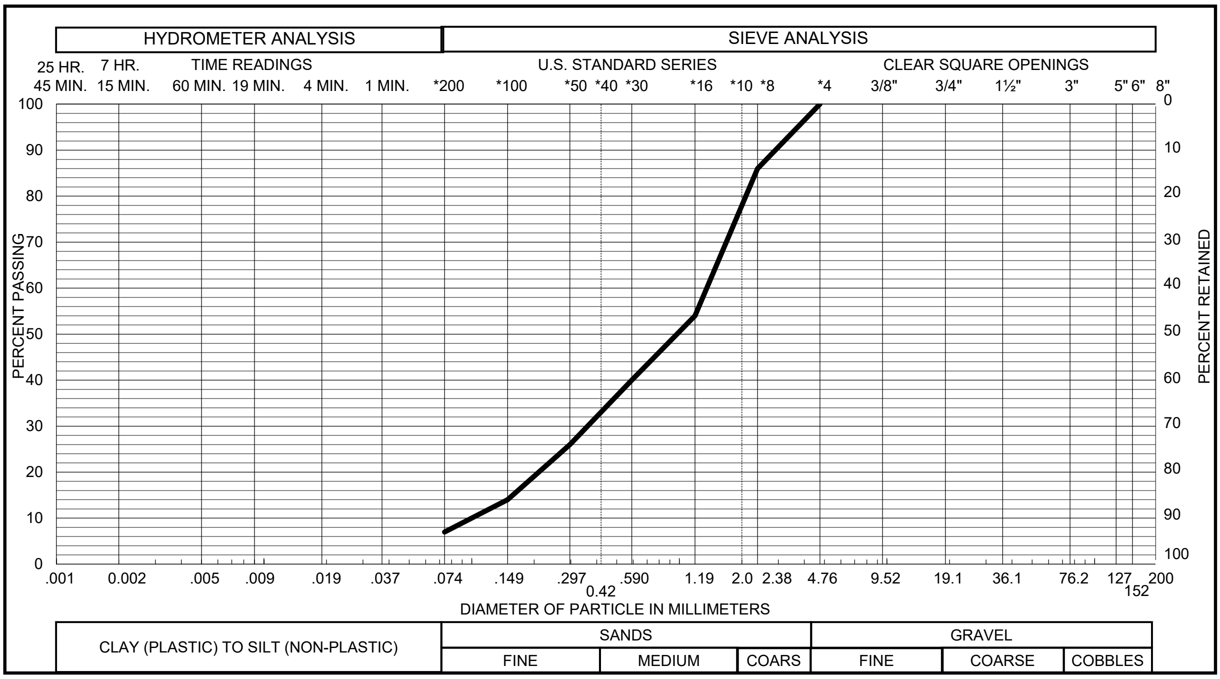
Gradation Test Results

FIG. B-7



Sample of SAND, SLIGHTLY SILTY (SP-SM)
From TH - 12 AT 0-4 FEET

GRAVEL 0 % SAND 90 %
SILT & CLAY 10 % LIQUID LIMIT %
PLASTICITY INDEX %



Sample of SAND, SLIGHTLY SILTY (SP-SM)
From TH - 13 AT 14 FEET

GRAVEL 0 % SAND 93 %
SILT & CLAY 7 % LIQUID LIMIT %
PLASTICITY INDEX %

TRINSIC RESIDENTIAL GROUP
CROSSROADS APARTMENTS
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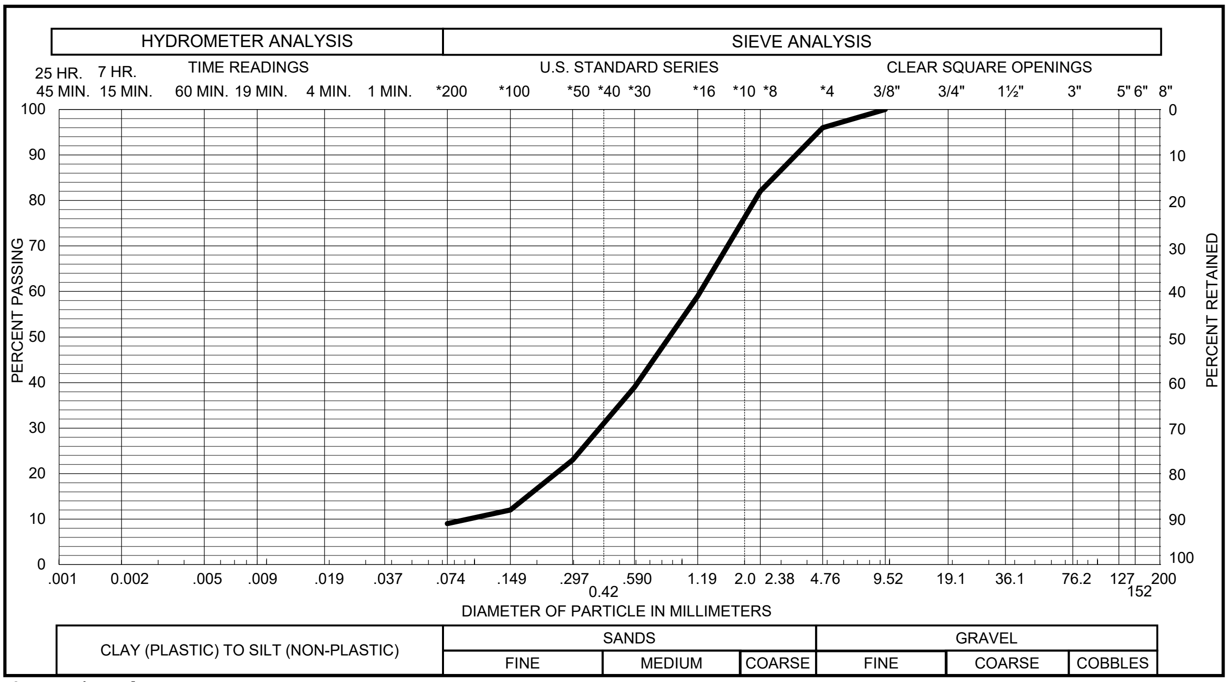
Gradation Test Results

FIG. B-8



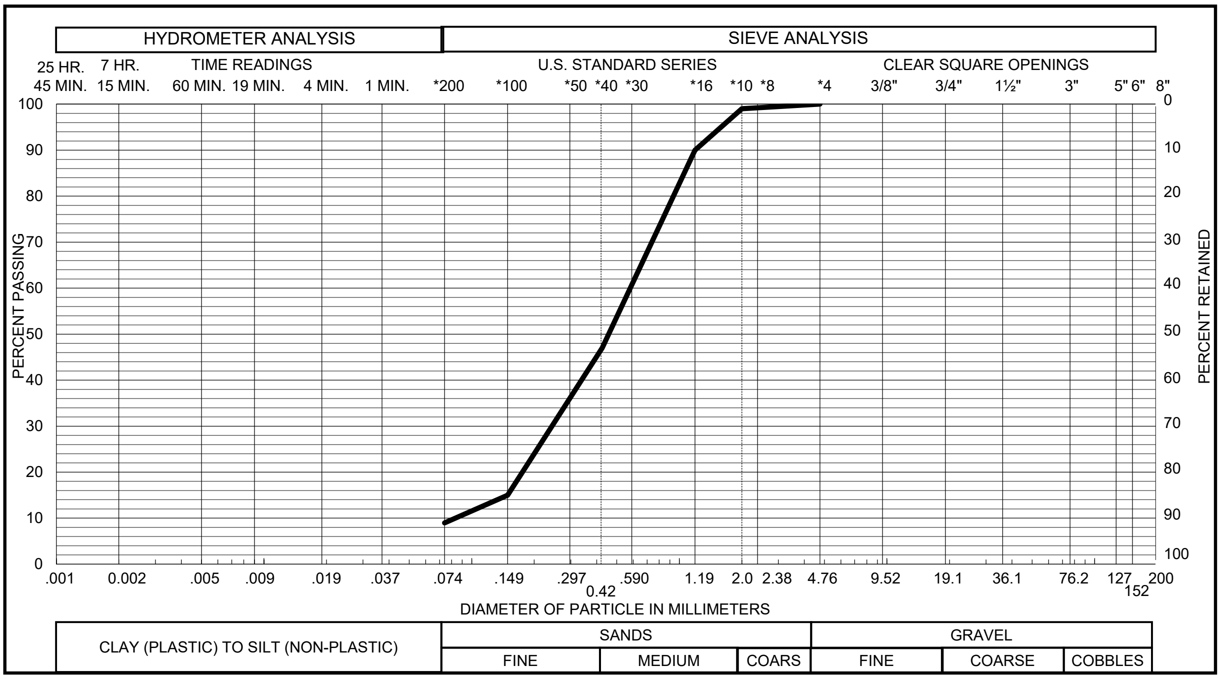
Sample of SAND, SLIGHTLY SILTY (SP-SM)

From TH - 15 AT 19 FEET

GRAVEL 4 % SAND 87 %

SILT & CLAY 9 % LIQUID LIMIT %

PLASTICITY INDEX %



Sample of SAND, SLIGHTLY SILTY (SP-SM)

From TH - 17 AT 0-4 FEET

GRAVEL 0 % SAND 91 %

SILT & CLAY 9 % LIQUID LIMIT %

PLASTICITY INDEX %

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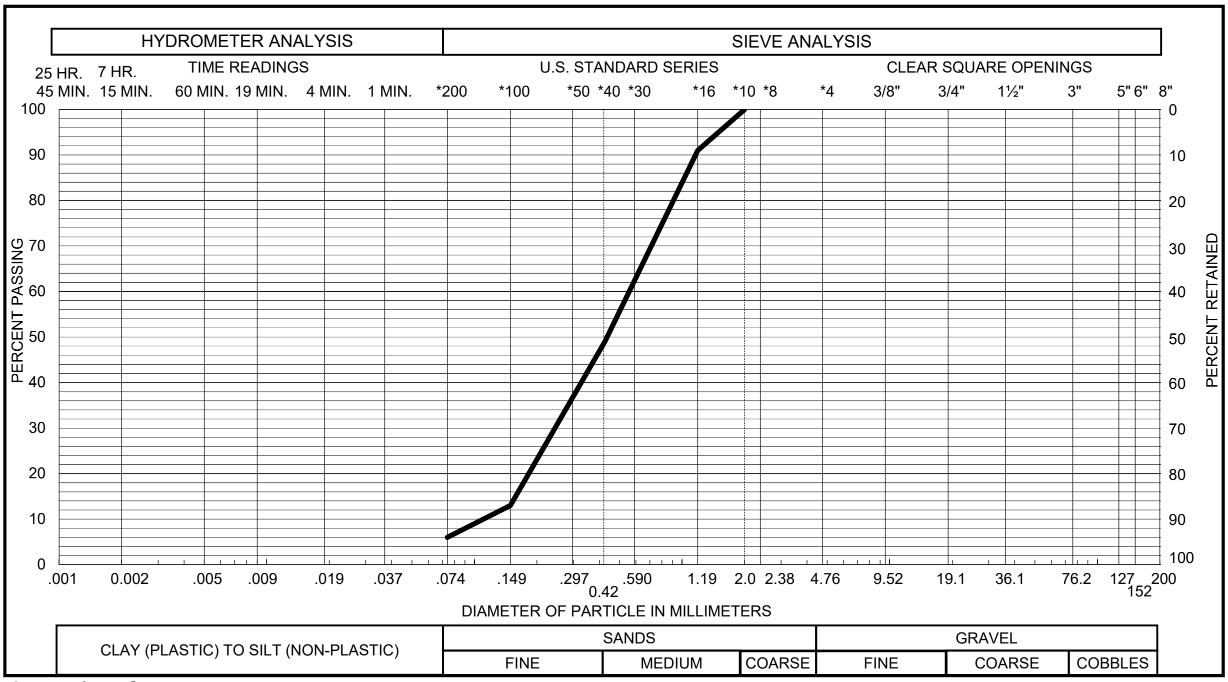
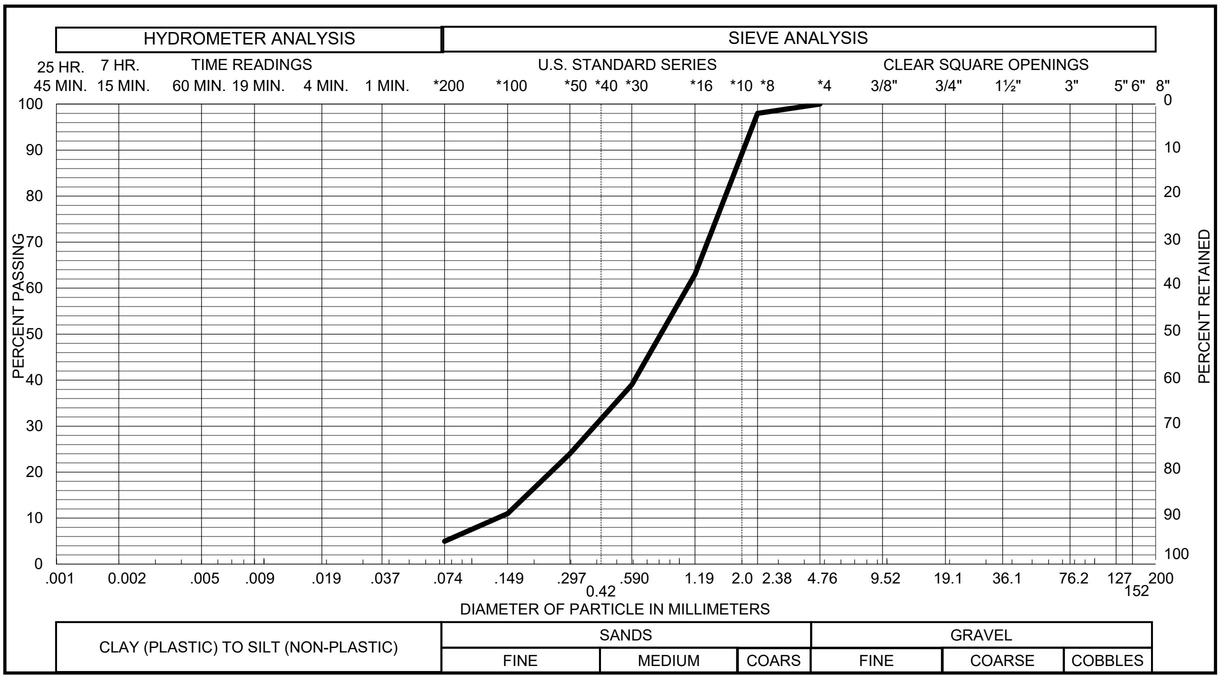
Gradation Test Results

FIG. B-9



Sample of SAND, SLIGHTLY SILTY (SP-SM)
From TH - 18 AT 0-4 FEET

GRAVEL 0 % SAND 94 %
SILT & CLAY 6 % LIQUID LIMIT %
PLASTICITY INDEX %



Sample of SAND, SLIGHTLY SILTY (SP-SM)
From TH - 19 AT 4 FEET

GRAVEL 0 % SAND 95 %
SILT & CLAY 5 % LIQUID LIMIT %
PLASTICITY INDEX %

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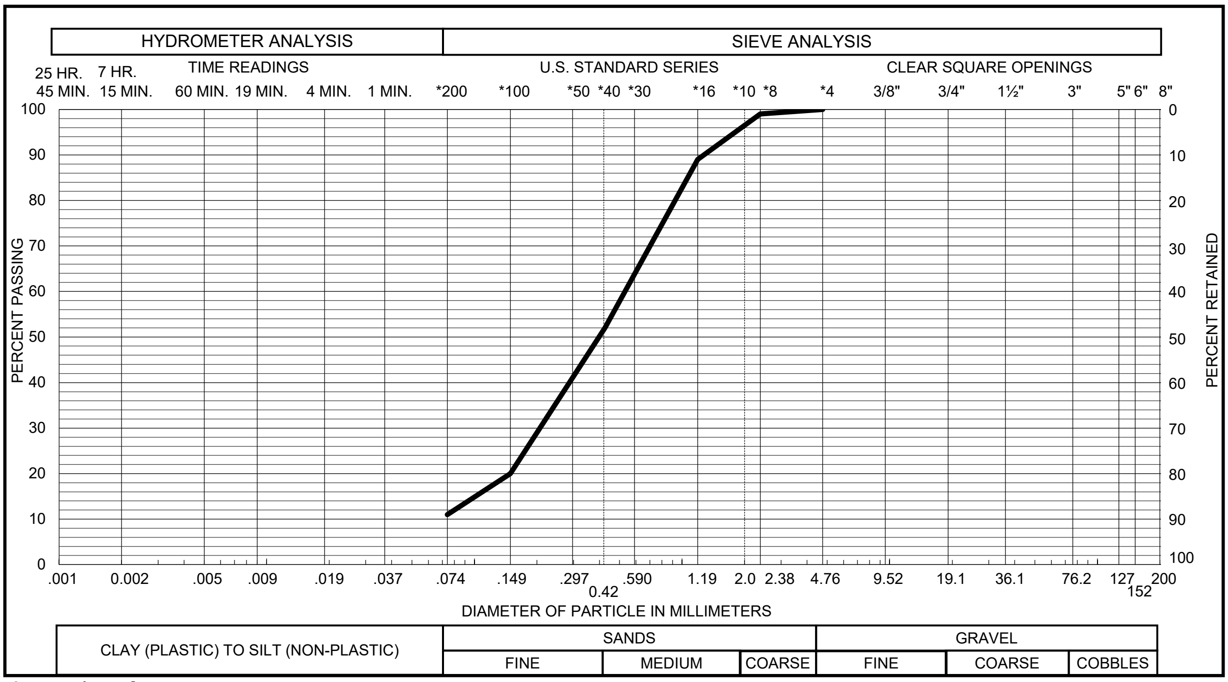
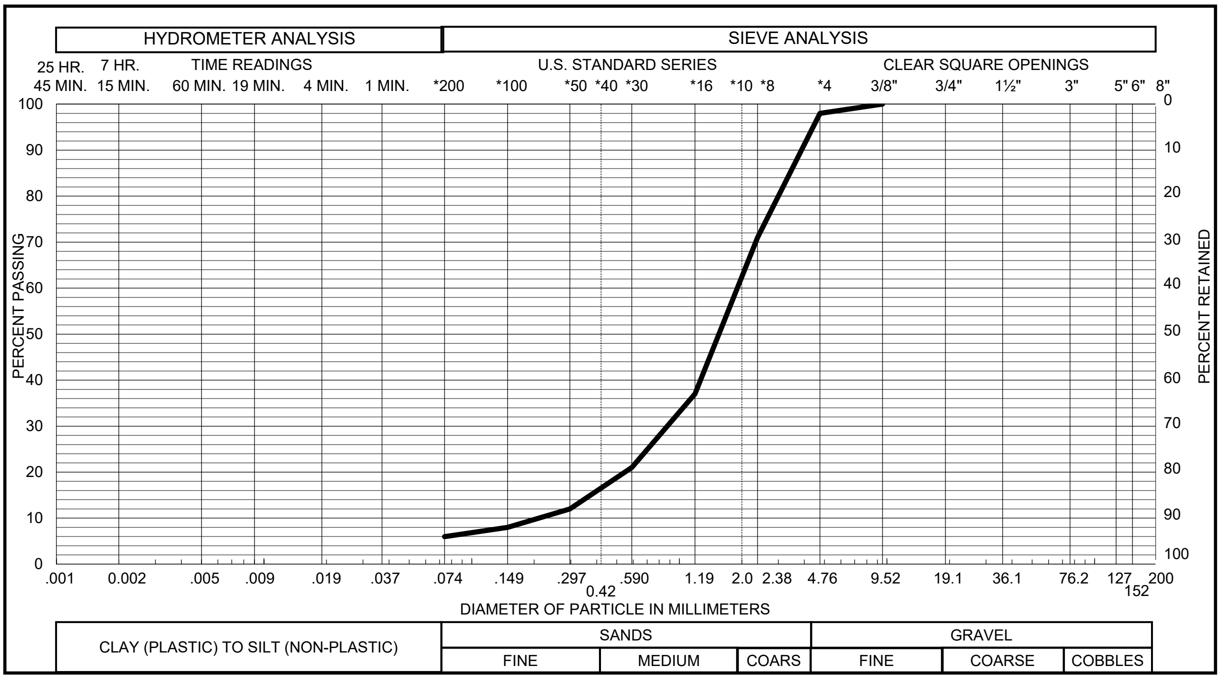
Gradation Test Results

FIG. B-10



Sample of SAND, SLIGHTLY SILTY (SP-SM)
From TH - 21 AT 0-4 FEET

GRAVEL 0 % SAND 89 %
SILT & CLAY 11 % LIQUID LIMIT %
PLASTICITY INDEX %



Sample of SAND, SLIGHTLY SILTY (SP-SM)
From TH - 22 AT 9 FEET

GRAVEL 2 % SAND 92 %
SILT & CLAY 6 % LIQUID LIMIT %
PLASTICITY INDEX %

TRINSIC RESIDENTIAL GROUP
CROSSROADS APARTMENTS
CTL|T PROJECT NO. CS19308-125

Gradation Test Results

FIG. B-11

TABLE 1

SUMMARY OF LABORATORY TESTING
CTL|T PROJECT NO. CS19308-125

				ATTERBERG LIMITS		SWELL TEST RESULTS*					
BORING	DEPTH (FEET)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	SWELL (%)	APPLIED PRESSURE (PSF)	SWELL PRESSURE (PSF)	PASSING NO. 200 SIEVE (%)	WATER SOLUBLE SULFATES (%)	DESCRIPTION
TH-1	14	9.4	126						23		SAND, SILTY (SM)
TH-1	19	8.6	121			-0.1	2400				SAND, SILTY (SM)
TH-2	0-4	8.4		23	2				28	<0.1	FILL, SAND, SILTY
TH-2	9	7.7	122						12		SAND, SLIGHTLY SILTY (SP-SM)
TH-2	14	9.0	127						12		SAND, SLIGHTLY SILTY (SP-SM)
TH-3	4	10.1	100			-1.3	500		35		SAND, SILTY (SM)
TH-3	19	8.8	125						15		SAND, SILTY (SM)
TH-4	0-4	5.0		NV	NP				8		SAND, SLIGHTLY SILTY (SP-SM)
TH-4	4	9.7	123						9	<0.1	SAND, SLIGHTLY SILTY (SP-SM)
TH-4	14	9.5	124						9		SAND, SLIGHTLY SILTY (SP-SM)
TH-5	4	5.4	107						11		SAND, SLIGHTLY SILTY (SP-SM)
TH-5	14	10.3	123						8		SAND, SLIGHTLY SILTY (SP-SM)
TH-6	4	8.5	120						9	<0.1	SAND, SLIGHTLY SILTY (SP-SM)
TH-6	9	9.5	121						10		SAND, SLIGHTLY SILTY (SP-SM)
TH-7	0-4	7.7		NV	NP				10		SAND, SLIGHTLY SILTY (SP-SM)
TH-7	4	4.0	101						5		SAND, SLIGHTLY SILTY (SP-SM)
TH-7	9	8.2	127						13		SAND, SILTY (SM)
TH-8	9	9.2	127						14		SAND, SILTY (SM)
TH-8	14	10.5	120						7		SAND, SLIGHTLY SILTY (SP-SM)
TH-9	4	1.6	99						9		SAND, SLIGHTLY SILTY (SP-SM)
TH-9	19	8.7	128						11		SAND, SLIGHTLY SILTY (SP-SM)
TH-10	9	8.6	111						5		SAND, SLIGHTLY SILTY (SP-SM)
TH-10	19	8.2	127						10		SAND, SLIGHTLY SILTY (SP-SM)
TH-11	4	4.1	104						8		SAND, SLIGHTLY SILTY (SP-SM)
TH-11	14	8.4	119						6		SAND, SLIGHTLY SILTY (SP-SM)
TH-12	0-4	3.4		NV	NP				10		SAND, SLIGHTLY SILTY (SP-SM)
TH-12	4	2.8	105						14		SAND, SILTY (SM)
TH-12	9	2.9	104						6		SAND, SLIGHTLY SILTY (SP-SM)
TH-13	4	1.8	107						16		SAND, SILTY (SM)
TH-13	14	3.0	106						7		SAND, SLIGHTLY SILTY (SP-SM)
TH-14	4	3.9	102						6	<0.1	SAND, SLIGHTLY SILTY (SP-SM)
TH-14	14	6.1	114						9		SAND, SLIGHTLY SILTY (SP-SM)
TH-15	9	3.0	103						16		SAND, SILTY (SM)

* SWELL MEASURED UNDER ESTIMATED IN-SITU OVERBURDEN PRESSURE.
NEGATIVE VALUE INDICATES COMPRESSION.

TABLE 1

SUMMARY OF LABORATORY TESTING
CTL|T PROJECT NO. CS19308-125

BORING	DEPTH (FEET)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	ATTERBERG LIMITS		SWELL TEST RESULTS*			PASSING NO. 200 SIEVE (%)	WATER SOLUBLE SULFATES (%)	DESCRIPTION
				LIQUID LIMIT (%)	PLASTICITY INDEX (%)	SWELL (%)	APPLIED PRESSURE (PSF)	SWELL PRESSURE (PSF)			
TH-15	19	6.3	117						9		SAND, SLIGHTLY SILTY (SP-SM)
TH-16	14	8.4	130	NV	NP				13		SAND, SILTY (SM)
TH-16	19	9.2	126						13		SAND, SILTY (SM)

* SWELL MEASURED UNDER ESTIMATED IN-SITU OVERBURDEN PRESSURE.
NEGATIVE VALUE INDICATES COMPRESSION.

Appendix F – Cost Estimate

HARRIS KOCHER SMITH
DENVER • DALLAS/FORT WORTH

Aura at Crossroads
Opinion of Probable Cost
March 24, 2022

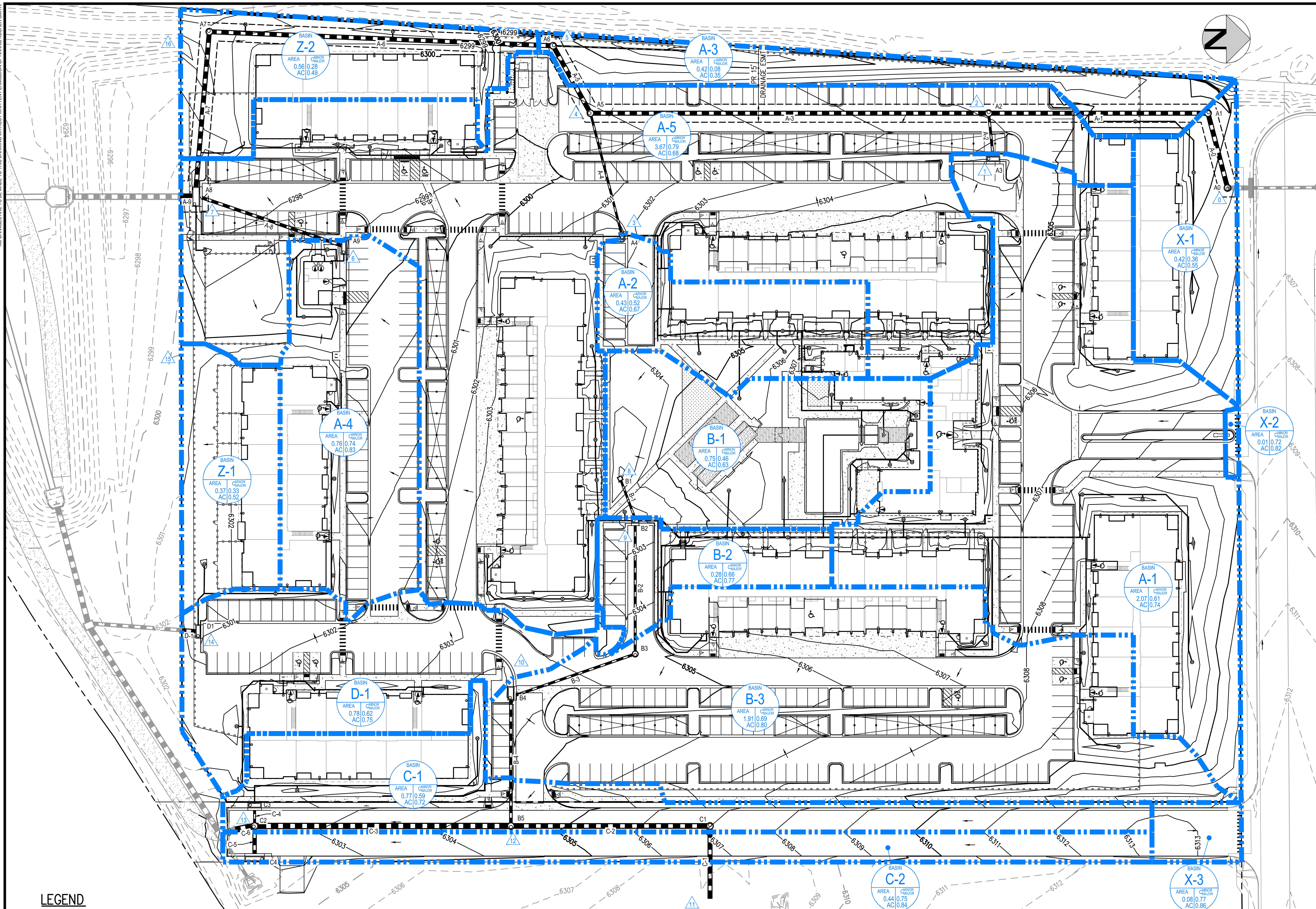
Storm Sewer Improvements

Tract C (Crossroads Metro District No. 1) Storm Sewer Improvements					
Item	**Description**	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
1	Connect to Future Box Base Manhole	EA	1	$ 500.00	$ 500.00
2	18" RCP (CIP)	LF	16	$ 67.00	$ 1,072.00
3	30" RCP (CIP)	LF	46	$ 100.00	$ 4,600.00
4	36" RCP (CIP)	LF	60	$ 124.00	$ 7,440.00
5	42" RCP (CIP)	LF	166	$ 150.00	$ 24,900.00
6	48" RCP (CIP)	LF	230	$ 202.00	$ 46,460.00
7	36"Ø Plug	EA	1	$ 200.00	$ 200.00
8	Box Base Manhole	EA	3	$ 12,034.00	$ 36,102.00
9	CDOT Type R 10' Inlet	EA	1	$ 7,894.00	$ 7,894.00
10	CDOT Type R 15' Inlet	EA	1	$ 10,265.00	$ 10,265.00
Tract C Storm Sewer Improvements Subtotal					$ 139,433.00

Private Storm Sewer Improvements (Non-Reimbursable)					
Item	**Description**	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
1	Connect to Existing Box Base Manhole	EA	1	$ 500.00	$ 500.00
2	15" RCP (CIP)	LF	140	$ 65.00	$ 9,100.00
3	18" RCP (CIP)	LF	147	$ 67.00	$ 9,849.00
4	24" RCP (CIP)	LF	234	$ 81.00	$ 18,954.00
5	30" RCP (CIP)	LF	102	$ 100.00	$ 10,200.00
6	Slab Base Manhole	EA	1	$ 4,500.00	$ 4,500.00
7	CDOT Type R 5' Inlet	EA	2	$ 5,736.00	$ 11,472.00
8	CDOT Type R 10' Inlet	EA	3	$ 7,894.00	$ 23,682.00
9	CDOT Type C Inlet	EA	1	$ 5,000.00	$ 6,000.00
Private Storm Sewer Improvements Subtotal					$ 94,257.00

Crossroads Metro District No. 1 On-Site Storm Sewer Improvements					
Item	**Description**	**Unit**	**Quantity**	**Unit Cost**	**Total Cost**
1	Connect to Existing 36" Stub	EA	1	$ 300.00	$ 300.00
2	36" RCP (CIP)	LF	1059	$ 124.00	$ 131,316.00
3	48" RCP (CIP)	LF	10	$ 202.00	$ 2,020.00
4	Box Base Manhole	EA	6	$ 12,304.00	$ 73,824.00
5	CDOT Type R 15' Inlet	EA	1	$ 10,265.00	$ 10,265.00
Public Storm Sewer Improvements Subtotal					$ 217,725.00
Storm Sewer Improvements Grand Total					**$ 451,415.00**

Appendix G – Drainage Maps



STRUCTURE TABLE	
STRUCTURE ID	DESCRIPTION
A0	TYPE I MANHOLE
A1	TYPE I MANHOLE
A2	TYPE I MANHOLE
A3	INLET TYPE R 10'
A4	INLET TYPE R 5'
A5	TYPE I MANHOLE
A6	TYPE I MANHOLE
A7	TYPE I MANHOLE
A8	INLET TYPE R 15' MOD
A9	INLET TYPE R 10'
B1	INLET TYPE C

STRUCTURE TABLE	
STRUCTURE ID	DESCRIPTION
B2	INLET TYPE R 5'
B3	TYPE II MANHOLE
B4	INLET TYPE R 10'
B5	TYPE I MANHOLE
C1	TYPE I MANHOLE
C2	TYPE I MANHOLE
C3	INLET TYPE R 10'
C4	INLET TYPE R 15'
D1	INLET TYPE R 10'

PIPE TABLE

NAME	UPSTREAM STRUCTURE	DOWNSTREAM STRUCTURE	SIZE	LENGTH	SLOPE	MATERIAL
A-0	A0	A1	36"	64.26'	0.50%	RCP
A-1	A1	A2	36"	182.49'	0.50%	RCP
A-2	A3	A2	18"	36.82'	4.50%	RCP
A-3	A2	A5	36"	331.29'	0.50%	RCP
A-4	A4	A5	15"	102.94'	1.50%	RCP
A-5	A5	A6	36"	64.06'	2.03%	RCP
A-6	A6	A7	36"	286.28'	0.58%	RCP
A-7	A7	A8	36"	130.14'	0.50%	RCP
A-8	A9	A8	24"	125.80'	1.00%	RCP
A-9	A8		48"	10.05'	0.50%	RCP
B-1	B1		15"	35.69'	0.50%	RCP
B-2	B2	B3	18"	109.40'	0.50%	RCP
B-3	B3	B4	18"	107.86'	0.50%	RCP
B-4	B4	B5	24"	110.33'	0.50%	RCP
C-1		C1	36"	60.28'	2.00%	RCP
C-2	C1	B5	42"	165.64'	1.30%	RCP
C-3	B5	C2	48"	213.24'	0.60%	RCP
C-4	C3	C2	18"	15.67'	5.00%	RCP
C-5	C4	C2	30"	25.67'	5.00%	RCP
C-6	C2		48"	16.52'	0.60%	RCP

DESIGN POINT SUMMARY

DESIGN POINT	Q5 (CFS)	Q100 (CFS)
0	16.48	38.58
1	4.61	9.36
2	19.17	43.45
3	0.88	1.90
4	19.60	44.42
5	19.55	45.20
6	2.76	5.24
7	30.16	65.43
8	1.38	3.17
9	2.06	4.57
10	6.85	13.80
11	35.00	60.50
12	41.65	73.75
13	44.47	79.25
14	2.08	4.20
15	0.47	1.27
16	0.57	1.43

DIRECT RUNOFF SUMMARY

SUBBASIN	AREA (AC)	Q5 (CFS)	Q100 (CFS)
X-1	0.42	0.58	1.50
X-2	0.01	0.05	0.10
X-3	0.08	0.26	0.50
A-1	2.07	4.61	9.36
A-2	0.43	0.88	1.90
A-3	0.42	0.13	0.94
A-4	0.76	2.76	5.24
A-5	3.67	8.72	17.06
B-1	0.75	1.38	3.17
B-2	0.28	0.74	1.45
B-3	1.91	4.89	9.52
C-1	0.77	1.86	3.84
C-2	0.44	1.39	2.64
D-1	0.78	2.08	4.20
Z-1	0.37	0.47	1.27
Z-2	0.38	0.57	1.43

LEGEND

PROPERTY LINE
EXISTING CONTOURS (5229, 5230)
PROPOSED CONTOURS (5229, 5230)
PROPOSED STORM SEWER
PROPOSED DRAINAGE BASIN
SURFACE FLOW DIRECTION

BASIN DESIGNATION — BASIN OS 1
BASIN SIZE IN ACRES — AREA 1.23 AC
5-YR RATIONAL (POST-PROJECT) C COEFFICIENT — C MINOR 0.45
100-YR RATIONAL (POST-PROJECT) C COEFFICIENT — C MAJOR 0.67
BASIN DESIGN POINT (1)

811 Know what's below. Call before you dig.

SCALE: 1" = 40' (40, 0, 40, 80)

DESIGNED BY: EEM
CHECKED BY: JDO
DRAWN BY: EEM

ISSUE DATE: 08-06-2021

DATE	REVISION COMMENTS
10-29-2021	PER COUNTY COMMENTS
01-13-2022	PER COUNTY COMMENTS

HARRIS KOCHER SMITH
1120 Lincoln Street, Suite 1000
Denver, Colorado 80203
P: 303.623.6300 F: 303.623.6311
HarrisKocherSmith.com

TRINSIC ACQUISITION COMPANY, LLC

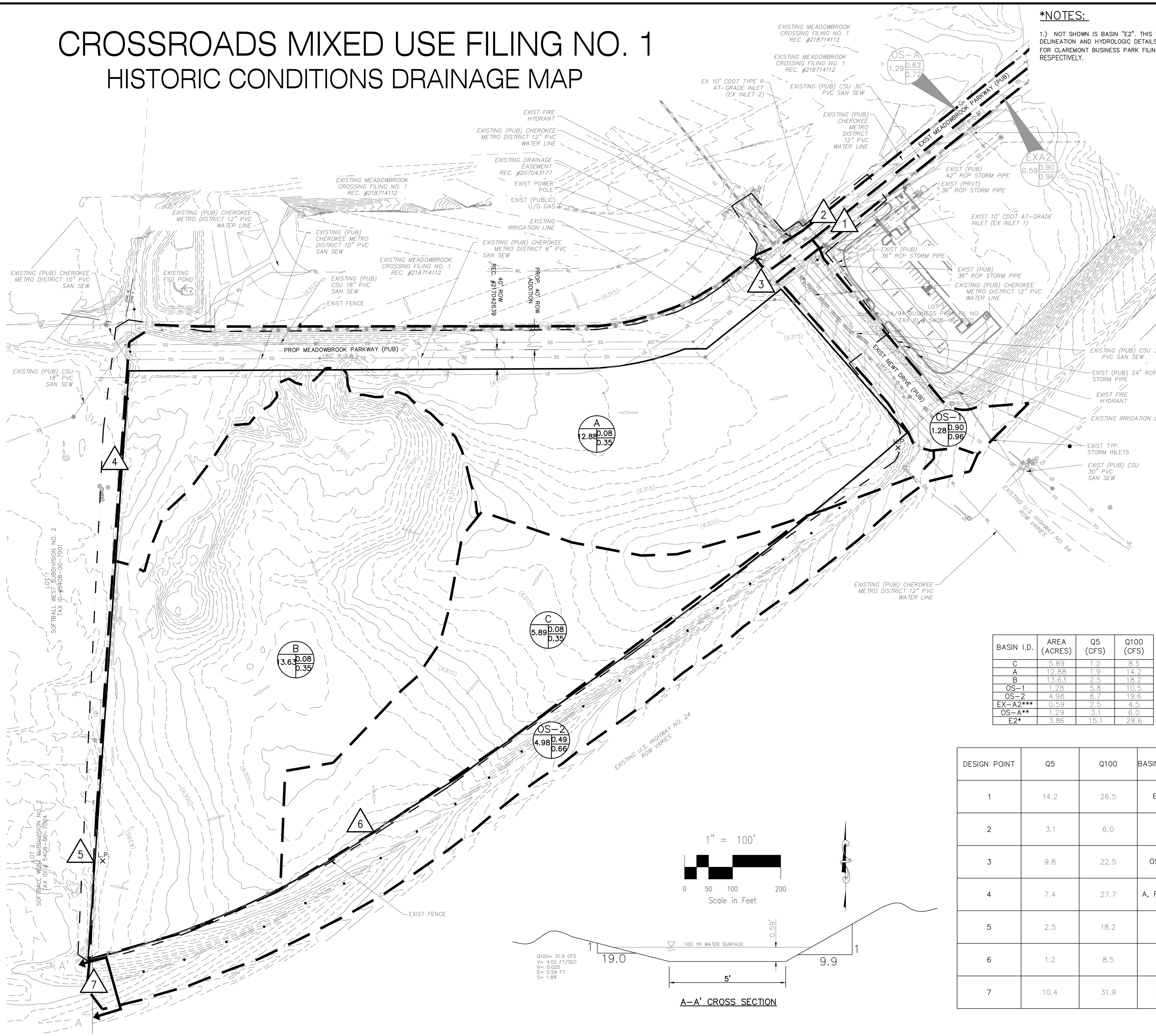
AURA AT CROSSROADS
DRAINAGE PLAN

PROJECT #: 200823
SHEET NUMBER
1
1 OF 1

FILEPATH: K:\200823\ENGINEERING\DRAINAGE\DRAINAGE PLAN.DWG LAYOUT: LAYOUT1 (2)
5 XREFs: e-legal, p-base, p-base-byot, p-legal, p-util-byot
PLOTTED: TUE 04/05/22 5:38:36P BY: ETHAN MARKS

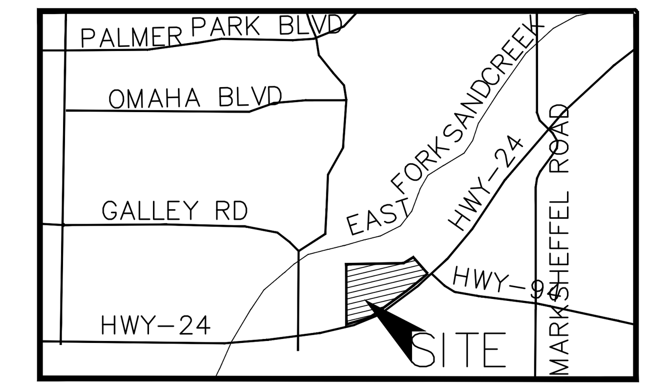
CROSSROADS MIXED USE FILING NO. 1

HISTORIC CONDITIONS DRAINAGE MAP



*NOTES:

1.) NOT SHOWN IS BASIN "E2". THIS BASIN LIES TO THE EAST OF BASIN "EX–A2". DELINEATION AND HYDROLOGIC DETAILS OF THIS BASIN CAN BE FOUND IN THE "FDR FOR CLAREMONT BUSINESS PARK FILING NO. 2" ON PAGES 39 AND 41, RESPECTIVELY.



VICINITY MAP
N.T.S.

LEGEND

- BASIN DESIGNATION (Z), ACRES (25), C5 (.25), C100 (.35)
- SURFACE DESIGN POINT
- BASIN BOUNDARY
- EXIST MAJ CONT
- EXIST MIN CONT
- EXISTING FLOW DIRECTION ARROW
- H.P. HIGH POINT
- L.P. LOW POINT
- PROPOSED SWALE
- EXISTING SWALE
- CONSTRUCTION/DISTURBANCE LIMITS
- SITE BOUNDARY
- R.O.W./EASEMENT
- LOT LINE
- ST — EX. STORM SEWER LINE
- UE — EX. UNDERGROUND ELECTRIC LINE
- SS — EX. SANITARY SEWER LINE
- WL — EX. WATER LINE
- ST — EX. STORM SEWER LINE
- 9 — LOT NUMBER
- EX. IRRIGATION VALVE
- EX. STORM INLET
- EX. GAS TEST NODE
- EX. TELEPHONE PEDESTAL
- EX. ELECTRIC VAULT
- EX. SANITARY MANHOLE
- EX. WATER VALVE

BASIN I.D.	AREA (ACRES)	Q5 (CFS)	Q100 (CFS)
C	5.89	1.2	8.5
A	12.88	1.9	14.2
B	13.63	2.5	18.2
OS–1	1.28	5.8	10.5
OS–2	4.98	8.7	19.6
EX–A2***	0.59	2.5	4.5
OS–A**	1.29	3.1	6.0
E2*	3.86	15.1	28.6

DESIGN POINT	Q5	Q100	BASIN(S)/FLOWBYS	OUTFALL
1	14.2	26.5	E2, EX–A2	EXIST 10' CDOT TYPE R AT GRADE INLET
2	3.1	6.0	OS–A	EXIST 10' CDOT TYPE R AT GRADE INLET
3	9.8	22.5	OS–1, FBDP1	END OF PAVEMENT
4	7.4	27.7	A, FB–DP2, DP3	DISCHARGE TO ADJACENT PARCEL (LOT 1)
5	2.5	18.2	B	DISCHARGE TO ADJACENT PARCEL (LOT2)
6	1.2	8.5	C	DISCHARGE TO CDOT ROW
7	10.4	31.9	OS2, DP6	CDOT BARROW DITCH

HISTORIC DRAINAGE MAP
CROSSROADS MIXED USE
JOB NO. 18–003
DATE PREPARED: JANUARY 31, 2022
DATE REVISED:

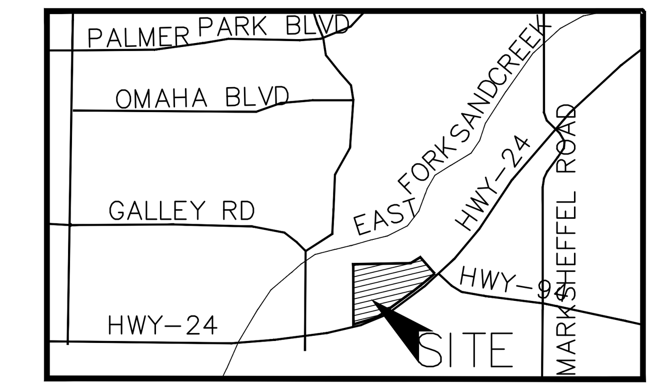
212 N. WAHSATCH AVE., STE 305
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485
CIVIL CONSULTANTS, INC.

PCD FILING NO: SF 21–029

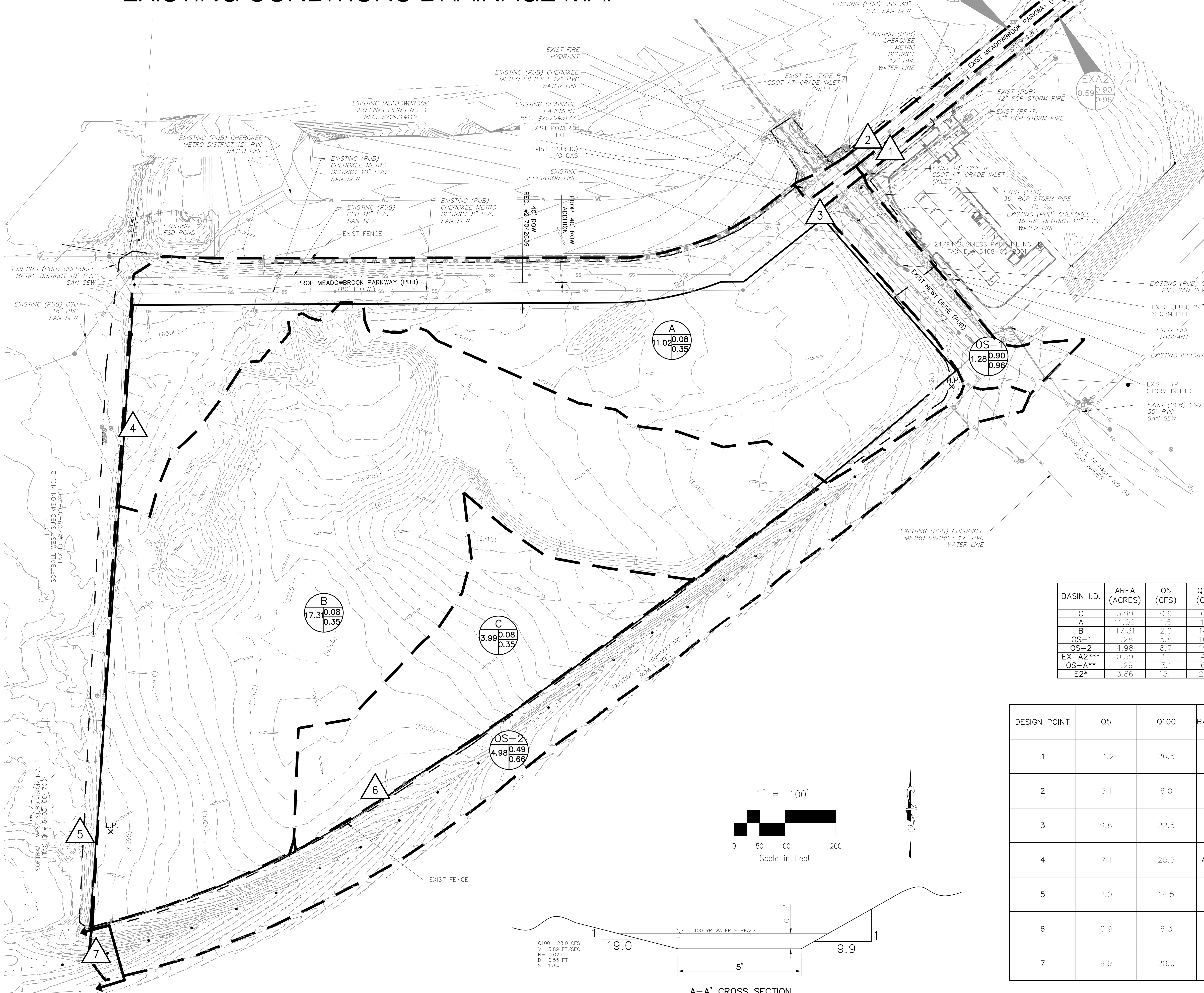
CROSSROADS MIXED USE FILING NO. 1
EXISTING CONDITIONS DRAINAGE MAP

***NOTES:**

1.) NOT SHOWN IS BASIN "E2". THIS BASIN LIES TO THE EAST OF BASIN "EX-A2". DELINEATION AND HYDROLOGIC DETAILS OF THIS BASIN CAN BE FOUND IN THE "FDR FOR CLAREMONT BUSINESS PARK FILING NO. 2" ON PAGES 39 AND 41, RESPECTIVELY.



VICINITY MAP
N.T.S.



A-A' CROSS SECTION

LEGEND

- BASIN DESIGNATION (Z; 25 ACRES; .25 C5; .35 C100)
- SURFACE DESIGN POINT
- BASIN BOUNDARY
- EXIST MAJ CONT
- EXIST MIN CONT
- EXISTING FLOW DIRECTION ARROW
- H.P. HIGH POINT
- L.P. LOW POINT
- PROPOSED SWALE
- EXISTING SWALE
- CONSTRUCTION/DISTURBANCE LIMITS
- SITE BOUNDARY
- R.O.W./EASEMENT
- LOT LINE
- ST EX. STORM SEWER LINE
- UE EX. UNDERGROUND ELECTRIC LINE
- SS EX. SANITARY SEWER LINE
- WL EX. WATER LINE
- ST EX. STORM SEWER LINE
- 9 LOT NUMBER
- EX. IRRIGATION VALVE
- EX. STORM INLET
- EX. GAS TEST NODE
- EX. TELEPHONE PEDESTAL
- EX. ELECTRIC VAULT
- EX. SANITARY MANHOLE
- EX. WATER VALVE

BASIN I.D.	AREA (ACRES)	Q5 (CFS)	Q100 (CFS)
C	3.99	0.9	6.3
A	11.02	1.5	11.1
B	17.31	2.0	14.5
OS-1	1.28	5.8	10.5
OS-2	4.98	8.7	19.6
EX-A2***	0.59	2.5	4.5
OS-A**	1.29	3.1	6.0
E2*	3.86	15.1	28.6

DESIGN POINT	Q5	Q100	BASIN(S)/FLOWBYS	OUTFALL
1	14.2	26.5	E2, EX-A2	EXIST 10' CDOT TYPE R AT GRADE INLET
2	3.1	6.0	OS-A	EXIST 10' CDOT TYPE R AT GRADE INLET
3	9.8	22.5	OS-1, FB-DP1	END OF PAVEMENT
4	7.1	25.5	A, FB-DP2, DP3	DISCHARGE TO ADJACENT PARCEL (LOT 1)
5	2.0	14.5	B	DISCHARGE TO ADJACENT PARCEL (LOT 2)
6	0.9	6.3	C	DISCHARGE TO CDOT ROW
7	9.9	28.0	OS2, DP6	CDOT BARROW DITCH

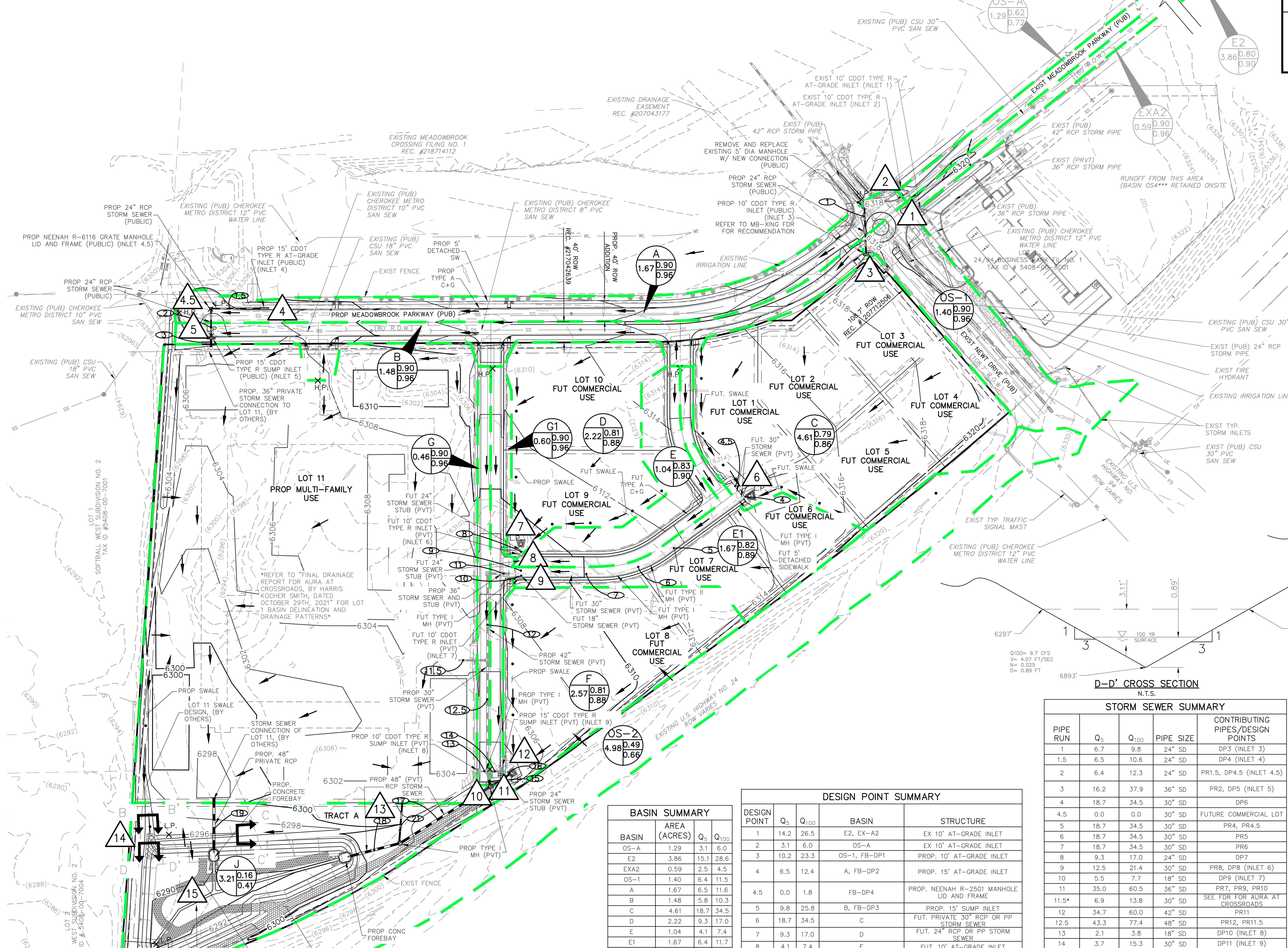
EXISTING DRAINAGE MAP
CROSSROADS MIXED USE
JOB NO. 18-003
DATE PREPARED: JANUARY 31, 2022
DATE REVISED:

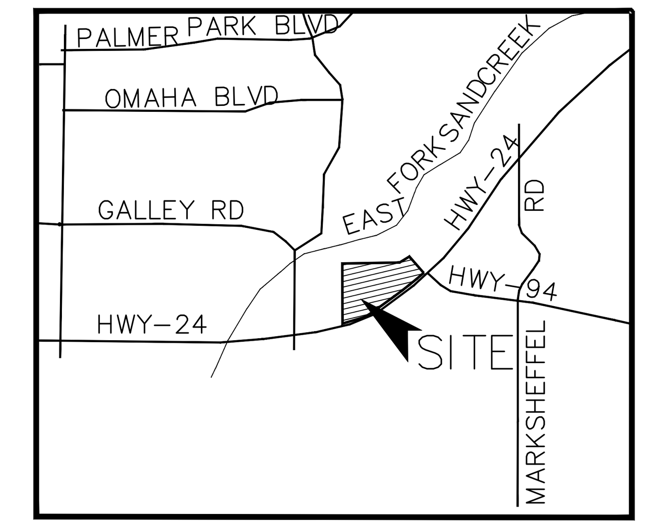
CIVIL CONSULTANTS, INC.
212 N. WAHSATCH AVE., STE 305
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

PCD FILING NO: SF 21-029

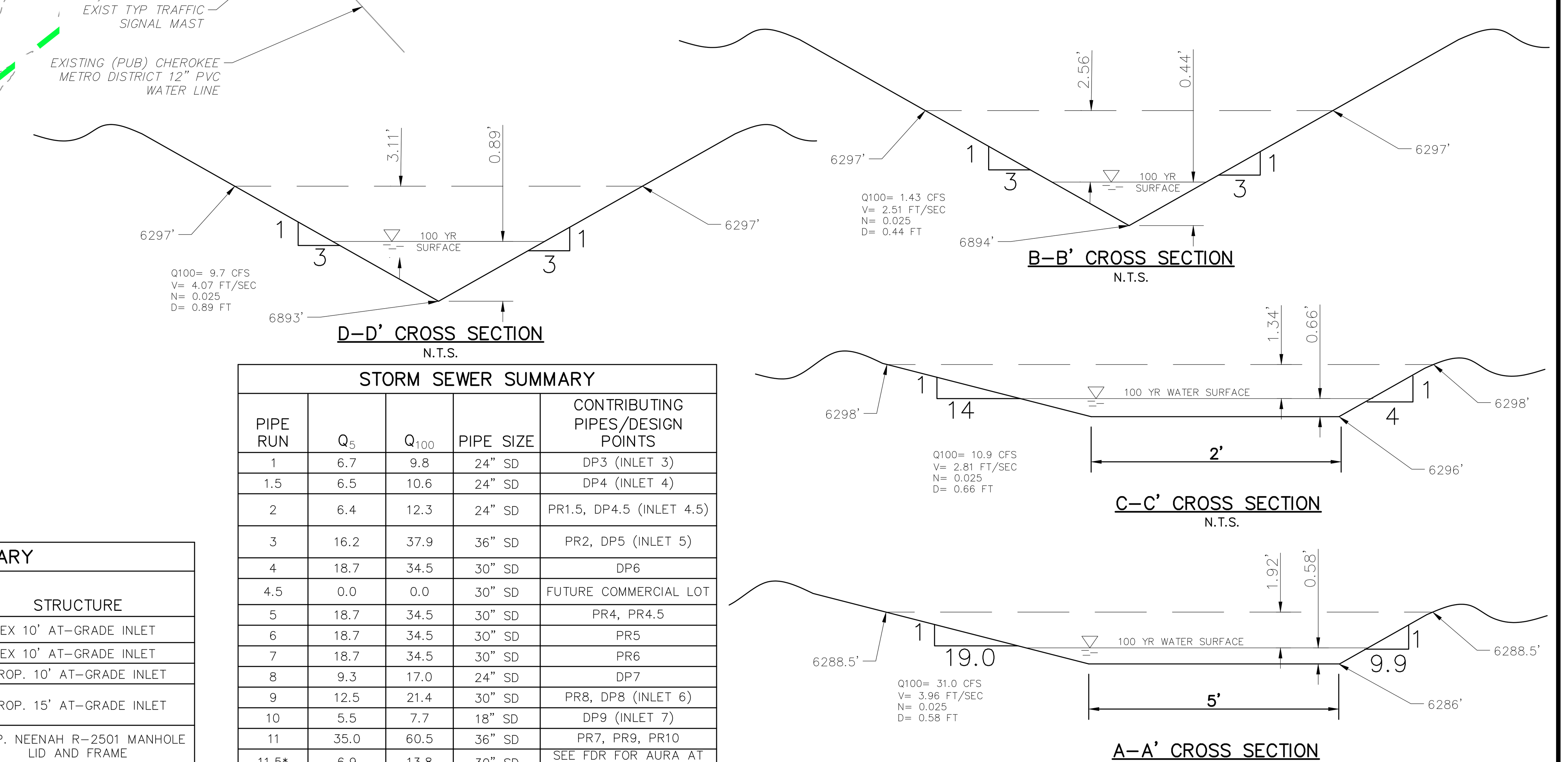
CROSSROADS MIXED USE FILING NO. 1

FUTURE CONDITIONS DRAINAGE MAP





VICINITY MAP
N.T.S.



FULL SPECTRUM DETENTION POND POND 1 (PRIVATE)	
WQ VOLUME	0.863 AC-FT
EURV VOLUME	3.295 AC-FT
100 YR STORAGE VOLUME	4.668 AC-FT
100 YR WATER SURFACE EL	6294.96
SPILLWAY CREST EL	6294.98
TOP OF EMBANKMENT EL	6297.00
SPILLWAY DESIGN FLOW DEPTH	0.86 FT

BASIN SUMMARY

BASIN	AREA (ACRES)	Q_5	Q_{100}
OS-A	1.29	3.1	6.0
E2	3.86	15.1	28.6
EXA2	0.59	2.5	4.5
OS-1	1.40	6.4	11.5
A	1.67	6.5	11.6
B	1.48	5.8	10.3
C	4.61	18.7	34.5
D	2.22	9.3	17.0
E	1.04	4.1	7.4
E1	1.67	6.4	11.7
F	2.57	10.8	19.6
G	0.46	2.1	3.8
G1	0.60	2.8	5.0
J	3.21	2.3	10.0
OS-2	4.98	8.7	19.6
A-5*	3.67	8.72	17.06
Z-1*	0.37	0.47	1.27
Z-1*	0.78	2.08	4.20
Z-2*	0.38	0.57	1.43

DESIGN POINT SUMMARY

DESIGN POINT	Q_5	Q_{100}	BASIN	STRUCTURE
1	14.2	26.5	E2, EX-A2	EX 10' AT-GRADE INLET
2	3.1	6.0	OS-A	EX 10' AT-GRADE INLET
3	10.2	23.3	OS-1, FB-DP1	PROP. 10' AT-GRADE INLET
4	6.5	12.4	A, FB-DP2	PROP. 15' AT-GRADE INLET
4.5	0.0	1.8	FB-DP4	PROP. NEENAH R-2501 MANHOLE LID AND FRAME
5	9.8	25.8	B, FB-DP3	PROP. 15' SUMP INLET
6	18.7	34.5	C	FUT. PRIVATE 30" RCP OR PP STORM SEWER
7	9.3	17.0	D	FUT. 24" RCP OR PP STORM SEWER
8	4.1	7.4	E	FUT. 10' AT-GRADE INLET
9	6.4	11.7	E1	FUT. 10' AT-GRADE INLET
10	2.1	3.8	G	PROP. 10' SUMP INLET
11	3.7	15.3	G1, FB-DP8, FB-DP9	PROP. 15' SUMP INLET
12	10.8	19.6	F	PROP. 24" RCP OR PP STORM SEWER
13	1.3	10.9	A-5 OVERFLOW*, Z-1*, D-1 OVERFLOW*	PROP. 2' BTM EARTHEN SWALE, RIP RAP RUNDOWN
14	2.0	9.7	Z-2*, DP13	PROP. TRIANGULAR EARTHEN SWALE
15	116.7	235.0	J, DP14, PR19, PR18	FULL SPECTRUM DET POND
16	9.9	31.0	POND OUTFALL, OS2	EXISTING CDOT ROADSIDE DITCH

*REFER TO FDR FOR AURA AT CROSSROADS, DATED OCTOBER 29TH 2021, FOR CONTRIBUTING BASIN DETAILS

STORM SEWER SUMMARY

PIPE RUN	Q_5	Q_{100}	PIPE SIZE	CONTRIBUTING PIPES/DESIGN POINTS
1	6.7	9.8	24" SD	DP3 (INLET 3)
1.5	6.5	10.6	24" SD	DP4 (INLET 4)
2	6.4	12.3	24" SD	PR1.5, DP4.5 (INLET 4.5)
3	16.2	37.9	36" SD	PR2, DP5 (INLET 5)
4	18.7	34.5	30" SD	DP6
4.5	0.0	0.0	30" SD	FUTURE COMMERCIAL LOT
5	18.7	34.5	30" SD	PR4, PR4.5
6	18.7	34.5	30" SD	PR5
7	18.7	34.5	30" SD	PR6
8	9.3	17.0	24" SD	DP7
9	12.5	21.4	30" SD	PR8, DP8 (INLET 6)
10	5.5	7.7	18" SD	DP9 (INLET 7)
11	35.0	60.5	36" SD	PR7, PR9, PR10
11.5*	6.9	13.8	30" SD	SEE FDR FOR AURA AT CROSSROADS
12	34.7	60.0	42" SD	PR11
12.5	43.3	77.4	48" SD	PR12, PR11.5
13	2.1	3.8	18" SD	DP10 (INLET 8)
14	3.7	15.3	30" SD	DP11 (INLET 9)
15	48.0	93.7	48" SD	PR12.5, PR13, PR14
16	10.8	19.6	24" SD	DP12
17	57.0	110.1	48" SD	PR15, PR16
18	57.9	112.1	48" SD	PR17, PR21
19*	35.4	65.5	48" SD	SEE FDR FOR AURA AT CROSSROADS
20	1.2	11.4	18" SD	POND OUTFALL
21*	2.1	4.2	30" SD	SEE FDR FOR AURA AT CROSSROADS

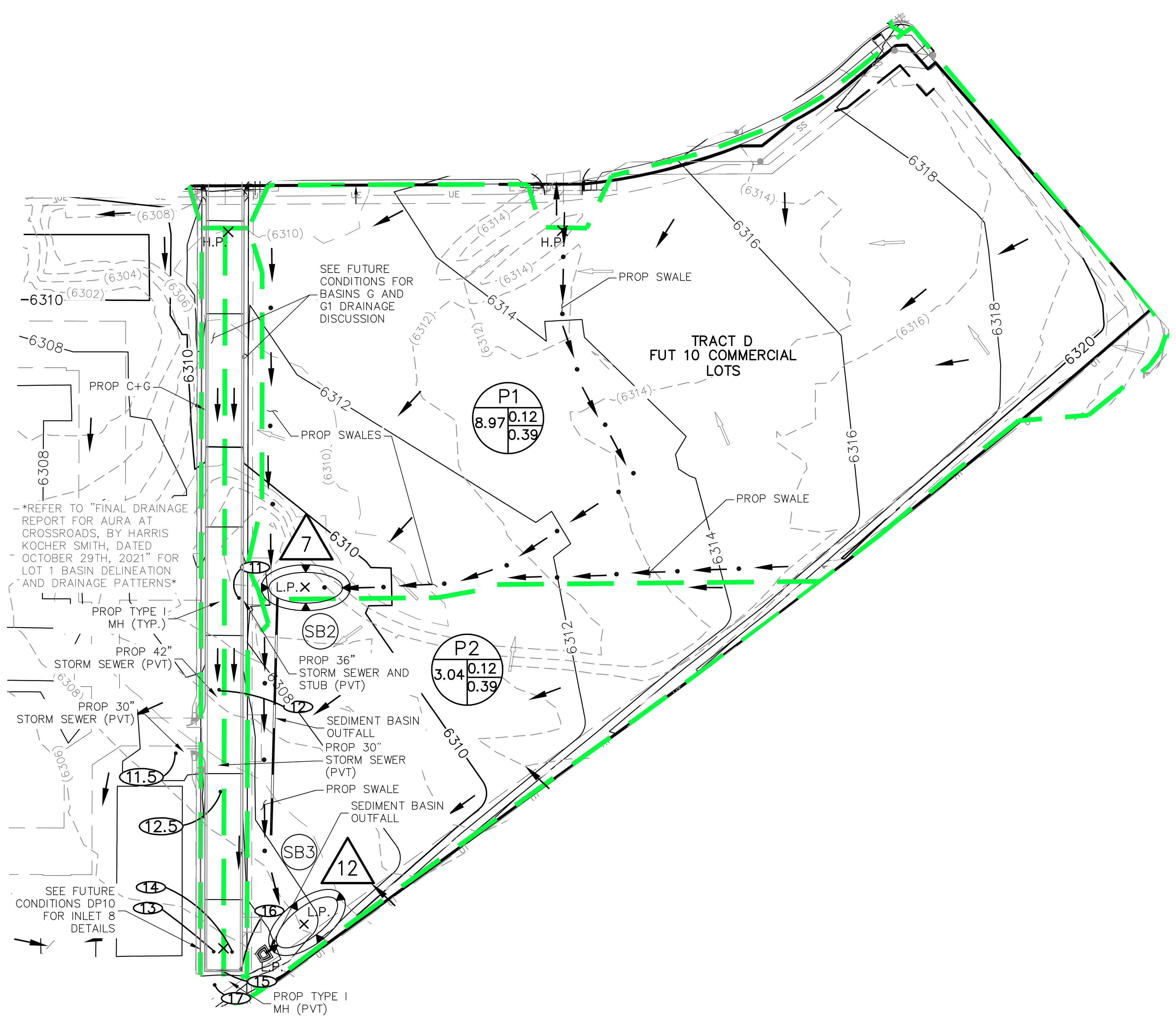
SD = STORM DRAIN
* REFER TO "FDR FOR AURA AT CROSSROADS FOR CONTRIBUTING PIPE FLOW DETAILS

FUTURE DRAINAGE MAP
CROSSROADS MIXED USE
JOB NO. 18-003
DATE PREPARED: FEBRUARY 1ST, 2022
DATE REVISED:

CIVIL CONSULTANTS, INC.
212 N. WAHSATCH AVE., STE 305
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

PCD FILING NO: SF-20-029

CROSSROADS MIXED USE FILING NO. 1
PROPOSED CONDITIONS DRAINAGE MAP



SEDIMENT BASIN TABLE

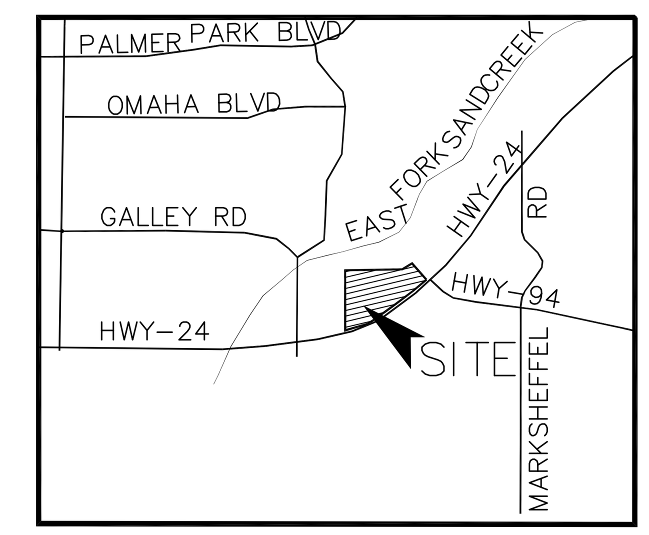
SEDIMENT BASIN NO.	UPSTREAM DRAINAGE AREA AC.	BASIN WIDTH FT.	BASIN LENGTH FT.	ANTIC. MAX WATER HT FT.	REQ'D VOLUME C.F.	SPILLWAY LENGTH FT.	HOLE DIA. IN.	ROWS OF HOLES IN STANDPIPE
SB2	9	55	110	3	36,168	13	7/8	1
SB3	4	33.5	67	3	16,818	6	9/16	1

BASIN SUMMARY			
BASIN	AREA (ACRES)	Q_5	Q_{100}
P1	8.97	3.8	20.7
P2	3.04	1.3	7.2

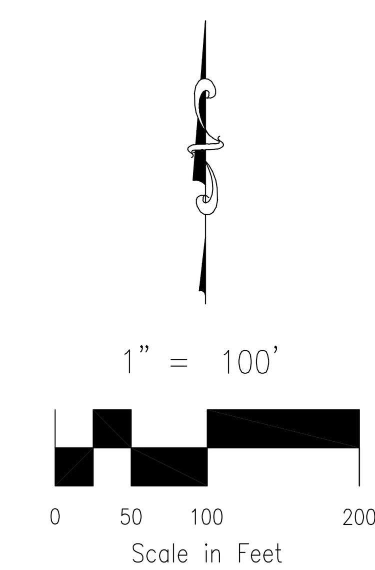
DESIGN POINT SUMMARY				
DESIGN POINT	Q_5	Q_{100}	BASIN	STRUCTURE
7	3.8	20.7	P1	PROPOSED SEDIMENT BASIN (SB2)
12	5.1	27.9	P2, DP7	PROPOSED SEDIMENT BASIN (SB3)

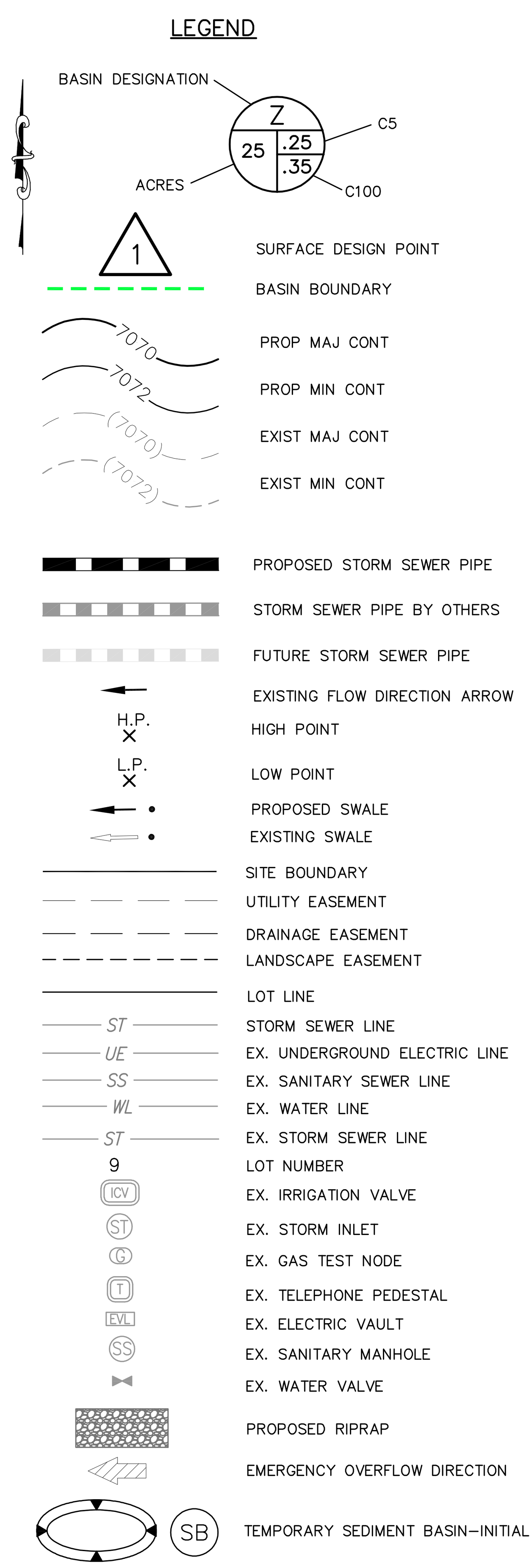
STORM SEWER SUMMARY				
PIPE RUN	Q_5	Q_{100}	PIPE SIZE	CONTRIBUTING PIPES/DESIGN POINTS
11	0.0	0.0	36" SD	N/A
11.5*	6.9	13.8	30" SD	SEE FDR FOR AURA AT CROSSROADS
12	0.0	0.0	42" SD	PR11
12.5	6.9	13.8	48" SD	PR12, PR11.5
13	2.1	3.8	18" SD	DP10 (INLET 8)
14	3.7	15.3	30" SD	DP11 (INLET 9)
15	48.0	93.7	48" SD	PR12.5, PR13, PR14
16	10.8	19.6	24" SD	DP12
17	57.0	110.1	48" SD	PR15, PR16

SD = STORM DRAIN
* REFER TO "FDR FOR AURA AT CROSSROADS FOR CONTRIBUTING PIPE FLOW DETAILS



VICINITY MAP
N.T.S.





NOTES:

1.) REFER TO CROSSROADS MIXED USE FILING NO. 1 FUTURE CONDITIONS MAP FOR SURROUNDING BASIN DELINEATION AND DRAINAGE DETAILS

PROPOSED DRAINAGE MAP
CROSSROADS MIXED USE
JOB NO. 18-003
DATE PREPARED: FEBRUARY 7TH 2021
DATE REVISED:

CIVIL CONSULTANTS, INC.
212 N. WAHSATCH AVE., STE 305
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

PCD FILING NO: SF-20-029

CROSSROADS MIXED USE

DRAINAGEWAY EXHIBIT
FEBRUARY 2021

1" = N.T.S.

0 N.T.S.
Scale in Feet

LEGEND

- SURFACE DESIGN POINT
- SITE BOUNDARY
- EXISTING RIP RAP BARRIERS
- 6280 PROPOSED CONTOUR
- 6290 EXISTING CONTOUR
- PROPOSED WATER FITTING
- EXISTING FLOW ARROW
- 1.3% EXISTING DITCH SLOPE
- EXISTING STORM SEWER AND FES
- PROPOSED STORM SEWER
- R.O.W./EASEMENT
- PROPOSED SWALE
- PROPOSED SANITARY SEWER MANHOLE
- PROPOSED SEWER LINE
- PROPOSED WATER LINE
- PROPOSED EMERGENCY OVERFLOW DIRECTION

HISTORIC DESIGN POINT SUMMARY

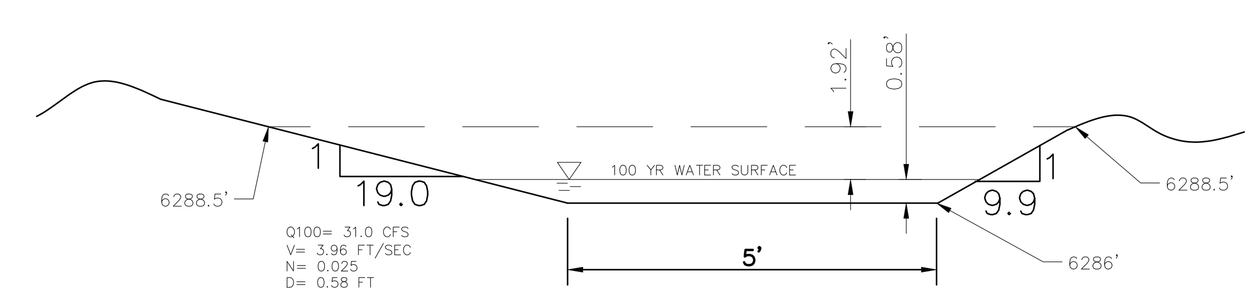
DESIGN POINT	Q5 (CFS)	Q100 (CFS)
4	7.4	27.7
5	8.3	18.2
6	1.2	8.5
7	10.4	31.9

FUTURE DESIGN POINT SUMMARY

DESIGN POINT	Q5 (CFS)	Q100 (CFS)
4	0.0	0.0
5	0.0	0.0
6	0.0	0.0
16	9.9	27.7

NOTES:

1.) REFER TO DRAINAGE MAPS IN FINAL DRAINAGE REPORT FOR CROSSROADS MIXED USE FOR DETAILED ON SITE FLOWS AS WELL AS HYDROLOGIC AND HYDRAULIC ANALYSES CORRESPONDING TO CHANGES FROM HISTORIC AND EXISTING CONDITIONS



A–A' CROSS SECTION
N.T.S.

PCD FILING NO: SP-20-011

CIVIL CONSULTANTS, INC.
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