MASTER DEVELOPMENT DRAINAGE PLAN (MDDP) MEMORANDUM

for

INDIAN HILLS PLANNED BUSINESS PARK TRACT A, INDIAN HILLS FILING NO. 1

Prepared for:

M-3 Real Estate LLC
855 Broadview Place
Colorado Springs, CO 80904

April 17, 2017
Revised May 9, 2017
Revised June 7, 2017

Prepared by:

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JPS Project No. 111602

DRAINAGE REPORT STATEMENTS
INDIAN HILLS PLANNED BUSINESS PARK
TRACT A, INDIAN HILLS FILING NO. 1

Engineer's Statement:
This report and plan for the final drainage design of Indian Hills Planned Business Park was prepared by me (or under my direct supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the City of Colorado Springs Drainage Criteria Manual and is in conformity with the master plan of the drainage basin. I understand that the City of Colorado Springs does not and will not assume liability for drainage facilities designed by others. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

COLORADO REGISTERED JOHN P. SCHWAB 29891 PROFESSIONAL ENGINEER

John P. Schwab, Colorado P.E. No. 29891 6/7/17 Date

Developer's Statement:
M-3 Real Estate LLC hereby certifies that the drainage facilities for Indian Hills Planned Business Park shall be constructed according to the design presented in this report. I understand that the City of Colorado Springs does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that are submitted to the City of Colorado Springs pursuant to Section 7.7.906 of the City Code; and cannot, on behalf of M-3 Real Estate LLC, guarantee that final drainage design review will absolve M-3 Real Estate LLC and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

M-3 Real Estate LLC
Name of Developer

Authorized Signature 6/7/17 Date

Michael K. Trapp
Printed Name

Partner
Title

Address: 855 Broadview Place, Colorado Springs, CO 80904

City of Colorado Springs Statement:
Filed in accordance with Section 7.7.906 of the Code of the City of Colorado Springs, 2001, as amended.

For City Engineer 06/08/2017 Date

Conditions:

I. INTRODUCTION

A. Property Location and Description

Indian Hills Planned Business Park (PBP) is a proposed commercial development on a 13.3-acre parcel at the northwest corner of Centennial Boulevard and Van Buren Street in Colorado Springs. The proposed Concept Plan for this site includes four commercial buildings along Centennial Boulevard, along with an Office / Warehouse site along the west side of the property.

Development of this property will include construction of Van Buren Street along the south boundary of the site, extending westerly from Centennial Boulevard to the southwest corner of the property. Stormwater quality and full spectrum detention will be provided for these public road improvements, as well as the on-site commercial development.

Access to the new commercial lots will be provided via a private driveway extending west from Centennial Boulevard at the intersection of Mesa Valley Road along with additional private driveways extending north from Van Buren Street along the south boundary of the property.

The property (El Paso County Assessor's Parcel #73363-03-002) is currently platted as Tract A, Indian Hills Village, and the property is located in the Southwest Quarter of Section 36, Township 13 South, Range 67 West of the 6th P.M. The site is bounded by vacant properties to the north, west, and south, and Centennial Boulevard adjoins the eastern boundary of the site.

This report is intended to serve as a Drainage Memorandum in support of the Concept Plan for the site. Upcoming Site Development Plan submittals will include a Master Development Drainage Plan (MDDP) and Final Drainage Report.

B. References

Drexel, Barrell & Co., "Final Drainage Report for Indian Hills Village Phase 1," November, 2004.

Gilbert, Meyer & Sams, Inc., "Master Plan for Mesa Drainage Basin," 1986.

II. FLOODPLAIN IMPACTS

The site is located beyond the limits of any 100-year floodplain as shown in the FEMA floodplain map for this area, FIRM Panel No. 08041C0727F, dated March 17, 1997.

III. EXISTING DRAINAGE CONDITIONS

The proposed development site generally slopes downward to the southeast, with average grades of 2-10 percent. The on-site soils are classified by SCS as "Razor-Midway complex" soils (Type 75). These soils have a very slow infiltration rate, and are classified as hydrologic soils group D.

According to the "Master Plan for the Mesa Drainage Basin," this site is located within Sub-Basin 28, which generally drains south and west to the East Fork channel of the Mesa Drainage Basin, ultimately flowing to Monument Creek. The master drainage plan further states that "on-site detention facilities are required within each subdivision or development within sub-basin 28."

Drainage planning for this subdivision was previously studied in the November, 2004 "Final Drainage Report for Indian Hills Village Phase 1" by Drexel, Barrell & Co. The subdivision drainage report identifies Tract A along the west side of Centennial Boulevard as lying within Basins "I, L, and M." The Drexel-Barrell report states that these basins "are historically tributary to the existing drainage swale located at the southern property line just west of the Centennial Boulevard right-of-way."

This site is impacted by several off-site drainage basins (Basins OS-4, OS-5, and OS-6) comprising upstream areas north and west of the property. According to the Drexel-Barrell report, off-site Basin OS-4 adjoining the north boundary of this site "will be collected by the proposed public storm sewer infrastructure located in Centennial Boulevard." In a similar manner, the subdivision drainage report states that Basins "OS-5 and OS-6 are tributary to Centennial Boulevard. With future development of Indian Hills Village flows from these basins will be routed through the development to the storm sewer in Centennial Boulevard."

Previous improvements to Centennial Boulevard along the frontage of this property included construction of a 36-inch RCP public storm sewer system flowing south, including a public storm inlet at the northwest corner of Centennial Boulevard and Van Buren Street.

IV. PROPOSED DRAINAGE CONDITIONS

As shown on the enclosed Drainage Plan (Figure D1), developed runoff from the site will continue to follow historic drainage patterns to the southeast. The majority of the developed site lies within Basin L, which will continue to flow southeasterly to Design Point L at the southeast corner of the site. Off-site flows from Basins OS5 and OS6 will combine with Basin L at Design Point L, with developed peak flows calculated as $Q_5 =$ 24.6 cfs and $Q_{100} = 58.9$ cfs.

As depicted conceptually on the enclosed Developed Drainage Plan (Sh. D1), a private storm sewer system will convey developed flows from Basin L to the proposed private Full-Spectrum Detention Pond L at the southeast corner of the property. The on-site

stormwater detention facility will provide the required stormwater detention and water quality capture volume to mitigate developed flow impacts from Basin L prior to discharging into the downstream drainage system.

The City is currently preparing for construction of improvements to Centennial Boulevard, and the extension of Centennial Boulevard south of Van Buren Street is planned to include a downstream regional stormwater detention pond south of this site. As an alternative to constructing on-site stormwater detention facilities, the developer has been engaged with City Engineering in discussions regarding potential cost participation in the planned regional public detention pond, which would also include cost sharing to upsize the downstream public storm sewer system in Centennial Boulevard.

The proposed extension of Van Buren Street to the west along the south boundary of the property has been delineated as Basin N on the attached Developed Drainage Plan. Roadway drainage from this basin will flow easterly to a pair of public storm inlets on the west side of the intersection at Centennial Boulevard, and these public flows will be conveyed into the back side of the existing public storm inlet at the northwest corner of Centennial Boulevard and Van Buren Street. Developed peak flows at Design Point N are calculated as $Q_5 = 2.3$ cfs and $Q_{100} = 4.5$ cfs. Stormwater quality and full spectrum detention will be provided for the public road improvements in this small basin as part of the Centennial Boulevard improvement project constructed by the City.

The proposed Indian Hills Planned Business Park will have a limited development impact (less than one acre) within Basin I at the northeast corner of the site. Off-site flows from Basins OS4 will continue to flow southeasterly through Basin I to Design Point I at the northwest corner of Centennial Boulevard and Mesa Valley Road. Developed peak flows at Design Point I are calculated as $Q_5 = 3.5$ cfs and $Q_{100} = 13.3$ cfs. These flows will be conveyed through a private storm sewer into the existing public storm sewer system at the intersection of Centennial Boulevard and Mesa Valley Road. As depicted on the enclosed Developed Drainage Plan, a proposed stormwater quality and full spectrum detention facility will be provided along the east boundary of Basin I to mitigate drainage impacts from this part of the site.

Proper erosion control measures will be required for development of the site, including appropriate Best Management Practices (BMP's) such as silt fence along downstream property boundaries to minimize off-site transport of construction sediment.

V. DRAINAGE PLANNING – FOUR STEP PROCESS

City of Colorado Springs Drainage Criteria require drainage planning to include a Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainageways, and implementing long-term source controls. As stated in DCM Volume 2, the Four Step Process is applicable to all new and re-development projects with construction activities that disturb 1 acre or greater or that disturb less than 1 acre but are part of a larger common plan of development.

The Four Step Process will be implemented as follows in this project:

Step 1: Employ Runoff Reduction Practices

- Minimizing Directly Connected Impervious Areas (MDCIA): Drainage design for the proposed commercial buildings will discharge roof drain downspouts across pervious landscaped areas to encourage stormwater infiltration where possible.
- FSD: All developed drainage will be routed through private full-spectrum detention pond facilities with grass-lined bottoms to encourage stormwater infiltration prior to discharge to the downstream drainage system.

Step 2: Implement BMPs that Provide a Water Quality Capture Volume with Slow Release

- FSD: A Full-Spectrum Detention Pond will be provided in the southeast corner of the site. On-site drainage will be routed through the extended detention basin, which will capture and slowly release the WQCV over an extended release period.

Step 3: Stabilize Drainageways

- There are no major drainageways adjacent to this site. Impacts on downstream drainageways will be minimized by routing developed flows through a Full-Spectrum Detention Pond.

Step 4: Implement Site Specific and Other Source Control BMPs

- The proposed commercial site development will implement a Stormwater Management Plan including proper housekeeping practices and spill containment procedures.
- On-site drainage will be routed through a private Full-Spectrum Detention (FSD) basin to minimize introduction of contaminants to the City's public drainage system.

VI. STORMWATER DETENTION & WATER QUALITY

As required by City Engineering policies for commercial development involving disturbed areas greater than one acre, stormwater detention and water quality improvements will be implemented with development of this site. The proposed drainage and grading plan will direct surface drainage to the proposed Full-Spectrum Detention (FSD) pond facilities along the east boundary of the site, which will provide the required stormwater detention and water quality capture volume in accordance with the "City Drainage Criteria Manual, Volumes 1 and 2." The proposed on-site detention facilities will be privately owned and maintained by the property owners.

The proposed Detention Pond L will have an outlet structure and discharge pipe connecting to the existing Centennial Boulevard public storm sewer system at the intersection of Centennial Boulevard and Van Buren Street.

VII. PUBLIC IMPROVEMENTS / DRAINAGE BASIN FEES

This project consists of a private commercial site development with private drainage facilities within the property. No public drainage facilities are anticipated at this time. Public street improvements will include the extension of Van Buren Street along the south boundary of the property.

The proposed on-site stormwater detention facilities and private storm drainage improvements will be privately owned and maintained.

Depending on further discussions with the City, this development may contribute to the cost of off-site public drainage facilities in Centennial Boulevard and downstream regional stormwater detention facilities.

The site lies completely within the Mesa Drainage Basin. Since this site has been previously platted as Tract A, Indian Hills Village, no drainage basin fees or bridge fees are applicable at this time.

VIII. SUMMARY

The developed drainage patterns for the proposed Indian Hills Planned Business Park will remain consistent with historic conditions and the overall drainage plan for this area. The proposed on-site stormwater detention facilities will provide stormwater detention and water quality enhancement to mitigate developed flow impacts from the site prior to discharge into the Centennial Boulevard public storm sewer system. The public storm sewer currently extends to daylight south of Van Buren Street in an existing drainage swale which is the historic and adequate drainage outfall for this part of the Mesa Drainage Basin.

Proper construction and maintenance of the proposed storm drainage and detention facilities, in conjunction with proper erosion control practices during and after construction, will ensure that this development has no significant adverse drainage impact on downstream or surrounding areas.

Table 6-6. Runoff Coefficients for Rational Method
(Source: UDFCD 2001)

Land Use or Surface Characteristics	Percent Impervious	Runoff Coefficients											
		2-year		5-year		10-year		25-year		50-year		100-year	
		HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D	HSG A&B	HSG C&D
Business													
Commercial Areas	95	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.87	0.87	0.88	0.88	0.89
Neighborhood Areas	70	0.45	0.49	0.49	0.53	0.53	0.57	0.58	0.62	0.60	0.65	0.62	0.68
Residential													
1/8 Acre or less	65	0.41	0.45	0.45	0.49	0.49	0.54	0.54	0.59	0.57	0.62	0.59	0.65
1/4 Acre	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
1/3 Acre	30	0.18	0.22	0.25	0.30	0.32	0.38	0.39	0.47	0.43	0.52	0.47	0.57
1/2 Acre	25	0.15	0.20	0.22	0.28	0.30	0.36	0.37	0.46	0.41	0.51	0.46	0.56
1 Acre	20	0.12	0.17	0.20	0.26	0.27	0.34	0.35	0.44	0.40	0.50	0.44	0.55
Industrial													
Light Areas	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Heavy Areas	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
Parks and Cemeteries	7	0.05	0.09	0.12	0.19	0.20	0.29	0.30	0.40	0.34	0.46	0.39	0.52
Playgrounds	13	0.07	0.13	0.16	0.23	0.24	0.31	0.32	0.42	0.37	0.48	0.41	0.54
Railroad Yard Areas	40	0.23	0.28	0.30	0.35	0.36	0.42	0.42	0.50	0.46	0.54	0.50	0.58
Undeveloped Areas													
Historic Flow Analysis--Greenbelts, Agriculture	2	0.03	0.05	0.09	0.16	0.17	0.26	0.26	0.38	0.31	0.45	0.36	0.51
Pasture/Meadow	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Forest	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50
Exposed Rock	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
Offsite Flow Analysis (when landuse is undefined)	45	0.26	0.31	0.32	0.37	0.38	0.44	0.44	0.51	0.48	0.55	0.51	0.59
Streets													
Paved	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
Gravel	80	0.57	0.60	0.59	0.63	0.63	0.66	0.66	0.70	0.68	0.72	0.70	0.74
Drive and 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
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	0	0.02	0.04	0.08	0.15	0.15	0.25	0.25	0.37	0.30	0.44	0.35	0.50

3.2 Time of Concentration

One of the basic assumptions underlying the Rational Method is that runoff is a function of the average rainfall rate during the time required for water to flow from the hydraulically most remote part of the drainage area under consideration to the design point. However, in practice, the time of concentration can be an empirical value that results in reasonable and acceptable peak flow calculations.

For urban areas, the time of concentration (t_c) consists of an initial time or overland flow time (t_i) plus the travel time (t_t) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time (t_i) plus the time of travel in a concentrated form, such as a swale or drainageway. The travel portion (t_t) of the time of concentration can be estimated from the hydraulic properties of the storm sewer, gutter, swale, ditch, or drainageway. Initial time, on the other hand, will vary with surface slope, depression storage, surface cover, antecedent rainfall, and infiltration capacity of the soil, as well as distance of surface flow. The time of concentration is represented by Equation 6-7 for both urban and non-urban areas.

$$t_c = t_i + t_t \quad \text{(Eq. 6-7)}$$

Where:

t_c = time of concentration (min)

t_i = overland (initial) flow time (min)

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

3.2.1 Overland (Initial) Flow Time

The overland flow time, t_i, may be calculated using Equation 6-8.

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \quad \text{(Eq. 6-8)}$$

Where:

t_i = overland (initial) flow time (min)
C_5 = runoff coefficient for 5-year frequency (see Table 6-6)
L = length of overland flow (300 ft maximum for non-urban land uses, 100 ft maximum for urban land uses)
S = average basin slope (ft/ft)

Note that in some urban watersheds, the overland flow time may be very small because flows quickly concentrate and channelize.

3.2.2 Travel Time

For catchments with overland and channelized flow, the time of concentration needs to be considered in combination with the travel time, t_t, which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, the overland travel time, t_t, can be estimated with the help of Figure 6-25 or Equation 6-9 (Guo 1999).

$$V = C_v S_w^{0.5} \quad \text{(Eq. 6-9)}$$

Where:

V = velocity (ft/s)

C_v = conveyance coefficient (from Table 6-7)

S_w = watercourse slope (ft/ft)

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)*	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

* For buried riprap, select C_v value based on type of vegetative cover.

The travel time is calculated by dividing the flow distance (in feet) by the velocity calculated using Equation 6-9 and converting units to minutes.

The time of concentration (t_c) is then the sum of the overland flow time (t_i) and the travel time (t_t) per Equation 6-7.

3.2.3 First Design Point Time of Concentration in Urban Catchments

Using this procedure, the time of concentration at the first design point (typically the first inlet in the system) in an urbanized catchment should not exceed the time of concentration calculated using Equation 6-10. The first design point is defined as the point where runoff first enters the storm sewer system.

$$t_c = \frac{L}{180} + 10 \qquad \text{(Eq. 6-10)}$$

Where:

t_c = maximum time of concentration at the first design point in an urban watershed (min)

L = waterway length (ft)

Equation 6-10 was developed using the rainfall-runoff data collected in the Denver region and, in essence, represents regional "calibration" of the Rational Method. Normally, Equation 6-10 will result in a lesser time of concentration at the first design point and will govern in an urbanized watershed. For subsequent design points, the time of concentration is calculated by accumulating the travel times in downstream drainageway reaches.

3.2.4 Minimum Time of Concentration

If the calculations result in a t_c of less than 10 minutes for undeveloped conditions, it is recommended that a minimum value of 10 minutes be used. The minimum t_c for urbanized areas is 5 minutes.

3.2.5 Post-Development Time of Concentration

As Equation 6-8 indicates, the time of concentration is a function of the 5-year runoff coefficient for a drainage basin. Typically, higher levels of imperviousness (higher 5-year runoff coefficients) correspond to shorter times of concentration, and lower levels of imperviousness correspond to longer times of

INDIAN HILLS PLANNED BUSINESS PARK
COMPOSITE RUNOFF COEFFICIENTS

DEVELOPED CONDITIONS

5-YEAR C VALUES

BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
OS4	2.56	2.56	OPEN SPACE	0.15							0.150
I	2.13	0.70	COMMERCIAL	0.82	1.43	OPEN SPACE	0.15				0.370
OS4,I	4.69										0.250
OS5	1.13	1.13	OPEN SPACE	0.15							0.150
OS6	3.94	3.94	OPEN SPACE	0.15							0.150
L	10.94	8.10	COMMERCIAL	0.82	2.84	OPEN SPACE	0.15				0.646
OS5,OS6,L	16.01										0.489
N	0.61	0.46	ROADWAY	0.9	0.15	LANDSCAPE	0.15				0.716

100-YEAR C VALUES

BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	C	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	C	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	C	WEIGHTED C VALUE
OS4	2.56	2.56	OPEN SPACE	0.5							0.500
I	2.13	0.70	COMMERCIAL	0.89	1.43	OPEN SPACE	0.5				0.628
OS4,I	4.69										0.558
OS5	1.13	1.13	OPEN SPACE	0.5							0.500
OS6	3.94	3.94	OPEN SPACE	0.5							0.500
L	10.94	8.10	COMMERCIAL	0.89	2.84	OPEN SPACE	0.5				0.789
OS5,OS6,L	16.01										0.697
N	0.61	0.46	ROADWAY	0.96	0.15	LANDSCAPE	0.5				0.847

IMPERVIOUS AREAS

BASIN	TOTAL AREA (AC)	(AC)	SUB-AREA 1 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	AREA (AC)	SUB-AREA 2 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	(AC)	SUB-AREA 3 DEVELOPMENT/ COVER	PERCENT IMPERVIOUS	WEIGHTED % IMP
OS4	2.56	2.56	OPEN SPACE	0							0.000
I	2.13	0.70	COMMERCIAL	95	1.43	OPEN SPACE	0				31.221
OS4,I	4.69										14.179
OS5	1.13	1.13	OPEN SPACE	0							0.000
OS6	3.94	3.94	OPEN SPACE	0							0.000
L	10.94	8.10	COMMERCIAL	95	2.84	OPEN SPACE	0				70.338
OS5,OS6,L	16.01										48.064
N	0.61	0.46	ROADWAY	100	0.15	LANDSCAPE	0				75.410

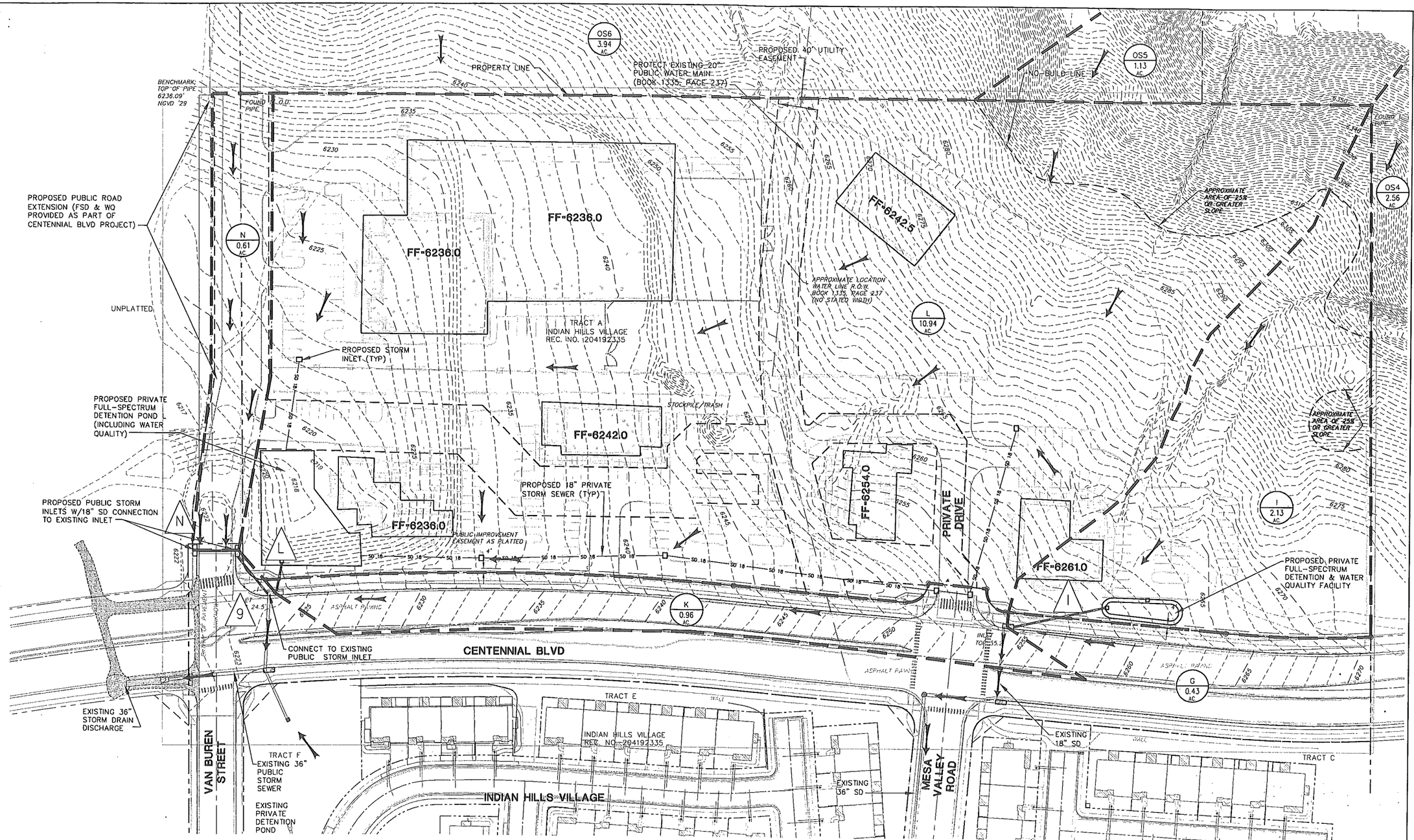
INDIAN HILLS PLANNED BUSINESS PARK
RATIONAL METHOD

DEVELOPED FLOWS

					Overland Flow			Channel flow									
BASIN	DESIGN POINT	AREA (AC)	C 5-YEAR[7]	C 100-YEAR[7]	LENGTH (FT)	SLOPE (FT/FT)	Tco[1] (MIN)	CHANNEL LENGTH (FT)	CONVEYANCE COEFFICIENT C	SLOPE (FT/FT)	SCS[2] VELOCITY (FT/S)	Tt[3] (MIN)	TOTAL Tc[4] (MIN)	TOTAL Tc[4] (MIN)	INTENSITY[5] 5-YR (IN/HR)	INTENSITY[5] 100-YR (IN/HR)	PEAK FLOW Q5[6] (CFS)	PEAK FLOW Q100[6] (CFS)
OS4		2.56	0.150	0.500	230	0.027	18.9	250	10.00	0.288	5.37	0.8	19.7	19.7	3.11	5.22	1.19	6.68
I		2.13	0.370	0.628	0		0.0	480	20.00	0.104	6.46	1.2	1.2	5.0	5.17	8.68	4.07	11.61
OS4,I	I	4.69	0.250	0.558									21.0	21.0	3.02	5.07	3.54	13.26
OS5		1.13	0.150	0.500	179	0.044	14.2	184	10.00	0.035	1.86	1.7	15.8	15.8	3.44	5.77	0.58	3.26
OS6		3.94	0.150	0.500	300	0.245	10.4	174	10.00	0.245	4.95	0.6	11.0	11.0	3.99	6.70	2.36	13.20
L		10.94	0.646	0.789	0		0.0	1150	20.00	0.077	5.56	3.4	3.4	5.0	5.17	8.68	36.53	74.92
OS5,OS6,L	L	16.01	0.489	0.697									19.3	19.3	3.14	5.28	24.61	58.88
N	N	0.61	0.716	0.847	15	0.020	2.2	470	20.00	0.026	3.19	2.5	4.6	5.0	5.17	8.68	2.26	4.48

1) OVERLAND FLOW Tco = (0.395*(1.1-RUNOFF COEFFICIENT)*(OVERLAND FLOW LENGTH^(0.5)/(SLOPE^(0.333))
2) SCS VELOCITY = C * ((SLOPE(FT/FT)^0.5)
C = 2.5 FOR HEAVY MEADOW
C = 5 FOR TILLAGE/FIELD
C = 7 FOR SHORT PASTURE AND LAWNS
C = 10 FOR NEARLY BARE GROUND
C = 15 FOR GRASSED WATERWAY
C = 20 FOR PAVED AREAS AND SHALLOW PAVED SWALES

3) MANNING'S CHANNEL TRAVEL TIME = L/V (WHEN CHANNEL VELOCITY IS KNOWN)
4) Tc = Tco + Tt
*** IF TOTAL TIME OF CONCENTRATION IS LESS THAN 5 MINUTES, THEN 5 MINUTES IS USED
5) INTENSITY BASED ON I-D-F EQUATIONS IN CITY OF COLORADO SPRINGS DRAINAGE CRITERIA MANUAL
$I_5 = -1.5 * \ln(Tc) + 7.583$
$I_{100} = -2.52 * \ln(Tc) + 12.735$
6) Q = CiA



GENERAL DRAINAGE NOTES:

1. BUILDERS SHALL PROVIDE POSITIVE DRAINAGE AWAY FROM STRUCTURES AND ACCOUNT FOR POTENTIAL CROSS-LOT DRAINAGE IMPACTS WITHIN SITE.

2. BUILDERS AND PROPERTY OWNERS SHALL IMPLEMENT & MAINTAIN EROSION CONTROL BEST MANAGEMENT PRACTICES FOR PROTECTION OF DOWNSTREAM PROPERTIES AND FACILITIES.

SUMMARY HYDROLOGY TABLE

DESIGN POINT	Q5 (CFS)	Q100 (CFS)
I	3.5	13.3
L	24.6	58.9
N	2.3	4.5

DRAINAGE LEGEND

- FLOW DIRECTION ARROW
- FLOWLINE
- DRAINAGE BASIN BOUNDARY
- PROPERTY LINE
- 5 — DESIGN POINT
- C14 / 23.21 AC — DEVELOPED BASIN DESIGNATION / DEVELOPED BASIN AREA (ACRES)

50' 0 25' 50' 100'

ORIGINAL SCALE: 1"=50' (24" X 36" SHEET)
CONTOUR INTERVAL = 1'

PRELIMINARY
CPC PUD 16-00145

INDIAN HILLS PLANNED BUSINESS PARK
CENTENNIAL BLVD, COLORADO SPRINGS, CO

DEVELOPED DRAINAGE PLAN

JPS ENGINEERING
19 E. Willamette Ave.
Colorado Springs, CO 80903
PH: 719-477-9429
FAX: 719-471-0766
www.jpsengr.com

CALL UTILITY NOTIFICATION CENTER OF COLORADO
1-800-922-1987
CALL 2-BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

No.	REVISION	BY	DATE

HORZ. SCALE: 1"=50'	DRAWN: BJJ
VERT. SCALE: N/A	DESIGNED: JPS
SURVEYED: LWA	CHECKED: JPS
CREATED: 12/03/16	LAST MODIFIED: 5/09/17
PROJECT NO: 111602	MODIFIED BY: BJJ
SHEET: D1	

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