
Preliminary Drainage Report

Proposed Kum & Go #2300

**7160 Eudora Drive
Commerce City, Colorado**

February 20, 2023

PLCSP202200444

Prepared For:

Kum & Go, LC

1459 Grand Avenue
Des Moines, IA 50309

Prepared By:



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ENGINEERS STATEMENT

I hereby certify that this preliminary study for the proposed Kum & Go #2300 at 7160 Eudora Drive was prepared by me (or under my direct supervision) in accordance with the provisions of City of Commerce City's Storm Drainage Design and Technical Criteria Manual for the owners thereof.

Landis Gordon, P.E.
Registered Professional Engineer
State of Colorado
No. 56446

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1. INTRODUCTION

The intent of this report is to show the routing of minor and major storms through the proposed site in accordance with the City of Commerce City's standards. For this retail site, a minor flow is defined as the 5-year frequency storm and a major flow as the 100-year frequency storm. The information given in this report is for the purpose of providing an adequately detailed analysis of on-site drainage areas and receiving structures.

2. GENERAL LOCATION AND DESCRIPTION

2.1. LOCATION

2.1.1. CITY, COUNTY, STATE HIGHWAY, AND LOCAL STREETS

The proposed Kum & Go, fueling and convenience store, is located in the City of Commerce City at the intersection of Eudora Drive and East 72nd Avenue. More specifically, the project is located at 7160 Eudora Drive.

2.1.2. TOWNSHIP, RANGE, SECTION

The project lies within the Northeast Quarter of Section 6, Township 3 South, Range 67 West of the 6th Principal Meridian in the City of Commerce City, Adams County, Colorado.

2.1.3. MAJOR DRAINAGEWAYS AND FACILITIES

There exists a small, private detention and water quality pond on-site providing for the existing industrial user at this address. Treated discharge from the pond enters the Commerce City MS4 storm drain system through the back of an inlet set in the southeast corner of Eudora and 72nd. From there any runoff is eventually routed to the South Platte River, through a series of pipes and open swale, approximately one and one-fifth mile to the east.

2.1.4. SURROUNDING DEVELOPMENTS

The site is immediately adjacent to a Santiago's Mexican Restaurant to the northeast and a retail cannabis shop and storage yard to the south. Industrial uses occupy properties across the rights of way of Elm Street on the east and 72nd Avenue on the north. The immediate Eudora Drive right-of-way on the west is followed by the arterial right-of-way for Vasquez Boulevard / Highway 6 right-of-way.



Vicinity Map

2.2. DESCRIPTION OF PROPERTY

The project site will be re-developed as a Kum & Go fueling center and convenience store. The fueling component will consist of eight, two station pump stands under a 6027 square foot canopy. The convenience store consists of a 3968 square foot shop with general retail, service space, and bathrooms. The existing equipment rental facility, including offices, warehousing, and storage yard, will be entirely demolished. The proposed infrastructure includes private on-site inlets and PVC piping, connecting to an on-grade water quality and detention pond that ultimately connects to the storm sewer in East 72nd Avenue. Right-of-way improvements along the Elm Street frontage are a Commerce City requirement with the development of this project.

2.2.1. AREA

The private property limits included in this development accounts for 2.31 acres. The total area to be redeveloped is approximately 2.62 acres with the inclusion of ROW improvements. It will be necessary to obtain a CDPS Permit for construction from the Colorado Department of Health and the Environment.

2.2.2. GROUND COVER

The existing site includes a 19,500 square foot building (office and warehouse), approximately 10,000 square feet of formal landscaping, with the remainder being paved storage yard. The proposed condition will include the 3968 square foot convenience store, 6027 square foot canopy/fueling pad, 36,185 square feet of parking, sidewalk, drives, and other hardscape. The remaining 54,298 square feet will consist of pervious areas of landscaping and stormwater facilities. The site has very mild grades and generally slopes north to the existing stormwater pond. Proposed grades will generally mimic what is in-place.

The NRCS soil survey, as available through the cooperative Web Soil Survey internet page, shows the entire property to be underlain with Vona sandy loam (0 to 1 percent slopes) with a Hydrologic Soil Group 'A' classification. A site specific geotechnical study for the site generally found silty sand with gravel and silty to clayey sand fill for the first 4 feet, and silty sand with some clay to a depth of 12.5 feet. Beyond this, the remaining soil was found to be poorly graded sand with gravel generally to a depth of 25 feet. Groundwater was not encountered and is not expected to influence construction or on-site drainage facilities.

2.2.3. EXISTING DRAINAGEWAYS, FLOODING HISTORY, AND IRRIGATION FACILITIES

No major drainage-ways or facilities exist on the project site and the site lies in Zone X, areas of minimal flood hazard, on the current FIRM, Panel 08001C0608H, effective March 5, 2007 (ref. Appendix A). There is no known history of flooding problems on the site. No major irrigation facilities exist within or adjacent to the site.

2.2.4. EASEMENTS WITHIN AND ADJACENT TO THE SITE

At the north end of the property there is a platted detention pond easement which, unfortunately, does not coincide with either the existing or proposed pond facilities. There is a 5-foot wide utility and drainage easement on the west side of the site parallel to the previously vacated Eudora Drive right-of-way that is not being utilized and does not serve benefit to the City or the proposed development. We are seeking to have these easements vacated, the pond easement being re-dedicated at a location considerate of the proposed facility. There is another 5-foot wide utility and drainage easement parallel to the Elm Street right-of-way and a variable width utility easement on the west side of the property, within the previously vacated Eudora Drive. Both of those easements are being utilized and will be retained. The proposed development will not require any modification to the utilities that exist and are remaining in easements slated to be retained.

2.2.5. ENVIRONMENTAL CONCERNS

A Phase I Environmental Site Assessment of the property identified three Recognized Environmental Conditions (RECs). Two of those were specific to the property; (1) used oil staining in a service bay, and (2) an on-site oil water separator. The third REC was associated with the property to the immediate east where contamination was left in place following clean up operations of the former Approved Oil Services operation. All RECs were subsequently investigated by laboratory soil and groundwater sampling and determined to have been eliminated as concerns in a subsequent Phase II ESA. Excerpts of both reports have been included in Appendix A, herewith.

3. DRAINAGE BASINS AND SUB-BASINS

3.1. MAJOR BASIN DESCRIPTIONS

The Mile High Flood District geographic information system mapping, as publicly available, shows the site proximal to the Fairfax Tributary with reference to the Drainage Outfall System Planning □ Northern Commerce City and Irondale Area study from 1986. Within that document the site is at the south most perimeter of the basin boundary with no detailed data or improvements pertinent to the location identified.

General drainage pattern at the site and local thereto provide for storm runoff to enter either the Eudora Drive or Elm Street right-of-way from developments located between the two through the stretch from East 72nd Avenue to East 69th Avenue. It appears the north/south high point of this basin is at the subject parcel's south property line, though the extremely flat and undulating elevations make that difficult to ascertain with certainty.

3.2. SUB-BASIN DESCRIPTIONS

Runoff from excess rainfall on the existing site is conveyed overland and through an underground storm drain system to an on-site detention and water quality pond. Controlled and treated discharged from that facility are piped to the MS4 system in East 72nd Avenue. In general, this pattern will be maintained with the re-development, though all existing drainage infrastructure will be removed in the process of committing improvements.

The re-developed parcel will divide into nine on-site basins and one off-site basin associated with the Elm Street upgrade. Each of those basins and the consideration for runoff therefrom is described as follows:

Basin A □ A 0.24-acre area of landscaping and walks on the west side of the site. Runoff will sheet flow east to a grass swale and collect in a landscape area inlet (Inlet 1). This will then be piped underground to the proposed storm system on site and into the proposed detention and water quality pond.

Basin B □ This is the proposed convenience store building, 0.09-acre, from which runoff will be conveyed to the underground storm system by directly connected

downspout laterals. This will then be piped underground to the proposed storm system on site and into the proposed detention and water quality pond.

Basin C - This is the proposed fueling canopy, 0.14-acre, from which runoff will be conveyed to the underground storm system by directly connected downspout laterals. This will then be piped underground to the proposed storm system on site and into the proposed detention and water quality pond.

Basin D □ A 0.45-acre area of parking, drives, and landscaping adjacent to the east property boundary. Runoff will sheet flow to curb and gutter and be collected at a single, low point 5' Type R inlet (Inlet 2), set in the north curb and enter an on-site storm system and into the proposed detention and water quality pond.

Basin E □ The bulk of the parking, drive space, along with landscaping on the north and east side of the convenience store. Runoff from this 0.48 acre basin will be collected at a single 5' Type R inlet (Inlet 3), set in a low point of parking curb to the north of the fueling canopy. This will then be piped underground to the proposed storm system on site and into the proposed detention and water quality pond.

Basin F □ This 0.54-acre of impervious area contains the detention and water quality facility and peripheral landscaping. Any excess runoff therefrom will enter the pond directly without concentrating or being routed to the on-site storm drains. This will then be piped underground to the proposed storm system on site and into the proposed detention and water quality pond.

Basin G □ A drive area of 0.05 acres from which any runoff will be directly tributary to the Eudora Dr. right-of-way without concentrating. Discharge for the 100-year storm event is fully compensated for within the proposed water quality and detention facility.

Basin H □ A Landscape area of 0.16 acres along the southern property from which any runoff will be directly tributary to the southern property without concentrating. Discharge for the 100-year storm event is fully compensated for within the proposed water quality and detention facility.

Basin I □ A landscaping area of 0.20 acres from which any runoff will be directly tributary to the Elm Street right-of-way without concentrating. Discharge for the 100-year storm event is fully compensated for within the proposed water quality and detention facility.

Basin OS-1 □ The 0.31-acres of west half Elm Street improvements that the City is requiring as a condition of site re-development. Runoff from this basin will continue within the right-of-way to public inlets set in the curb return at the East 72nd Avenue intersection.

Design points provide for accumulation of runoff in the proposed drainage system. Four locations of confluence are identified in the proposed plan and are detailed as follows:

Design Point 1 □ A junction just off the northwest fueling canopy corner. Piping from Inlet-1, the building downspout and the canopy downspout will tie directly to this structure.

Design Point 2 □ Inlet 3 set across from the canopy on the north end of the site hardscaping. Piping from DP 1, Inlet 2 and all runoff from the Basin E come together in this structure.

Design Point 3 □ Discharge from the back of Inlet 3 (DP-2) and the large open area around the pond (Basin F) combine within the detention and water quality facility. Treated and detained runoff will then enter a discharge pipe that connects to the MS4 system at the back of an inlet at the southeast corner of East 72nd Avenue and Eudora Drive.

Design Point 4 □ Provides for quantifying total flows concentrating in the Elm Street curb and gutter from improvement areas and Basin I considered in this report.

The site is effectively cut off from off-site run-on by the Eudora Drive and Elm Street right-of-way and the south fence line which is on a slight rise. Overall grades are generally to the north precluding any run-on from that direction.

4. DRAINAGE DESIGN CRITERIA

4.1. CRITERIA, REFERENCES, AND CONSTRAINTS

4.1.1. CRITERIA

This project's storm drainage design follows the regulations, standards, and criteria of the City of Commerce City's Storm Drainage Design and Technical Criteria Manual (the 'criteria' hereafter), and the Mile High Flood District's Urban Storm Drainage Criteria Manual, Volumes I, II, and III ('USD CM') as referenced by the former.

4.1.2. REFERENCES AND CONSTRAINTS

There are no known prior drainage studies for the site or region that have been found for reference or establishing any constraints quantified outside of the criteria applied.

4.2. CALCULATIONS

4.2.1. HYDROLOGIC

This site, when fully re-developed, will have a heavily landscaped presence along Elm Street and Eudora Drive and the convenience store built along Eudora Drive. Concrete parking, access drives, and fueling points will occupy the space between those two east/west extents. The irregular shaped northern portion of the site (Basin F) will be landscaping and will contain the at grade water quality and detention facility. The impervious area for the re developed site is 50.15%; less than half of what exists on the site with the current development.

The criteria used for this study is from the City of Commerce City Storm Drainage Design and Technical Criteria, dated March 2022. Peak runoff values were calculated using the rational method:

Q □ CIA

- Q □ Storm runoff in cubic feet per second (cfs)
- C □ Rainfall coefficients - ratio runoff to rainfall
- I □ Rainfall intensity in inches per hour
- A □ Drainage area in acres

The minor (5-year) and major (100-year) storm events were calculated using the Rainfall Intensity Frequency Values from the criteria. The runoff coefficient values “C” were taken from the UDSCM, Volume 1. Composite “C” values were determined for each basin and times of concentration (tc) calculated using UDSCM methods also described in the referenced Volume 1 document. All hydrologic calculations for the 5-year and 100-year frequency events are included in the Appendix.

Hydrologic summary of the data and methods utilized in this report includes:

- Design Rainfall: 1-hour point rainfall depths of 1.12 and 2.43 for the 5-year and 100-year storm events, respectively. Depths were obtained from Table 5.2 of the criteria.
- Hydrologic Soil Group: NRCS hydrologic soil group A
- Conveyance System Design Storm Recurrence Intervals: 5-year and 100-year
- Detention is per the USDCM, Volume 2 full spectrum detention design guidelines as aided by the MHFD Excel design tool “Detention Design” available through the district’s website.

4.2.2. HYDRAULIC CRITERIA

Inlet capacities have been analyzed per the procedures of the USDCM, Volume 1 street, inlet, and storm drain guidelines as aided by the MHFD Excel design tool “Street Capacity and Inlet Sizing” available through the district’s website. For this report storm drains are sized with a normal depth allowance providing for a maximum of 80□ capacity analyzed using Autodesk’s Hydraflow Storm Sewers Extension, version 8 for AutoCAD. All hydraulic calculations for the 5-year and 100-year frequency events are included in the Appendix.

Hydraulic data and analysis methods used in this report include:

- All inlets are □sump’ condition and sized with a 50□ grate clogging factor.
- Inlets and storm drains sized for the 100-year event.
- Drains sized with a manning’s □’ value of 0.011 for HDPE and 0.013 for RCP

4.2.3. STORM WATER QUALITY CRITERIA

The on-site detention and water quality pond will be provided with a Bioretention facility, with underdrain, satisfying all City of Commerce City MS4 permit requirements. Design is per the USDCM, Volume 3 guidelines and is aided by the aforementioned “Detention Design” tool.

5. DRAINAGE FACILITY DESIGN

5.1. GENERAL CONCEPT

Most excess rainfall from the site will sheet flow to the perimeter curb where it will be intercepted at inlets and directed to an underground storm drain system. Capture from areas of building or canopy will collect at roof level in downspouts and be tied to the storm drains without first splashing onto the surface. The storm drain conveys to, and ultimately discharges into an at-grade detention and water quality pond. In the pond runoff is treated for quality and detained for rate and quantity before being released to the public system in East 72nd Avenue, piped into the back of the inlet at the southeast corner of 72nd and Eudora. The overall storm improvements for this project will consist of:

- two (2) 5' Type R inlets
- one (1) landscape area inlet
- 6-inch to 12-inch private PVC or HDPE storm drains
- 15-inch to 18-inch private RCP storm drains
- at-grade water quality and detention pond, including FES inlet and a modified Type C Inlet outlet control device
- 24-inch public RCP storm drain

5.2. SPECIFIC DETAILS

5.2.1. ENCOUNTERED PROBLEMS

No exceptional conditions have presented themselves in the analysis and design of storm water facilities proposed to provide for the subject site.

5.2.2. DESIGN FLOWS AND VOLUMES

All hydrologic and hydraulic analysis, including rates and volumes, are detailed in Appendix B of this report.

5.2.3. EXISTING FACILITIES

There are no existing on-site facilities to remain. The existing public system to which the controlled and treated site discharge will be conveyed will only be modified in as much is necessary to attach the new outfall pipe to the existing inlet. That inlet is the same connecting point as utilized by the existing system being demolished.

5.2.4. PROPOSED FACILITIES

5' Type R concrete curb inlets will be used on-site to capture overland runoff and convey it to the private underground storm drains. Roof drains will be either D3034 PVC or dual wall HDPE if less than 15-inches in diameter. Lateral lines at 15-inches and trunk lines at 18-inches diameter or over will be class III reinforced concrete pipe.

The at-grade detention and water quality facilities will be constructed with maximum 4 (horizontal) to 1 (vertical) side slopes. Access to the pond bottom

will be provided at a 10 (horizontal) to 1 (vertical) maximum grade. Since this will be a bioretention facility the pond bottom will be flat and provided with a PVC underdrain. Concentrated discharge into the pond will be provided at a concrete flared end section with Type VL rock riprap scour protection. The outlet control structure will be constructed as a modified CDOT Type C inlet and include control plates for water quality discharge (underdrain inflow pipe), full spectrum detention (trash screen and orifice plate), and emergency overflow (standard Type C grate).

Off-site flow contribution to the site is topographically prohibited in both the existing and proposed conditions. Treated and controlled runoff from the site will be at rates and volumes less than in the existing condition. That is as a result of the increased restrictions associated with the full spectrum detention design relative to the extended detention basin design utilized for the current facility. Even emergency overflow or bypass rates will be decreased as a result of the greatly increased pervious area associated with the re-developed site relative to existing. Points of site contribution to the public system remain unchanged.

5.2.5. FACILITY MAINTENANCE

Trash pick-up and collection will be a part of the regular site operations for Kum & Go. Should trash, silt, or other debris impair the on-site stormwater conveyance drains it can be accessed at inlets, clean outs, or manholes and manually cleared or jet routed in extreme instances. Primary consideration for upkeep of the pond facility is regular landscape maintenance. Any observance of trash or silt accumulation therein can be manually removed either by hand or with the aid of light equipment that will be able to access the pond bottom at a 10:1 path. Should damage or defect to any structural facilities be observed or any indication that the pond is not otherwise operating as expected (e.g. holding water in excess of the prescribed drain times) a design engineer will need to be consulted to evaluate and prescribe remediation. Maintenance of all facilities described in this report will remain the responsibility of Kum & Go, Inc. or their accessors or assigns and records of those activities should be kept for 3 years after execution.

5.2.6. DRAINAGE EASEMENTS AND TRACTS

A permanent, non-exclusive easement will be provided over the detention and quality facility and discharge pipe out to the public right-of-way and connection to the MS4. Construction of buildings will be restricted from within the easement.

5.2.7. STORMWATER CONTROL MEASURES

The water quality element of the on-site stormwater facility will be provided through Bioretention with partial infiltration. Design follows the guidelines of USDCM, Volume III, Chapter 4 (T-3) for said structures and is completed with the aid of the "Detention Design" Excel tool available from the MHFD.

5.2.8. JURISDICTIONS HAVING AUTHORITY

To the best of our knowledge compliance with the provisions of the City of Commerce City Storm Drainage Criteria Manual will satisfy any extra-jurisdictional requirements.

5.2.9. VARIANCES

No drainage variances are being requested.

6. CONCLUSIONS

6.1. COMPLIANCE WITH STANDARDS

This drainage report presents the drainage analysis for a Kum & Go fueling and convenience store at 7160 Eudora Drive and complies with the criteria and standards of the City of Commerce City Storm Drainage Design and Technical Criteria Manual. No new publicly held facilities are a part of the proposed improvements.

6.2. DRAINAGE CONCEPT

The drainage system provides a 5-year and 100-year level of protection for the site and surrounding properties that may be impacted by site improvement.

6.3. WATER QUALITY

Post-construction stormwater quality improvement is provided by the installation of a Bioretention facility, with partial infiltration, as prescribed in Volume 3 of the USDCM and specifically allowed within the City of Commerce City's Storm Drainage Criteria Manual. Upon improvement completion the site will provide for compliance with the WQCV Standard of the CDPHE COR090000 Municipal Separate Storm Sewer System permit (4.a.iv.(A)).

7. REFERENCES

1. City of Commerce City *Storm Drainage Design and Technical Criteria Manual*, March 2022.
2. Urban Drainage and Flood Control District *Urban Storm Drainage and Technical Criteria Manual*, Volume I, revised August 2018.
3. Urban Drainage and Flood Control District *Urban Storm Drainage and Technical Criteria Manual*, Volume II, revised September 2017.
4. Urban Drainage and Flood Control District *Urban Storm Drainage and Technical Criteria Manual*, Volume III, revised January 2021.
5. McLaughlin Water Engineers, Ltd. *Drainage Outfall Systems Planning – Northern Commerce City and Irondale Area*, April 1986
6. FEMA National Flood Hazard Map 08001C0608H, effective March 5, 2007.
7. Soil Map □ Adams County Area, Parts of Adams and Denver Counties, Colorado as available through the National Cooperative Soil Survey - Web Soil Survey internet database.

APPENDICES

APPENDIX A
Reference Materials



SITE

E. 72nd Ave

Dahlia St

Vaquez Blvd

Encina Dr

Elm Dr

Fairfax Dr

E. 69th Ave

Google Earth

Image Landsat / Copernicus

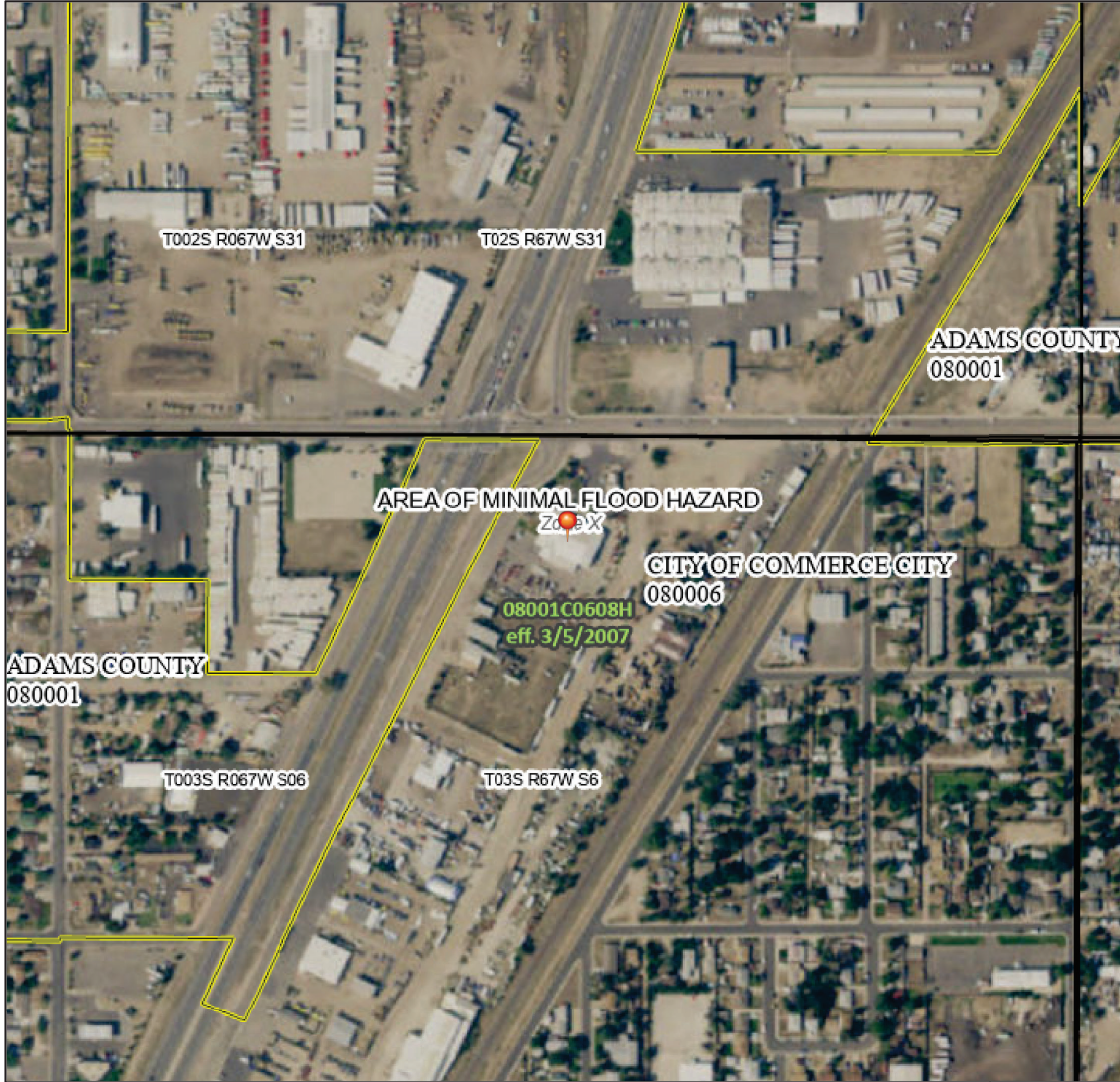
1000 ft



National Flood Hazard Layer FIRMette



104°55'55"W 39°49'49"N



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, AB99
		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		Cross Sections with 1% Annual Chance Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
OTHER FEATURES		Profile Baseline
		Hydrographic Feature
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped
		The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

0 250 500 1,000 1,500 2,000 Feet 1:6,000 104°55'18"W 39°49'21"N
 Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

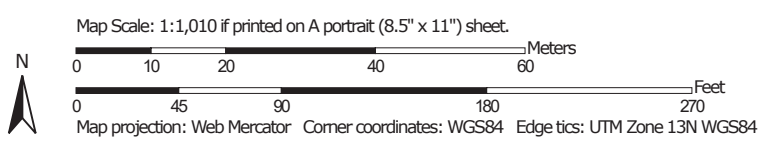
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards. The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 6/9/2022 at 11:34 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

Hydrologic Soil Group—Adams County Area, Parts of Adams and Denver Counties, Colorado
(7160 Eudora Street)



































Soil Map may not be valid at this scale.



Hydrologic Soil Group—Adams County Area, Parts of Adams and Denver Counties, Colorado
(7160 Eudora Street)

MAP LEGEND

Area of Interest (AOI)		 C
 Area of Interest (AOI)		 C/D
Soils		 D
Soil Rating Polygons		 Not rated or not available
 A		Water Features
 A/D		 Streams and Canals
 B		Transportation
 B/D		 Rails
 C		 Interstate Highways
 C/D		 US Routes
 D		 Major Roads
 Not rated or not available		 Local Roads
Soil Rating Lines		Background
 A		 Aerial Photography
 A/D		
 B		
 B/D		
 C		
 C/D		
 D		
 Not rated or not available		
Soil Rating Points		
 A		
 A/D		
 B		
 B/D		

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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: Adams County Area, Parts of Adams and Denver Counties, Colorado
Survey Area Data: Version 18, Aug 31, 2021

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

Date(s) aerial images were photographed: Jun 9, 2021—Jun 12, 2021

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
VoA	Vona sandy loam, 0 to 1 percent slopes	A	2.4	100.0%
Totals for Area of Interest			2.4	100.0%

Description

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

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

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

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

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

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

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

Rating Options

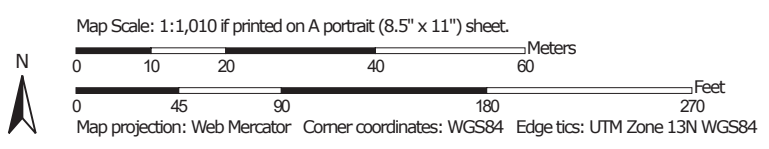
Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Soil Map—Adams County Area, Parts of Adams and Denver Counties, Colorado
(7160 Eudora Street)







































Soil Map may not be valid at this scale.



Soil Map—Adams County Area, Parts of Adams and Denver Counties, Colorado
(7160 Eudora Street)

MAP LEGEND

Area of Interest (AOI)		Area of Interest (AOI)		Spoil Area
Soils		Soil Map Unit Polygons		Stony Spot
		Soil Map Unit Lines		Very Stony Spot
		Soil Map Unit Points		Wet Spot
Special Point Features		Blowout		Other
		Borrow Pit		Special Line Features
		Clay Spot	Water Features	
		Closed Depression		Streams and Canals
		Gravel Pit	Transportation	
		Gravelly Spot		Rails
		Landfill		Interstate Highways
		Lava Flow		US Routes
		Marsh or swamp		Major Roads
		Mine or Quarry		Local Roads
		Miscellaneous Water	Background	
		Perennial Water		Aerial Photography
		Rock Outcrop		
		Saline Spot		
		Sandy Spot		
		Severely Eroded Spot		
		Sinkhole		
		Slide or Slip		
		Sodic Spot		

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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: Adams County Area, Parts of Adams and Denver Counties, Colorado
Survey Area Data: Version 18, Aug 31, 2021

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

Date(s) aerial images were photographed: Jun 9, 2021—Jun 12, 2021

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
VoA	Vona sandy loam, 0 to 1 percent slopes	2.4	100.0%
Totals for Area of Interest		2.4	100.0%



BRANCH ADDRESS
200 South Raritan Street
Denver, Colorado 80223
Phone: 303-744-2125

HEADQUARTERS
4140 E. 14th St.
Des Moines, IA 50313-3804
Toll-Free: 800-369-5500

The Complete Solution

January 17, 2022

Dan Garneau
Kum & Go, L.C.
1459 Grand Avenue
Des Moines, Iowa 50309

Mary Kasal
EES
5201 South Cherry Street
Glendale, Colorado 80246

Subject: Phase I ESA for Kum & Go #2300, Southeast Corner of Eudora Dr. and E. 72nd Ave., Commerce City, Adams County, Colorado

Dear Mr. Garneau:

Seneca has performed a Phase I Environmental Site Assessment (ESA) in conformance with the scope and limitations of ASTM Practice E 1527-13 for the commercial property listed above. Any exceptions to or deletions from, this practice are described in [Section 4.3](#) of the Phase I ESA.

The Phase I ESA has identified the following Recognized Environmental Conditions (RECs), Historically Recognized Environmental Conditions (HRECs) Controlled Recognized Environmental Conditions (CRECs), and/or Vapor Encroachment Conditions (VECs):

- CREC and BER-Petroleum products and hazardous chemicals from former Approved Oil Service, 5390 E. 72nd Ave. Contamination was left in place following cleanup operations, the remaining contamination is considered a CREC and BER for the Subject Property as there is potential for contamination to migrate onto the Subject Property over time. For additional details see [Section 6.1.2](#).
- REC- Used oil staining near the used oil pump station inside the service bay at the Subject Property. A large amount of used oil staining on a concrete surface has the potential to leach into the soil below through seams and cracks. For additional details see [Section 7.2](#).
- REC- An in-use oil water separator on the eastern side of the Subject Property. An operating oil water separator has the potential to leach into the soil and groundwater. For additional details see [Section 7.3](#).

Non-Scope Environmental Concerns

- No registered USTs on the Subject Property.

Branch Locations

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Remediation & Process Controls • Automotive & Commercial Equipment

- The Subject Property **does not** have shallow groundwater based on data from groundwater monitoring wells located approximately 400-feet downgradient; therefore there are no anticipated UST installation concerns during site development.
- The following are not anticipated to be negatively impacted by the additional site development: Wetlands or Other Protected Waters of the US, Threatened, Endangered, or Protected Flora/Fauna and Critical Habitats and Historical Structures and Archaeological and Cultural Resources.

In the event that further clarification is desired regarding the identified concerns, Seneca will present recommendations upon request.

Please do not hesitate to contact Josh Stewart at 515-322-0234 or jstewart@senecaco.com if you have any questions concerning the information presented in the report. We appreciate the opportunity to have performed this investigation.

Sincerely,

Seneca Companies, Inc.

A handwritten signature in blue ink, appearing to read "J. Stewart", is positioned above the typed name.

Josh Stewart
Project Manager

Phase I Environmental Site Assessment
Kum & Go #2300
Southeast Corner of Eudora Dr. and E. 72nd Ave.
Commerce City, Adams County, Colorado, 80022

Prepared for:
Dan Garneau
Kum & Go, L.C.
1459 Grand Avenue
Des Moines, Iowa 50309

Mary Kasal
EES
5201 South Cherry Street
Glendale, Colorado 80246

Prepared by:
Josh Stewart
Seneca Companies, Inc.
200 South Raritan Street
Denver, Colorado 80223
303-744-2125

January 17, 2022
Expiration Date: June 14, 2022
Seneca Project: 6530019



The Complete Solution

February 11, 2022

Dan Garneau
Kum & Go, L.C.
1459 Grand Avenue
Des Moines, IA 50309

Subject: Phase II Environmental Site Assessment Results: Kum & Go #2300, 7160 Eudora Drive, Commerce City, Adams County, CO

Mr. Garneau:

The enclosed report is intended to summarize the observations and conclusions of the Phase II Environmental Site Assessment conducted for the property located at the above referenced location. All activities are based on a directive from Kum & Go, L.C. and conditions identified during the site inspection.

The following RECs were investigated as part of this assessment.

Recognized Environmental Conditions (RECs)

- CREC and BER- Petroleum products and hazardous chemicals from former Approved Oil Service, 5390 E. 72nd Ave. Contamination was left in place following cleanup operations, the remaining contamination is considered a CREC and BER for the Subject Property as the contamination has the potential to migrate onto the Subject Property over time.
- REC- Heavy used oil staining near the used oil pump station inside the service bay at the Subject Property. A large amount of used oil staining on a concrete surface has the potential to leach into the soil below through seams and cracks. In addition, the used oil pump empties into an AST located on the northern side of the property in a damaged containment unit. Any used oil pumped to the AST has potential to spill and leak into the subsurface through the damaged containment unit.
- REC- An in-use oil water separator on the eastern side of the Subject Property. An operating oil water separator has the potential to leach oil based contaminants into the soil and groundwater.

Objective

Objective 1 - Assess whether there has been a release of hazardous substances within the meaning of CERCLA, for purposes including landowner liability protections

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Kansas City, MO • South Sioux City, NE • Tulsa, OK • Nashville, TN

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Objective 2 - Provide information relevant to identifying, defining or implementing landowner [continuing obligations] or the criteria established under CERCLA for maintaining the CERCLA landowner liability protections.

Results

The Subject Property is currently used as a heavy equipment rental facility, with used oil storage and processing operations on site. Soil and groundwater data was collected as part of this assessment. Soil samples were collected from each of the borings intervals that exhibited the highest field screening value or at the soil/water interface. Soil and groundwater concentrations for the selected analytes were measured at below Tier 1 RBSL's. All environmental concerns have been eliminated.

Seneca Environmental Services appreciates the opportunity to assist Kum & Go, L.C. with this investigation. Please do not hesitate to contact Mike Dimino at 303-210-0364 or mdimino@senecaco.com if you have any questions concerning the information presented in the report.

Sincerely,

Seneca Companies, Inc.

A handwritten signature in blue ink, appearing to read "Mike Dimino".

Mike Dimino

Branch Operations Manager

Phase II Environmental Site Assessment
Kum & Go #2300
7160 Eudora Drive
Commerce City, Adams County, CO

Prepared for:
Dan Garneau
Kum & Go, L.C.
1459 Grand Avenue
Des Moines, IA

Prepared by:
Seneca Companies, Inc.

Mike Dimino
200 South Raritan St.
Denver, Colorado 80223
303-744-2125

February 11, 2022
Seneca Project: 6530006

APPENDIX B
Hydrologic and Hydraulic Calculations

Runoff Coefficients

Corridor / Design Package: Kum & Go - 7160 Eudora Drive, Commerce City, CO
 System Name: Developed Condition

Computed: LCG Date: 2/20/2023
 Checked: _____ Date: 2/20/2023

Sub-Basin Data			Composite C			Sub Area (Drives & Walks)				Sub Area (Roof)				Sub Area(Lawns A Group soils)			
Basin ID	Description	Total Area (ac)	C _s	C ₁₀₀	i	C _s	C ₁₀₀	i	Area (ac)	C _s	C ₁₀₀	i	Area (ac)	C _s	C ₁₀₀	i	Area (ac)
A	WEST LANDSCAPING	0.24	0.09	0.21	12.83	0.75	0.81	100	0.03	0.75	0.81	90	0.00	0.01	0.13	2	0.21
B	BUILDING	0.09	0.75	0.81	90.00	0.75	0.81	100	0.00	0.75	0.81	90	0.09	0.01	0.13	2	0.00
C	CANOPY	0.14	0.75	0.81	90.00	0.75	0.81	100	0.00	0.75	0.81	90	0.14	0.01	0.13	2	0.00
D	EAST DRIVE AND LANDSCAPE	0.45	0.45	0.54	60.43	0.75	0.81	100	0.27	0.75	0.81	90	0.00	0.01	0.13	2	0.18
E	WALKS AND DRIVES	0.48	0.73	0.79	97.60	0.75	0.81	100	0.47	0.75	0.81	90	0.00	0.01	0.13	2	0.01
F	LANDSCAPE	0.54	0.01	0.13	2.00	0.75	0.81	100	0.00	0.75	0.81	90	0.00	0.01	0.13	2	0.54
Total Detained Composite		1.93	0.39	0.48	51.23	0.75	0.81	100	0.76	0.75	0.81	90	0.23	0.01	0.13	2	0.94
G	WEST ENTRANCE	0.05	0.75	0.81	100.00	0.75	0.81	100	0.05	0.75	0.81	90	0.00	0.01	0.13	2	0.00
H	SOUTH LANDSCAPE	0.16	0.01	0.13	2.00	0.75	0.81	100	0.00	0.75	0.81	90	0.00	0.01	0.13	2	0.16
I	EAST LANDSCAPE	0.20	0.09	0.21	13.09	0.75	0.81	100	0.02	0.75	0.81	90	0.00	0.01	0.13	2	0.18
Total On-Site Composite		2.34	0.35	0.44	45.59	0.75	0.81	100	0.83	0.75	0.81	90	0.23	0.01	0.13	2	1.27
OS-1	OFFSITE DRIVE	0.31	0.63	0.70	84.51	0.75	0.81	100	0.26	0.75	0.81	90	0.00	0.01	0.13	2	0.05
Total Composite		2.65	0.38	0.47	50.15	0.75	0.81	100	1.09	0.75	0.81	90	0.23	0.01	0.13	2	1.32

Standard Form SF-1 - Time of Concentration

Corridor / Design Package: Kum & Go - 7160 Eutaw Drive, Commerce City, CO
 System Name: Developed Condition

Computed: LCG Date: 2/20/2023
 Checked: KMH Date: 2/20/2023

SUB-BASIN DATA				INITIAL/OVERLAND FLOW (t)			TRAVEL TIME (t)						Tc CHECK (Urbanized basins)			FINAL Tc (min)			
Basin ID	Description	C _s	Area (ac)	Length (ft)	Slope (ft/ft)	t _i (min)	Length (ft)	Slope (ft/ft)	Code	Description	Convey Coef (C _c)	V	t _r (min)	t _e = t _r + t _i (min)	(Yes / No)	Length (ft)	t _{c,max} (min)	Tc _{max} > t _e	
A	WEST LANDSCAPING	0.09	0.24	51	0.038	8.4	61	0.02	6	Paved areas and shallow paved swales	20.00	2.83	0.36	8.73	Yes	112	10.62	Regional Tc	8.73
B	BUILDING	0.75	0.09	30	0.01	3.5	0	0.02	6	Paved areas and shallow paved swales	20.00	2.83	0.00	3.46	Yes	30	10.17	Regional Tc	5.00
C	CANOPY	0.75	0.14	30	0.01	3.5	0	0.02	6	Paved areas and shallow paved swales	20.00	2.83	0.00	3.46	Yes	30	10.17	Regional Tc	5.00
D	EAST DRIVE AND LANDSCAPE	0.45	0.45	40	0.012	7.0	384.0	0.02	6	Paved areas and shallow paved swales	20.00	2.83	2.26	9.24	Yes	424	12.36	Regional Tc	9.24
E	WALKS AND DRIVES	0.73	0.48	40	0.02	3.3	158	0.02	6	Paved areas and shallow paved swales	20.00	2.83	0.93	4.28	Yes	198	11.10	Regional Tc	5.00
F	LANDSCAPE	0.01	0.54	75	0.022	13.1	38	0.25	6	Paved areas and shallow paved swales	20.00	10.00	0.06	13.20	Yes	113	10.63	Check	13.20
G	WEST ENTRANCE	0.75	0.05	15	0.025	1.8	0	0.02	6	Paved areas and shallow paved swales	20.00	2.83	0.00	1.81	Yes	15	10.08	Regional Tc	5.00
H	SOUTH LANDSCAPE	0.00	0.00	15	0.043	4.8	0	0.02	6	Paved areas and shallow paved swales	20.00	2.83	0.00	4.75	Yes	15	10.08	Regional Tc	5.00
I	EAST LANDSCAPE	0.75	0.05	42	0.013	3.8	0	0.02	6	Paved areas and shallow paved swales	20.00	2.83	0.00	3.76	Yes	42	10.23	Regional Tc	5.00
OS-1	OFFSITE DRIVE	0.01	0.16	28	0.02	8.3	309	0.01	6	Paved areas and shallow paved swales	20.00	2.00	2.58	10.86	Yes	337	11.87	Regional Tc	10.86

Notes:
 $t_i = (0.395 * (1.1 - C_s) * (L^{0.5})) / (S^{0.33})$, from UDFCD Eqn 6-3
 Velocity from $V = C_s * S^{0.5}$, from UDFCD Eqn 6-4, C_s from Table 6-2(See Sheet Design Info)
 $t_r = L / 60V$
 $t_{c,max} = 10L / 180$
 Final Tc > 10 min for nonurban watersheds

Code	Type of Land Surface	Conveyance Factor, K
1	Heavy meadow	2.5
2	Tillage/field	5
3	Short pasture and lawns	7
4	Nearly bare ground	10
5	Grassed waterway	15
6	Paved areas and shallow paved swales	20

Standard Form SF-2 . Storm Drainage System Design (Rational Method Procedure)
 Corridor / Design Package: Kum & Go - 7160 Eudora Drive, Commerce City, CO
 System Name: Developed Condition

Computed: LCG Date: 2/20/2023
 Checked: KMH Date: 2/20/2023

Design Storm: Proposed 5-yr P = 1.12 in

LOCATION	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				Lawns & Gro	PIPE		TRAVEL TIME		REMARKS			
		AREA DESIGN	AREA (AC)	RUNOFF COEFF	t _c (MIN)	C.A. (AC)	IIN / HR	Q (CFS)	t _c (MIN)	SUM (C'A)(AC)	IIN / HR	Q(CFS)	SLOPE(%)	STREETFLOW (C)	DESIGNFLOW (C)	SLOPE(%)	PIPE SIZE(IN)		LENGTH(FT)	VELOCITY(FPS)	t _c (MIN)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
A	WEST LANDSCAPING	A	0.24	0.09	8.73	0.022	3.19	0.07													
B	BUILDING	B	0.09	0.75	5.00	0.068	3.80	0.26													
C	CANOPY	C	0.14	0.75	5.00	0.104	3.80	0.39													
	A.B.C	1							8.73	0.194	3.19	0.62									
D	EAST DRIVE AND LANDSCAPE	D	0.45	0.45	9.24	0.202	3.12	0.63													
E	WALKS AND DRIVES	E	0.48	0.73	5.00	0.353	3.80	1.34													
	DP1, D.E	2							9.24	0.749	3.12	2.34									
F	LANDSCAPE	F	0.54	0.01	13.20	0.005	2.70	0.01													
	DP2, F	3							13.20	0.754	2.70	2.03									
G	WEST ENTRANCE	G	0.05	0.75	5.00	0.035	3.80	0.13													
H	SOUTH LANDSCAPE	H	0.16	0.01	5.00	0.002	3.80	0.01													
I	EAST LANDSCAPE	I	0.20	0.09	5.00	0.019	3.80	0.07													
OS-1	OFFSITE DRIVE	OS-1	0.31	0.63	10.86	0.166	2.63	0.56													
	I, OS-1	4							10.86	0.215	2.93	0.63									
	BASIN TOTAL								3.49												

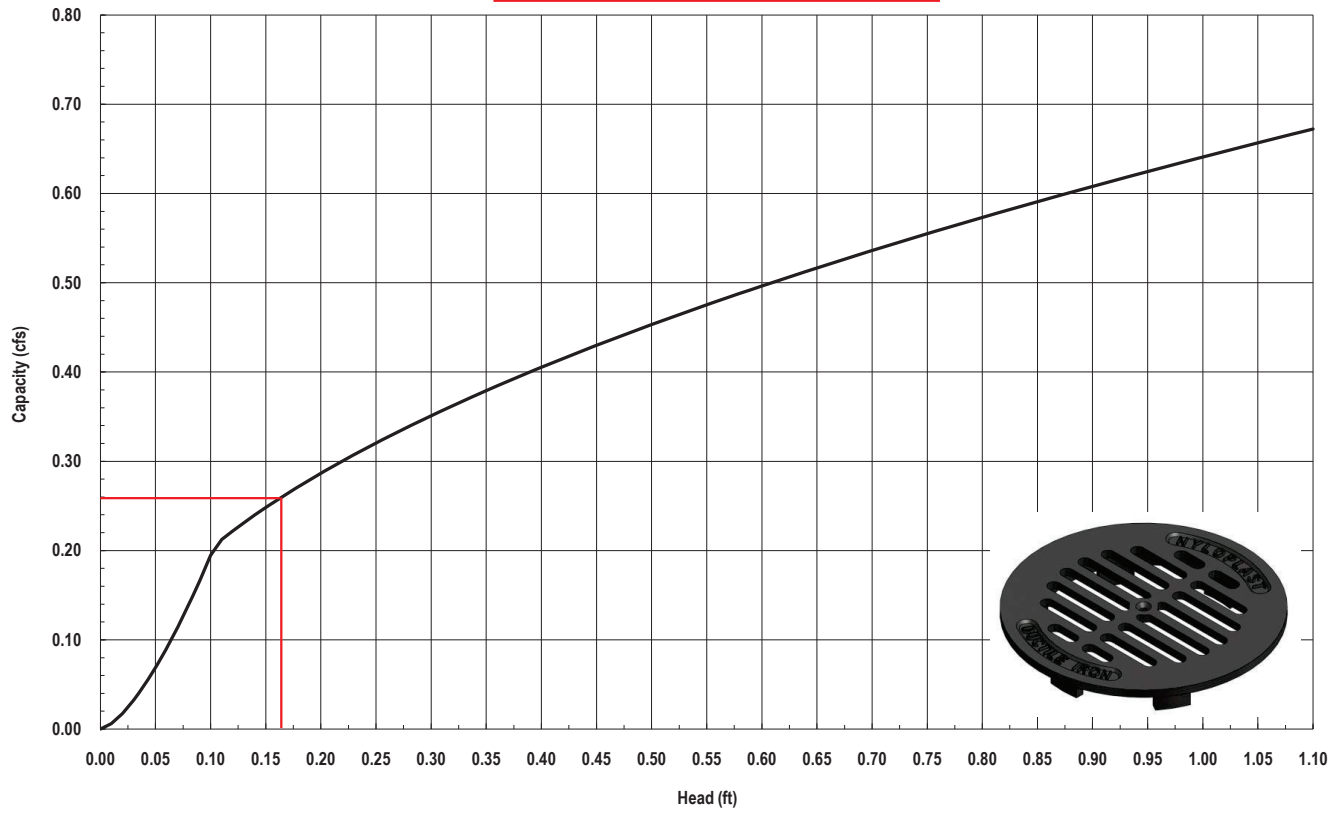
Design Storm: Proposed 100-yr P = 2.43 in

LOCATION	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET	PIPE		TRAVEL TIME		REMARKS			
		AREA DESIGN	AREA (AC)	RUNOFF COEFF	t _c (MIN)	C.A. (AC)	IIN / HR	Q (CFS)	t _c (MIN)	SUM (C'A)(AC)	IIN / HR	Q(CFS)	SLOPE(%)	STREETFLOW (C)	DESIGNFLOW (C)	SLOPE(%)	PIPE SIZE(IN)		LENGTH(FT)	VELOCITY(FPS)	t _c (MIN)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
A	WEST LANDSCAPING	A	0.24	0.21	8.73	0.048	6.92	0.33													
B	BUILDING	B	0.09	0.81	5.00	0.074	8.24	0.61													
C	CANOPY	C	0.14	0.81	5.00	0.112	8.24	0.92													
	A.B.C	1							8.73	0.234	6.92	1.62									
D	EAST DRIVE AND LANDSCAPE	D	0.45	0.54	9.24	0.240	6.78	1.63													
E	WALKS AND DRIVES	E	0.48	0.79	5.00	0.383	8.24	3.15													
	DP1, D.E	2							9.24	0.857	6.78	5.81									
F	LANDSCAPE	F	0.54	0.13	13.20	0.070	5.85	0.41													
	DP2, F	3							13.20	0.927	5.85	5.42									
G	WEST ENTRANCE	G	0.05	0.81	5.00	0.038	8.24	0.31													
H	SOUTH LANDSCAPE	H	0.16	0.13	5.00	0.021	8.24	0.17													
I	EAST LANDSCAPE	I	0.20	0.21	5.00	0.041	8.24	0.34													
OS-1	OFFSITE DRIVE	OS-1	0.31	0.70	10.86	0.218	6.36	1.39													
	I, OS-1	4							10.86	0.259	2.93	0.76									
	BASIN TOTAL								9.26												

- (1) Basin Description linked to C-Value Sheet
- (2) Basin Design Point
- (3) Enter the Basin Name from C Value Sheet
- (4) Basin Area linked to C-Value Sheet
- (5) Composite C linked to C-Value Sheet
- (6) Time of Concentration linked to C-Value Sheet
- (7) =Column 4 x Column 5
- (8) =28.5*P¹⁰/Column 6/0.786
- (9) =Column 7 x Column 8
- (10) =Column 6 + Column 21
- (11) Add the Basin Areas (7) to get the combined basin AC
- (12) =28.5*P¹⁰/Column 10/0.786
- (13) Sum of Qs
- (14) Additional Street Overland Flow
- (15) Additional Street Overland Flow
- (16) Design Pipe Flow
- (17) Pipe Slope
- (18) Pipe Size
- (19) Additional Flow Length
- (20) Velocity
- (21) =Column 19 / Column 20 / 60

Nyloplast 8" Drop In Grate Inlet Capacity Chart

GRATE FOR DROP INLET - ST#5



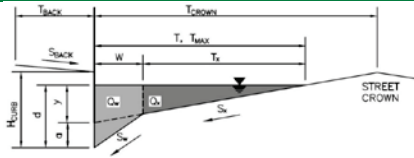
Nyloplast

3130 Verona Avenue • Buford, GA 30518
(866) 888-8479 / (770) 932-2443 • Fax: (770) 932-2490
© Nyloplast Inlet Capacity Charts June 2012

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)
 (Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: **Inlet 2**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb
 Side Slope Behind Curb (leave blank for no conveyance credit behind curb)
 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)
 Height of Curb at Gutter Flow Line
 Distance from Curb Face to Street Crown
 Gutter Width
 Street Transverse Slope
 Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)
 Street Longitudinal Slope - Enter 0 for sump condition
 Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$T_{BACK} = 0.0$ ft
 $S_{BACK} =$ ft/ft
 $n_{BACK} = 0.012$

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 19.0$ ft
 $W = 1.00$ ft
 $S_X = 0.020$ ft/ft
 $S_W = 0.083$ ft/ft
 $S_0 = 0.000$ ft/ft
 $n_{STREET} = 0.012$

Max. Allowable Spread for Minor & Major Storm
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 Check boxes are not applicable in SUMP conditions

	Minor Storm	Major Storm	
$T_{MAX} =$	19.0	19.0	ft
$d_{MAX} =$	5.0	5.0	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

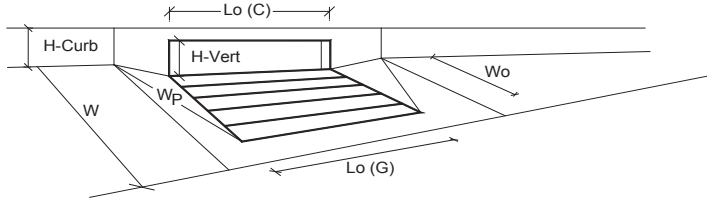
MINOR STORM Allowable Capacity is not applicable to Sump Condition
 MAJOR STORM Allowable Capacity is not applicable to Sump Condition

$Q_{allow} =$

Minor Storm	Major Storm	
SUMP	SUMP	cfs

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)

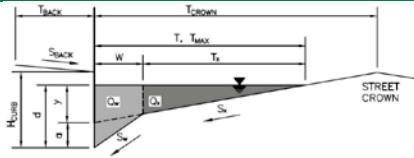


Design Information (Input)	MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)	3.00	3.00	inches	
Number of Unit Inlets (Grate or Curb Opening)	1	1		
Water Depth at Flowline (outside of local depression)	5.0	5.0	inches	
Grate Information				
Length of a Unit Grate	N/A	N/A	feet	
Width of a Unit Grate	N/A	N/A	feet	
Open Area Ratio for a Grate (typical values 0.15-0.90)	N/A	N/A		
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	N/A	N/A		
Grate Weir Coefficient (typical value 2.15 - 3.60)	N/A	N/A		
Grate Orifice Coefficient (typical value 0.60 - 0.80)	N/A	N/A		
Curb Opening Information				
Length of a Unit Curb Opening	5.00	5.00	feet	
Height of Vertical Curb Opening in Inches	6.00	6.00	inches	
Height of Curb Orifice Throat in Inches	6.00	6.00	inches	
Angle of Throat (see USDCM Figure ST-5)	63.40	63.40	degrees	
Side Width for Depression Pan (typically the gutter width of 2 feet)	1.00	1.00	feet	
Clogging Factor for a Single Curb Opening (typical value 0.10)	0.10	0.10		
Curb Opening Weir Coefficient (typical value 2.3-3.7)	3.60	3.60		
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	0.67	0.67		
Low Head Performance Reduction (Calculated)				
Depth for Grate Midwidth	N/A	N/A	ft	
Depth for Curb Opening Weir Equation	0.33	0.33	ft	
Grated Inlet Performance Reduction Factor for Long Inlets	N/A	N/A		
Curb Opening Performance Reduction Factor for Long Inlets	1.00	1.00		
Combination Inlet Performance Reduction Factor for Long Inlets	N/A	N/A		
Total Inlet Interception Capacity (assumes clogged condition)				
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	4.2	4.2	cfs	
Q PEAK REQUIRED =	0.6	1.6	cfs	

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)
 (Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: **Inlet 3**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb
 Side Slope Behind Curb (leave blank for no conveyance credit behind curb)
 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

Height of Curb at Gutter Flow Line
 Distance from Curb Face to Street Crown
 Gutter Width
 Street Transverse Slope
 Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)
 Street Longitudinal Slope - Enter 0 for sump condition
 Manning's Roughness for Street Section (typically between 0.012 and 0.020)

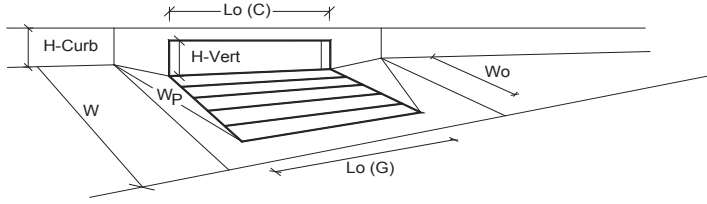
Max. Allowable Spread for Minor & Major Storm
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 Check boxes are not applicable in SUMP conditions

MINOR STORM Allowable Capacity is not applicable to Sump Condition
 MAJOR STORM Allowable Capacity is not applicable to Sump Condition

T_{BACK}	=	0.0	ft																
S_{BACK}	=		ft/ft																
n_{BACK}	=	0.012																	
H_{CURB}	=	6.00	inches																
T_{CROWN}	=	20.0	ft																
W	=	1.00	ft																
S_X	=	0.020	ft/ft																
S_Y	=	0.083	ft/ft																
S_0	=	0.000	ft/ft																
n_{STREET}	=	0.012																	
<table border="1"> <tr> <td></td> <td>Minor Storm</td> <td>Major Storm</td> <td></td> </tr> <tr> <td>T_{MAX}</td> <td>20.0</td> <td>20.0</td> <td>ft</td> </tr> <tr> <td>d_{MAX}</td> <td>5.0</td> <td>5.0</td> <td>inches</td> </tr> <tr> <td></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td></td> </tr> </table>					Minor Storm	Major Storm		T_{MAX}	20.0	20.0	ft	d_{MAX}	5.0	5.0	inches		<input type="checkbox"/>	<input type="checkbox"/>	
	Minor Storm	Major Storm																	
T_{MAX}	20.0	20.0	ft																
d_{MAX}	5.0	5.0	inches																
	<input type="checkbox"/>	<input type="checkbox"/>																	
<table border="1"> <tr> <td></td> <td>Minor Storm</td> <td>Major Storm</td> <td></td> </tr> <tr> <td>Q_{allow}</td> <td>SUMP</td> <td>SUMP</td> <td>cfs</td> </tr> </table>					Minor Storm	Major Storm		Q_{allow}	SUMP	SUMP	cfs								
	Minor Storm	Major Storm																	
Q_{allow}	SUMP	SUMP	cfs																

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)	MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)	3.00	3.00	inches	
Number of Unit Inlets (Grate or Curb Opening)	1	1		
Water Depth at Flowline (outside of local depression)	5.0	5.0	inches	
Grate Information				
Length of a Unit Grate	N/A	N/A	feet	
Width of a Unit Grate	N/A	N/A	feet	
Open Area Ratio for a Grate (typical values 0.15-0.90)	N/A	N/A		
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	N/A	N/A		
Grate Weir Coefficient (typical value 2.15 - 3.60)	N/A	N/A		
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Curb Opening Information				
Length of a Unit Curb Opening	5.00	5.00	feet	
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Height of Curb Orifice Throat in Inches	6.00	6.00	inches	
Angle of Throat (see USDCM Figure ST-5)	63.40	63.40	degrees	
Side Width for Depression Pan (typically the gutter width of 2 feet)	1.00	1.00	feet	
Clogging Factor for a Single Curb Opening (typical value 0.10)	0.10	0.10		
Curb Opening Weir Coefficient (typical value 2.3-3.7)	3.60	3.60		
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Low Head Performance Reduction (Calculated)				
Depth for Grate Midwidth	N/A	N/A	ft	
Depth for Curb Opening Weir Equation	0.33	0.33	ft	
Grated Inlet Performance Reduction Factor for Long Inlets	N/A	N/A		
Curb Opening Performance Reduction Factor for Long Inlets	1.00	1.00		
Combination Inlet Performance Reduction Factor for Long Inlets	N/A	N/A		
Total Inlet Interception Capacity (assumes clogged condition)				
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	4.2	4.2	cfs	
Q PEAK REQUIRED =	1.3	3.2	cfs	

Channel Report

15 in Pipe (Inlet 2-3)

Circular

Diameter (ft) = 1.25

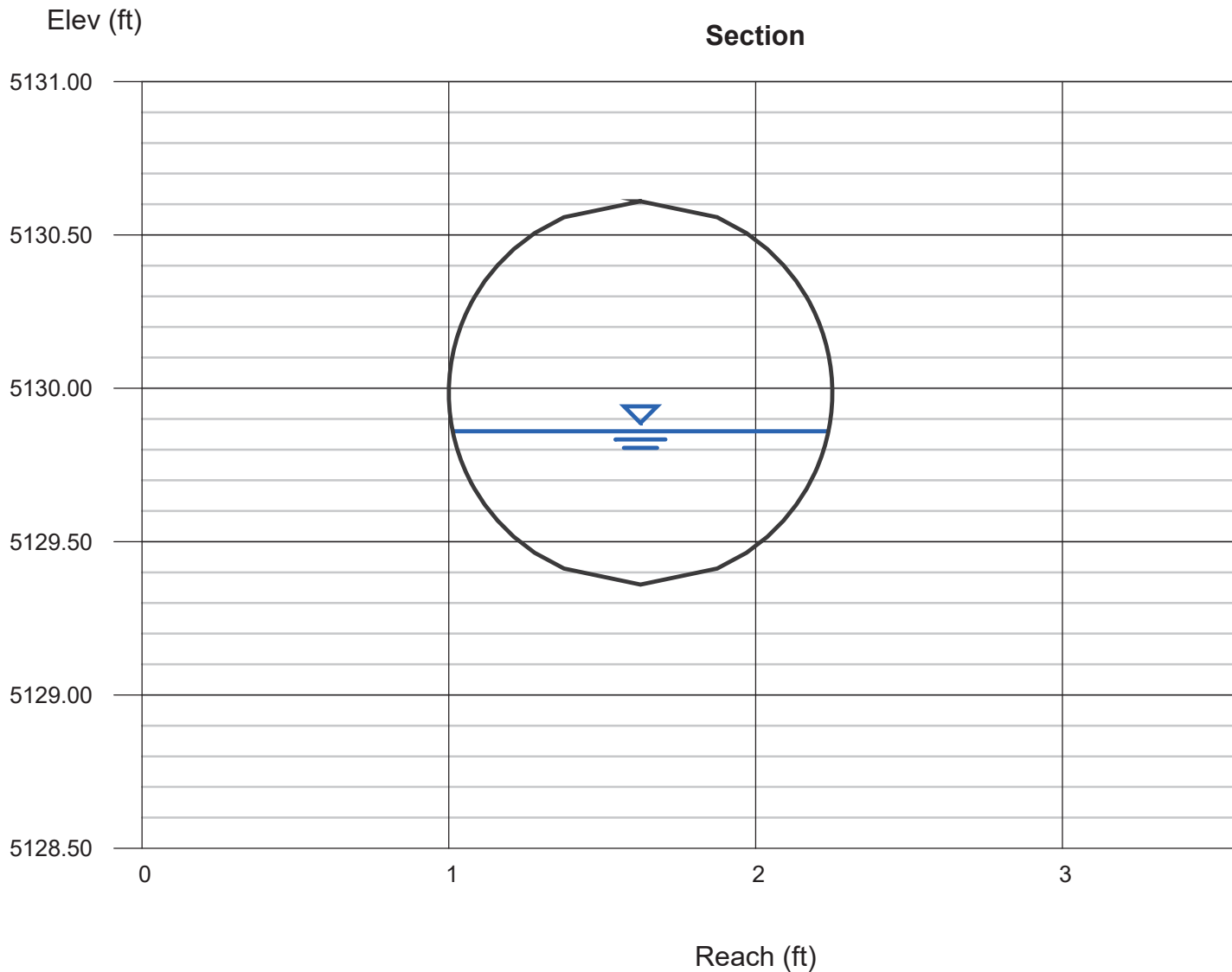
Invert Elev (ft) = 5129.36
Slope (%) = 0.50
N-Value = 0.012

Highlighted

Depth (ft) = 0.50
Q (cfs) = 1.630
Area (sqft) = 0.46
Velocity (ft/s) = 3.55
Wetted Perim (ft) = 1.71
Crit Depth, Yc (ft) = 0.51
Top Width (ft) = 1.22
EGL (ft) = 0.70

Calculations

Compute by: Known Q
Known Q (cfs) = 1.63



Channel Report

24 in Pipe (Inlet 3-FES)

Circular

Diameter (ft) = 2.00

Invert Elev (ft) = 5128.70

Slope (%) = 0.50

N-Value = 0.012

Calculations

Compute by: Known Q

Known Q (cfs) = 5.81

Highlighted

Depth (ft) = 0.80

Q (cfs) = 5.810

Area (sqft) = 1.17

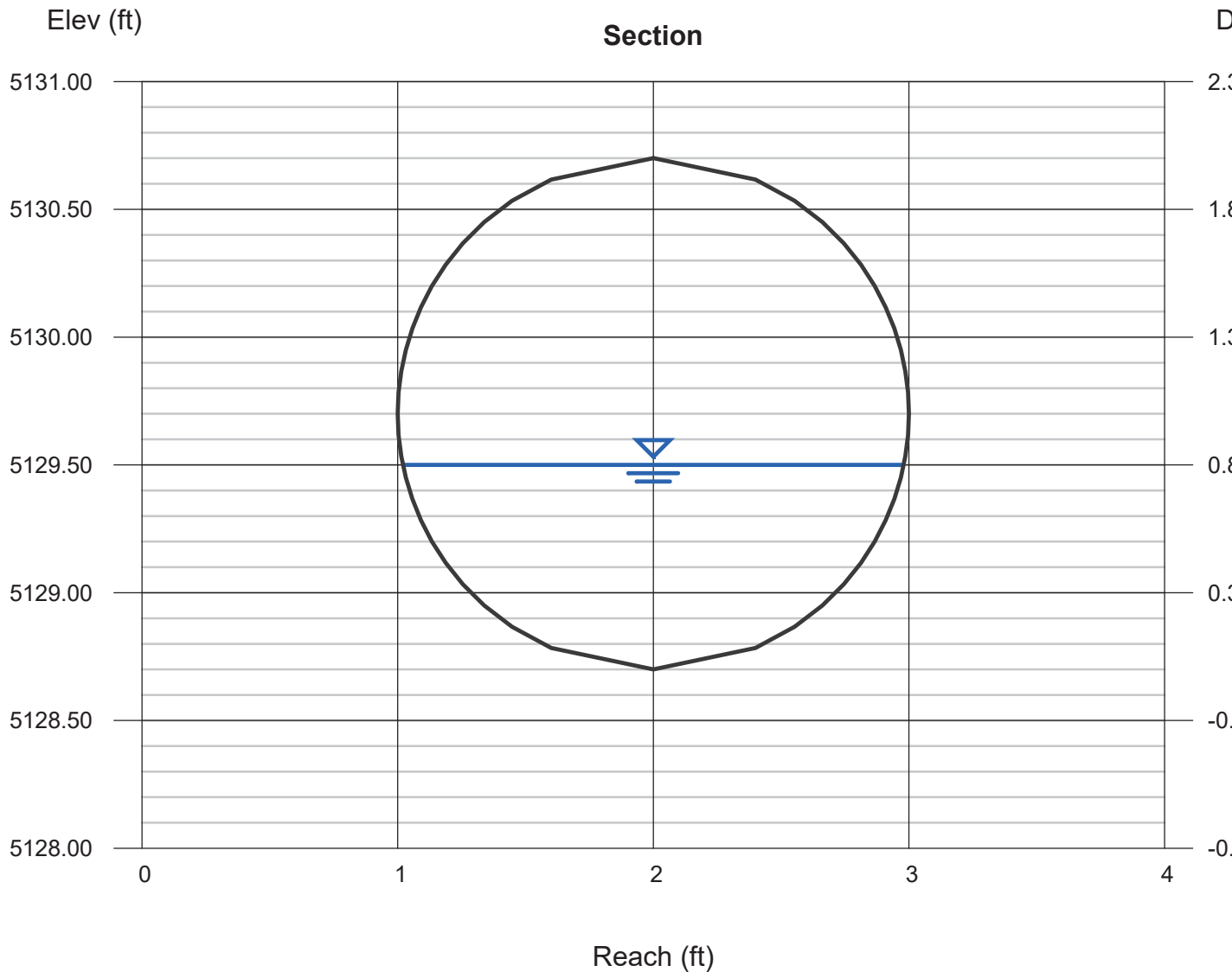
Velocity (ft/s) = 4.95

Wetted Perim (ft) = 2.74

Crit Depth, Yc (ft) = 0.85

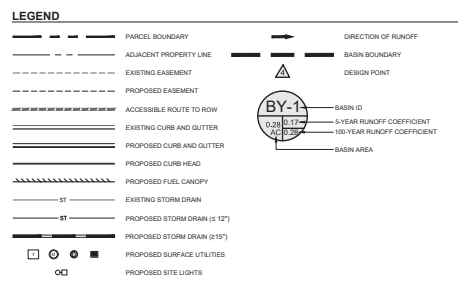
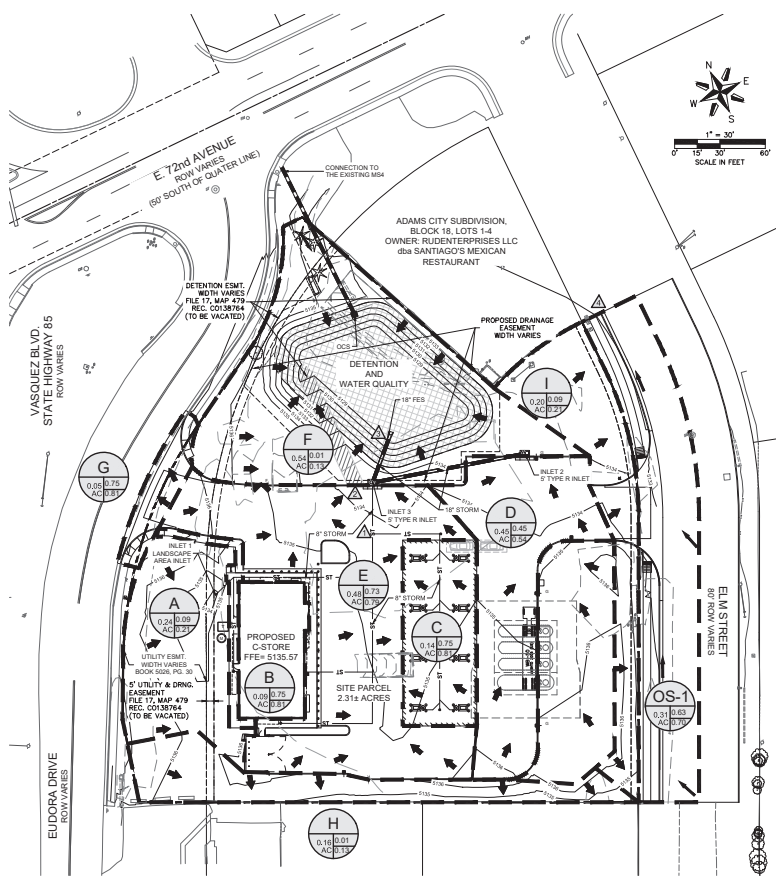
Top Width (ft) = 1.96

EGL (ft) = 1.18



APPENDIX C
Drainage Map

DRAINAGE PLAN
KUM & GO GAS AND C-STORE
 PART OF THE NORTHEAST QUARTER OF SECTION 6, TOWNSHIP 3 SOUTH, RANGE 67
 WEST OF THE 6th P.M., CITY OF COMMERCE CITY, ADAMS COUNTY, COLORADO



DESIGN POINT	TRIBUTARY BASIN	AREA (AC)	PERCENT IMPERVIOUS	COEFFICIENT				TOTAL RUNOFF	
				CS	C1000	CS (CF5)	Q100 (CF5)	Q5	Q100 (CF5)
	A	0.24	12.83%	0.09	0.21	0.07	0.33		
	B	0.09	90.00%	0.75	0.81	0.26	0.61		
	C	0.14	90.00%	0.75	0.81	0.39	0.92		
1	D	0.45	60.43%	0.45	0.54	0.63	1.63	0.62	1.62
	E	0.48	97.60%	0.73	0.79	1.34	3.15		
2	F	0.54	2.00%	0.01	0.13	0.01	0.41	2.34	5.81
3	G	0.05	100.00%	0.75	0.81	0.13	0.31		
	H	0.16	2.00%	0.01	0.13	0.01	0.17		
	I	0.20	13.09%	0.09	0.21	0.07	0.34		
4	OS-1	0.31	84.51%	0.63	0.79	0.99	1.39	0.63	0.76
	Total Composite	2.65	50.15%	0.38	0.47	3.49	9.26		

DETENTION POND SUMMARY				
POND NUMBER	EURV DETENTION VOLUME	16-YR DETENTION VOLUME	PROVIDED VOLUME	100-YEAR WATER SURFACE ELEVATION
POND	3,920 CF	8,842 CF	10,293 CF	5129.84'

7160 EUDORA STREET
COMMERCE CITY, COLORADO
STORE No. 2300
DRAINAGE MAP

KUM & GO

6400 Westpark Parkway
 West Des Moines, Iowa
 50266
 P: 515-226-0128
 F: 515-223-8873

DATE: 7/26/2017

SCALE: 1" = 30'

D1.0
1 OF 1

EES
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 ENGINEERING
 SOLUTIONS, INC.

3801 E. Florida Avenue, Suite 425
 Denver, CO 80210
 303-675-7567 www.ees-us.com