CONSULTING ENGINEERS

UTILITY REPORT

FOR

THE ACADEMY AT MAPLETON HILL

AT

311 MAPLETON AVENUE

BOULDER, CO 80303

FOR

MAPLETON HILL INVESTMENT GROUP

The ACADEMY

BOULDER'S BOUTIQUE RETIREMENT COMMUNITY

AUGUST 1, 2016

JVA, Incorporated
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August l, 2016

Mr. Edward Stafford, Development Review Manager
City of Boulder – Planning and Development Services
1739 Broadway, Third Floor
P.O. Box 791
Boulder, CO 80306-0791

RE: Mapleton Hill
Utility Report
JVA Job No. 2462.1c

Dear Edward:

As requested by the City of Boulder, JVA has prepared an analysis of the proposed utility design and conditions for the proposed development for the Academy at Mapleton Hill. The following report is primarily intended to analyze the water and wastewater demands based on the proposed site improvements. This report has been produced in accordance with the City of Boulder Design & Construction Standards.

It is our understanding that the information provided herein meets the requirements of the City of Boulder for the utility submission required for the Site Review submittal.

Please contact us if you have any questions regarding this submission.

Sincerely,

JVA, Inc.

Charles R. Hager IV, P.E.
Vice President

John Wojcicki, EIT
Design Engineer

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JVA Project No. 2462.1c

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MAPLETON HILL UTILITY REPORT

INTRODUCTION

GENERAL LOCATION AND DESCRIPTION

Mapleton Hill Investment Group is proposing a development near the intersection of Mapleton Avenue and 4th Street in Boulder, Colorado. The subject property is approximately 15.77-acres of developed land located on a tract of land in the Northwest and Southwest Quarters of Section 25 Township 1 North, Range 71 West of the 6th Principal Meridian in the City and County of Boulder, State of Colorado. The site is bound by 4th Street to the East, Mapleton Avenue to the south, Trailhead residential subdivision to the north, and city of Boulder Tracts to the west. A vicinity map is included in the Appendix of this report.

The proposed development includes private drives to access multiple proposed and existing buildings and cottages along with associated parking, sidewalks, and landscaping. Please refer to Sheet C2.0 – Preliminary Utility Plan, at the end of this report.

Building A is the largest building on site located near the southwest corner of the property. Building A consists of three sections, The Lodge, Annex A East, Annex A West. Building B, C, D, E, F, G, H, I, J are proposed high density residential, care facility buildings located centrally on site. Building K is a proposed pool building adjacent to Building A. Building L is an existing building located in the northwest portion of the site. Building M is a proposed chapel located to the west of Building A. Additionally, there are seven proposed cottages along 4th Street, two proposed cottages near the northwest portion of the site, one proposed cottage located centrally onsite, one existing cottage to the west, one relocated cottage to the west and a proposed trail facility located in the northwest portion of the site. The existing church building located to the southeast of the property will remain. The building located in the northeast corner of the site will remain with this development.

UTILITIES

WATER SYSTEM

There are several water mains within Mapleton Avenue and 4th Street. There are larger transmission mains and an 8” CIP distribution main. These water mains are part of the City’s public water system. There are existing water lines which extend through the site to service the existing buildings and provide fire protection, however the size and location of the domestic water service connections and meters for the buildings to remain are unknown at this time. The services for the existing buildings to remain, must be reattached to the proposed water main.

The development includes 8-inch PVC water mains installed through the site within proposed easements. The proposed water main system is looped and connects to the existing 8” CIP public water distribution mains at the intersection of 4th Street and Maxwell Avenue and the Mapleton Avenue right-of-way (ROW) south of the site.

The buildings each have a domestic water service line, meter, an internal fire suppression system and a fire service line. Similarly, each cottage building will have one service connection and meter, an internal fire suppression system and one fire service line. Table 1, below, is a summary of IFC 2015 fire flow requirements for each building at Mapleton Hill. Buildings are grouped based on having a single fire suppression system.

Table 1: IFC 2015 - Summary Analysis

Structure	Total Floor Area/s (SF)	Construction Type	Required Fire Hydrant Flow (gpm)*	Required Number of Hydrants
Building A, K, M	178,295	I, VA, VB	3750	4
Building B	78,422	I, VA	2,500	3
Building C	54,356	IA	1,250	1
Building D	9,624	VA	875	1
Building E	15,836	VA	1,125	1
Building F & G	44,295	I, VA	1,875	2
Building H & J	45,923	I, VA	1,875	2
Building I	20,355	I, VA	1,250	1
Building L	21,042	VA	1,250	1
Cottage 1	3,398	Type	500	1
Cottage 2	3,312	Type	500	1
Cottage 3	3,312	Type	500	1
Cottage 4	3,428	Type	500	1
Cottage 5	3,398	Type	500	1
Cottage 6	3,312	Type	500	1
Cottage 7	3,312	Type	500	1
Cottage 8	3,312	Type	500	1
Cottage 9	3,398	Type	500	1
Cottage 10	3,398	Type	500	1
Relocated Cottage	1,182	Type	500	1
Existing Cottage	1,137	Type	500	1
Trail Facility	448	Type	1,500	1

*Note: All applicable buildings received a 50% reduction in required fire flow from Table B105.1(2) for being fully sprinkled.

A few buildings have noteworthy connection exceptions. Building A, K & M will be served from one domestic and one fire suppression system. Building F & G will be served from one domestic and one fire suppression system. Building H & I will be served from one domestic and one fire suppression system The existing cottage building does not require a fire service line since it does not have a change in use and remains residential but the domestic water connection will need to be reestablished. The fire and domestic connections to the existing Building L must be reestablished. The fire and domestic connections to the relocated cottage must be reestablished. The Trail Facility does not have a fire suppression connection. The existing service connections to the existing church in the southeast corner of the site and to the building office building in the northeast must be protected in place or connected to the public mains.

The fire hydrant demands have been based on square footage of space for each structure of the project and type of construction used for the structure. Per the 2015-International Fire Code,

structures to be sprinkled may receive a 50% reduction in the required fire flow – a number determined using table B105.1 of that code.

Existing hydrants that are located internal to the site will be removed with the development. The existing hydrants located along 4th Street and Mapleton will remain. The hydrants to remain include, the existing hydrant located at the northeast corner of the property near the future medical office building on 4th Street, the existing hydrant located on the northwest corner of the intersection of 4th Street and Maxwell Avenue, and the southwest corner of site adjacent to an access drive off of Mapleton Avenue. To meet City Code and International Fire Code hydrant count for each building, nine hydrants are proposed throughout the site.

Final plumbing fixture unit counts for each building and its respective water meter have not been calculated at this time. It is anticipated that they will be provided by a plumbing or mechanical engineer in the application for Building Permit. Water system demands have been forecast using tables from the City of Boulder Design and Construction Standards; Table 5-1: Average Day Water Demands and Table 5-2: Water Demand Peaking Factors for Forecasting Demands. Calculations are included in the appendix. The following peak hour demands, totaling 95.2 gpm, were forecast for each of the buildings:

Table 2: Mapleton Hill Peak Hour Demands by Structure

Structure	Peak Hour Demand (gpm)		Building	Peak Hour Demand (gpm)
Building A	18.0		Cottage 1	1.0
Building B	12.0		Cottage 2	1.0
Building C	16.9		Cottage 3	1.0
Building D	1.9		Cottage 4	1.0
Building E	8.1		Cottage 5	1.0
Building F	3.9		Cottage 6	1.0
Building G	3.9		Cottage 7	1.0
Building H	5.2		Cottage 8	1.0
Building I	3.9		Cottage 9	1.0
Building J	3.4		Cottage 10	1.0
Building K	1.4		Relocated Cottage	1.0
Building L	3.9		Existing Cottage	1.0
Building M	0.5		Trail Facility	0.2

Irrigation water meters are anticipated for the proposed site. The size and number of the irrigation meters has not yet been determined. It is anticipated that at least two irrigation meters will be required. An existing tank located at the west end of the property owned by Silver Lake Ditch Company may be used for irrigation services or a new irrigation system will be included with this development.

The layout of the system has been designed so that portions of the water line may be isolated for maintenance by closing valves without disrupting a significant amount of services. Refer to the Utility Plan drawings for locations of valves.

SANITARY SEWER SYSTEM

As shown on the Utility Plan, there are existing sewer main manholes located in 4th Street with mains travelling through adjacent alleyways to the east. Service lines coming from these manholes serve the existing buildings onsite, however many of the existing service line locations are unknown and existing structure services will need to be protected or reestablished. The manhole on 4th Street located to the north of Maxwell Avenue have an 8" VCP main outflowing down the alleyways. The development proposes to install 8-inch PVC sanitary mains within proposed easements to serve the buildings at Mapleton Hill. All Buildings will discharge via individual service lines to new sanitary mains within the site. Building A, K & M will have a single service line. Building F & G will have a single service line. Building H & J will have a single service line. The total estimated peak discharge from all buildings to the 4th Street system will be 135,800 gallons per day (gpd). The 8-inch sanitary sewer mains be installed at a minimum slope of 0.33% to maintain minimum required wastewater main capacities. Peak discharge at this minimum slope is expected to flow less than 38% full.

Sanitary sewer service discharges are forecast using Tables 6-1 and 6-2 of the City of Boulder Design and Construction Standards, Average Day Load by Development Type and Factors for Forecasting Wastewater Discharges, respectively. See the appendix for calculations.

STORM SEWER SYSTEM

Runoff from the proposed streets and buildings sheet flows and will be collected and piped towards the onsite water quality and detention basins located in several areas on site. The detention release rate will be evaluated so as not to cause hazardous conditions upstream or downstream for the major and minor storm events. See Drainage Report prepared by JVA Inc. for reference.

GROUNDWATER SYSTEM

At this time, no information is available on groundwater onsite. Groundwater levels can be expected to fluctuate with varying seasonal and weather conditions, irrigation demands on or adjacent to the site and with fluctuations in nearby water features.

Permanent groundwater dewatering may be needed in the event that the building will require foundation drain system. It is understood that water quality testing is required for a groundwater discharge system and groundwater treatment may also be needed. Additional detail will be provided at Tech Doc submittal.

DRY UTILITY SYSTEM

All dry utilities such as gas, telecom, overhead electric and others will be coordinated with the owner and the utility companies.

CONCLUSIONS

The utilities for this Armory Community project have been analyzed carefully to meet the City of Boulder standards. Proposed water mains will typically be 8 inches in size in order to provide adequate capacity for fire suppression to various buildings on the site. Available water mains surrounding the site are 8 inches and larger.

The buildings on the site will be served by new sewer mains, typically 8 inches in size, and will be connected to the existing 8 inch sewer main system in 4th Street to the east of the site.

REFERENCES

1. "City of Boulder Design and Construction Standards," Revised Edition.
2. "International Fire Code," 2015 Edition.

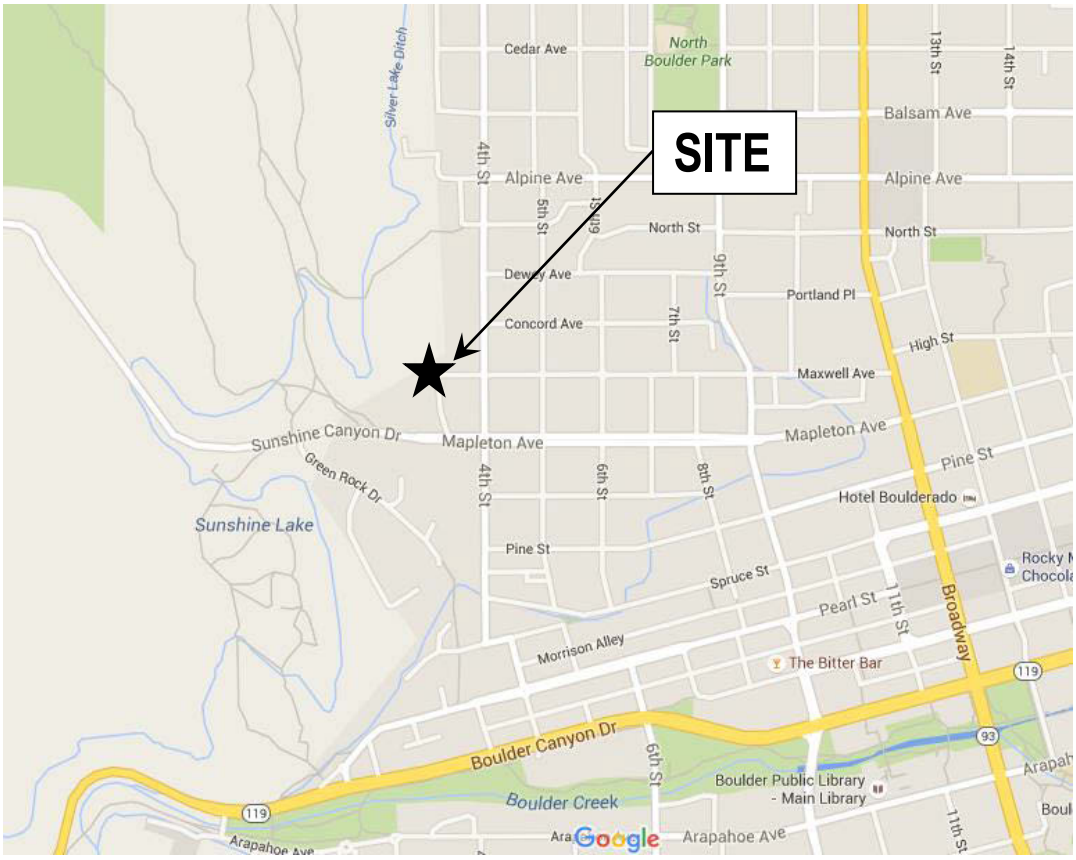
APPENDIX A – SITE MAPS

MAPLETON HILL

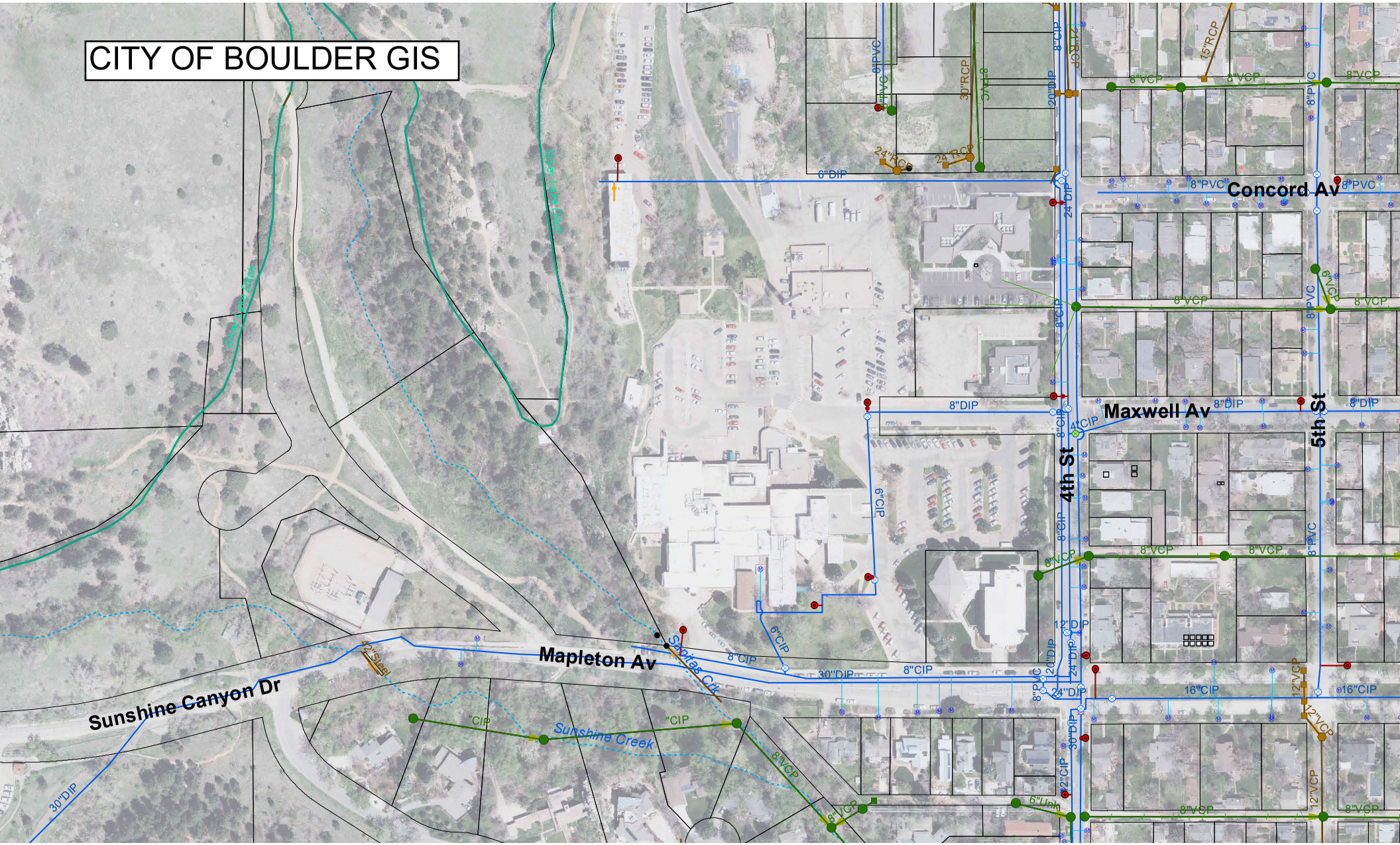
AT

MAPLETON AVENUE & 4TH STREET

BOULDER, COLORADO



VICINITY MAP – NOT TO SCALE


CITY OF BOULDER GIS
Concord Av
Maxwell Av
4th St
5th St
Mapleton Av
Sunshine Canyon Dr
Sunshine Creek
Skunk Creek Ditch
Silver Lake Ditch
8"PVC
8"VCP
8"DIP
8"CIP
6"DIP
6"CIP
24"DIP
30"DIP
20"DIP
16"CIP
12"VCP
15"RCP
30"RCP
24"RCP
42"Steel
30"DIP

APPENDIX B - CALCULATIONS, TABLES AND REFERENCES

Mapleton Hill

Building Size & Construction Type
July 26, 2016

Building	Building Type	Structured Parking / Basment Area	First Floor Area (sf)	Second Floor Area (sf)	Third Floor Area (sf)	Total Building Area (sf)	Number of Stories	Occupancy Group	Construction Type	Fire Flow Requirement (gpm)	Sprinkler Type	Reduced Fire Flow For Sprinklered Building	Min. # of Hydrants	Notes
A, K & M	Residential - Care Facility	39,785	50,378	44,051	44,081	178,295	3	S2, MU, R2, I1, A3	Type I, Type V-A, Type V-B	7,500	13	3,750	4	Includes Parking Garage, Lodge, East Annex, West Annex, Building K & M and
B	Residential - Care Facility	18,969	8,431	25,253	25,769	78,422	2	S-2, MU, R2, I2	Type I, Type V-A	5,000	13	2,500	3	Includes Parking Garage and Bridges
C	Residential - Care Facility	15,712	10,785	16,385	11,474	54,356	3	I1, I2	Type I-A	2,500	13	1,250	1	Includes Parking Garage
D	Residential - Care Facility	4,698	4,012	914		9,624	2	A-3	Type V-A	1,750	13	875	1	
E	Residential - Care Facility	5,278	10,558			15,836	1	R2	Type V-A	2,250	13	1,125	1	
F & G	Residential - Care Facility	16,637	13,829	13,829		44,295	2	S2, R2	Type I, Type V-A	3,750	13, 13R	1,875	2	Includes Parking Garage, Building F & G
H & J	Residential - Care Facility	19,002	14,789	12,132		45,923	2	S2, R2	Type I, Type V-A	3,750	13, 13R	1,875	2	Includes Parking Garage, Building J & H
I	Residential - Care Facility	7,108	6,765	6,482		20,355	2	S2, R2	Type I, Type V-A	2,500	13, 13R	1,250	1	Includes Parking Garage
L	Residential - Care Facility		7,014	7,014	7,014	21,042	3	R2	Type V-A	2,500	13R	1,250	1	
Cottage 1	Residential		1,772	1,626		3,398	2	R	Type V-B	500	13R	N/A	1	
Cottage 2	Residential		1,656	1,656		3,312	2	R	Type V-B	500	13R	N/A	1	
Cottage 3	Residential		1,656	1,656		3,312	2	R	Type V-B	500	13R	N/A	1	
Cottage 4	Residential		1,772	1,656		3,428	2	R	Type V-B	500	13R	N/A	1	
Cottage 5	Residential		1,772	1,626		3,398	2	R	Type V-B	500	13R	N/A	1	
Cottage 6	Residential		1,656	1,656		3,312	2	R	Type V-B	500	13R	N/A	1	
Cottage 7	Residential		1,656	1,656		3,312	2	R	Type V-B	500	13R	N/A	1	
Cottage 8	Residential		1,656	1,656		3,312	2	R	Type V-B	500	13R	N/A	1	
Cottage 9	Residential		1,772	1,626		3,398	2	R	Type V-B	500	13R	N/A	1	
Cottage 10	Residential		1,772	1,626		3,398	2	R	Type V-B	500	13R	N/A	1	
Relocated Cottage	Residential		1,182			1,182	1	R	Type V-B	500	13R	N/A	1	
Existing Cottage	Residential		1,137			1,137	1	R	Type V-B	500	13R	N/A	1	
Trail Facility	Residential - Care Facility		448			448	1		Type V-B	1,500	13R	N/A	1	

APPENDIX B

FIRE-FLOW REQUIREMENTS FOR BUILDINGS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

SECTION B101
GENERAL

B101.1 Scope. The procedure for determining fire-flow requirements for buildings or portions of buildings hereafter constructed shall be in accordance with this appendix. This appendix does not apply to structures other than buildings.

SECTION B102
DEFINITIONS

B102.1 Definitions. For the purpose of this appendix, certain terms are defined as follows:

FIRE-FLOW. The flow rate of a water supply, measured at 20 pounds per square inch (psi) (138 kPa) residual pressure, that is available for fire fighting.

FIRE-FLOW CALCULATION AREA. The floor area, in square feet (m^2), used to determine the required fire flow.

SECTION B103
MODIFICATIONS

B103.1 Decreases. The fire chief is authorized to reduce the fire-flow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.

B103.2 Increases. The fire chief is authorized to increase the fire-flow requirements where conditions indicate an unusual susceptibility to group fires or conflagrations. An increase shall not be more than twice that required for the building under consideration.

B103.3 Areas without water supply systems. For information regarding water supplies for fire-fighting purposes in rural and suburban areas in which adequate and reliable water supply systems do not exist, the *fire code official* is authorized to utilize NFPA 1142 or the *International Wildland-Urban Interface Code*.

SECTION B104
FIRE-FLOW CALCULATION AREA

B104.1 General. The fire-flow calculation area shall be the total floor area of all floor levels within the *exterior walls*, and under the horizontal projections of the roof of a building, except as modified in Section B104.3.

B104.2 Area separation. Portions of buildings which are separated by *fire walls* without openings, constructed in accordance with the *International Building Code*, are allowed to be considered as separate fire-flow calculation areas.

B104.3 Type IA and Type IB construction. The fire-flow calculation area of buildings constructed of Type IA and Type IB construction shall be the area of the three largest successive floors.

Exception: Fire-flow calculation area for open parking garages shall be determined by the area of the largest floor.

SECTION B105
FIRE-FLOW REQUIREMENTS FOR BUILDINGS

B105.1 One- and two-family dwellings, Group R-3 and R-4 buildings and townhouses. The minimum fire-flow and flow duration requirements for one- and two-family *dwellings*, Group R-3 and R-4 buildings and townhouses shall be as specified in Tables B105.1(1) and B105.1(2).

B105.2 Buildings other than one- and two-family dwellings, Group R-3 and R-4 buildings and townhouses. The minimum fire-flow and flow duration for buildings other than one- and two-family *dwellings*, Group R-3 and R-4 buildings and townhouses shall be as specified in Tables B105.2 and B105.1(2).

TABLE B105.1(1)
REQUIRED FIRE-FLOW FOR ONE- AND TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS AND TOWNHOUSES

FIRE-FLOW CALCULATION AREA (square feet)	AUTOMATIC SPRINKLER SYSTEM (Design Standard)	MINIMUM FIRE-FLOW (gallons per minute)	FLOW DURATION (hours)
0-3,600	No automatic sprinkler system	1,000	1
3,601 and greater	No automatic sprinkler system	Value in Table B105.1(2)	Duration in Table B105.1(2) at the required fire-flow rate
~~0-3,600~~	Section 903.3.1.3 of the *International Fire Code* or Section P2904 of the *International Residential Code*	~~500~~	~~1/2~~
3,601 and greater	Section 903.3.1.3 of the *International Fire Code* or Section P2904 of the *International Residential Code*	1/2 value in Table B105.1(2)	1

For SI: 1 square foot = 0.0929 m^2, 1 gallon per minute = 3.785 L/m.

TABLE B105.1(2)
REFERENCE TABLE FOR TABLES B105.1(1) AND B105.2

FIRE-FLOW CALCULATION AREA (square feet)					FIRE-FLOW (gallons per minute)[b]	FLOW DURATION (hours)
Type IA and IB[a]	Type IIA and IIIA[a]	Type IV and V-A[a]	Type IIB and IIIB[a]	Type V-B[a]		
0-22,700	0-12,700	0-8,200	0-5,900	0-3,600	1,500	2
22,701-30,200	12,701-17,000	8,201-10,900	5,901-7,900	3,601-4,800	1,750	
30,201-38,700	17,001-21,800	10,901-12,900	7,901-9,800	4,801-6,200	2,000	
38,701-48,300	21,801-24,200	12,901-17,400	9,801-12,600	6,201-7,700	2,250	
48,301-59,000	24,201-33,200	17,401-21,300	12,601-15,400	7,701-9,400	2,500	
59,001-70,900	33,201-39,700	21,301-25,500	15,401-18,400	9,401-11,300	2,750	
70,901-83,700	39,701-47,100	25,501-30,100	18,401-21,800	11,301-13,400	3,000	3
83,701-97,700	47,101-54,900	30,101-35,200	21,801-25,900	13,401-15,600	3,250	
97,701-112,700	54,901-63,400	35,201-40,600	25,901-29,300	15,601-18,000	3,500	
112,701-128,700	63,401-72,400	40,601-46,400	29,301-33,500	18,001-20,600	3,750	
128,701-145,900	72,401-82,100	46,401-52,500	33,501-37,900	20,601-23,300	4,000	4
145,901-164,200	82,101-92,400	52,501-59,100	37,901-42,700	23,301-26,300	4,250	
164,201-183,400	92,401-103,100	59,101-66,000	42,701-47,700	26,301-29,300	4,500	
183,401-203,700	103,101-114,600	66,001-73,300	47,701-53,000	29,301-32,600	4,750	
203,701-225,200	114,601-126,700	73,301-81,100	53,001-58,600	32,601-36,000	5,000	
225,201-247,700	126,701-139,400	81,101-89,200	58,601-65,400	36,001-39,600	5,250	
247,701-271,200	139,401-152,600	89,201-97,700	65,401-70,600	39,601-43,400	5,500	
271,201-295,900	152,601-166,500	97,701-106,500	70,601-77,000	43,401-47,400	5,750	
295,901-Greater	166,501-Greater	106,501-115,800	77,001-83,700	47,401-51,500	6,000	
—	—	115,801-125,500	83,701-90,600	51,501-55,700	6,250	
—	—	125,501-135,500	90,601-97,900	55,701-60,200	6,500	
—	—	135,501-145,800	97,901-106,800	60,201-64,800	6,750	
—	—	145,801-156,700	106,801-113,200	64,801-69,600	7,000	
—	—	156,701-167,900	113,201-121,300	69,601-74,600	7,250	
—	—	167,901-179,400	121,301-129,600	74,601-79,800	7,500	
—	—	179,401-191,400	129,601-138,300	79,801-85,100	7,750	
—	—	191,401-Greater	138,[illegible]	[illegible]	[illegible]	

Cottages 1-10, Relocated Cottage, Existing Cottage
Trail Facility
Building D
Building E
Building C, I, L
Building F&G, H&J
Building B
Building A&K&M

For SI: 1 square foot = 0.0929 m^2, 1 gallon per minute = 3.785 L/m, 1 pour

a. Types of construction are based on the *International Building Code*.

b. Measured at 20 psi residual pressure.

TAB[illegible]
REQUIRED FIRE-FLOW FOR BUILDINGS OTHER THAN ONE- AND TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS AND TOWNHOUSES

AUTOMATIC SPRINKLER SYSTEM (Design Standard)	MINIMUM FIRE-FLOW (gallons per minute)	FLOW DURATION (hours)
No automatic sprinkler system	Value in Table B105.1(2)	Duration in Table B105.1(2)
Section 903.3.1.1 of the *International Fire Code*	25% of the value in Table B105.1(2)[a]	Duration in Table B105.1(2) at the reduced flow rate
Section 903.3.1.2 of the *International Fire Code*	25% of the value in Table B105.1(2)[b]	Duration in Table B105.1(2) at the reduced flow rate

For SI: 1 gallon per minute = 3.785 L/m.

a. The reduced fire-flow shall be not less than 1,000 gallons per minute.

b. The reduced fire-flow shall be not less than 1,500 gallons per minute.

APPENDIX C
FIRE HYDRANT LOCATIONS AND DISTRIBUTION

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

SECTION C101
GENERAL

C101.1 Scope. In addition to the requirements of Section 507.5.1 of the *International Fire Code*, fire hydrants shall be provided in accordance with this appendix for the protection of buildings, or portions of buildings, hereafter constructed or moved into the jurisdiction.

SECTION C102
NUMBER OF FIRE HYDRANTS

C102.1 Minimum number of fire hydrants for a building. The number of fire hydrants available to a building shall be not less than the minimum specified in Table C102.1.

SECTION C103
FIRE HYDRANT SPACING

C103.1 Hydrant spacing. Fire apparatus access roads and public streets providing required access to buildings in accordance with Section 503 of the *International Fire Code* shall be provided with one or more fire hydrants, as determined by Section C102.1. Where more than one fire hydrant is required, the distance between required fire hydrants shall be in accordance with Sections C103.2 and C103.3.

C103.2 Average spacing. The average spacing between fire hydrants shall be in accordance with Table C102.1.

Exception: The average spacing shall be permitted to be increased by 10 percent where existing fire hydrants provide all or a portion of the required number of fire hydrants.

C103.3 Maximum spacing. The maximum spacing between fire hydrants shall be in accordance with Table C102.1.

SECTION C104
CONSIDERATION OF EXISTING FIRE HYDRANTS

C104.1 Existing fire hydrants. Existing fire hydrants on public streets are allowed to be considered as available to meet the requirements of Sections C102 and C103. Existing fire hydrants on adjacent properties are allowed to be considered as available to meet the requirements of Sections C102 and C103 provided that a fire apparatus access road extends between properties and that an easement is established to prevent obstruction of such roads.

TABLE C102.1
REQUIRED NUMBER AND SPACING OF FIRE HYDRANTS

FIRE-FLOW REQUIREMENT (gpm)	MINIMUM NUMBER OF HYDRANTS	AVERAGE SPACING BETWEEN HYDRANTS[a, b, c, f, g] (feet)	MAXIMUM DISTANCE FROM ANY POINT ON STREET OR ROAD FRONTAGE TO A HYDRANT[d, f, g]
1,750 or less	1	500	250
2,000-2,250	2	450	225
2,500	3	450	225
3,000	3	400	225
3,500-4,000	4	350	210
4,500-5,000	5	300	180
5,500	6	300	180
6,000	6	250	150
6,500-7,000	7	250	150
7,500 or more	8 or more[e]	200	120

For SI: 1 foot = 304.8 mm, 1 gallon per minute = 3.785 L/m.

a. Reduce by 100 feet for dead-end streets or roads.

b. Where streets are provided with median dividers that cannot be crossed by fire fighters pulling hose lines, or where arterial streets are provided with four or more traffic lanes and have a traffic count of more than 30,000 vehicles per day, hydrant spacing shall average 500 feet on each side of the street and be arranged on an alternating basis.

c. Where new water mains are extended along streets where hydrants are not needed for protection of structures or similar fire problems, fire hydrants shall be provided at spacing not to exceed 1,000 feet to provide for transportation hazards.

d. Reduce by 50 feet for dead-end streets or roads.

e. One hydrant for each 1,000 gallons per minute or fraction thereof.

f. A 50-percent spacing increase shall be permitted where the building is equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1 of the *International Fire Code*.

g. A 25-percent spacing increase shall be permitted where the building is equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.2 or 903.3.1.3 of the *International Fire Code* or Section P2904 of the *International Residential Code*.

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Job Name: Mapleton Hill
Job Number: 2462.1c
Date: 7/26/2016
By: JPW

Forecast Water System Demands

Estimate future water demands at Mapleton Hill based on Table 5-1 and 5-2 of the Boulder Design and Construction Standards. Add residential and commercial demands for mixed use buildings.

DOMESTIC/RESIDENTIAL DEMANDS

Building	Estimated Number of Residents	Average Day Demand			Maximum/Day (2.0 - High Density 2.5 - Medium Density Peaking Factor)		Maximum/Hour (5.0 Peaking Factor)	
		gpcd	gpd	gpm	gpd	gpm	gpd	gpm
A	69	75	5,175	3.6	10,350	7.2	25875	18.0
B	46	75	3,450	2.4	6,900	4.8	17250	12.0
C	65	75	4,875	3.4	9,750	6.8	24375	16.9
E	31	75	2,325	1.6	4,650	3.2	11625	8.1
F	15	75	1,125	0.8	2,250	1.6	5625	3.9
G	15	75	1,125	0.8	2,250	1.6	5625	3.9
H	20	75	1,500	1.0	3,000	2.1	7500	5.2
I	15	75	1,125	0.8	2,250	1.6	5625	3.9
J	13	75	975	0.7	1,950	1.4	4875	3.4
L	15	75	1,125	0.8	2,250	1.6	5625	3.9
Cottage 1	2	150	300	0.2	750	0.5	1500	1.0
Cottage 2	2	150	300	0.2	750	0.5	1500	1.0
Cottage 3	2	150	300	0.2	750	0.5	1500	1.0
Cottage 4	2	150	300	0.2	750	0.5	1500	1.0
Cottage 5	2	150	300	0.2	750	0.5	1500	1.0
Cottage 6	2	150	300	0.2	750	0.5	1500	1.0
Cottage 7	2	150	300	0.2	750	0.5	1500	1.0
Cottage 8	2	150	300	0.2	750	0.5	1500	1.0
Cottage 9	2	150	300	0.2	750	0.5	1500	1.0
Cottage 10	2	150	300	0.2	750	0.5	1500	1.0
Relocated Cottage	2	150	300	0.2	750	0.5	1500	1.0
Existing Cottage	2	150	300	0.2	750	0.5	1500	1.0
Total Domestic Peak Hour Demand (gpm), All Buildings								**91.2**

COMMERCIAL DEMANDS

Building	Estimated Acreage	Average Day Demand			Maximum/Day (2.5 peaking factor)		Maximum/Hour (2.5 Peaking Factor)	
		gpad	gpd	gpm	gpd	gpm	gpd	gpm
D	0.11	10000	1100	0.8	2750	1.9	2750	1.9
K	0.08	10000	800	0.6	2000	1.4	2000	1.4
M	0.03	10000	300	0.2	750	0.5	750	0.5
Trail Facility	0.01	10000	100	0.1	250	0.2	250	0.2
Total Commercial Peak Hour Demand (gpm), All Buildings								**4.0**

Total Residential and Commercial Peak Hour Demand (gpm), All Buildings	**95.2**

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Forecast Wastewater Discharges

Estimate future water wastewater discharges at Mapleton Hill based on Table 6-1 and 6-2 of the Boulder Design and Construction Standards.

DOMESTIC/RESIDENTIAL DISCHARGES

Building	Estimated Number of Residents*	Average Day Load			Peak Day Load (4.0 Peaking Factor)	
		gpcd	gpd	gpm	gpd	gpm
A	69	100	6,900	4.8	27,600	19.17
B	46	100	4,600	3.2	18,400	12.78
C	65	100	6,500	4.5	26,000	18.06
E	31	100	3,100	2.2	12,400	8.61
F	15	100	1,500	1.0	6,000	4.17
G	15	100	1,500	1.0	6,000	4.17
H	20	100	2,000	1.4	8,000	5.56
I	15	100	1,500	1.0	6,000	4.17
J	13	100	1,300	0.9	5,200	3.61
L	15	100	1,500	1.0	6,000	4.17
Cottage 1	2	100	200	0.1	800	0.56
Cottage 2	2	100	200	0.1	800	0.56
Cottage 3	2	100	200	0.1	800	0.56
Cottage 4	2	100	200	0.1	800	0.56
Cottage 5	2	100	200	0.1	800	0.56
Cottage 6	2	100	200	0.1	800	0.56
Cottage 7	2	100	200	0.1	800	0.56
Cottage 8	2	100	200	0.1	800	0.56
Cottage 9	2	100	200	0.1	800	0.56
Cottage 10	2	100	200	0.1	800	0.56
Relocated Cottage	2	100	200	0.1	800	0.56
Existing Cottage	2	100	200	0.1	800	0.56
Total Domestic Peak Day Load (gpm), All Buildings					**131,200**	**91.19**

COMMERCIAL BUILDING DISCHARGES

Building	Estimated Acreage	Average Day Discharge			Peak Day Discharge	
		gpad	gpd	gpm	gpd	gpm
D	0.11	5,000	550	0.4	2,200	1.53
K	0.08	5,000	400	0.3	1,600	1.11
M	0.03	5,000	150	0.1	600	0.42
Trail Facility	0.01	5,000	50	0	200	0.14
Total Commercial Peak Day Load					**4,600**	**3.20**

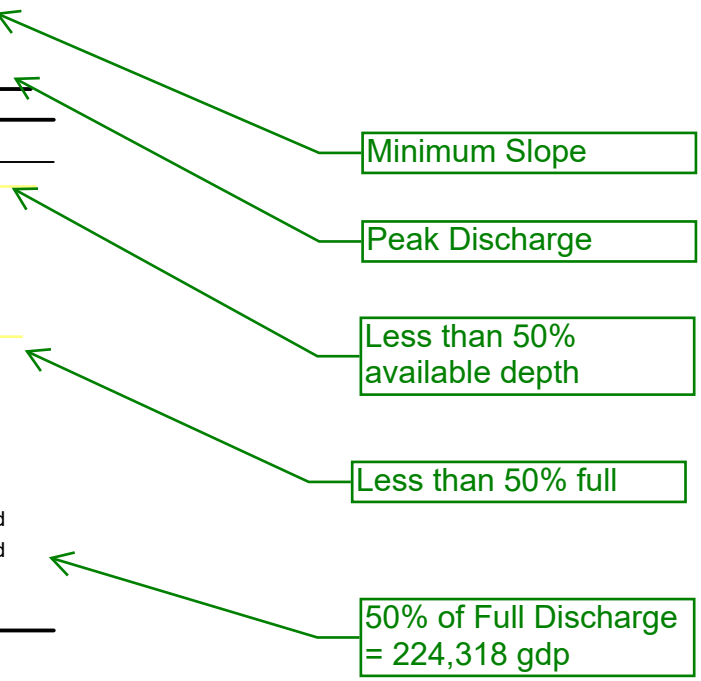
Total Residential and Commercial Peak Discharge	**135,800**	**94.39**

Armory, Boulder: 8-inch PVC Sewer Main
Worksheet for Circular Channel

Project Description	
Worksheet	Mapleton: Sanitary Sewer Main 8-inch
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.3300	%
Diameter	8.0	in
Discharge	135,800	gpd

Results		
Depth	3.0	in
Flow Area	0.1	ft²
Wetted Perimeter	0.88	ft
Top Width	0.67	ft
Critical Depth	0.21	ft
Percent Full	37.7	%
Critical Slope	0.6432	%
Velocity	1.74	ft/s
Velocity Head	0.05	ft
Specific Energy	3.6	in
Froude Number	0.71	
Maximum Discharge	482,600	gpd
Discharge Full	448,636	gpd
Slope Full	0.0302	%
Flow Type	Subcritical	



(4) Table 5-1 indicates water demand forecasting for average-day conditions.

Table 5-1: Average Day Water Demands

Development Type	Average-Day Demand
Residential	
Low Density	180 gpcd
Medium Density	150 gpcd
High Density	75 gpcd
Commercial	10,000 gpad
Industrial	12,000 gpad

(5) Table 5-2 indicates water demand peaking factors for forecasting demands.

Table 5-2: Water Demand Peaking Factors for Forecasting Demands

Development Type	Maximum/Hour	Maximum/Day
Residential		
Low Density	5.1	5.1
Medium Density	5.0	2.5
High-Density	5.0	2.0
Commercial	2.5	2.5
Industrial	1.5	1.5

(6) Water design flows that reduce the water system pressures below acceptable levels specified in this section or elsewhere in these Standards are considered detrimental to the overall system. In these situations, the Director will deny project approval, or require the developer to provide additional water system improvements, both onsite and offsite, to ensure no reduction in levels of service.

(B) Water Services

Design flows for water services shall be determined in conformance with the most current Uniform Plumbing Code (UPC), adopted by the City of Boulder.

5.05 Materials and Installation

Construction of water-related public improvements shall be in compliance with these Standards. All pipe shall be of adequate strength to support the trench and AASHTO HS-20 highway loadings. The type of pipe to be installed shall comply with these Standards, and shall be based upon applicable design flows, pressures, site conditions, corrosion protection, and maintenance requirements.

5.06 Corrosion Protection

Corrosion protection will be required for all water system improvements where corrosive soil conditions are encountered. The Engineer shall perform a soils resistivity survey to evaluate the corrosion potential of soils in proposed projects or developments, and recommend any necessary corrosion protection measures, such as alternative pipe type or cathodic protection. The Director will review the soils resistivity survey and Engineer's recommendations and the service history for water system corrosion in the area, and determine the pipe type or protection to be used prior to construction plan approval.

(2) Wastewater collection mains shall be designed to ensure transport of suspended materials and preclude material deposits considering minimum-day flows.

(3) The peak flow shall be determined using average-day forecasts adjusted by a peaking factor and including the allowed and any existing system infiltration or inflow.

(4) Flow capacity and loading data of existing and future conditions for the City's major wastewater collection system shall be obtained from the Utilities Division for use in designing and analyzing proposed improvements. This information is compiled using the City's standard Hydra hydraulic analysis program, and is available in both hard copy and electronic formats.

(5) The minimum-day flow shall be determined using average day-forecasts adjusted by a minimum flow factor and including the allowed and any existing infiltration or inflow.

(6) Average-day flow forecasts shall include the ultimate area, population density, existing wastewater flow, anticipated industrial discharge, and any allowed infiltration/inflow, that produces the greatest wastewater flow rates.

(7) Surface water, ground water, or cooling water shall not be discharged into the wastewater collection system. Prohibited connections include roof drains, storm inlets, foundation perimeter drains, area drains for open patios or driveway entrances to parking structures, and ground water sump systems.

(8) Floor drains internal to covered parking structures, that collect drainage from rain and ice drippings from parked cars or water used to wash-down internal floors, shall be connected to the sanitary sewer using appropriate grease and sediment traps.

(9) Table 6-1 indicates wastewater discharge forecasting for average-day conditions:

Table 6-1: Average Day Load by Development Type

Development Type	Average Day Load
Residential	100 gpcd
Average Persons per Single-Family Unit	3.2
Average Persons per Multi-Family Unit	2.0
Non-Residential	
Commercial	5000 gpad
Industrial	4500 gpad
Infiltration	200 gidm**

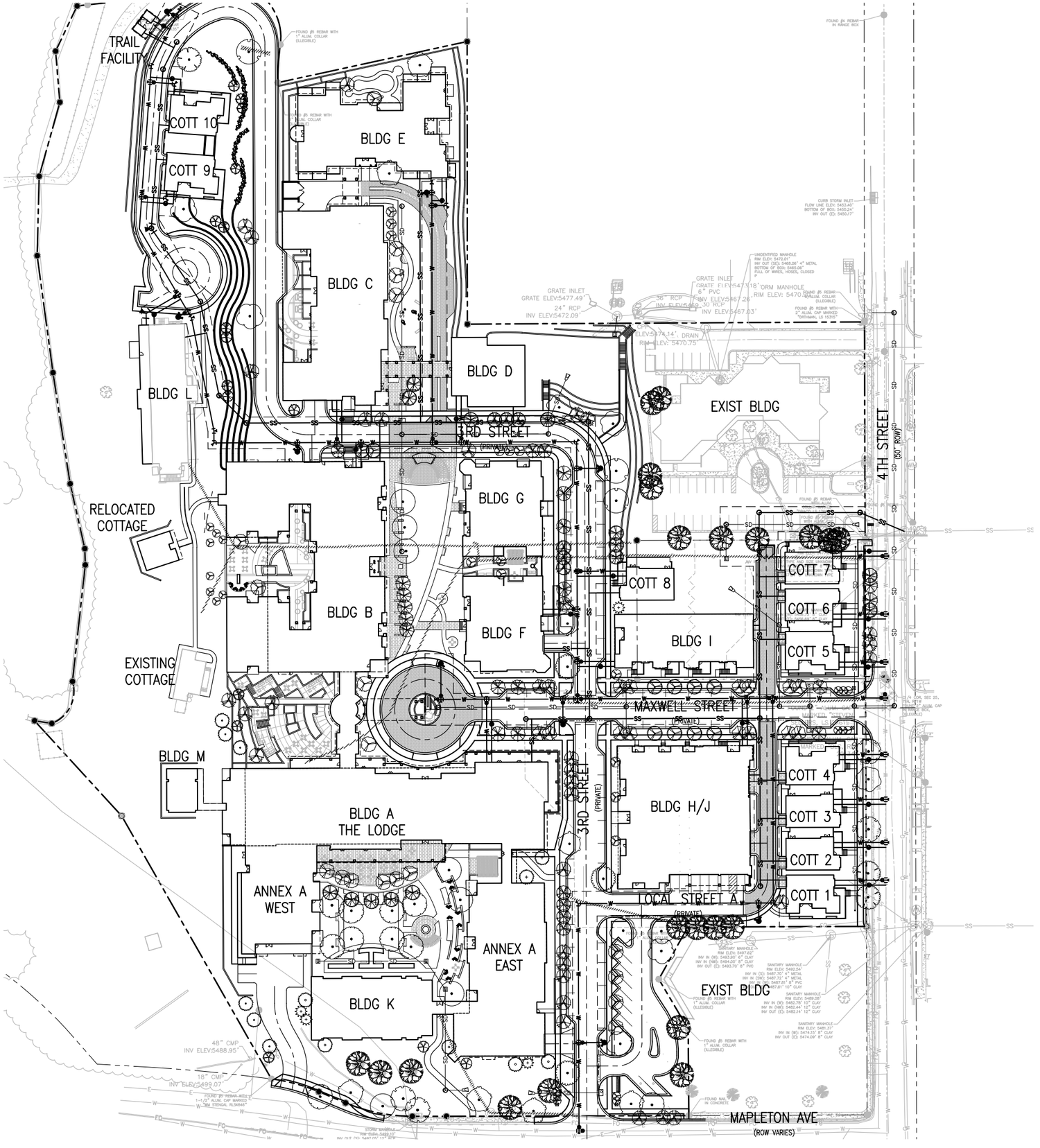
NOTES: * The Industrial Average-Day Load Indicates Non-Water Intensive Industrial Development
** Gallons Per Inch-Diameter-Mile

(10) The average-day forecast loads indicated in Table 6-1 represent minimum forecast loads in determining design flows. Where proposed development is known (based on specific applications or use), and the anticipated wastewater loads exceed the minimum forecast demands, the greater load shall be used to determine design flows.

(11) Table 6-2 indicates the wastewater peaking and minimum flow factors for forecasting discharges. These flow factors are, used to determine minimum required wastewater main capacity:

Table 6-2: Factors for Forecasting Wastewater Discharges

Collection Main Diameter	Minimum Factor	Peaking Factor
10 inches and smaller	0.25	4.0
12 to 15 inches	0.30	3.5



The ACADEMY
BOULDER'S BOUTIQUE RETIREMENT COMMUNITY

DEVELOPER:
MAPLETON HILL INVESTMENT GROUP

ARCHITECT:
THE MULHERN GROUP, LTD.
ARCHITECTURE • PLANNING • INTERIORS

ENGINEER:
JVA, INC.

CONSULTANT:
PCS GROUP, INC.

SITE REVIEW SUBMITTAL

THE ACADEMY AT MAPLETON HILL

BOULDER, COLORADO

DATE:	REVISION:
07-18-16	SITE REVIEW

SHEET NAME:
PRELIMINARY OVERALL UTILITY PLAN

SHEET NUMBER:
C2.0

RELOCATED COTTAGE
CONNECT UTIL SVCS TO PUBLIC MAIN
EXISTING COTTAGE
CONNECT UTIL SVCS TO PUBLIC MAIN
BLDG B
BLDG F
BLDG M
BLDG A THE LODGE
ANNEX A WEST
BLDG K
ANNEX A EAST
BLDG I
BLDG H/J
EXIST BLDG
MATCHLINE C2.2
COTT 8
COTT 7
COTT 6
COTT 5
COTT 4
COTT 3
COTT 2
COTT 1
FIRE SVC
DOM SVC & METER
SS SVC
TEE W/ GV (TYP)
8" PVC SS MAIN (TYP)
8" PVC WATER MAIN (TYP)
FH ASSY
6" PVC
EXIST FH
4' SS MH (TYP)
BEND (TYP)
MAXWELL STREET (PRIVATE)
3RD STREET (PRIVATE)
4TH STREET (50' ROW)
LOCAL STREET A (PRIVATE)
MAPLETON AVE (ROW VARIES)
25.0' UTIL ESMT (TYP)
SANITARY MANHOLE RIM ELEV: 5497.62' INV IN (W): 5493.90' 6" CLAY INV IN (NW): 5494.00' 8" CLAY INV OUT (E): 5493.70' 8" PVC
SANITARY MANHOLE RIM ELEV: 5492.54' INV IN (S): 5487.70' 4" METAL INV IN (SW): 5487.72' 4" METAL INV IN (W): 5487.81' 8" PVC INV OUT (E): 5487.61' 10" CLAY
SANITARY MANHOLE RIM ELEV: 5489.08' INV IN (W): 5482.78' 10" CLAY INV IN (NW): 5482.44' 12" CLAY INV OUT (E): 5482.14' 12" CLAY
SANITARY MANHOLE RIM ELEV: 5481.37' INV IN (W): 5474.15' 8" CLAY INV OUT (E): 5474.09' 8" CLAY
FOUND #5 REBAR WITH 1" ALUM. COLLAR (ILLEGIBLE)
FOUND NAIL IN CONCRETE
48" CMP INV ELEV:5488.95'
18" CMP INV ELEV:5499.07'
FOUND #5 REBAR WITH 1-1/2" ALUM. CAP MARKED "WM STENGAL RLS4846"
STORM MANHOLE RIM ELEV: 5499.10' INV OUT (S): 5497.05' 12" RCP
30 0 30 60
SCALE IN FEET

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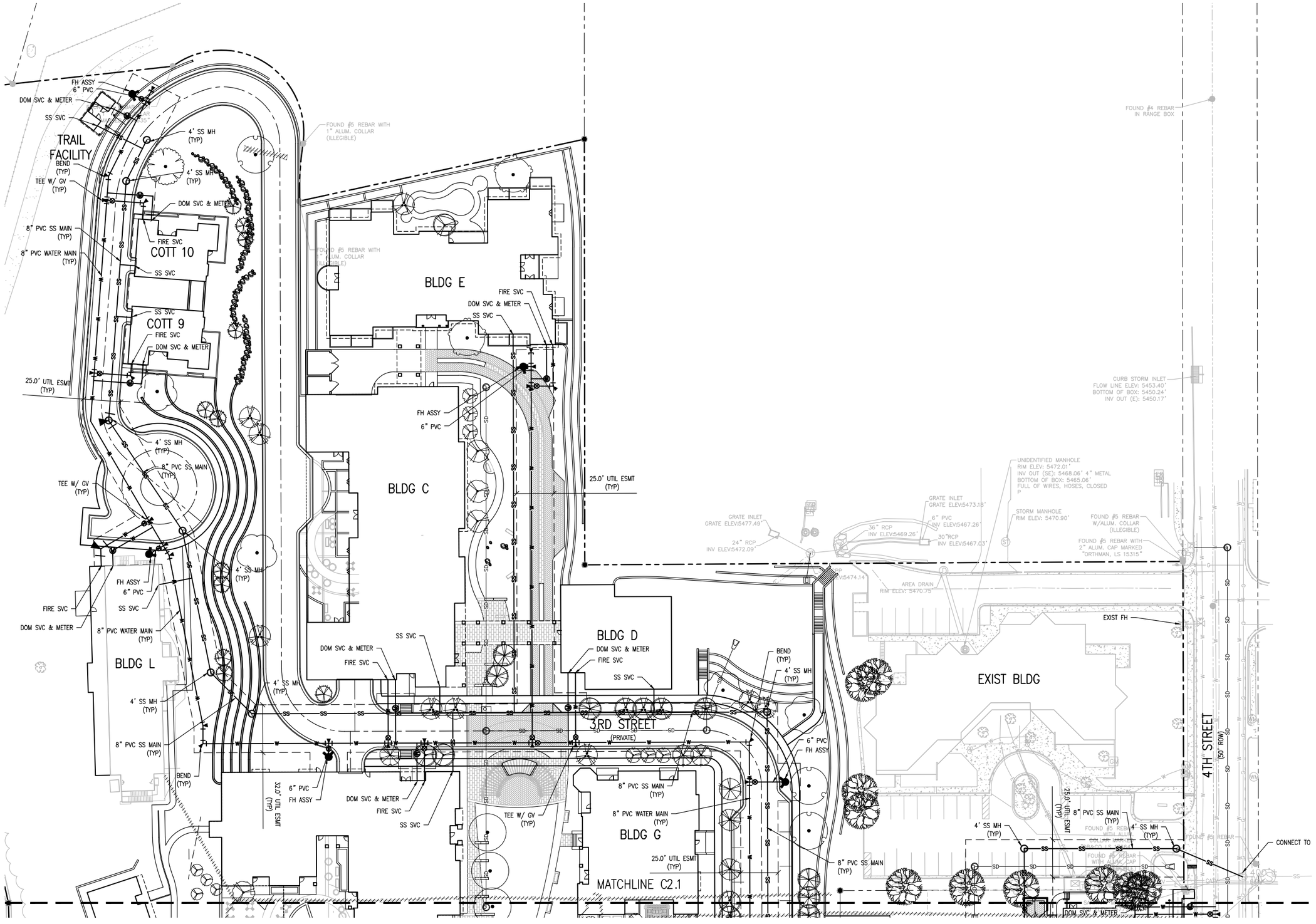
THE ACADEMY AT MAPLETON HILL

BOULDER, COLORADO

DATE:	REVISION:
07-18-16	SITE REVIEW

SHEET NAME:
PRELIMINARY DETAILED UTILITY PLAN

SHEET NUMBER:
C2.1



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BOULDER, COLORADO

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07-18-16	SITE REVIEW

SHEET NAME:
PRELIMINARY DETAILED UTILITY PLAN

SHEET NUMBER:
C2.2

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