



# Community Planning & Permitting

Courthouse Annex • 2045 13th Street • Boulder, Colorado 80302  
Mailing Address: P.O. Box 471 • Boulder, Colorado 80306  
303-441-3930 • [www.BoulderCounty.gov](http://www.BoulderCounty.gov)

**MEMO TO:** County Health and Parks Departments, FPD  
**FROM:** Pete L'Orange, Planner II  
**DATE:** February 1, 2023  
**RE:** Site Plan Review application SPR-23-0005

**Docket SPR-23-0005: NILES Commercial Structure**

**Request:** Site Plan Review application for construction of a commercial structure on an approximately 0.16-acre parcel at 364 2nd Ave in the Niwot Rural Community District I (NRCD I).  
**Location:** 364 2<sup>nd</sup> Avenue, Lots 19-20 Blk 26 Niwot, Section 25, Township 2N, Range 70W  
**Zoning:** Niwot Rural Community District I (NRCD 1) Zoning District  
**Owner/**  
**Applicant:** Ashley Niles Properties LLC  
**Agent:** Katherine Willis, Lightwell Architecture LLC

Site Plan Review by the Boulder County Community Planning & Permitting Director is required for new building/grading/access or floodplain development permits in the plains and mountainous areas of unincorporated Boulder County. The subject review process considers potential significant impact to the ecosystem, surrounding land uses and infrastructure, and safety concerns due to natural hazards.

The Community Planning & Permitting staff values comments from individuals and referral agencies. Please check the appropriate response below or send a letter to the Community Planning & Permitting Department at P.O. Box 471, Boulder, Colorado 80306 or via email to [planner@bouldercounty.org](mailto:planner@bouldercounty.org). All comments will be made part of the public record and given to the applicant. Only a portion of the submitted documents may have been enclosed; you are welcome to call the Community Planning & Permitting Department at 303-441-3930 or email [planner@bouldercounty.org](mailto:planner@bouldercounty.org) to request more information.

Please return responses by **February 21, 2023.**

(Please note that due to circumstances surrounding COVID-19, application timelines and deadlines may need to be modified as explained in the CPP Notice of Emergency Actions issued March 23, 2020 (see <https://boco.org/covid-19-cpp-notice-20200323>)).

\_\_\_\_\_ We have reviewed the proposal and have no conflicts.

\_\_\_\_\_ Letter is enclosed.

Signed Name \_\_\_\_\_ Printed Name \_\_\_\_\_

Agency or Address \_\_\_\_\_

Date \_\_\_\_\_



# Boulder County Land Use Department

Courthouse Annex Building  
 2045 13th Street • PO Box 471 • Boulder, Colorado 80302  
 Phone: 303-441-3930  
 Email: [planner@bouldercounty.org](mailto:planner@bouldercounty.org)  
 Web: [www.bouldercounty.org/lu](http://www.bouldercounty.org/lu)  
 Office Hours: Mon., Wed., Thurs., Fri. 8 a.m. to 4:30 p.m.  
 Tuesday 10 a.m. to 4:30 p.m.

<i>Shaded Areas for Staff Use Only</i>
Intake Stamp

## Planning Application Form

The Land Use Department maintains a submittal schedule for accepting applications. Planning applications are accepted on Mondays, by appointment only. Please call 303-441-3930 to schedule a submittal appointment.

Project Number		Project Name					
<input type="checkbox"/> Appeal <input type="checkbox"/> Correction Plat <input type="checkbox"/> Exemption Plat <input type="checkbox"/> Final Plat <input type="checkbox"/> Limited Impact Special Use <input type="checkbox"/> Limited Impact Special Use Waiver <input type="checkbox"/> Location and Extent		<input type="checkbox"/> Modification of Site Plan Review <input type="checkbox"/> Modification of Special Use <input type="checkbox"/> Preliminary Plan <input type="checkbox"/> Resubdivision (Replat) <input type="checkbox"/> Rezoning		<input type="checkbox"/> Road Name Change <input type="checkbox"/> Road/Easement Vacation <input checked="" type="checkbox"/> Site Plan Review <input type="checkbox"/> Site Plan Review Waiver <input type="checkbox"/> Sketch Plan <input type="checkbox"/> Special Use/SSDP		<input type="checkbox"/> Special Use (Oil & Gas development) <input type="checkbox"/> State Interest Review (1041) <input type="checkbox"/> Subdivision Exemption <input type="checkbox"/> Variance <input type="checkbox"/> Other:	
Location(s)/Street Address(es) <b>364 2ND AVE</b>							
Subdivision Name <b>NIWOT - NI</b>							
Lot(s) <b>19-20</b>	Block(s) <b>26</b>	Section(s) <b>25</b>	Township(s) <b>2N</b>	Range(s) <b>70</b>			
Area in Acres <b>.16</b>	Existing Zoning	Existing Use of Property <b>COMMERCIAL</b>		Number of Proposed Lots <b>1</b>			
Proposed Water Supply <b>LEFT HAND</b>			Proposed Sewage Disposal Method				

### Applicants:

Applicant/Property Owner <b>ASHLEY NILES PROPERTIES LLC</b>		Email	
Mailing Address <b>PO BOX 396</b>			
City <b>NIWOT</b>	State <b>CO</b>	Zip Code <b>80544</b>	Phone <b>720-445-1899</b>
Applicant/Property Owner/Agent/Consultant		Email <b>a.niles2011@gmail.com</b>	
Mailing Address			
City	State	Zip Code	Phone
Agent/Consultant <b>LIGHTWELL ARCHITECTURE, LLC</b>		Email <b>katherine@lightwellarchitecture.com</b>	
Mailing Address <b>2244 LOMBARDY ST</b>			
City <b>LONGMONT</b>	State <b>CO</b>	Zip Code <b>80305</b>	Phone <b>303-763-0140</b>

### Certification (Please refer to the Regulations and Application Submittal Package for complete application requirements.)

I certify that I am signing this Application Form as an owner of record of the property included in the Application. I certify that the information and exhibits I have submitted are true and correct to the best of my knowledge. I understand that all materials required by Boulder County must be submitted prior to having this matter processed. I understand that public hearings or meetings may be required. I understand that I must sign an Agreement of Payment for Application processing fees, and that additional fees or materials may be required as a result of considerations which may arise in the processing of this docket. I understand that the road, school, and park dedications may be required as a condition of approval. I understand that I am consenting to allow the County Staff involved in this application or their designees to enter onto and inspect the subject property at any reasonable time, without obtaining any prior consent.

**All landowners are required to sign application. If additional space is needed, attach additional sheet signed and dated.**

Signature of Property Owner <i>Ashley Niles</i>	Printed Name <b>ASHLEY NILES</b>	Date <b>9-7-22</b>
Signature of Property Owner	Printed Name	Date

The Land Use Director may waive the landowner signature requirement for good cause, under the applicable provisions of the Land Use Code.








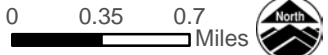
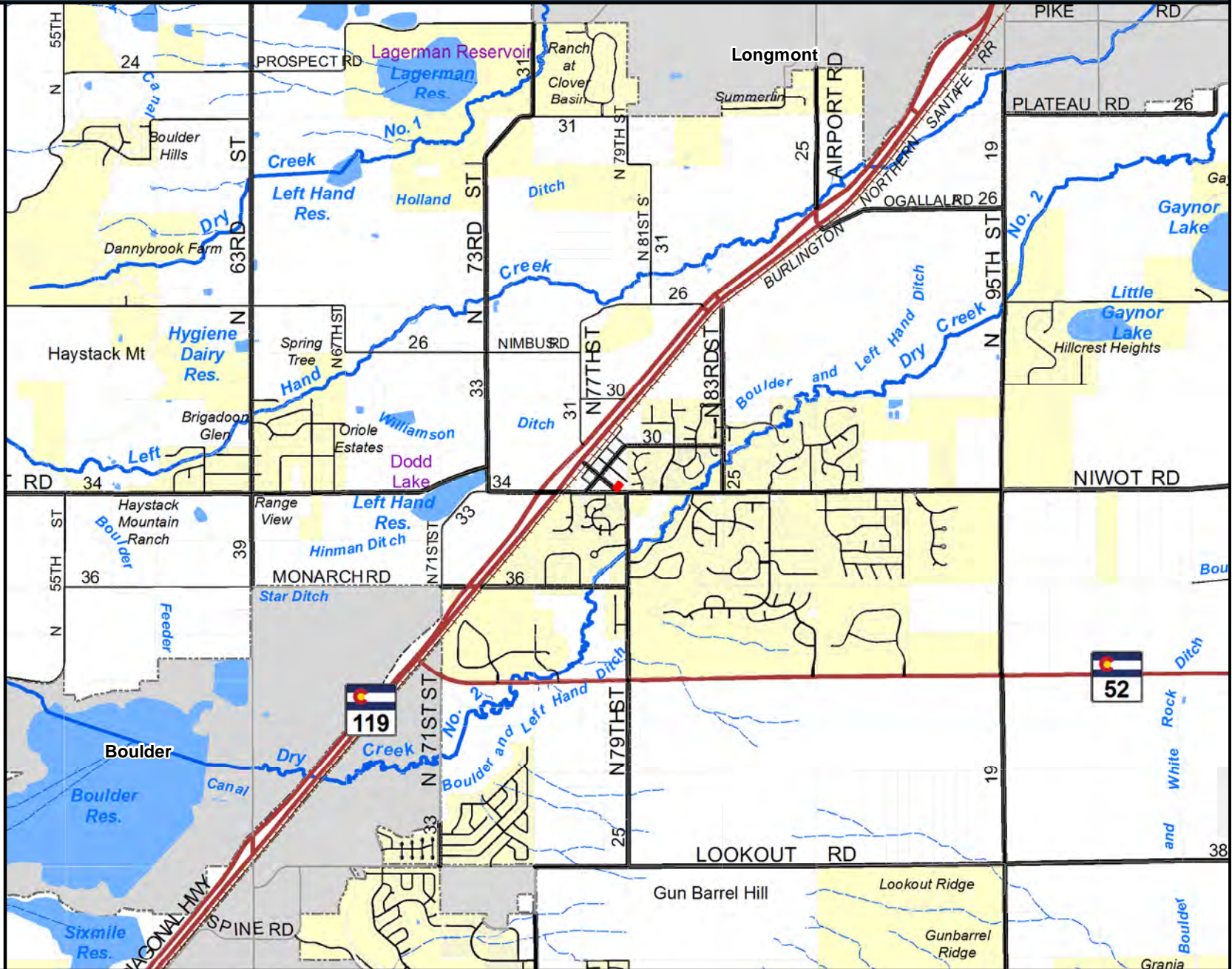
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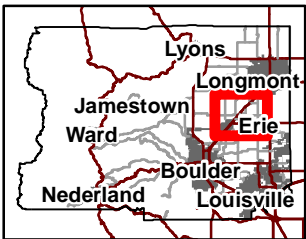
Vicinity

364 2ND AVE

-  Subject Parcel
-  Municipalities
- Subdivisions**
-  Subdivisions



Area of Detail Date: 11/8/2021



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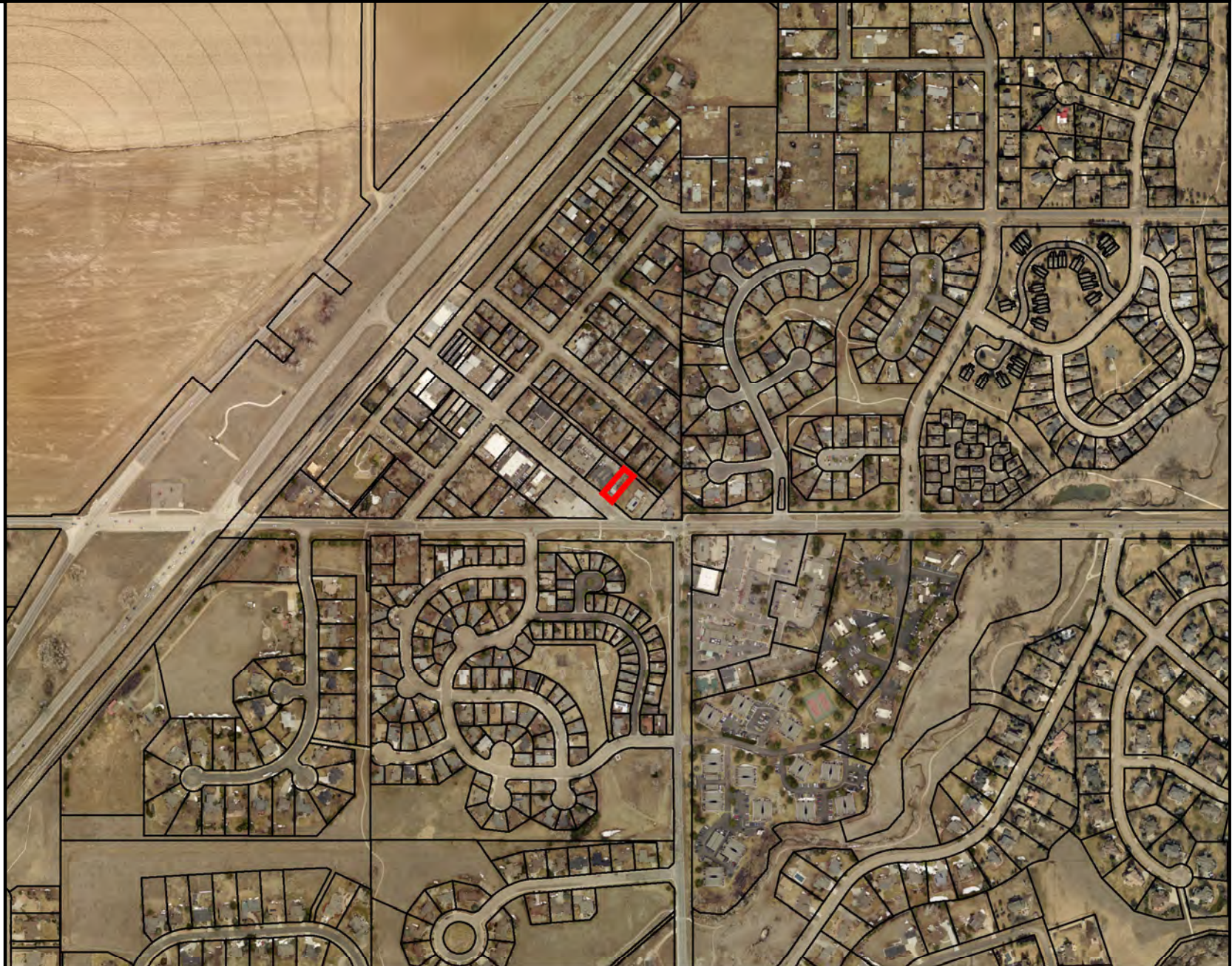


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Aerial  
364 2ND AVE

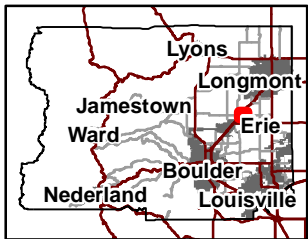
 Subject Parcel



0 0.05 0.1 Miles



Area of Detail Date: 11/8/2021



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Aerial  
364 2ND AVE

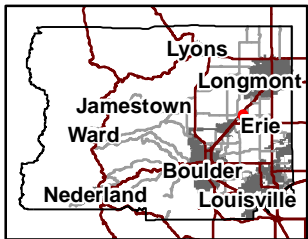
 Subject Parcel



0 0.0025 0.005  
Miles



Area of Detail Date: 11/8/2021



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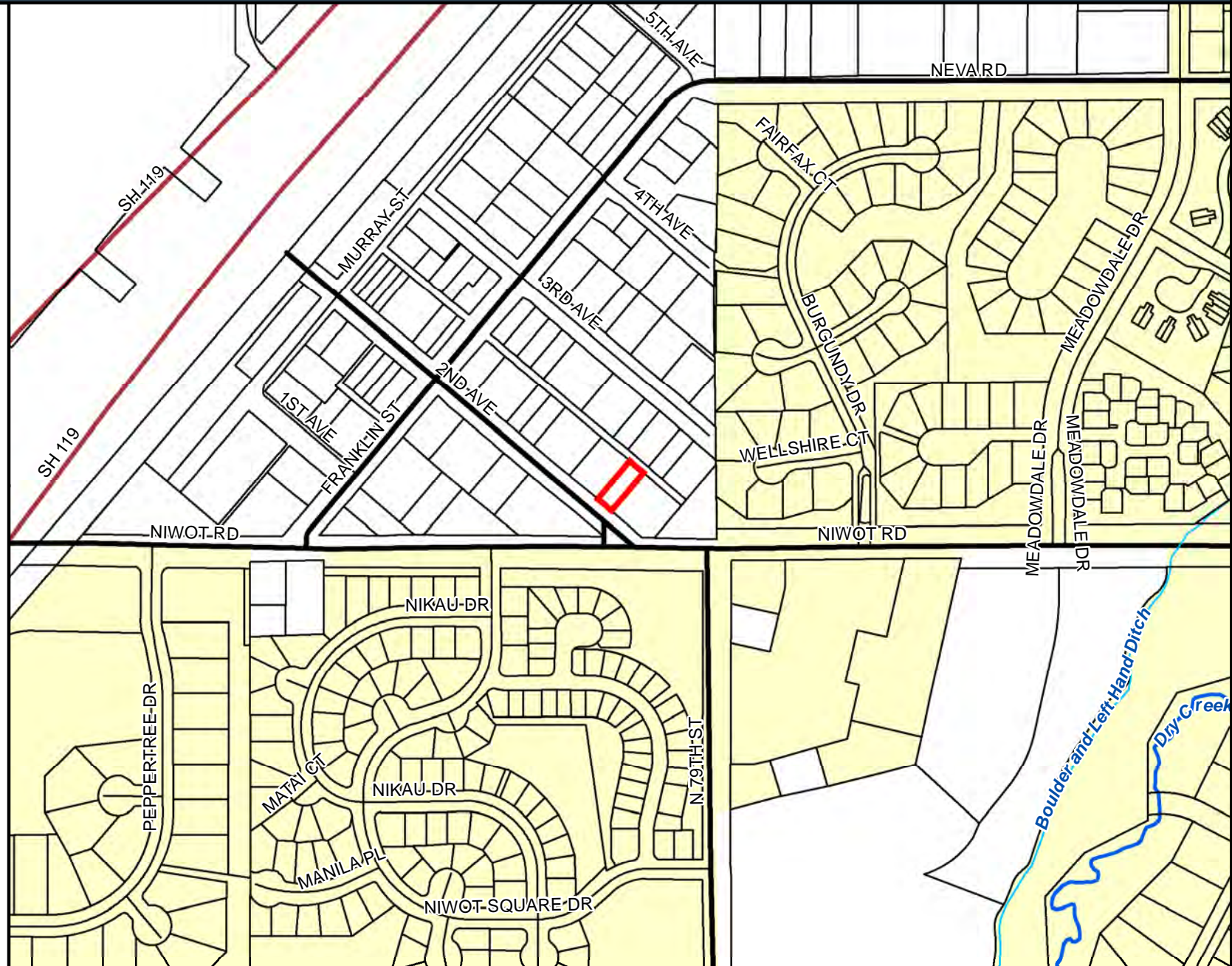
Location

364 2ND AVE

Subject Parcel

**Subdivisions**

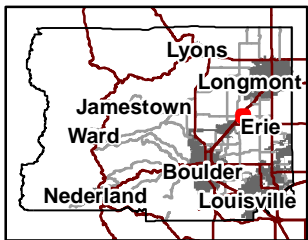
Subdivisions



0 0.035 0.07 Miles



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# Community Planning & Permitting

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Zoning

364 2ND AVE

Subject Parcel

### Major Road Setbacks

90 feet

160 feet

### Zoning Districts

Business

Multiple Family

NRCD I

NRCD II

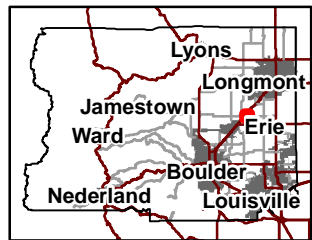
Rural Residential

Suburban Residential

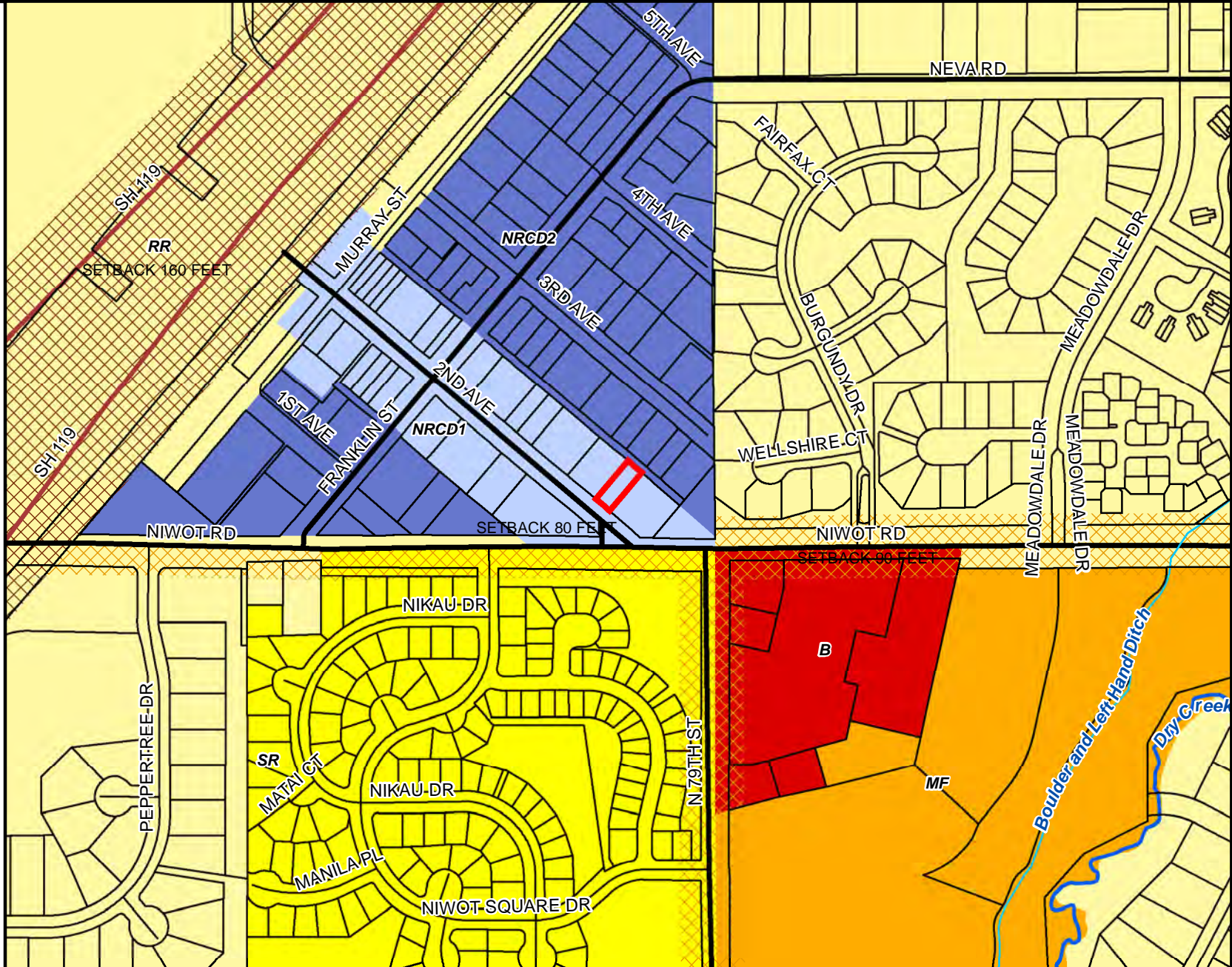
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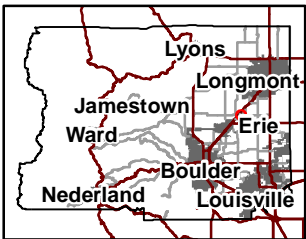
Comprehensive Plan

364 2ND AVE

 Subject Parcel



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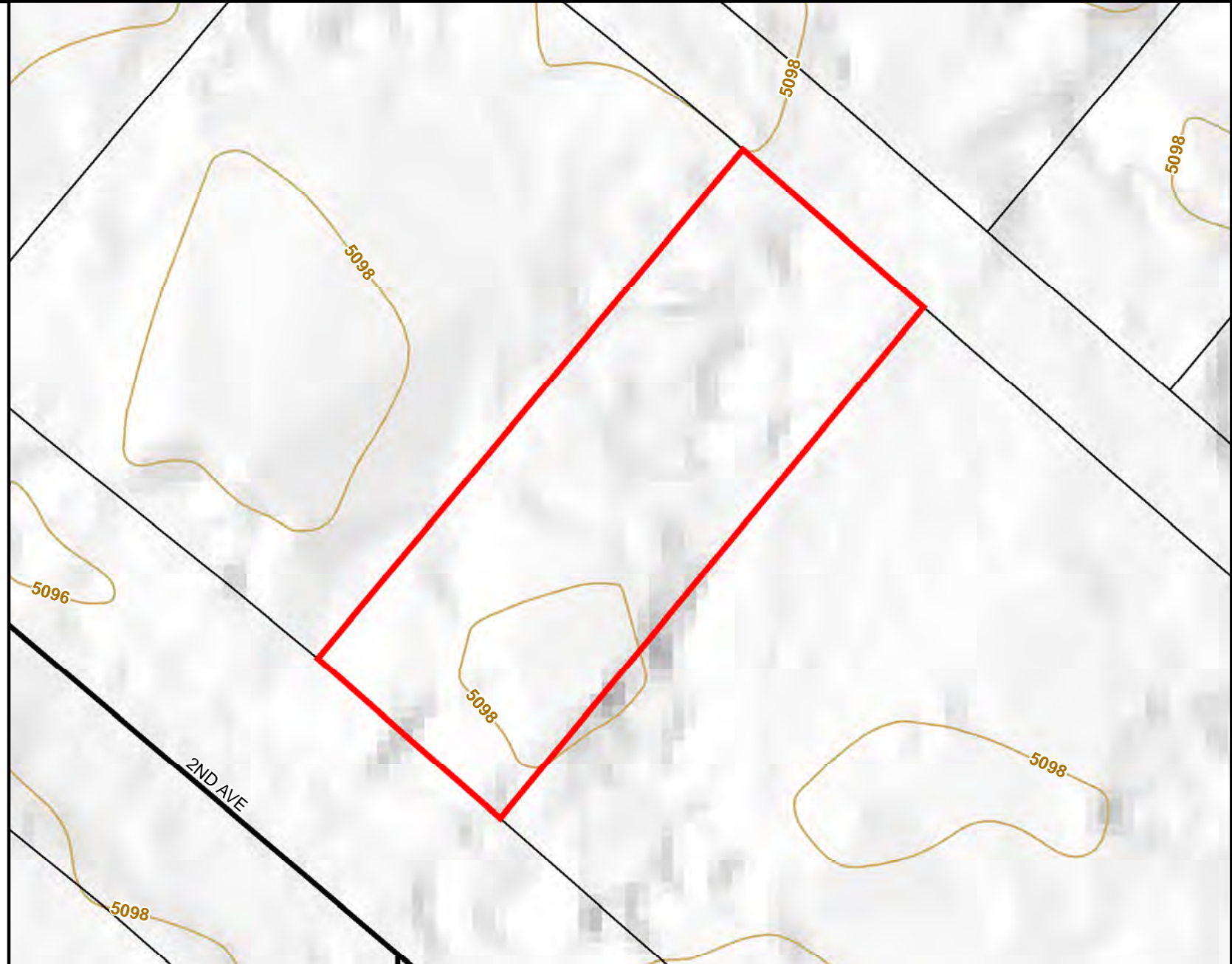
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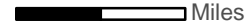
2045 13th Street, Boulder, CO 80302 303-441-3930 www.bouldercounty.org

## Elevation Contours

364 2ND AVE

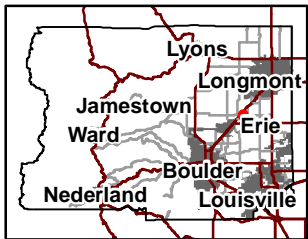
-  Subject Parcel
-  Contours 2'



0 0.0025 0.005  
 Miles



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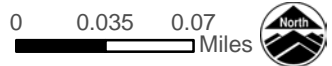
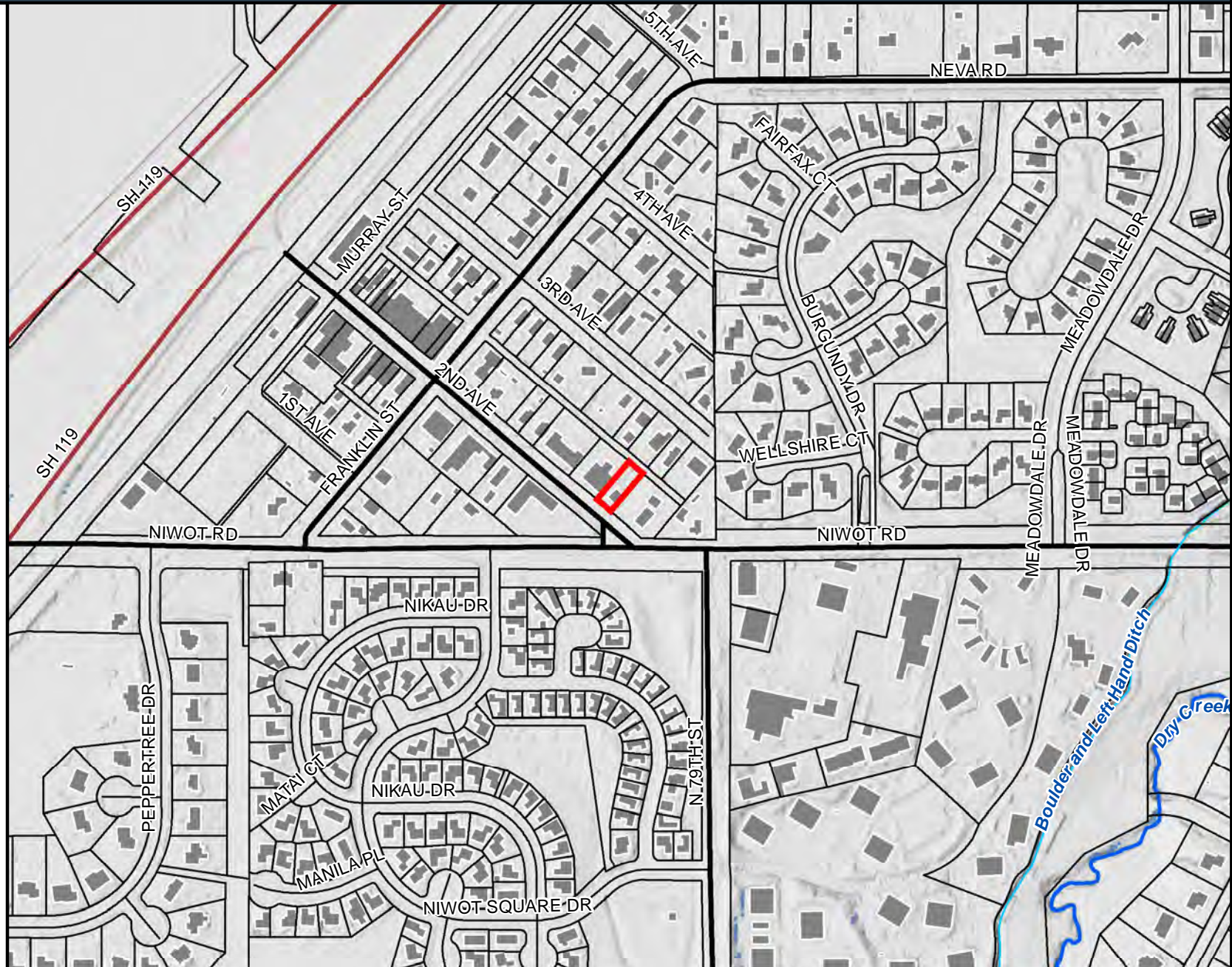
# Community Planning & Permitting

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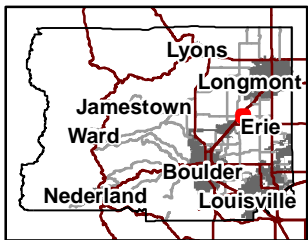
## Geologic Hazards

364 2ND AVE

-  Subject Parcel
-  Landslide high susceptibility area



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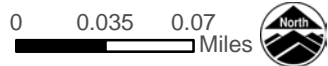
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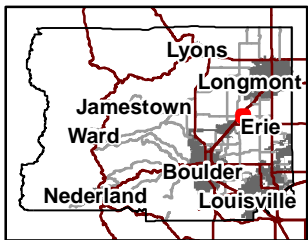
## Marijuana Business Regulatory Areas

364 2ND AVE

- Subject Parcel
- Marijuana Establishments



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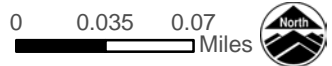
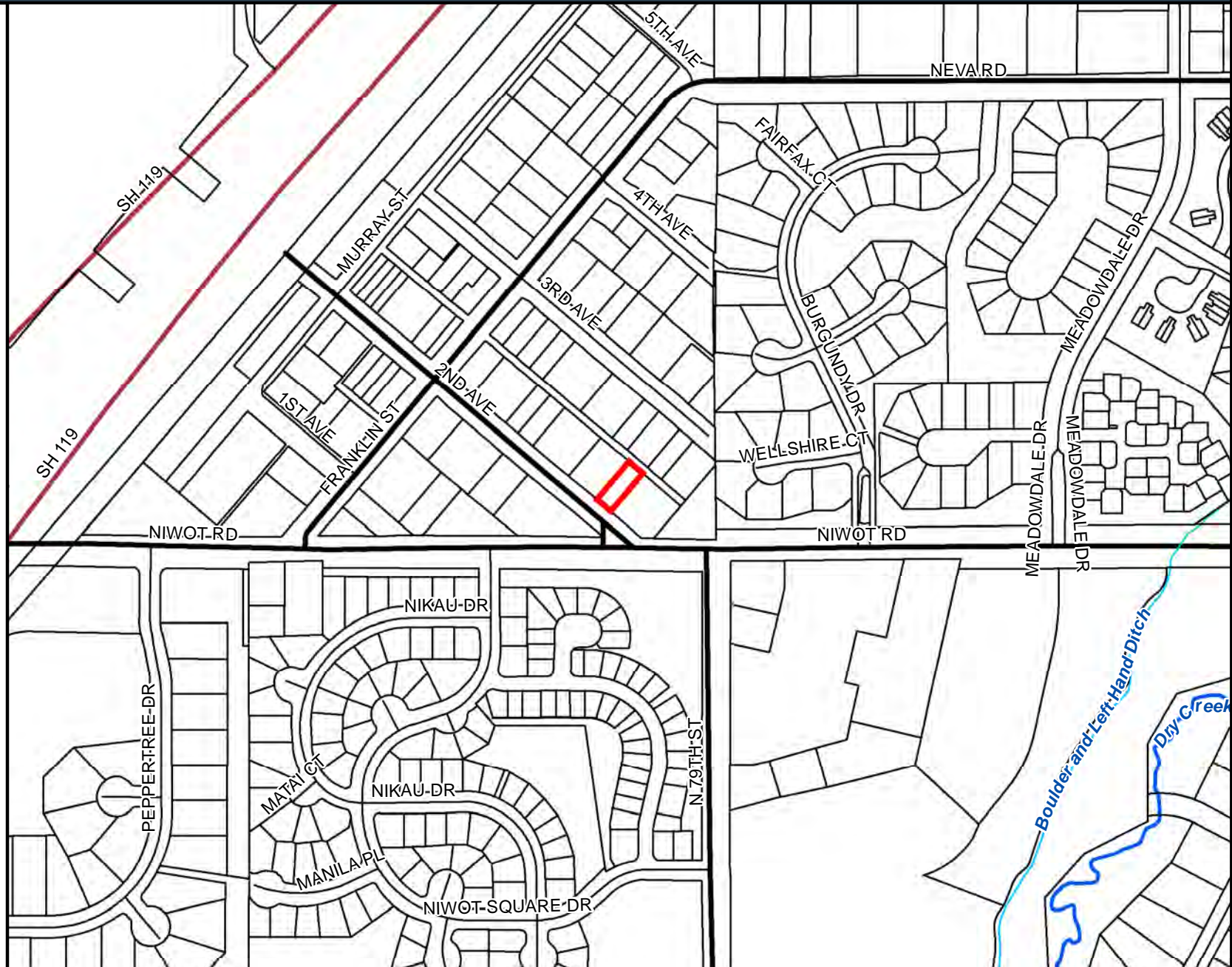
# Community Planning & Permitting

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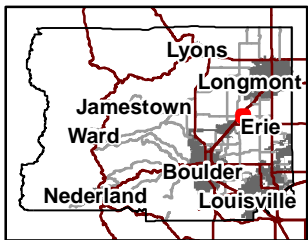
Planning Areas

364 2ND AVE

 Subject Parcel



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# Community Planning & Permitting

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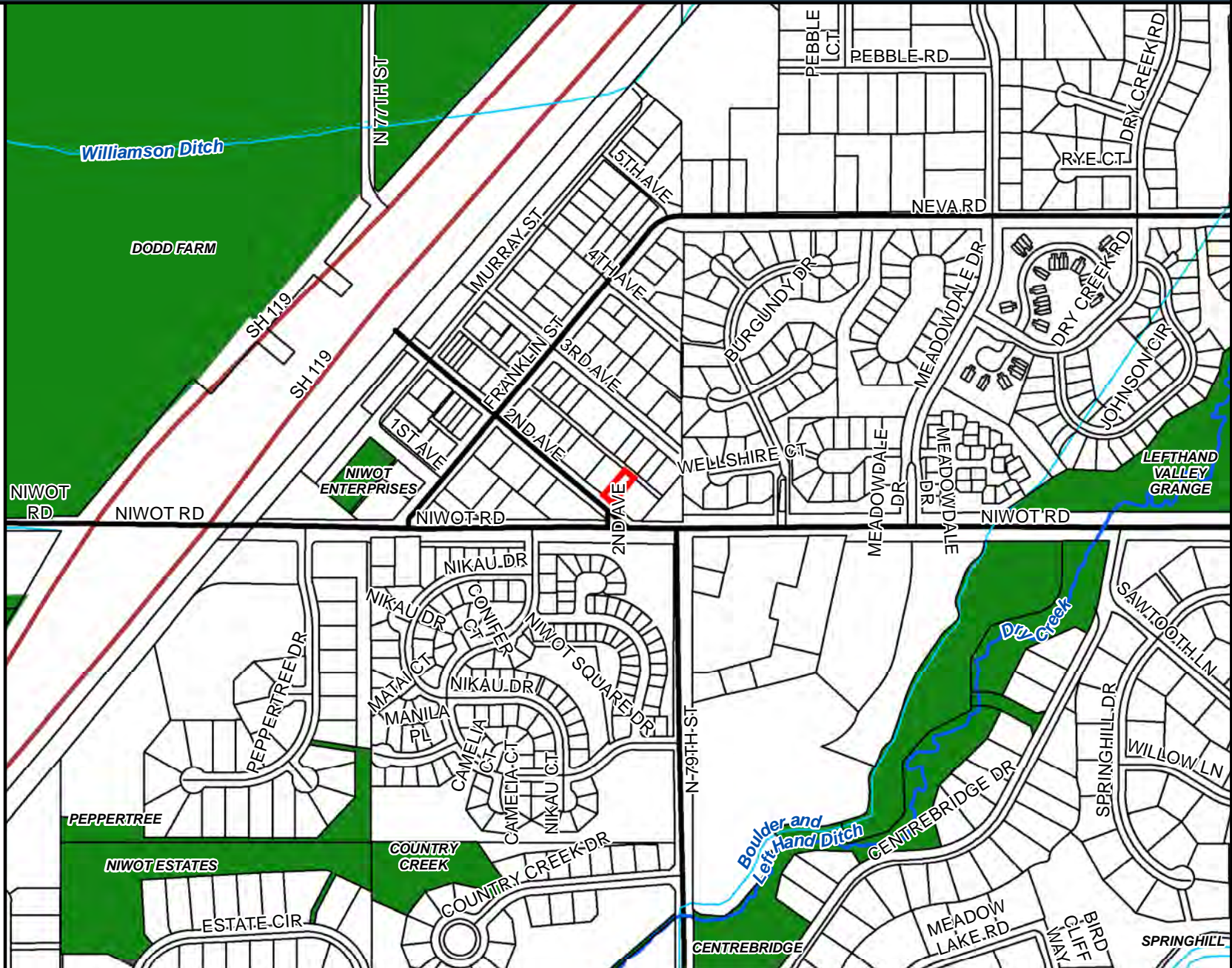
Public Lands & CEs

364 2ND AVE

Subject Parcel

## Boulder County Open Space

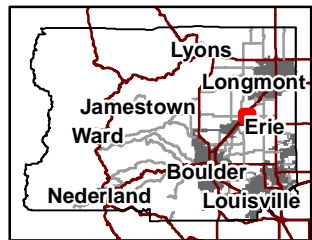
County Open Space



0 0.05 0.1 Miles



Area of Detail Date: 11/8/2021



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September 26<sup>th</sup>, 2022

Boulder County  
Community Planning & Permitting  
2045 13th Street  
Boulder, CO 80302

RE: Site Plan Review

Project: 364 2<sup>nd</sup> Ave, Niwot, CO 80544

## PROJECT NARRATIVE

### PROJECT SUMMARY

Niles Family Dentistry is currently located on 2<sup>nd</sup> ave in Niwot and they have been serving the Niwot community for many years. They are looking to continue their investment in Niwot and redevelop the 6,988 SF site located at 364 2<sup>nd</sup> Ave in Niwot. They are partnering with Lightwell Architecture LLC, to develop a proposed two-story commercial structure that will house Niles Family Dentistry on the first floor and the second floor will contain potential office space for Lightwell Architecture.

### LANDUSE CODE ARTICLE 4 -116 NIWOT RURAL COMMUNITY DISTRICT CODE SUMMARY

#### Article 4 – 4-116A B. 5 - Permitted Use

The project is located in Niwot Rural Community District I, Block 5. The Principal Uses allowed include Office Use and the proposed occupancy of the building is Office or Business use (Occupancy Group B). The project did consider a mixed-use occupancy, commercial and residential, but residential is not being considered at this time.

#### Article 4 – 4-116A C. – Lot, Building, and Structure Requirements

The maximum Building height is 30' and 15' within 25' of the rear property line and 15' within 20' of the front property line. The side setbacks are 0'. See the attached Site Plan and Building Elevations for the setbacks and maximum heights shown and dimensioned.

The Lot Coverage for Block 5 is 50% 6,988 SF X .5 = 3,494 SF allowed

Proposed Level One Floor Area = 3,130 + 125 SF (exit stair and 2<sup>nd</sup> level overhang) = 3,255 SF Total Proposed Building Coverage

FAR for Block 5: 0.6

Lot size = 6,988 SF X .6 = 4,192 SF allowed



Level 1 SF = 3,130 SF + Level 2 SF = 1,050 SF = Total 4,180 SF proposed.

#### Article 4 – 4-116A D – Parking Requirements

The Parking requirement is 1 parking space per 500 square feet of non-residential floor area.

The proposed development square footages are 4,180 SF (Level 1 – 3,130 + Level 2 – 1,050) / 500 = 8 parking spaces. We are proposing that the parking is located in the rear yard of the site and access is proposed from the alley. With this approach, the current curb cut located on 2<sup>nd</sup> ave can be eliminated to allow for a more safe and enhanced pedestrian experience. Also, credit is given for 1 space per 15' of street frontage for parcels without a curb cut on 2<sup>nd</sup> ave east of franklin street. We have 50' of frontage so this yields 3 parking spaces.

#### Article 4 – 4-116A E. 1. A (IV) – Drainage

See attached Preliminary Drainage Report from our Civil Engineer Curtis Stevens of Sanitas Group.

#### Article 4 – 4-116A E. 2 – Signs

The proposed development does include signage to meet the requirements. See attached Building Elevations.

#### Article 4 – 4-116A E. 3. – Landscaping

In Block 5 we are required to have a landscaped front yard (10' from the property line) with the exception to walks. We proposed to meet this requirement and also have included rain gardens located in the front (and rear) yard to address the required drainage requirements. These rain gardens would serve as planters. We propose to keep the large mature deciduous tree

In Blocks 5 and 6, a minimum of 20% of the area within each parcel must consist of landscaping, which may include hardscaped plazas, outdoor seating/serving areas, walkways within on-site open space areas, and other similar hardscaped on-site amenities. Hardscaped elements shall account for no more than two-thirds of the minimum landscaped area requirement.

Lot size = 6,988 SF X 20% = 1,398 SF Required (of that the Landscaped area that is planted not hardscaped is = 466 SF

Proposed SF of landscaping = 1,971 SF (of that the Landscaped area that is planted not hardscaped is) = 690 SF

#### Article 4 – 4-116A E. 4. – Outdoor Lighting

Schematic Design level lighting is indicated on the exterior elevations. A Lighting Plan for all Exterior Lighting is not required at this time per the Pre App Appointment Submittal Requirements. An electrical engineer is required for this commercial project and after Site Plan Review we will engage this consultant.

#### Article 4 – 4-116A E. 5. – Building Materials in the Non-Historic Area & 8. NRCD I Colors

The building materials are comprised of brick, concrete, windows, cement board, steel, and wood. These materials complement the historic and present-day buildings of Niwot. We have included unique brick cornice details that are inspired by brick detailing evident in Niwot's historic district which reinforces Niwot's architectural character. See the attached proposed color and material digital chips included and the Exterior Elevations.



Article 4 – 4-116A E. 6. – Building Form

- a.** Roofs should conform with the existing roof styles on 2nd Avenue within the same block.

The character of historic Niwot consists of many parapet or flat roof forms. We were inspired by these roof forms (which can also be found within this block specifically, portions of 300 2<sup>nd</sup> Ave.) and found it better suited for this site location and street front width (approximately 50'). A gable roof greatly increases building bulk and height, it was our intent to allow for views beyond for our neighbor buildings and lessen the building height. This approach will also provide a pedestrian-scale street presence.

- b.** Expanses of building façade on any side that are longer than 25 feet may, depending on site conditions and visibility, be required to incorporate design variations to break up the continuity of the wall in an attempt to reduce the possibility of a long monotonous wall.

The lot is approximately 50' wide so breaking up the continuity halfway through the building would have adverse effects on the character of the building and would result in a noncohesive building facade.

- c.** Second-story windows, patios, and decks shall be designed to minimize adverse impacts on the privacy of adjacent properties zoned NRCD I and Rural Residential.

Second-story windows and occupiable deck on the North East elevation are minimized in size to not have adverse impacts on the privacy of the adjacent properties.

Article 4 – 4-116A I. – Historic Landmark Designation

Per the attached document the existing structure is not eligible for landmark status.

# NIWOT COMMUNITY ENGAGEMENT REPORT

364 2nd Ave, Niwot, CO

REPORT OF THE COMMUNITY MEETING ON 8/03/22 & PUBLIC COMMENT AT THE NDRC MEETING ON 8/10/22





### PARKING & ACCESS COMMENTS:

- ① Community members raised questions about curb cuts, how the flow of traffic will change, alley maintenance and improvements.

### SITE COMMENTS:

- ② Lefty's is currently a place of social interaction.
- ③ Corner location - Gateway to commercial Niwot

LIGHTWELL

ARCHITECTURE

© 2022 LIGHTWELL ARCHITECTURE, LLC.

### APPLICANT RESPONSES:

- ① The design is in line with the Land Use Code requirements of the design of parking and alley improvements. The existing curb cut is proposed to be eliminated to provide safety for pedestrians. The County does prefer for access to be taken from the alley to promote safety and a pedestrian experience. This is a common urban planning goal and we are following the county's direction. The Civil Engineer confirmed that the amount of traffic won't change significantly. The flow of traffic will change during business hours instead of evenings as it is now. There are 11 parking spaces provided on the site. The possible reduction of parking spaces has been avoided. Our property's alley improvements are required and necessary and we will meet those requirements.
- ② We propose this building and the front yard also serve as a place of social interaction. The most public space of the building, the lobby, is positioned to be adjacent to 2nd Ave. Landscaping is proposed in the front yard and the Left-Hand benches are proposed for community use.
- ③ We believe this building (its recent design revisions) and location will be a social and community node at the gateway of Niwot. It will serve as an anchor and entrance to our town full of present-day character inspired by the unique fabric of the historic buildings that make Niwot what it is.

364 2ND AVE, NIWOT, CO

## BUILDING FORM COMMENTS:

- ① There was a discussion on the Building Form. As the code reads “Roofs should conform with the existing roof styles on 2nd Avenue within the same block”.

Also discussed was that a gable roof on this site isn't practical considering our approximate 50' site width. A gable roof slope with our current design would increase building height and go above the height limit.

## APPLICANT DESIGN REVISIONS:

- ① The character of historic Niwot consists of many parapet or flat roof forms. Either a true parapet roof or a false front. These roof types are commonly paired with brick buildings, often those with 0' side yard setbacks.

The parapet roof is proposed.

A gable roof increases building bulk and it is our intent to allow for views beyond for our neighbor buildings and lessen the building height.

The 2nd avenue facade is one of numerous roof forms but what is consistent among all these roof types is a horizontal datum. Our proposed structure reinforces this horizontal datum.

Additionally, the building height is below the maximum allowed building height.

LIGHTWELL

ARCHITECTURE

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364 2ND AVE, NIWOT, CO

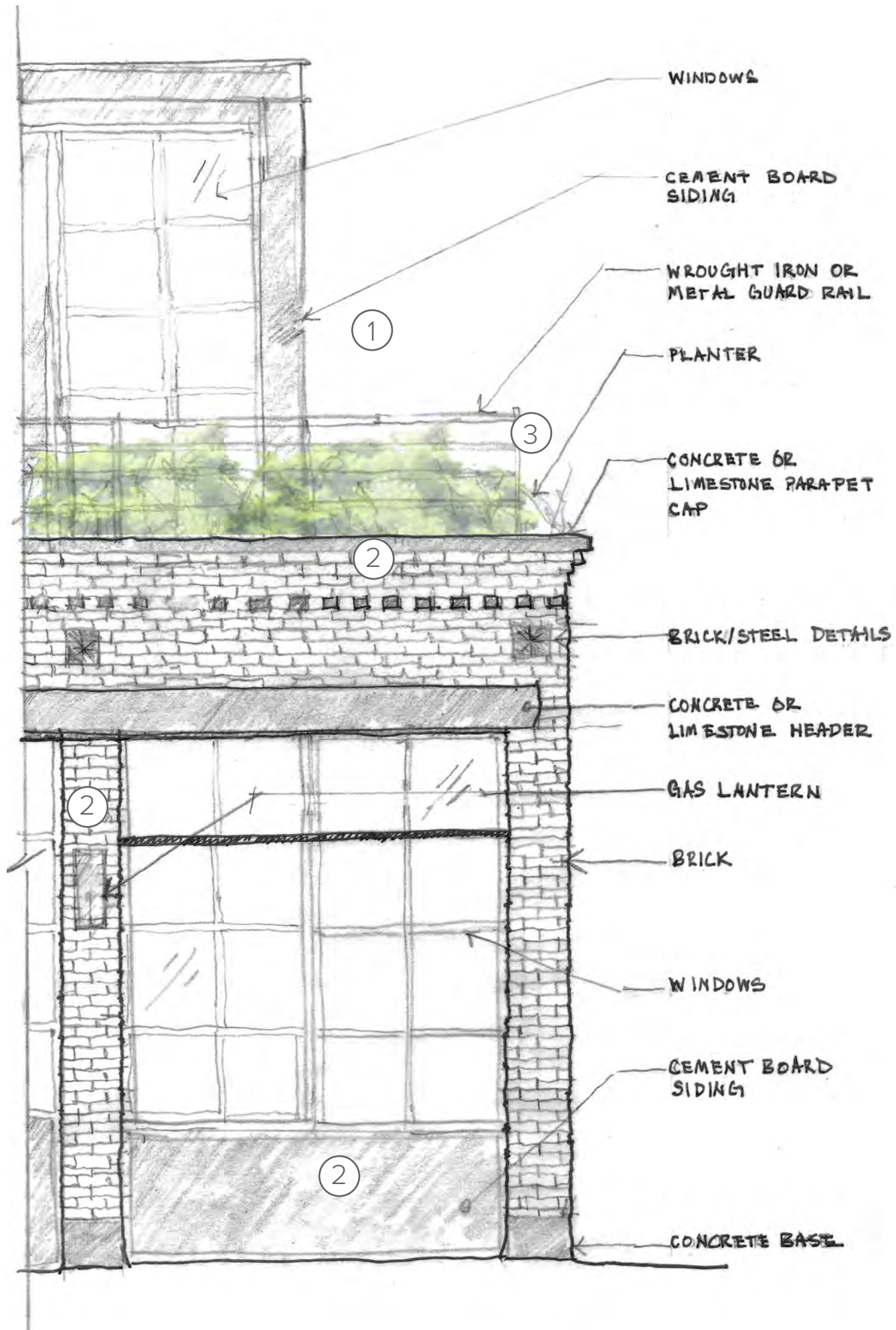


### BUILDING MATERIALS IN THE NON-HISTORIC AREA COMMENTS:

- ① The building isn't in character with the town. Request for more historic-looking building, from the 1900s.
- ② The design of the proposed building is too modern, there is too much glass on the front facade.
- ③ Glass railing is too modern and too noticeable. Wrought iron railing requested.

### APPLICANT DESIGN REVISIONS:

- ① It is our goal to complement the existing character and fabric of Niwot. As architects and planners, we are taught that we should not reproduce what was built in the 1900s. When buildings do this they essentially become false representations and diminish the value of actual structures built during this era. That being said, we are inspired by the existing massing, roof forms, brick details, and fenestration of some of the most appropriate and similar typology historic Niwot buildings
- ② We revised the design to incorporate brick columns along the 2nd street facade. Also, we added brick cornice details, that take inspiration from many of the existing historic buildings. Brick is the most prevalent facade material and glass is reduced. Additionally, we raised the window sill which is evident on many of our historic Niwot buildings. The same window & siding-to-brick wall ratio as the Wheel Works building is proposed.
- ③ We are proposing a wrought iron or metal guardrail on the second floor instead of glass. With the use of a wider planter, we are able to place the guardrail only on the east and west sides of the structure.



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364 2ND AVE, NIWOT, CO



September 26, 2022

Community Planning and Permitting  
2045 13<sup>th</sup> Street  
Boulder, CO 80302

Attn: Planner Assigned to 364 2<sup>nd</sup> Avenue Niwot

To whom this may concern:

As a long-time resident of Niwot, I am writing to you to strongly consider the continued approval of the current designs for Ashley Niles Dentistry located on the said location.

Dr. Ashely Niles is a big asset to our town and provides a tremendous dental service to the Niwot and local Boulder County communities. There is a current and future business need to expand her current operations and maintain the dental services we enjoy and also a needed tax base for our community.

Her architectural design proposal is very tasteful and incorporates appropriate design elements that are consistent with the ongoing necessary improvements needed for the overall entry point into our town.

Niwot business corridor currently has a very eclectic architectural style. There exists a wide variety of building designs which have occurred over the years as evidenced by the recently abandoned feed store to the automotive shop to the liquor store. Her proposal in no way violates any of this variety and in many ways helps continue to appropriately transition to a more refreshed look for our town.

The building she is replacing is an eyesore and deteriorating. Her proposed design places an appropriate conservative but modern design that mimics other newer builds such as Wheel Works and other “newer” business establishments in the town.

For the greater good of the community providing her services and the need to continually tastefully modernize our downtown, this development is a very welcome addition to Niwot. We need this evolution so we continue to attract businesses while satisfying the needs of our local residents.

Sincerely yours,

John and Amy Klein  
6483 Cranberry Court  
Niwot, CO 80503

Community Planning & Permitting

2045 13th Street  
Boulder, CO 80302

Attention: Planner assigned to 364 2nd Ave

9-26-22

To whom it may concern,

I’m writing today to underscore my support for the proposed project at 364 2<sup>nd</sup> Avenue in Niwot, CO. I’ve been a member of the Niwot community for more than 15 years - as a tenant, an employer, and the owner of a building in the center of old town at 137 2<sup>nd</sup> Ave.

Like most, I was drawn to Niwot because of its beauty, charm and old-town feel. Much of the town’s character and allure stems from its architecture – and most notably the architecture on the west end of 2<sup>nd</sup> Avenue. The beautiful brick buildings, with their clean, rectangular design and clever signage bring you back to a time when less was more. And the large windows in the retail shops invite passersby to come inside and be a part of the community. It’s like a step back in time – enchanting, welcoming and inspiring on so many levels.

The east end of 2<sup>nd</sup> Ave would benefit from buildings with a similar design and character, and the 364 project is just that. I’ve seen the plans and the proposal, and I’m a fervent believer that the brick, glass and natural materials in their design will bring a continuity to downtown Niwot that’s currently missing. This proposed building would complement its adjacent Niwot Inn & Spa perfectly, and create a much-needed gateway to downtown Niwot from the east.

Please feel free to reach out to me if I can provide any additional opinions on this matter.

Respectfully,

Bradford Fayfield  
Storm Mountain Media  
137 2<sup>nd</sup> Ave., Niwot, CO

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364 2ND AVE, NIWOT, CO





September 27, 2022

Dear Boulder County Commissioners,  
Dale Case and Denise Grimm

I highly recommend approval of the Site Plan Review submittal for the Niles Family Dentistry commercial building at 364 2<sup>nd</sup> Avenue in Niwot.

The design is thoughtful and reinforces the character of both historic and present-day Niwot with building form, materials and window patterns.

The exterior materials complement the adjacent buildings on the block.

This project is not within the historic district, but with massing and details, complements the historic nature of Niwot's commercial district. I appreciate that it is not a 'Disneyland-like' copy, but instead is a project of its own time.

As this project moves forward, it adds much needed life to 2<sup>nd</sup> Avenue. The former Lefty's building is in very poor condition and an upgrade will enhance this block tremendously.

It is my hope, with a clear understanding of the grading of the existing alley, that the historic grade of the alley will be allowed to remain, and minimal requirements for alley redesign will be placed on this project. Improvements that address the potholes are welcome.

Niles Family Dentistry is an active member of our business community, and I am thrilled that they are investing in Niwot for the long term. They are an asset to our community and this project will be an asset for years to come.

As a business and property owner within this block, I welcome this new addition.

Thank you for your consideration.

Anne Postle, Architect  
Osmosis Architecture Inc.'

Owner 240 2<sup>nd</sup> Avenue, 280 2<sup>nd</sup> Avenue, 290 2<sup>nd</sup> Avenue and 104 2<sup>nd</sup> Avenue

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6666 Apache Court  
Niwot, CO. 80503

September 28, 2022

Community Planning & Permitting  
2045 13th Street  
Boulder, CO 80302

To Whom It May Concern:

My name is Lawson Drinkard. My wife and I have been residents of Niwot since 2013. I am a retired architect. Since we live so close to "downtown" Niwot, we are there for one reason or another nearly every day. We love our downtown and the variety of experiences and services it has to offer.

I'm writing to share my thoughts about the new building being proposed by Dan and Ashley Niles at 364 2<sup>nd</sup> Avenue. I have had an opportunity to review the schematic drawings and the materials pallet being proposed for this new structure which will replace a dilapidated and crumbling building which is currently a community eyesore.

Though downtown Niwot has its own character, the buildings along 2<sup>nd</sup> Avenue don't represent any singular architectural style. There are a variety of heights, shapes, materials, window patterns, and roof forms. Some are significantly more attractive than others.

The design that Lightwell Architecture is proposing reinforces the character of downtown Niwot and complements the forms, materials, and scale of the best buildings that exist there. The architects have been careful with the overall height and the roof forms of the proposed building to keep a pedestrian scale and allow for views from adjacent structures.

In some public meetings related to this proposed design, references have been made to the intersection of 2<sup>nd</sup> Avenue and Niwot Road as being the "gateway" to our town. I believe Niwot should both respect its past and look toward its future. This building does both and I respectfully request that the owners and architects be given the necessary approvals to move forward with the current design.

Sincerely,

G. Lawson Drinkard, III

364 2ND AVE, NIWOT, CO



# Site Plan Review Fact Sheet

The applicant(s) is/are required to complete each section of this Site Plan Review (SPR) Fact Sheet even if the information is duplicated elsewhere in the SPR application. Completed Fact Sheets reduce the application review time which helps expedite the Director's Determination. Please make duplicates of this SPR Fact Sheet if the project involves more than two structures.

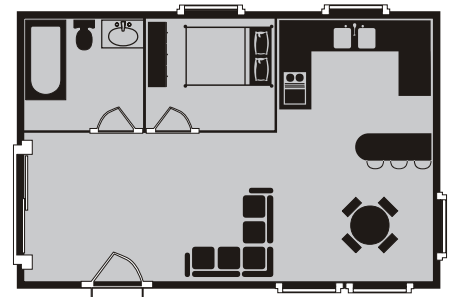
## Structure #1 Information

Type of Structure: (e.g. residence, studio, barn, etc.)		Commercial Structure			
Total Existing Floor Area: (Finished + Unfinished square feet including garage if attached.)		NA sq. ft.		Deconstruction: 720 sq. ft.	
Are new floor areas being proposed where demolition will occur? <input type="checkbox"/> No <input type="checkbox"/> Yes (include the new floor area square footage in the table below)					
Proposed Floor Area (New Construction Only)				<input type="checkbox"/> Residential <input checked="" type="checkbox"/> Non-Residential	
	Finished	Unfinished	Total	Height (above existing grade)	26' - 7"
Basement:	NA sq. ft.	sq. ft.	sq. ft.	Exterior Wall Material	Brick, CMU Cement Board
First Floor:	3,130 sq. ft.	sq. ft.	sq. ft.	Exterior Wall Color	See attached
Second Floor:	1,050 sq. ft.	sq. ft.	sq. ft.	Roofing Material	EPDM
Garage: <input type="checkbox"/> Detached <input type="checkbox"/> Attached	sq. ft.	sq. ft.	sq. ft.	Roofing Color	See attached
*Covered Porch:	sq. ft.	sq. ft.	sq. ft.	Total Bedrooms	NA
Total:	4,180 sq. ft.	sq. ft.	sq. ft.		

<b>Project Identification:</b>
Project Name: 364 2ND AVE
Property Address/Location: 364 2ND AVE
Current Owner: Ashley Niles Properties LLC
Size of Property in Acres: .16 acre

## Determining Floor Area

Floor Area is measured in terms of square feet. The total square footage is as everything within the exterior face of the exterior walls including garages and basements. **Covered porch area that is attached to the principal structure is included (see Article 18-131A).** The shaded area on the diagram indicates the area counted as square feet.



## Structure #2 Information

Type of Structure: (e.g. residence, studio, barn, etc.)					
Total Existing Floor Area: (Finished + Unfinished square feet including garage if attached.)				Deconstruction: sq. ft.	
Are new floor areas being proposed where demolition will occur? <input type="checkbox"/> No <input type="checkbox"/> Yes (include the new floor area square footage in the table below)					
Proposed Floor Area (New Construction Only)				<input type="checkbox"/> Residential <input type="checkbox"/> Non-Residential	
	Finished	Unfinished	Total	Height (above existing grade)	
Basement:	sq. ft.	sq. ft.	sq. ft.	Exterior Wall Material	
First Floor:	sq. ft.	sq. ft.	sq. ft.	Exterior Wall Color	
Second Floor:	sq. ft.	sq. ft.	sq. ft.	Roofing Material	
Garage: <input type="checkbox"/> Detached <input type="checkbox"/> Attached	sq. ft.	sq. ft.	sq. ft.	Roofing Color	
*Covered Porch:	sq. ft.	sq. ft.	sq. ft.	Total Bedrooms	
Total:	sq. ft.	sq. ft.	sq. ft.		

## Residential vs. Non-Residential Floor Area

Residential Floor Area includes all attached and detached floor area (as defined in Article 18-162) on a parcel, including principal and accessory structures used or customarily used for residential purposes, such as garages, studios, pool houses, home offices and workshops. Gazebos and carports up to a total combined size of 400 square feet are exempt. Barns used for agricultural purposes are not considered residential floor area.

**Note:** If an existing wall(s) and/or roof(s) are removed and a new wall(s)/roof(s) are constructed, the associated floor area due to the new wall(s)/roof(s) are considered new construction and must be included in the calculation of floor area for the Site Plan Review and shown on this Fact Sheet.

**If a Limited Impact Special Review is required,** then call 303-441-3930 and ask for a new Pre-Application conference for the Limited Impact Special Review.

\*See Article 18-131A for definition of covered porch.



## Grading Calculation

Cut and fill calculations are necessary to evaluate the disturbance of a project and to verify whether or not a Limited Impact Special Review (LISR) is required. A LISR is required when grading for a project involves more than 500 cubic yards (minus normal cut/fill and backfill contained within the foundation footprint).

If grading totals are close to the 500 yard trigger, additional information may be required, such as a grading plan stamped by a Colorado Registered Professional Engineer.

## Earth Work and Grading

This worksheet is to help you accurately determine the amount of grading for the property in accordance with the Boulder County Land Use Code. Please fill in all applicable boxes.

**Note:** Applicant(s) must fill in the shaded boxes even though foundation work does not contribute toward the 500 cubic yard trigger requiring Limited Impact Special Use Review. Also, all areas of earthwork must be represented on the site plan.

## Earth Work and Grading Worksheet:

	Cut	Fill	Subtotal
Driveway and Parking Areas	11	17	28
Berm(s)	0	0	0
Other Grading Slope Tie-In/Drainage	0	0	0
<b>Subtotal</b>	<b>11</b>	<b>17</b>	<b>28</b>

Box 1

\* If the total in Box 1 is greater than 500 cubic yards, then a Limited Impact Special Review is required.

	Cut	Fill	Total
Foundation	574	19	593
Material cut from foundation excavation to be removed from the property			538

## Excess Material will be Transported to the Following Location:

Excess Materials Transport Location:
T.B.D. - Contractor & earthwork subcontractor not selected at this time, so accurate site for export has not been determined. Will be selected and provided prior to building permitting.

## Narrative

Use this space to describe any special circumstances that you feel the Land Use Office should be aware of when reviewing your application, including discussion regarding any factors (listed in Article 4-806.2.b.i) used to demonstrate that the presumptive size limitation does not adequately address the size compatibility of the proposed development with the defined neighborhood. If more room is needed, feel free to attach a separate sheet.

SEE ATTACHED.

## Is Your Property Gated and Locked?

**Note:** If county personnel cannot access the property, then it could cause delays in reviewing your application.

## Certification

I certify that the information submitted is complete and correct. I agree to clearly identify the property (if not already addressed) and stake the location of the improvements on the site within four days of submitting this application. I understand that the intent of the Site Plan Review process is to address the impacts of location and type of structures, and that modifications may be required. Site work will not be done prior to issuance of a Grading or Building Permit.

Signature <i>Katherine Willis</i>	Date 9/26/22
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# LIGHTWELL ARCHITECTURE

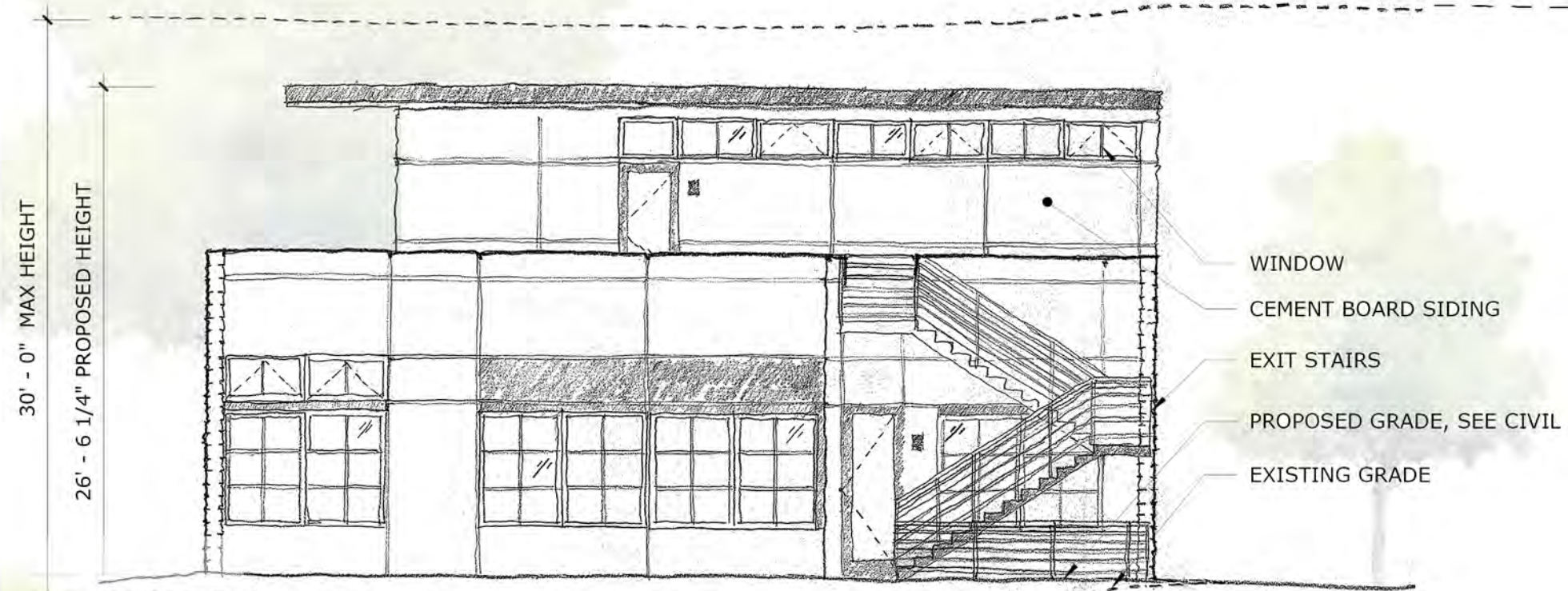
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PROJECT: 364 2ND AVE.

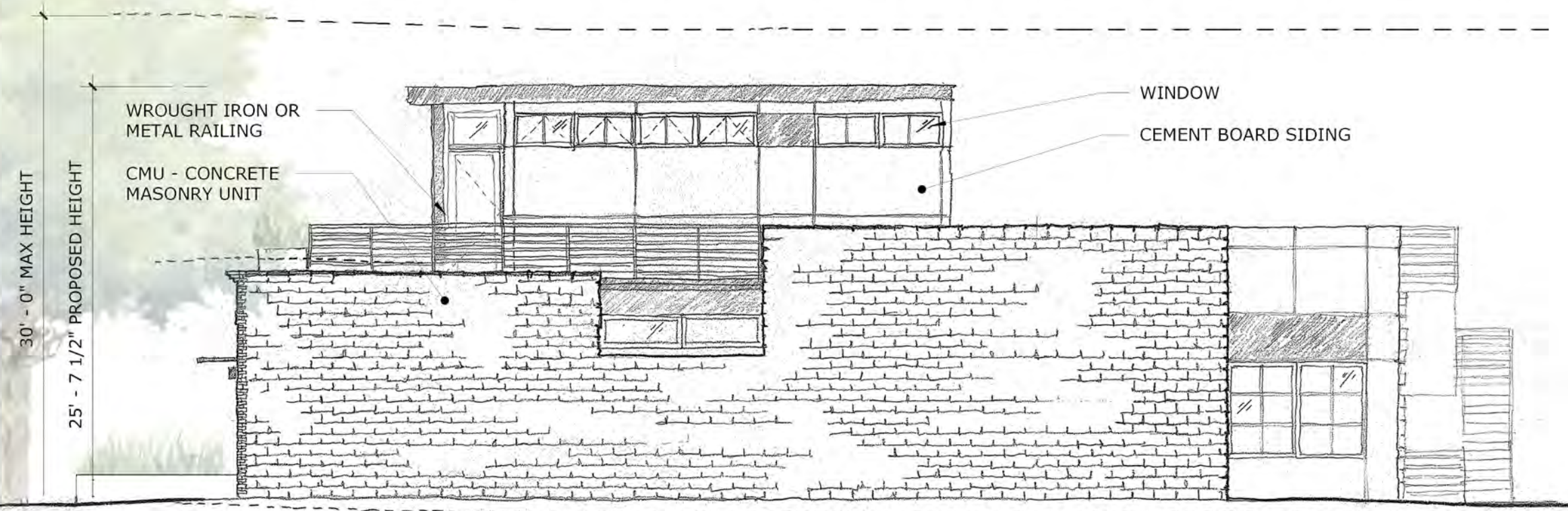
ISSUE: SITE PLAN REVIEW

DATE ISSUED: 09.26.22

SHEET NO.: EXTERIOR ELEVATIONS



**2** NORTH-EAST ELEVATION  
SCALE: 1/8" = 1'-0"



**1** SOUTH-EAST ELEVATION  
SCALE: 1/8" = 1'-0"



# LIGHTWELL

## ARCHITECTURE

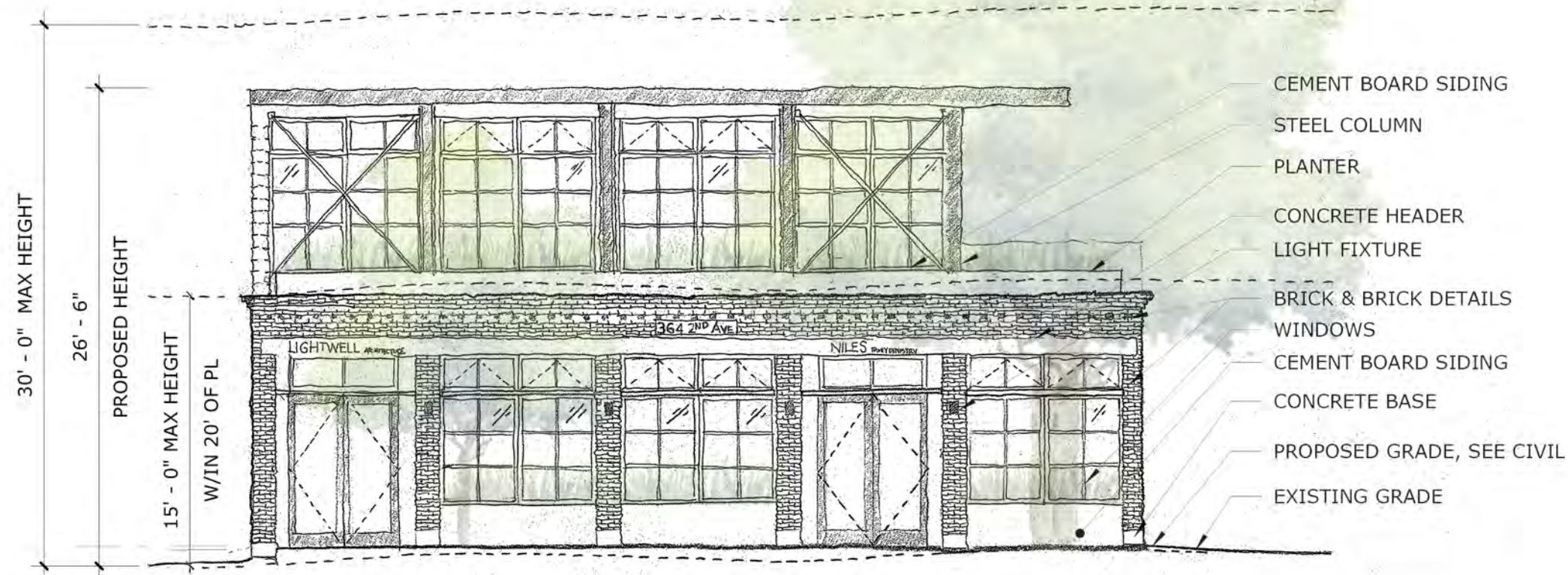
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PROJECT: 364 2ND AVE.

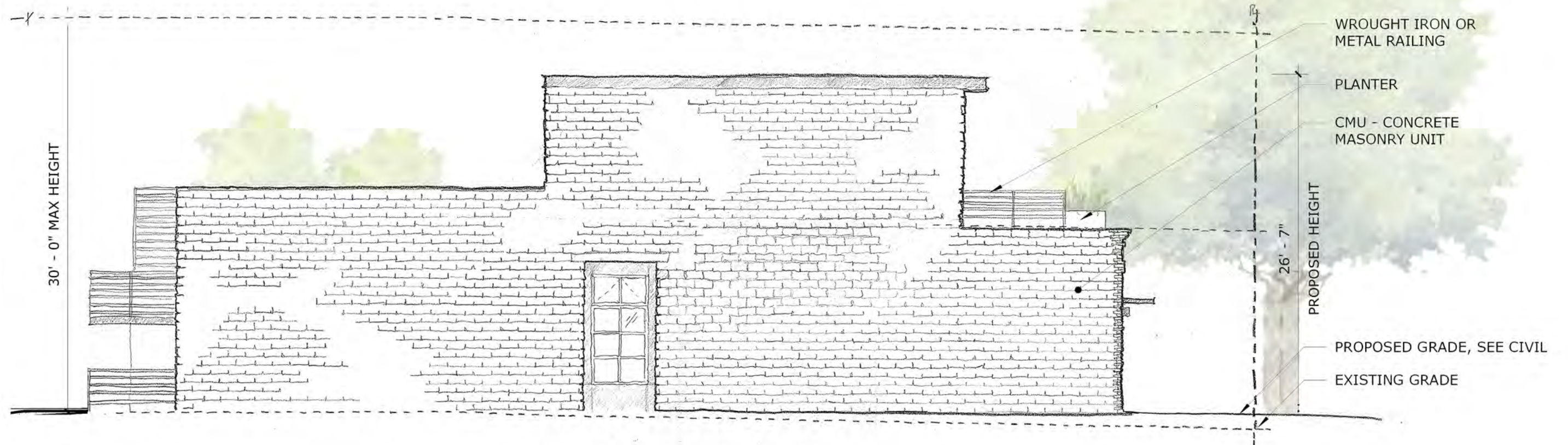
ISSUE: SITE PLAN REVIEW

DATE ISSUED: 09.26.22

SHEET NO.: EXTERIOR ELEVATIONS



**1** SOUTH-WEST ELEVATION  
SCALE: 1/8" = 1'-0"



**2** NORTH-WEST ELEVATION  
SCALE: 1/8" = 1'-0"



# LIGHTWELL ARCHITECTURE

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PROJECT: 364 2ND AVE.

ISSUE: SITE PLAN REVIEW

DATE ISSUED: 09.26.22

SHEET NO.: COLOR CHIPS & SAMPLES



CONCRETE BASE AND HEADER/SILL



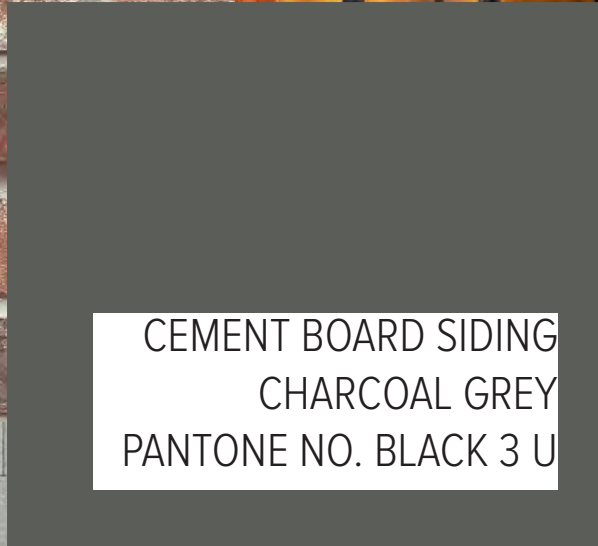
METAL CLAD WOOD WINDOWS - BLACK



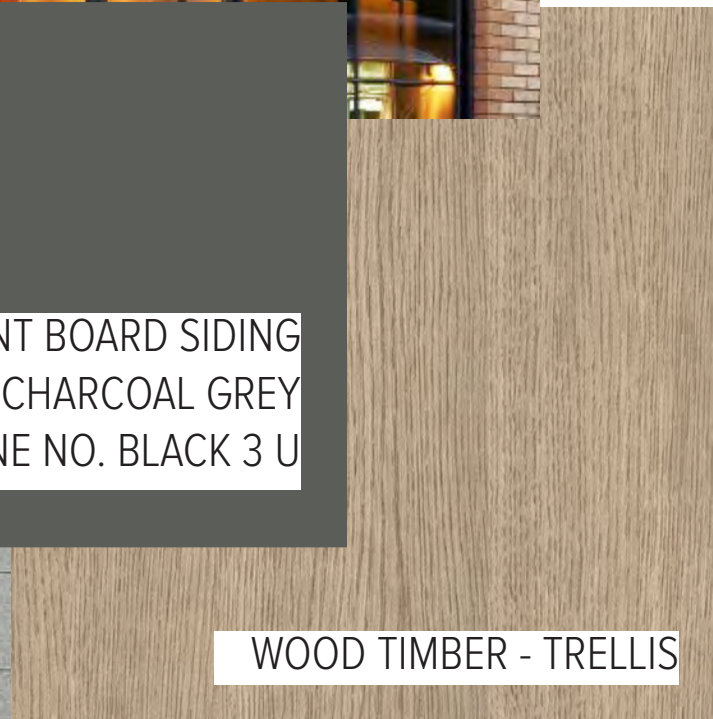
BRICK - DISTRESSED



STEEL COLUMN/BEAM



CEMENT BOARD SIDING  
CHARCOAL GREY  
PANTONE NO. BLACK 3 U



WOOD TIMBER - TRELLIS



CMU - CONCRETE MASONRY UNIT



PROJECT:  
364 2ND AVE.

PROJECT ADDRESS:  
364 2ND AVE,  
NIWOT

CLIENT:  
ASHLEY NILES  
PROPERTIES LLC

NOT FOR CONSTRUCTION

ISSUE: SITE PLAN REVIEW

DATE ISSUED: 09.26.22

REVISIONS

PLOT DATE: 9/26/2022 10:18:21 PM

PROJECT NO. 21.2150

SHEET TITLE:  
CODE ANALYSIS  
- ZONING &  
AREA PLANS

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SHEET NO.:

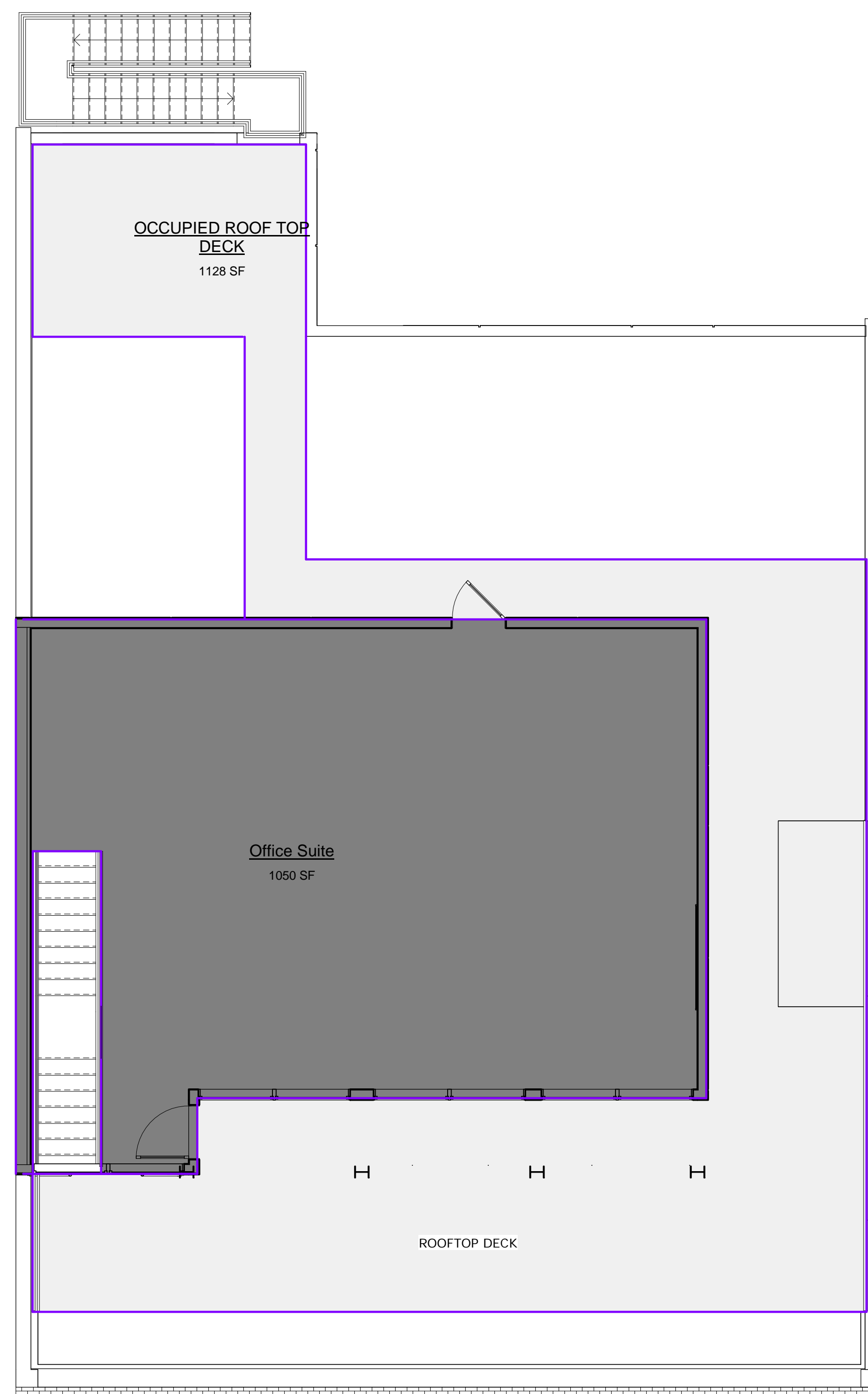
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ZONING CODE ANALYSIS

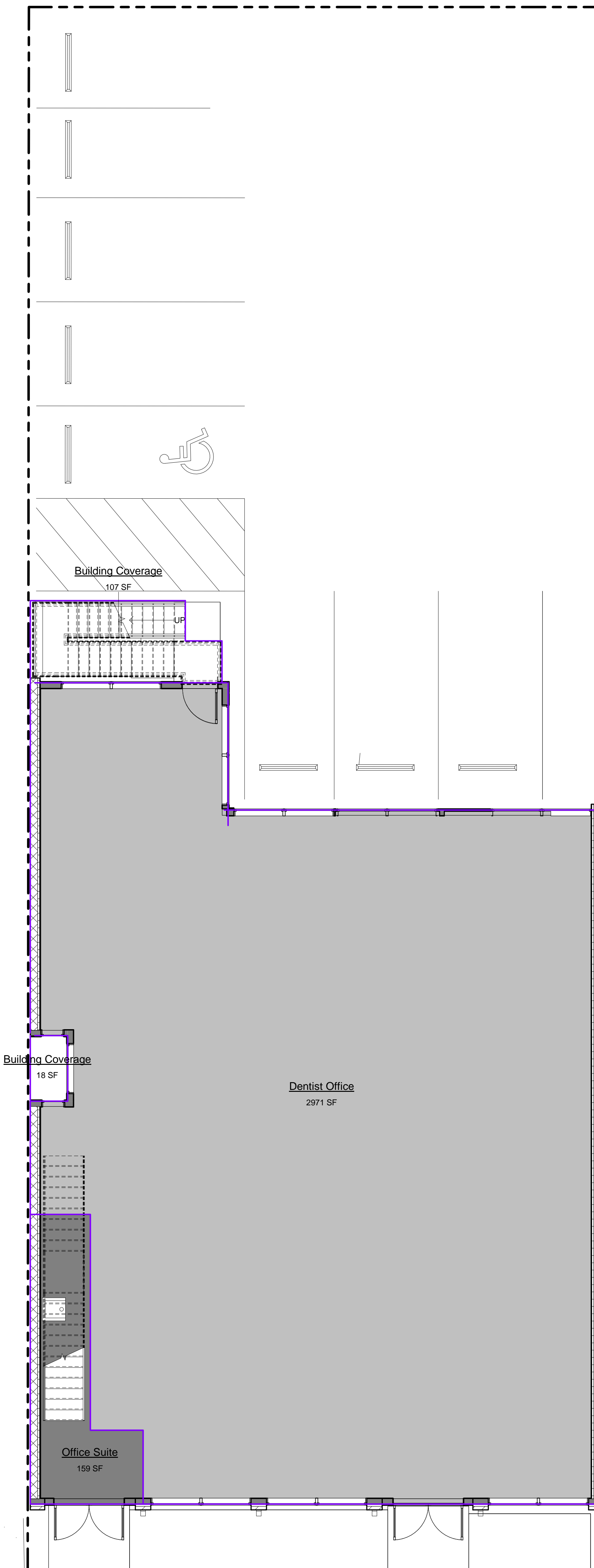
LAND USE CODE			
Section	Issue	Code Requirement	Remarks
	PARKING STANDARDS	REQUIRED MINIMUM NUMBER OF ACCESSIBLE SPACES / TOTAL PARKING SPACES PROVIDED 1:25	
	ACCESSIBLE PARKING SPACES		1 New Van Accessible Parking Space provided as required

AREA SCHEDULE (GROSS BUILDING)		
LEVEL	NAME	AREA
Level 1 t.o. Concrete		
Level 1 t.o. Concrete	Office Suite	159 SF
Level 1 t.o. Concrete	Dentist Office	2971 SF
		3130 SF
Level 2 t.o. Subfloor		1050 SF
Level 2 t.o. Subfloor	Office Suite	1050 SF
		4180 SF

AREA SCHEDULE - ROOF DECK		
LEVEL	NAME	AREA
Level 2 t.o. Subfloor		1128 SF
Level 2 t.o. Subfloor	OCCUPIED ROOF TOP DECK	1128 SF
		1128 SF



1 LEVEL 2 - AREA PLAN  
SCALE: 3/16" = 1'-0"



2 LEVEL 1 - AREA PLAN  
SCALE: 3/16" = 1'-0"

ZONING CODE ANALYSIS

LAND USE CODE			
Section	Issue	Code Requirement	Remarks
General Information	Property Address Parcel Number Sec-Town-Range: Area of Site in SF Area of Site in acres Property Flood Information Zone	364 2ND AVE.  BLOCK 5 6,988 SF	
4-116A	4-116A NIWOT RURAL COMMUNITY DISTRICT 1 (NRCD 1)	PRINCIPAL USES PERMITTED OFFICE USES	
4-116C	LOT, BUILDING, AND STRUCTURE REQUIREMENTS	MINIMUM LOT SIZE = 3,500 SF MAXIMUM BUILDING HEIGHT = 30' 15 feet within 25 feet of rear property line where the rear lot line is adjacent to a parcel or right-of-way outside of the NRCD 1. 15 feet within 20 feet of the front property line in Blocks 5 and 6. Minimum setbacks a. Front yard Blocks 5, 6: (A) 20 feet along 2nd Avenue with the ability to reduce the front setback to 10 feet as long as the front and rear combined setbacks are not less than 20 feet. b. Side yard(i) Block 1, 2, 3, 4, 5, 6: 0 feet (ii) Interior parcel lines perpendicular to 2nd Avenue shall be considered a side yard. c. Rear yard (iii) Block 5: 10 feet with the ability to reduce to 0 feet as long as the front and rear combined setbacks are not less than 20 feet. Lot Coverage a. Definition: The percentage of total parcel area that can be covered by structures. Blocks 5, 6: 50%  Floor Area Ratio (FAR) a. Definition: The ratio of the total above grade building floor area to total lot area. (i) Blocks 1, 2, 5, 6: 0.6 (ii) Blocks 5, 6 can propose an increase in FAR from 0.6 to a maximum of 0.7 if all residential square footage, with the exception of garages and carports, is located above non-residential uses. The additional FAR can be approved through the review process if it is determined that: (A) The proposal does not negatively impact historic resources.  LOT SIZE = 6,988 SF / 2 50% = 3,494 SF MAXIMUM BUILDING COVERAGE  Proposed Level One Floor Area = 3,130 + 125 SF (exit stair and 2nd level overhang) = 3,255 SF Total Proposed Building Coverage  LOT SIZE = 6,988 SF X .6 = 4,192.8 ALLOWED FAR SF = 4,193  Level 1 SF = 3,130 SF + Level 2 SF = 1,050 SF = Total 4,180 SF proposed	EXISTING LOT SIZE = 6,988 SF
Article 4 - 4-116A	D. PARKING REQUIREMENTS	The Parking requirement is 1 parking space per 500 square feet of non-residential floor area.	4,180 SF (Level 1 - 3,130 + Level 2 - 1,050) / 500 = 8 parking spaces.
4-116A	E. NRCD 3. LANDSCAPING  6. BUILDING FORM	a. In Blocks 5 and 6 - paving shall not be permitted in the front yard within 10 feet of the front property line with the exception of a driveway, patios, and walkways. b. Deciduous trees are preferred in the front yard. Any type of shrubs shall be allowed. c. In Blocks 5 and 6, a minimum of 20% of the area within each parcel must consist of landscaping, which may include hardscaped plazas, outdoor seating/serving areas, walkways within on-site open space areas, and other similar hardscaped onsite amenities. Hardscaped elements shall account for no more than two-thirds of the minimum landscaped area requirement.  a. Roofs should conform with the existing roof styles on 2nd Avenue within the same block.	Walkways are proposed in front yard. Existing tree in front yard will remain.  Flat Roof to match 283 2nd Ave and 263 2nd Ave properties
4-116A	4-116A NIWOT RURAL COMMUNITY DISTRICT 1 (NRCD 1)	Reduction in Parking Requirement a. The County Engineer and Zoning Administrator may approve up to a maximum 40% reduction total in required spaces if the applicant can demonstrate in a Parking Reduction Plan b. The applicant must demonstrate that the project will meet the following criteria: (i) The proposed use(s) do not generate as much parking demand as the standards were designed to accommodate: (ii) The reduction in parking will not increase the demand for on street parking in the adjacent residential neighborhood. (iii) The applicant commits to obtain additional parking spaces (Contingency Parking) at such point in time as a County-led parking study of the NRCD 1 finds that, due to cumulative growth in NRCD 1 parking demand, on-street parking in the NRCD 1 is no longer sufficient to meet demand, as described in 4-116 D.4.b; and (iv) The reduction in parking shall not be contrary to the purpose of this Code. c. Methods that can be used to achieve the maximum 40% reduction include: (i) Use of Current Surplus Parking. A reduction of up to 10% of the allowed 40% reduction of required spaces may be approved if an applicant proposes to utilize the current surplus of district parking with a commitment to utilize the common parking area when and if it is constructed, or utilize other approved on-site or shared parking. (A) The Niwot Transportation and Connectivity Plan (NTCP) recognizes the potential future need for additional parking within the district. At the time of adoption of 4-116, as amended, parking demand does not warrant the construction of a common parking area as there is adequate supply to accommodate existing uses and a surplus to accommodate a moderate level of additional use. When a parking study finds that surplus parking no longer exists, property owners must implement commitments to obtain Contingency Parking. (B) Commitment to Contingency Parking. The following provisions apply to applicants relying on surplus parking capacity in the NRCD 1 to gain approval of a Parking Reduction Plan: (1) The applicant must commit to obtaining additional spaces in an amount equivalent to the amount of parking reduction (number of spaces) for which the property was previously approved. (2) Additional spaces can be obtained either on-site or through a parking agreement. (3) The applicant must commit to obtain additional parking spaces within 1 year of completion of the County-led parking study. This period may be extended for up to 1 year if the applicant can show additional spaces will be obtained in a parking lot or other project under construction. (ii) Multi-Modal: A reduction of up to 10% of the allowed 40% reduction of required spaces may be approved for implementing multi-modal strategies such as bike racks, bus pass or ride share benefits. The applicant shall provide passenger loading and staging areas for ridesharing and autonomous vehicles. The applicants must submit evidence that the staging areas are sufficient to meet demand and transportation behaviors and technology warrant a reduction in parking. (iii) Shared Parking: A reduction of the required spaces may be approved for implementing a shared parking agreement with one or more other properties located within the NRCD 1 or within a County approved lot. The property owner shall submit sufficient data to demonstrate that the parking demand associated with the properties holding the shared parking agreement is complimentary and the timing of peak demand for the uses on the properties is not coincident. Said data to include either information on standard parking demand associated with the use(s) in question from a professional publication such as those published by the Institute of Transportation Engineers (ITE) or the Urban Land Institute (ULI) or a professionally prepared parking study. (iv) The property owners involved in an approved shared parking request shall submit a written agreement approved by the Community Planning & Permitting Director requiring that the parking spaces be maintained as long as the uses requiring parking exist or unless and until the required parking is provided elsewhere in accordance with the provisions of this article. Prior to the issuance of a building permit or, for existing buildings, prior to the issuance of a Certificate of Occupancy, such written agreement shall be recorded by the property owners with the Boulder County Clerk and Recorder and a copy filed with the Community Planning & Permitting Department.  6. Credit will be given for on-street parking at a ratio of 1 space per 15 feet of street frontage in the area west of Franklin: 1 space per 25 feet of frontage for parcels with curb-cuts on 2nd Avenue; and, 1 space per 15 feet of street frontage for parcels without curb-cuts on 2nd Avenue in the area east of Franklin Street.	Parcel will not contain a curb-cut. Parcel is on 2nd Avenue and is east of Franklin  50' of frontage / 15' = 3 Parking spaces









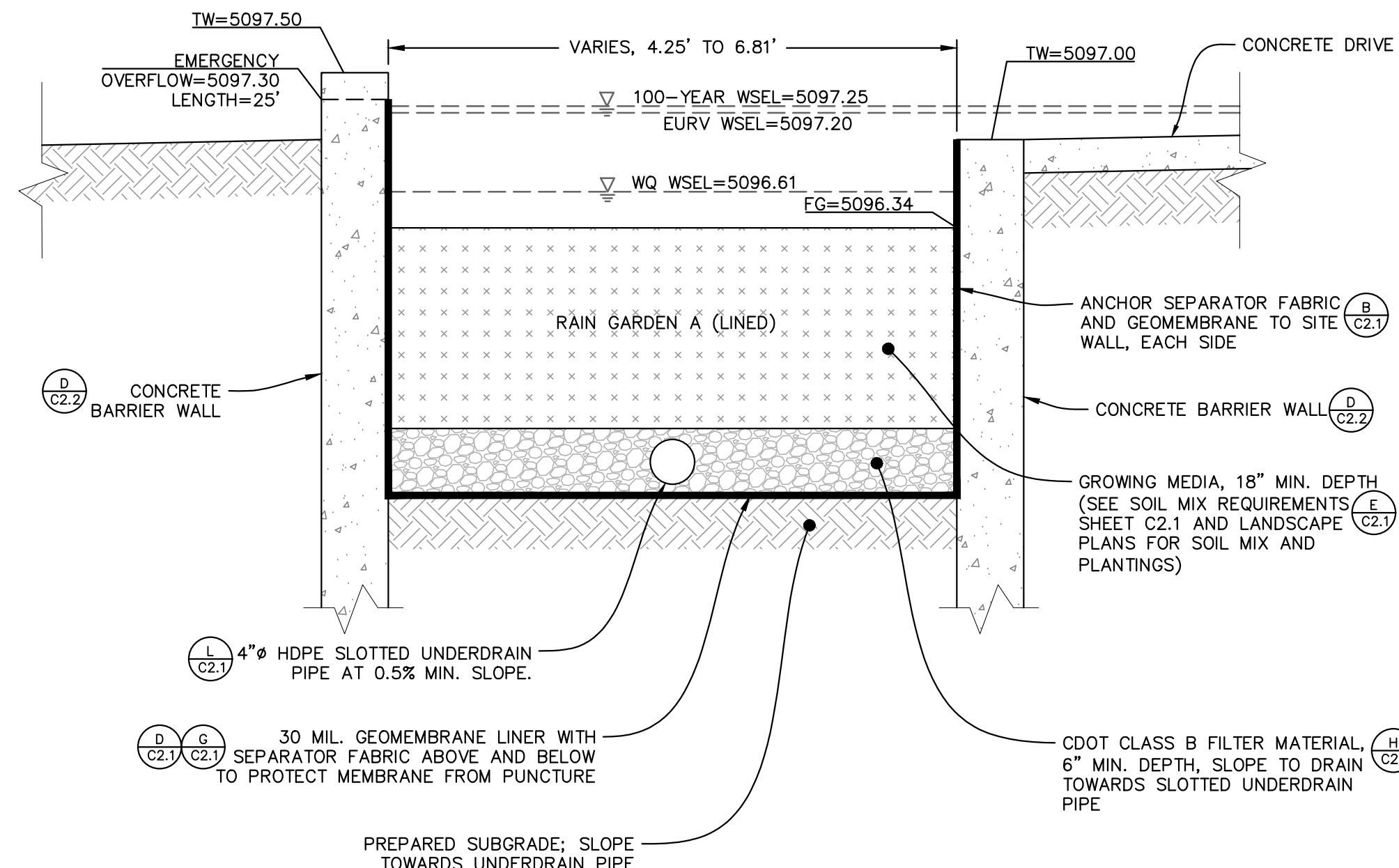




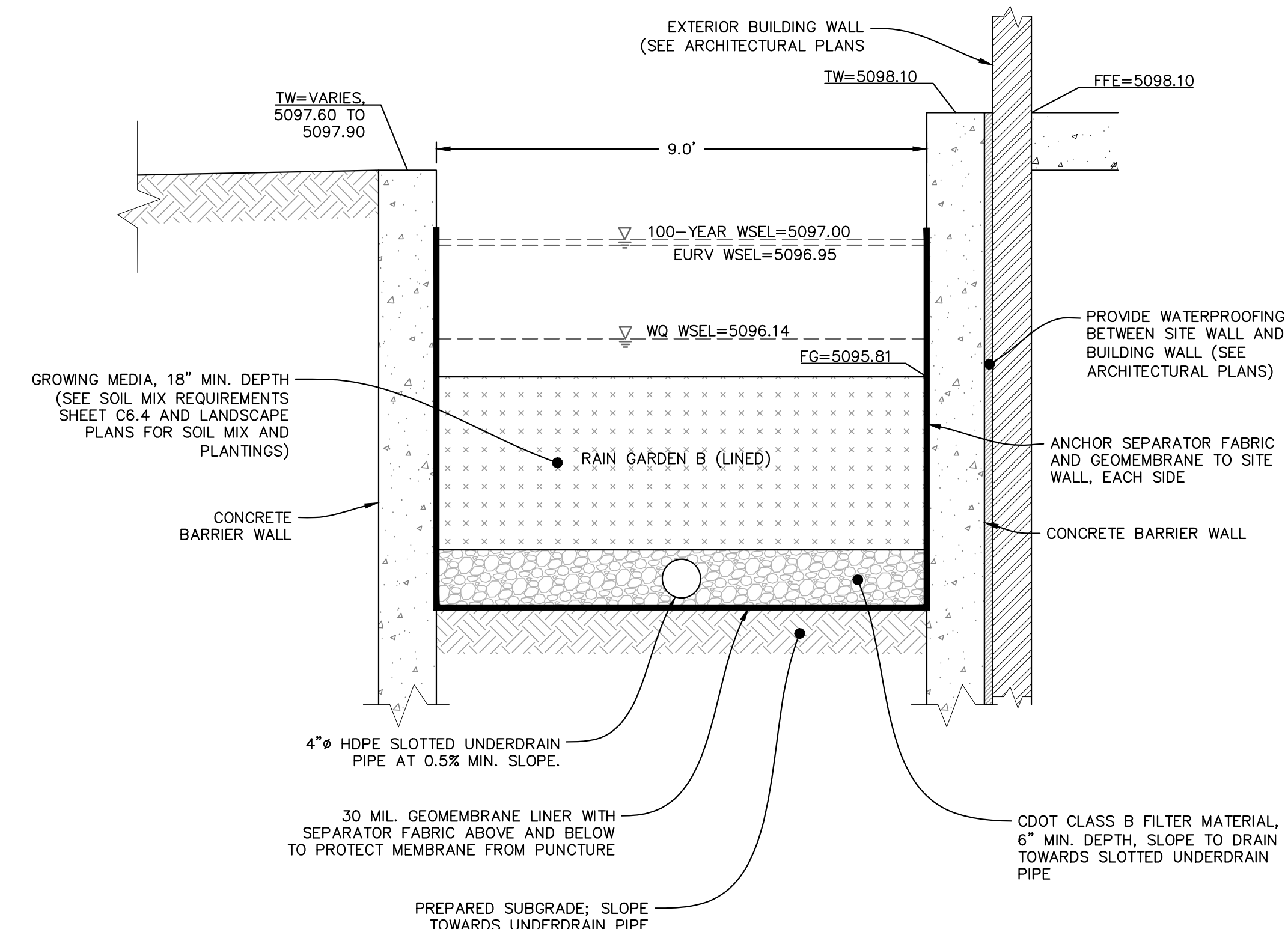




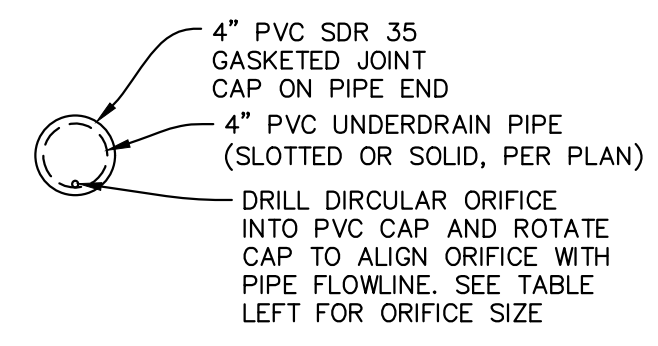




**RAIN GARDEN A SECTION THROUGH PLANTER**  
NO SCALE

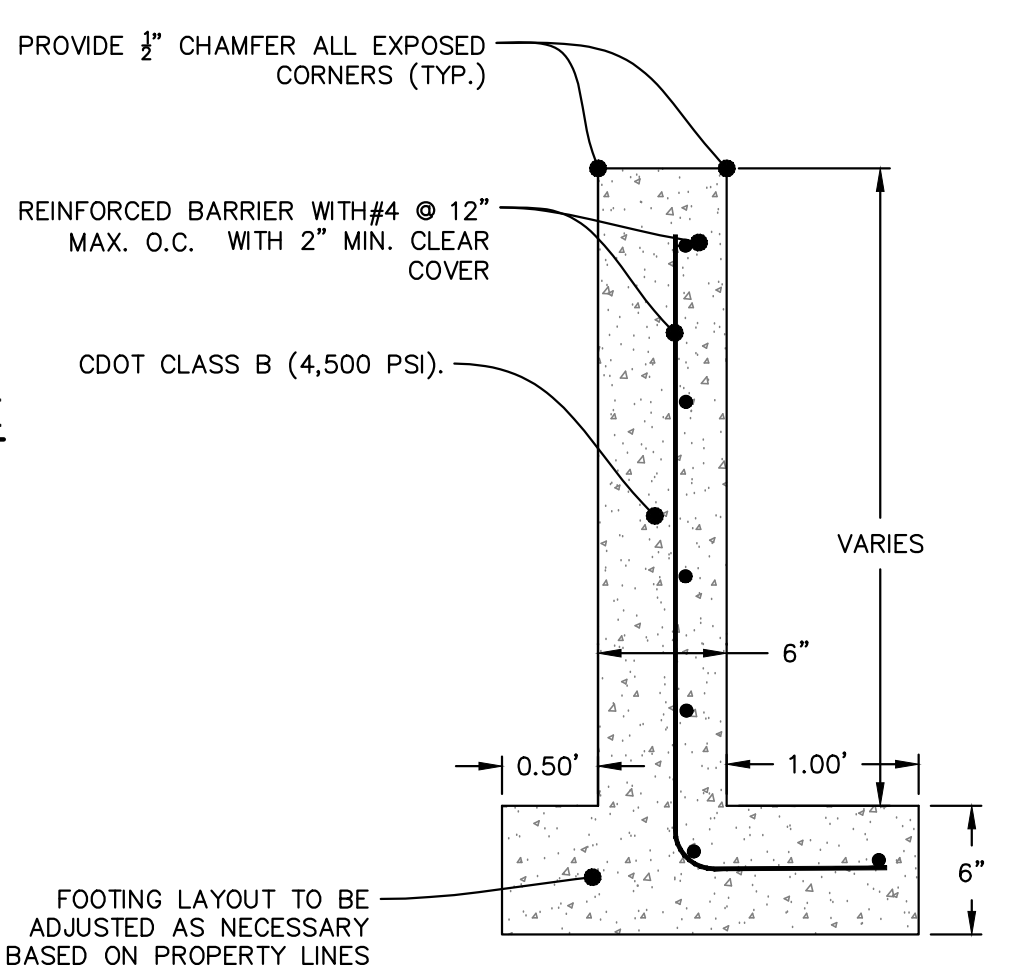


**RAIN GARDEN B SECTION THROUGH PLANTER**  
NO SCALE

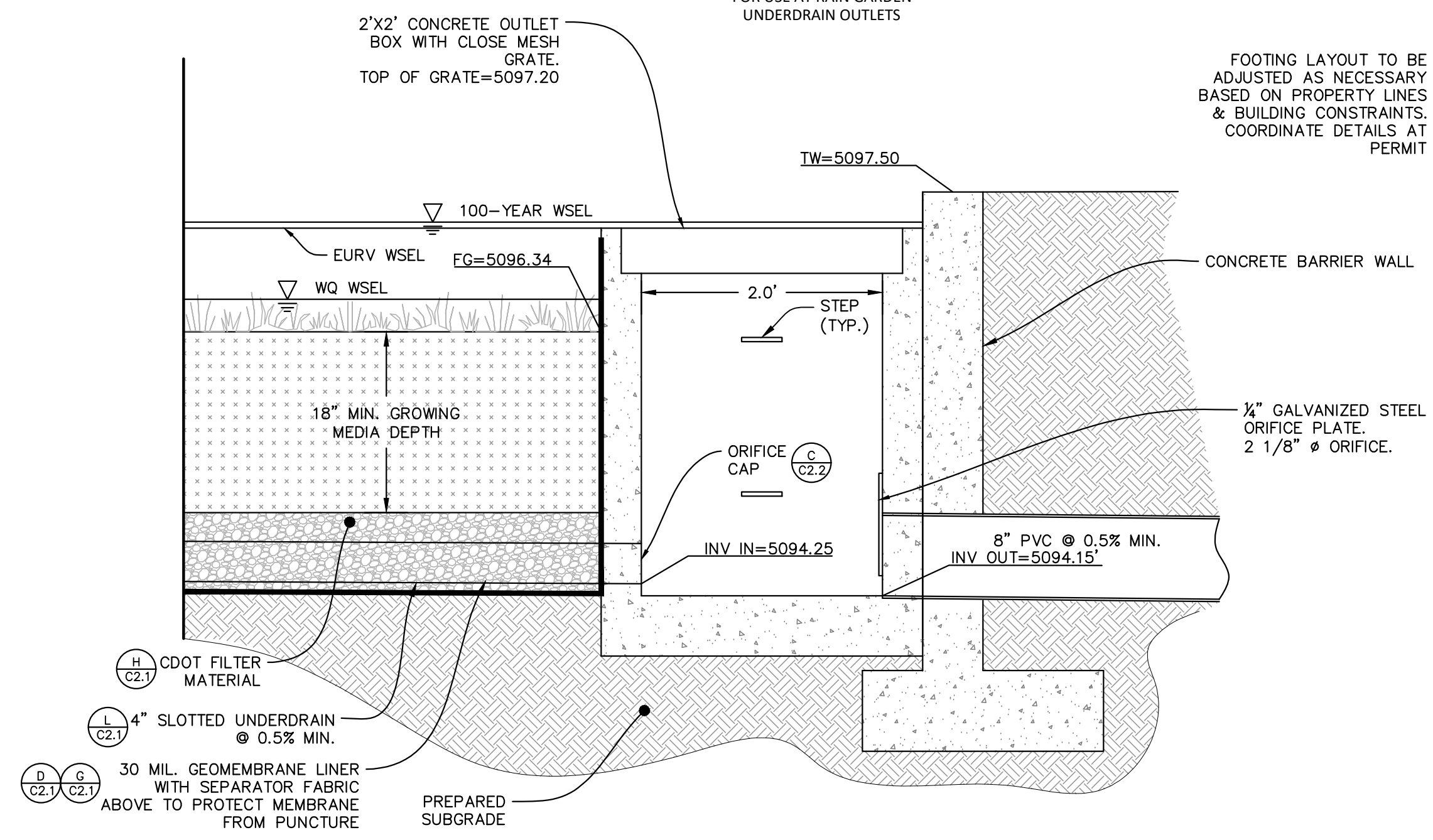


**ORIFICE SIZE TABLE**

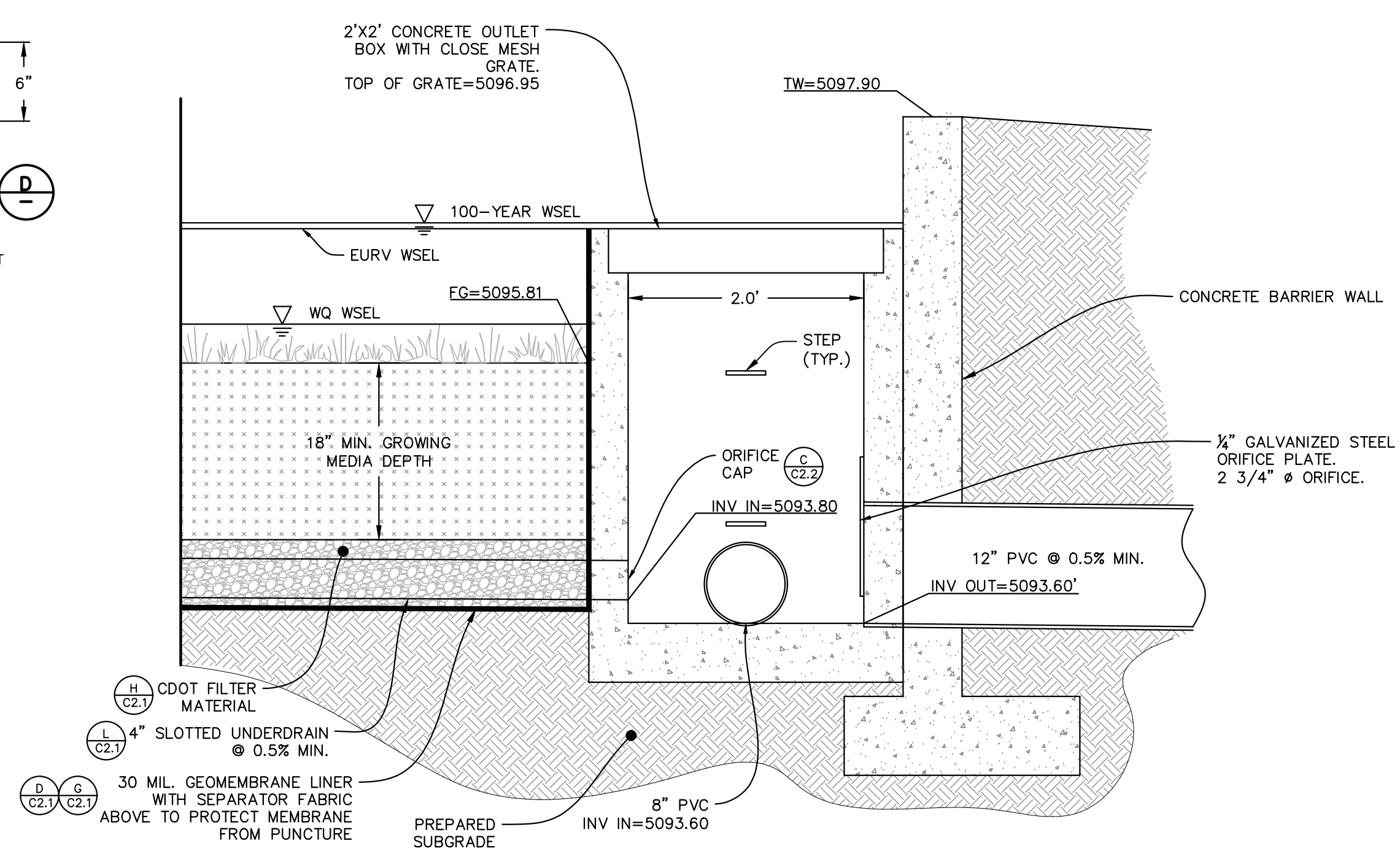
RAIN GARDEN	ORIFICE DIA.
A	3/16"
B	1/4"



**PRELIMINARY CONCRETE RAINGARDEN BARRIER**  
FINAL DESIGN TO BE COORDINATED WITH STRUCTURAL ENGINEER AT BUILDING PERMIT



**RAIN GARDEN A OUTLET STRUCTURE**  
NO SCALE



**RAIN GARDEN B OUTLET STRUCTURE**  
NO SCALE

PREPARED BY:  
  
**The Sanitas Group**  
101 FRONT ST, SUITE 350  
LOUISVILLE, CO 80027  
720.481.2710  
PROJECT CONTACT:  
CURTIS C. STEVENS, P.E.

PREPARED FOR:  
**ASHLEY NILES PROPERTIES, LLC**  
P.O. BOX 396  
NIWOT, COLORADO

SPR DOCUMENTS FOR:  
**364 2ND AVE**  
UNINCORPORATED BOULDER COUNTY  
STATE OF COLORADO

ISSUE	DATE
SPR	9/22/2022
DESIGNED BY:	TSG
DRAWN BY:	TSG
CHECKED BY:	CCS

DRAWING SCALE:  
HORIZONTAL: NONE  
VERTICAL: NONE

**PRELIM STORM DETAILS (2 OF 2)**  
PROJECT NO. B1418

**C2.2**  
SHEET: 5 OF 5

## **PRELIMINARY DRAINAGE REPORT**

For

### **NILES FAMILY DENTISTRY**

364 2<sup>nd</sup> Avenue  
Niwot, Colorado

September 2022

Prepared For:

**Niles Properties LLC**

P.O. Box 294

Florissant, CO 80816

Contact: Ashley Niles

Prepared By:



**The Sanitas Group, LLC**

901 Front Street, Suite 350

Louisville, CO 80027

Contact: Curtis C. Stevens, P.E., CFM

Mark L. Murphy, P.E., CFM



**FINAL DRAINAGE REPORT**  
For  
**NILES FAMILY DENTISTRY**  
364 2<sup>nd</sup> Avenue  
Niwot, Colorado

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## **CERTIFICATION STATEMENT**

I hereby certify that this plan and report for the preliminary drainage design of Niles Family Dentistry was prepared by me, or under my direct supervision, in accordance with the provisions of the Boulder County Storm Drainage Criteria Manual.

For and On Behalf Of:  
***The Sanitas Group, LLC***

---

Registered Professional Engineer

State of Colorado No. 40337



## 1.0 INTRODUCTION

This **Preliminary Drainage Report** [Report] is prepared on behalf of Niles Properties LLC for the proposed **Niles Family Dentistry** redevelopment project. The purpose of this report is to address the Boulder County [County] requirements for a “Preliminary Drainage Report and Plan” as outlined in Section 200 “Submittals”, “*Storm Drainage Criteria Manual*” [1]. This Report documents the existing drainage conditions present at the site and provides an analysis of the drainage conditions and water quality measures proposed for the **Niles Family Dentistry** redevelopment project.

## 2.0 EXISTING SITE CONDITIONS

The proposed project site is located at 364 2<sup>nd</sup> Avenue and is in the Southeast quarter of Section 25, Township 2 North, Range 70 West of the 6th P.M., County of Boulder, State of Colorado.

The 6,987-sf (0.160 acre) property is located within Lots 19 and 20, Block 26, Niwot, and measures 140-ft by 50±-ft.

The property is located on the northeast side of 2<sup>nd</sup> Avenue with an access drive off of 2<sup>nd</sup> Avenue. There is a 20-ft wide alley adjacent to the northeast side of the property. Commercial properties are located to the northwest and southeast of the site.

As shown on the “*Existing Conditions Drainage Plan*” included in the back pocket of this report, the existing site is currently developed with a one-story building and associated gravel drive, wood decks, and landscaping. There is an existing 4-ft wide concrete sidewalk on the northeast side of 2<sup>nd</sup> Avenue. Existing vegetation consists of grasses and trees.

The project site is within the Dry Creek drainage basin. Dry Creek is located approximately 2,100-ft east of the site. There is an existing 30-inch RCP storm sewer in 2<sup>nd</sup> Avenue and four grated inlets on the northeast side of 2<sup>nd</sup> Avenue, between Niwot Road and Franklin Street. The storm sewer drains to the northwest to Franklin Street, then northeast to Neva Road, discharging into a roadside ditch on the south side of Neva Road. The ditch drains to the east, then south to a detention pond located in the Johnson Farm Replat 1 subdivision before discharging into Dry Creek.

USDA Natural Resources Conservation Service classified the soils on the property as Nunn sandy clay loam (NnA) soils, having a Group C hydrologic soil [2].

As delineated on FEMA Flood Insurance Rate Map 08013CO410J, effective date 18 December 2012 [3], the project site is not impacted by a regulatory 100-year or 500-year floodplain. The site is located within FEMA Flood Zone X (area of minimal flood hazard).

### **3.0 PROPOSED DEVELOPEMENT**

The proposed redevelopment of the **364 2<sup>nd</sup> Avenue** site will consist of the construction of a new two-story commercial building and a parking lot on the northeast portion of the site, accessed from the adjacent alley.

The proposed development layout and grading are shown on the “*Proposed Conditions Drainage Plan*” included in Appendix F of this report.

### **4.0 DESIGN CRITERIA**

This Report was prepared using the criteria outlined in the Boulder County “*Storm Drainage Criteria Manual*”, [Criteria] [1], the Mile High Flood District [MHFD] “*Urban Storm Drainage Criteria Manual, Volumes 1 and 2*” [4], and the Mile High Flood District “*Urban Storm Drainage Criteria Manual, Volume 3 – Best Management Practices*” [5].

### **5.0 HYDROLOGY**

The rational method was used to calculate runoff rates for the 2-year, 5-year, 10-year and 100-year storm events. The 5-year and 100-year events are presented as the minor and major design storms, respectively. Per Section 501 of the Criteria, NOAA Atlas 2 point rainfall values shall be used as long as the UDFCD (now known as the MHFD) continues to prefer Atlas 2 to Atlas 14. In 2016 MHFD adopted the new Atlas 14 values, therefore, NOAA Atlas 14 point rainfall values were used in this drainage report.

No known Master Drainage Plans have been prepared for the project site.



### Existing Conditions

The existing drainage basins are delineated on the “Existing Conditions Drainage Plan” provided in Appendix F of this report. Drainage basin delineation, storm flow directions and off-site drainage conditions were determined visually during a site visit in June 2022. The site does not appear to receive any significant offsite drainage.

The existing site has been delineated into two drainage basins labeled Basin A1x and A2x where the “x” denotes existing conditions.

#### Basin A1x

Drainage Basin A1x is 0.11 acres consisting of the northeasterly portion of the existing building, wooden decks and landscape area on the northeasterly portion of the site. Runoff from Basin A1x drains southeasterly onto the adjacent property to the southeast of the subject property, designated Design Point (DP) 1.

#### Basin A2x

Drainage Basin A2x is 0.05 acres consisting of the southwesterly portion of the existing building, wooden decks, gravel driveway and landscape area on the southwesterly portion of the site. Runoff from Basin A2x drains southwesterly to the public storm sewer system in 2<sup>nd</sup> Avenue, designated DP 2.

Existing conditions storm water runoff is presented in Table 5.4. Basin description, imperviousness, weighted runoff coefficients, time of concentration and runoff values are provided for the existing drainage basin on a worksheet labeled “Rational Method Calculations” provided in Appendix B. For ease of reference, the existing conditions storm water flows are presented on the “Existing Conditions Drainage Plan” provided in the back pocket of this report.

**Table 5.4: Storm Runoff by Basin – Existing Conditions**

Basin I.D.	Design Point	5-year Minor Design Storm Runoff [cfs]	100-year Major Design Storm Runoff [cfs]
A1x	1	0.06	0.48
A2x	2	0.05	0.26

### Proposed Conditions

The proposed on-site drainage basins are delineated on the “*Proposed Conditions Drainage Plan*” provided in Appendix F of this report.

With the development proposal, the site is divided into two drainage basins, labeled Basins A1 and A2.

#### Basin A1

Drainage Basin A1 is 0.07 acres covering the northeast portion of the site and consists of the concrete and permeable paver parking lot and landscape area including Rain Garden A, located on the east side of the parking lot. Approximately 1,066-sf of permeable pavers will be used in the parking lot as a Low Impact Development (LID) feature. Runoff from Basin A1 will drain to Rain Garden A, then drain to the Rain Garden B outlet structure via a private 8” PVC storm sewer. A new 12” PVC storm sewer approximately 24-ft long will tie into the existing grated inlet in 2<sup>nd</sup> Avenue.

#### Basin A2

Drainage Basin A2 is 0.09 acres covering the southwest portion of the site, consisting of the proposed building, concrete sidewalks and landscape area including Rain Garden B, located adjacent to 2<sup>nd</sup> Avenue. Runoff from Basin A2 will drain to Rain Garden B, then release to the public storm sewer in 2<sup>nd</sup> Avenue via a 12” PVC storm sewer.

Proposed conditions storm water runoff for each basin is presented in Table 5.5. Basin description, imperviousness, weighted runoff coefficients, time of concentration and runoff values are provided for the proposed drainage basin on a worksheet labeled “*Rational Method Calculations*” provided in Appendix B. For ease of reference, the proposed conditions storm water flows are presented on the “*Proposed Conditions Drainage Plan*” provided in the back pocket of this report. A comparison of Existing and Proposed Conditions runoff rates for the two primary design points and overall site is presented in Table 5.6.



**Table 5.5: Storm Runoff by Basin – Proposed Conditions – Phase 2**

Basin I.D.	Design Point	5-year Minor Design Storm Runoff [cfs]	100-year Major Design Storm Runoff [cfs]
A1		0.13	0.50
A2		0.23	0.67
	1	0.00	0.00
	2	0.01	0.47

**Table 5.6: Storm Runoff Comparison**

Design Point	5-year Minor Design Storm Runoff [cfs]		$\Delta$ [cfs]	100-year Major Design Storm Runoff [cfs]		$\Delta$ [cfs]
	Existing Conditions	Proposed Conditions		Existing Conditions	Proposed Conditions	
1	0.06	0.00	-0.06	0.48	0.00	-0.48
2	0.05	0.01	-0.04	0.26	0.47	0.21
Overall Site	0.11	0.01	-0.10	0.74	0.47	-0.27

The proposed redevelopment project will result in decreases in runoff rates for the overall site compared to existing conditions due to the proposed rain gardens and controlled release rates through the outlet structures. Since all onsite runoff is directed to the proposed rain gardens, the runoff draining to the adjacent property at Design Point 1 will be eliminated, resulting in a slight increase in runoff at Design Point 2 during the 100-year major design storm.

## 6.0 HYDRAULICS

The proposed storm sewer is sized to convey the major storm runoff. Hydraulic calculations are provided in Appendix C.

## 7.0 STORM WATER DETENTION

Stormwater detention is required on the site to limit proposed conditions runoff rates to the existing conditions runoff rates. Two rain gardens will be utilized to provide both water quality treatment and stormwater detention. Rain Garden A will contain an 8" PVC outlet pipe to convey the discharge

from the outlet structure to the Rain Garden B outlet structure. The Rain Garden B outlet structure will convey the discharge from the rain gardens to the public storm sewer in 2<sup>nd</sup> Avenue via a 12-inch PVC outlet pipe. MHFD-Detention\_v4.05 was used to size the rain gardens and outlet structures. The peak runoff rates at the two design points and overall site are provided in Table 5.6.

## **8.0 STORMWATER QUALITY AND EROSION CONTROL**

The proposed project will implement permanent stormwater quality treatment Best Management Practices (BMPs) by utilizing two rain gardens (combination water quality and stormwater detention) to treat the runoff from the site. The rain gardens will contain an 18-inch growing media layer above 6-inches (minimum) of filter material with an underdrain within the filter material layer. The rain garden outlet structures are designed in accordance with MHFD recommendations to release the water quality capture volume (WQCV) over a 12 hour drain time. The outlet structures will also control the release of the excess urban runoff volume (EURV) and major design storm. The outflow from the rain garden outlet structures will discharge to the public storm sewer in 2<sup>nd</sup> Avenue.

The USDA Natural Resources Conservation Service soil classification on the project site is Nunn sandy clay loam, having a Group C hydrologic soil rating [2]. Group C soils typically have a slow infiltration rate when saturated. Based on the Group C soil rating and close proximity of the rain gardens to the proposed building, the rain gardens will be designed for no infiltration with a 4-inch slotted PVC underdrain.

Water quality calculations are provided in Appendix E.

Construction Best Management Practices [BMPs] will be installed prior to and during construction, to restrict the amount of sediment transported offsite by either wind or water. Construction BMPs include vehicle tracking control at the construction entrance, silt fencing, concrete washouts, and dust control. Detailed construction erosion control/stormwater management plans will be provided with the construction/permit documents.



## **9.0 WETLAND IMPACTS**

There are no known wetlands located on the project site.

## **10.0 CONCLUSIONS**

This Report meets the County's requirements for Preliminary Drainage Report information as outlined in the Criteria. The Report documents the existing drainage conditions present at the site and provides an analysis of the drainage conditions and water quality measures proposed for the **Niles Family Dentistry** redevelopment project. The proposed redevelopment will not adversely affect downstream drainage facilities or properties. Runoff rates for the minor and major storms will be less than existing runoff rates for the overall site.

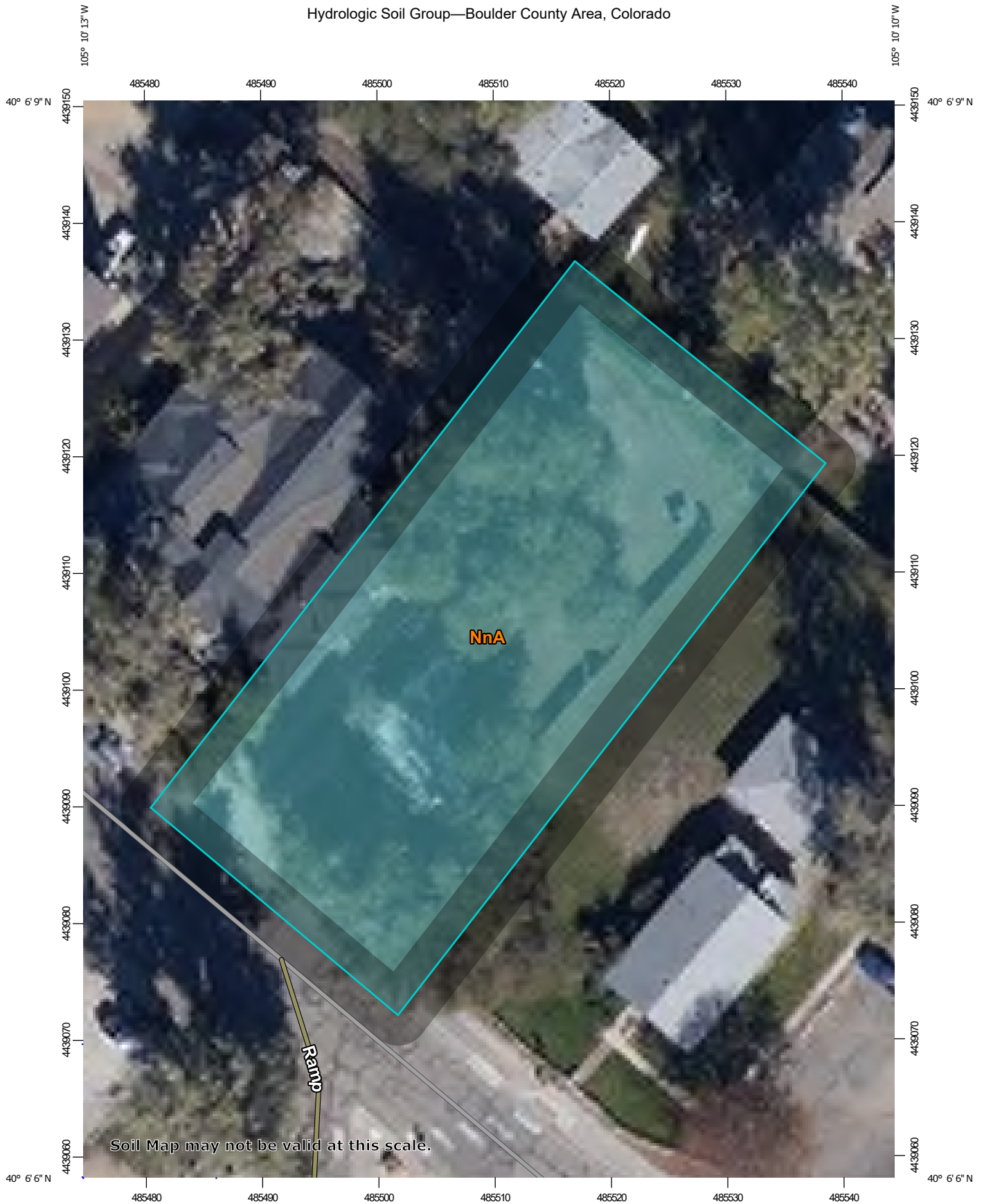
## 11.0 REFERENCES

- [1] “*Storm Drainage Criteria Manual*”, Boulder County, Latest Edition.
- [2] Soils Map, “*Web Soil Survey 3.0*”, USDA Natural Resources Conservation Service, June 2022.
- [3] “Flood Insurance Rate Map”, Federal Emergency Management Agency, Map Number 08013C0410], effective date 18 December 2012.
- [4] “*Urban Storm Drainage Criteria Manual, Volumes 1 and 2*”, Mile High Flood District, August 2018.
- [5] “*Urban Storm Drainage Criteria Manual, Volume 3 – Best Management Practices*” Urban Mile High Flood District, October 2019.

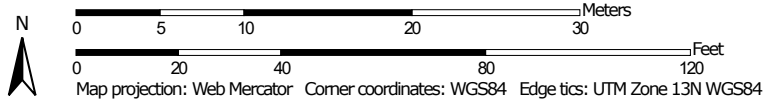


**APPENDIX A**  
Maps, Tables, and Figures

Hydrologic Soil Group—Boulder County Area, Colorado


































Map Scale: 1:450 if printed on A portrait (8.5" x 11") sheet.





## MAP LEGEND

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

## 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: Boulder County Area, Colorado  
 Survey Area Data: Version 18, Sep 2, 2021

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

Date(s) aerial images were photographed: Oct 1, 2018—Oct 31, 2018

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

## Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
NnA	Nunn sandy clay loam, 0 to 1 percent slopes	C	0.4	100.0%
<b>Totals for Area of Interest</b>			<b>0.4</b>	<b>100.0%</b>

### 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



*Tie-break Rule:* Higher

coefficients. Runoff coefficients are also presented and organized by imperviousness, soil type, and return period in Table 600-6 at the end of this section.

**Table 600-2. Recommended Percentage Imperviousness Values (UDFCD, 2016)**

Land Use or Surface Characteristics	Percentage Imperviousness
<i>Business</i>	
Downtown areas	95
Suburban areas	75
<i>Residential</i>	
Single-family	
2.5 acres or larger	12
0.75 – 2.5 acres	20
0.25 – 0.75 acres	30
0.25 acres or less	45
Apartments	75
<i>Industrial</i>	
Light areas	80
Heavy areas	90
Parks, cemeteries	10
Playgrounds	25
Schools	55
Railroad yard areas	50
<i>Undeveloped Areas</i>	
Historic flow analysis	2
Greenbelts, agricultural	2
Off-site flow analysis (when land use is not defined)	45
<i>Streets</i>	
Paved	100
Gravel (packed)	40
Drive and walks	90
Roofs	90
Lawns, sandy soil	2
Lawns, clayey soil	2



**Table 600-6. Rational Method Runoff Coefficient, C (Page 1 of 2) (UDFCD, 2016)**

Percentage Imperviousness	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
<b>Type A NRCS Hydrologic Soil Group</b>						
2	0.02	0.02	0.02	0.02	0.02	0.17
5	0.04	0.05	0.05	0.05	0.05	0.19
10	0.09	0.09	0.09	0.09	0.10	0.23
15	0.13	0.14	0.14	0.14	0.14	0.28
20	0.18	0.19	0.19	0.19	0.19	0.32
25	0.22	0.23	0.24	0.24	0.24	0.36
30	0.27	0.28	0.28	0.28	0.29	0.40
35	0.31	0.33	0.33	0.33	0.33	0.44
40	0.36	0.37	0.38	0.38	0.38	0.48
45	0.40	0.42	0.42	0.42	0.43	0.52
50	0.45	0.47	0.47	0.47	0.48	0.56
55	0.49	0.51	0.52	0.52	0.52	0.60
60	0.53	0.56	0.56	0.57	0.57	0.64
65	0.58	0.6	0.61	0.61	0.62	0.68
70	0.62	0.65	0.66	0.66	0.67	0.72
75	0.67	0.70	0.71	0.71	0.71	0.76
80	0.71	0.74	0.75	0.76	0.76	0.80
85	0.76	0.79	0.80	0.80	0.81	0.84
90	0.80	0.84	0.85	0.85	0.86	0.88
95	0.85	0.88	0.89	0.90	0.90	0.92
100	0.89	0.93	0.94	0.94	0.95	0.96
<b>Type B NRCS Hydrologic Soil Group</b>						
2	0.02	0.02	0.14	0.24	0.38	0.46
5	0.04	0.05	0.17	0.27	0.39	0.48
10	0.09	0.09	0.21	0.30	0.42	0.50
15	0.13	0.14	0.25	0.34	0.45	0.53
20	0.18	0.19	0.29	0.37	0.48	0.55
25	0.22	0.23	0.33	0.41	0.51	0.58
30	0.27	0.28	0.37	0.44	0.54	0.60
35	0.31	0.33	0.41	0.48	0.57	0.63
40	0.36	0.37	0.45	0.51	0.60	0.65
45	0.40	0.42	0.49	0.55	0.63	0.67
50	0.45	0.47	0.53	0.58	0.66	0.70

**Table 600-6. Rational Method Runoff Coefficient, C (Page 2 of 2) (UDFCD, 2016)**

Percentage Imperviousness	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
55	0.49	0.51	0.57	0.62	0.69	0.72
60	0.53	0.56	0.61	0.65	0.72	0.75
65	0.58	0.60	0.65	0.69	0.75	0.77
70	0.62	0.65	0.69	0.72	0.78	0.80
75	0.67	0.70	0.73	0.76	0.81	0.82
80	0.71	0.74	0.77	0.79	0.84	0.85
85	0.76	0.79	0.81	0.83	0.87	0.87
90	0.80	0.84	0.85	0.86	0.89	0.90
95	0.85	0.88	0.89	0.90	0.92	0.92
100	0.89	0.93	0.94	0.94	0.95	0.94
Type C/D NRCS Hydrologic Soil Groups						
2	0.02	0.07	0.22	0.32	0.43	0.52
5	0.04	0.10	0.24	0.34	0.45	0.53
10	0.09	0.14	0.27	0.37	0.47	0.55
15	0.13	0.18	0.31	0.41	0.50	0.58
20	0.18	0.23	0.35	0.44	0.53	0.60
25	0.22	0.27	0.39	0.47	0.55	0.62
30	0.27	0.31	0.42	0.50	0.58	0.64
35	0.31	0.36	0.46	0.53	0.61	0.67
40	0.36	0.40	0.50	0.57	0.63	0.69
45	0.40	0.44	0.53	0.60	0.66	0.71
50	0.45	0.49	0.57	0.63	0.69	0.73
55	0.49	0.53	0.61	0.66	0.72	0.76
60	0.53	0.57	0.64	0.69	0.74	0.78
65	0.58	0.62	0.68	0.73	0.77	0.80
70	0.62	0.66	0.72	0.76	0.80	0.82
75	0.67	0.70	0.76	0.79	0.82	0.85
80	0.71	0.75	0.79	0.82	0.85	0.87
85	0.76	0.79	0.83	0.85	0.88	0.89
90	0.80	0.83	0.87	0.89	0.90	0.91
95	0.85	0.88	0.90	0.92	0.93	0.94
100	0.89	0.92	0.94	0.95	0.96	0.96

**APPENDIX B**  
Hydrology Calculations



**Rational Method Calculations**  
**Overall Site**  
**Existing Conditions**



Project: 364 2nd Avenue  
 SG Project I.D.: B1418

Prepared By: MLM  
 Reviewed By: CCS  
 Date: 09/19/22

**Basin Description:** Overall Site

**NRCS Soil Type:** NnA, Nunn sandy clay loam

**NRCS Hydrologic Soil Rating:** C

**Basin Area=** 0.16 [acres] = 6,987 [sf]

Surface Characteristics <sup>1</sup>	Sub-Area [sf]	Imp [%]	Runoff Coefficients <sup>1</sup>			
			C <sub>2</sub>	C <sub>5</sub>	C <sub>10</sub>	C <sub>100</sub>
Asphalt	0	100	0.89	0.92	0.94	0.96
Concrete Drives & Walks	39	90	0.80	0.83	0.87	0.91
Roofs	943	90	0.80	0.83	0.87	0.91
Gravel (packed)	1063	40	0.36	0.40	0.50	0.69
Lawns, clayey	4942	2	0.02	0.07	0.22	0.52

<sup>1</sup> Boulder County "Storm Drainage Criteria Manual", Table 600-2 and 600-6

**Weighted Percent Imperviousness :**

I [%] = 20.15      A<sub>I</sub> = 1,407.85 [sf]

**Weighted Runoff Coefficients:**

C<sub>2</sub> = 0.18      C<sub>5</sub> = 0.23      C<sub>10</sub> = 0.35      C<sub>100</sub> = 0.60

# Rational Method Calculations

## Basin A1x Existing Conditions



Project: 364 2nd Avenue  
SG Project I.D.: B1418

Prepared By: MLM  
Reviewed By: CCS  
Date: 09/19/22

### Basin Description:

NRCS Soil Type: NnA, Nunn sandy clay loam

NRCS Hydrologic Soil Rating: C

Basin Area= 0.11 [acres] = 4,922 [sf]

Surface Characteristics <sup>1</sup>	Sub-Area [sf]	Imp [%]	Runoff Coefficients <sup>1</sup>			
			C <sub>2</sub>	C <sub>5</sub>	C <sub>10</sub>	C <sub>100</sub>
Asphalt	0	100	0.89	0.92	0.94	0.96
Concrete Drives & Walks	0	90	0.80	0.83	0.87	0.91
Roofs	542	90	0.80	0.83	0.87	0.91
Gravel (packed)	452	40	0.36	0.40	0.50	0.69
Lawns, clayey	3928	2	0.02	0.07	0.22	0.52

<sup>1</sup> Boulder County "Storm Drainage Criteria Manual", Table 600-2 and 600-6

### Weighted Percent Imperviousness :

I [%] = 15.18      A<sub>1</sub> = 747.17 [sf]

### Weighted Runoff Coefficients:

C<sub>2</sub> = 0.14      C<sub>5</sub> = 0.18      C<sub>10</sub> = 0.32      C<sub>100</sub> = 0.58

### Time of Concentration:

#### Sheet Flow:

L<sub>i</sub> [ft] = 64

S<sub>i</sub> [%] = 2.40

t<sub>i</sub> [min] = 9.91

#### Concentrated Flow:

L<sub>t1</sub> [FT] = 0

L<sub>t2</sub> [FT] = 0

S<sub>t1</sub> [%] = 2.00

S<sub>t2</sub> [%] = 0.00

K<sub>1</sub><sup>3</sup> = 15.00

K<sub>2</sub><sup>3</sup> = 15.00

V<sub>t1</sub> [fps]<sup>4</sup> = 2.12

V<sub>t2</sub> [fps]<sup>4</sup> = 0.00

t<sub>t1</sub> [min] = 0.00

t<sub>t2</sub> [min] = 0.00

<sup>3</sup> BCSDCM, Table 600-1

<sup>4</sup> BCSDCM, Eqn 600.4

t<sub>t</sub> [min] = 0.00

### Time of Concentration:

t<sub>c</sub> = t<sub>i</sub> + t<sub>t</sub> [min] = 9.91

t<sub>c</sub> (minimum) = 5 min

t<sub>c</sub> [min] = 9.9

Check for Urbanized Basins:

t<sub>c</sub><sup>5</sup> [min] = 16.21

<sup>5</sup> Boulder County "Storm Drainage Criteria Manual", Eqn 600.5

### Rainfall Intensity<sup>6</sup>

I<sub>2</sub> [in/hr] = 2.14

I<sub>5</sub> [in/hr] = 2.90

I<sub>10</sub> [in/hr] = 3.69

I<sub>100</sub> [in/hr] = 7.33

<sup>6</sup> Boulder County "Storm Drainage Criteria Manual", Eqn 500.1, NOAA Atlas 14

### Runoff - Rational Method Equation<sup>7</sup>

Q<sub>2</sub> [cfs] = 0.03

Q<sub>5</sub> [cfs] = 0.06

Q<sub>10</sub> [cfs] = 0.13

Q<sub>100</sub> [cfs] = 0.48

<sup>7</sup> Boulder County "Storm Drainage Criteria Manual", Eqn 600.1

# Rational Method Calculations

## Basin A2x

### Existing Conditions



Project: 364 2nd Avenue  
SG Project I.D.: B1418

Prepared By: MLM  
Reviewed By: CCS  
Date: 09/19/22

#### Basin Description:

NRCS Soil Type: NnA, Nunn sandy clay loam

NRCS Hydrologic Soil Rating: C

Basin Area= 0.05 [acres] = 2,065 [sf]

Surface Characteristics <sup>1</sup>	Sub-Area [sf]	Imp [%]	Runoff Coefficients <sup>1</sup>			
			C <sub>2</sub>	C <sub>5</sub>	C <sub>10</sub>	C <sub>100</sub>
Asphalt	0	100	0.89	0.92	0.94	0.96
Concrete Drives & Walks	39	90	0.80	0.83	0.87	0.91
Roofs	401	90	0.80	0.83	0.87	0.91
Gravel (packed)	611	40	0.36	0.40	0.50	0.69
Lawns, clayey	1015	2	0.02	0.07	0.22	0.52

<sup>1</sup> Boulder County "Storm Drainage Criteria Manual", Table 600-2 and 600-6

#### Weighted Percent Imperviousness :

I [%] = 31.97      A<sub>I</sub> = 660.25 [sf]

#### Weighted Runoff Coefficients:

C<sub>2</sub> = 0.29      C<sub>5</sub> = 0.33      C<sub>10</sub> = 0.44      C<sub>100</sub> = 0.65

#### Time of Concentration:

##### Sheet Flow:

L<sub>i</sub> [ft] = 40

S<sub>i</sub> [%] = 2.00

t<sub>i</sub> [min] = 7.00

##### Concentrated Flow:

L<sub>t1</sub> [FT] = 0

L<sub>t2</sub> [FT] = 0

S<sub>t1</sub> [%] = 2.00

S<sub>t2</sub> [%] = 0.00

K<sub>1</sub><sup>3</sup> = 15.00

K<sub>2</sub><sup>3</sup> = 15.00

V<sub>t1</sub> [fps]<sup>4</sup> = 2.12

V<sub>t2</sub> [fps]<sup>4</sup> = 0.00

t<sub>t1</sub> [min] = 0.00

t<sub>t2</sub> [min] = 0.00

<sup>3</sup> BCSDCM, Table 600-1

<sup>4</sup> BCSDCM, Eqn 600.4

t<sub>t</sub> [min] = 0.00

#### Time of Concentration:

t<sub>c</sub> = t<sub>i</sub> + t<sub>t</sub> [min] = 7.00

t<sub>c</sub> (minimum) = 5 min

t<sub>c</sub> [min] = 7.0

Check for Urbanized Basins:

t<sub>c</sub><sup>5</sup> [min] = 13.44

<sup>5</sup> Boulder County "Storm Drainage Criteria Manual", Eqn 600.5

#### Rainfall Intensity<sup>6</sup>

I<sub>2</sub> [in/hr] = 2.43

I<sub>5</sub> [in/hr] = 3.29

I<sub>10</sub> [in/hr] = 4.18

I<sub>100</sub> [in/hr] = 8.30

<sup>6</sup> Boulder County "Storm Drainage Criteria Manual", Eqn 500.1, NOAA Atlas 14

#### Runoff - Rational Method Equation<sup>7</sup>

Q<sub>2</sub> [cfs] = 0.03

Q<sub>5</sub> [cfs] = 0.05

Q<sub>10</sub> [cfs] = 0.09

Q<sub>100</sub> [cfs] = 0.26

<sup>7</sup> Boulder County "Storm Drainage Criteria Manual", Eqn 600.1



# Rational Method Calculations

## Basin Ap Proposed Conditions



Project: 364 2nd Avenue  
SG Project I.D.: B1418

Prepared By: MLM  
Reviewed By: CCS  
Date: 09/19/22

**Basin Description:** Overall Site

**NRCS Soil Type:** NnA, Nunn sandy clay loam

**NRCS Hydrologic Soil Rating:** C

**Basin Area=** 0.16 [acres] = 6,987 [sf]

Surface Characteristics <sup>1</sup>	Sub-Area [sf]	Imp [%]	Runoff Coefficients <sup>1</sup>			
			C <sub>2</sub>	C <sub>5</sub>	C <sub>10</sub>	C <sub>100</sub>
Asphalt	0	100	0.89	0.92	0.94	0.96
Concrete Drives & Walks	1986	90	0.80	0.83	0.87	0.91
Roofs	3226	90	0.80	0.83	0.87	0.91
Permeable Paver	1066	7	0.10	0.15	0.30	0.65
Lawns, clayey	709	2	0.02	0.07	0.22	0.52

<sup>1</sup> Boulder County "Storm Drainage Criteria Manual", Table 600-2 and 600-6

**Weighted Percent Imperviousness :**

I [%] = 68.40      A<sub>1</sub> = 4,779.61 [sf]

**Weighted Runoff Coefficients:**

C<sub>2</sub> = 0.61      C<sub>5</sub> = 0.65      C<sub>10</sub> = 0.72      C<sub>100</sub> = 0.83

# Rational Method Calculations

## Basin A1

### Proposed Conditions



Project: 364 2nd Avenue  
SG Project I.D.: B1418

Prepared By: MLM  
Reviewed By: CCS  
Date: 09/19/22

#### Basin Description:

NRCS Soil Type: NnA, Nunn sandy clay loam

NRCS Hydrologic Soil Rating: C

Basin Area= 0.07 [acres] = 3,244 [sf]

Surface Characteristics <sup>1</sup>	Sub-Area [sf]	Imp [%]	Runoff Coefficients <sup>1</sup>			
			C <sub>2</sub>	C <sub>5</sub>	C <sub>10</sub>	C <sub>100</sub>
Asphalt	0	100	0.89	0.92	0.94	0.96
Concrete Drives & Walks	1794	90	0.80	0.83	0.87	0.91
Roofs	0	90	0.80	0.83	0.87	0.91
Permeable Paver	1066	7	0.10	0.15	0.30	0.65
Lawns, clayey	384	2	0.02	0.07	0.22	0.52

<sup>1</sup> Boulder County "Storm Drainage Criteria Manual", Table 600-2 and 600-6

#### Weighted Percent Imperviousness :

I [%] = 52.31      A<sub>1</sub> = 1,696.90 [sf]

#### Weighted Runoff Coefficients:

C<sub>2</sub> = 0.48      C<sub>5</sub> = 0.52      C<sub>10</sub> = 0.61      C<sub>100</sub> = 0.78

#### Time of Concentration:

##### Sheet Flow:

L<sub>i</sub> [ft] = 44

S<sub>i</sub> [%] = 2.00

t<sub>i</sub> [min] = 5.56

##### Concentrated Flow:

L<sub>t1</sub> [FT] = 36

S<sub>t1</sub> [%] = 0.50

K<sub>1</sub><sup>3</sup> = 15.00

V<sub>t1</sub> [fps]<sup>4</sup> = 1.06

t<sub>t1</sub> [min] = 0.57

L<sub>t2</sub> [FT] = 0

S<sub>t2</sub> [%] = 0.00

K<sub>2</sub><sup>3</sup> = 15.00

V<sub>t2</sub> [fps]<sup>4</sup> = 0.00

t<sub>t2</sub> [min] = 0.00

<sup>3</sup> BCSDCM, Table 600-1

<sup>4</sup> BCSDCM, Eqn 600.4

t<sub>t</sub> [min] = 0.57

#### Time of Concentration:

t<sub>c</sub> = t<sub>i</sub> + t<sub>t</sub> [min] = 6.12

t<sub>c</sub> (minimum) = 5 min

t<sub>c</sub> [min] = 6.1

Check for Urbanized Basins:

t<sub>c</sub><sup>5</sup> [min] = 10.92

<sup>5</sup> Boulder County "Storm Drainage Criteria Manual", Eqn 600.5

#### Rainfall Intensity<sup>6</sup>

I<sub>2</sub> [in/hr] = 2.53

I<sub>5</sub> [in/hr] = 3.43

I<sub>10</sub> [in/hr] = 4.36

I<sub>100</sub> [in/hr] = 8.65

<sup>6</sup> Boulder County "Storm Drainage Criteria Manual", Eqn 500.1, NOAA Atlas 14

#### Runoff - Rational Method Equation<sup>7</sup>

Q<sub>2</sub> [cfs] = 0.09

Q<sub>5</sub> [cfs] = 0.13

Q<sub>10</sub> [cfs] = 0.20

Q<sub>100</sub> [cfs] = 0.50

<sup>7</sup> Boulder County "Storm Drainage Criteria Manual", Eqn 600.1

# Rational Method Calculations

## Basin A2

### Proposed Conditions



Project: 364 2nd Avenue  
SG Project I.D.: B1418

Prepared By: MLM  
Reviewed By: CCS  
Date: 09/19/22

#### Basin Description:

NRCS Soil Type: NnA, Nunn sandy clay loam

NRCS Hydrologic Soil Rating: C

Basin Area= 0.09 [acres] = 3,744 [sf]

Surface Characteristics <sup>1</sup>	Sub-Area [sf]	Imp [%]	Runoff Coefficients <sup>1</sup>			
			C <sub>2</sub>	C <sub>5</sub>	C <sub>10</sub>	C <sub>100</sub>
Asphalt	0	100	0.89	0.92	0.94	0.96
Concrete Drives & Walks	192	90	0.80	0.83	0.87	0.91
Roofs	3226	90	0.80	0.83	0.87	0.91
Gravel (packed)	0	40	0.36	0.40	0.50	0.69
Lawns, clayey	326	2	0.02	0.07	0.22	0.52

<sup>1</sup> Boulder County "Storm Drainage Criteria Manual", Table 600-2 and 600-6

#### Weighted Percent Imperviousness :

I [%] = 82.34      A<sub>1</sub> = 3,082.72 [sf]

#### Weighted Runoff Coefficients:

C<sub>2</sub> = 0.73      C<sub>5</sub> = 0.76      C<sub>10</sub> = 0.81      C<sub>100</sub> = 0.88

#### Time of Concentration:

##### Sheet Flow:

L<sub>i</sub> [ft] = 73

S<sub>i</sub> [%] = 1.00

t<sub>i</sub> [min] = 5.19

##### Concentrated Flow:

L<sub>t1</sub> [FT] = 21

S<sub>t1</sub> [%] = 0.50

K<sub>1</sub><sup>3</sup> = 15.00

V<sub>t1</sub> [fps]<sup>4</sup> = 1.06

t<sub>t1</sub> [min] = 0.33

L<sub>t2</sub> [FT] = 0

S<sub>t2</sub> [%] = 0.00

K<sub>2</sub><sup>3</sup> = 15.00

V<sub>t2</sub> [fps]<sup>4</sup> = 0.00

t<sub>t2</sub> [min] = 0.00

<sup>3</sup> BCSDCM, Table 600-1

<sup>4</sup> BCSDCM, Eqn 600.4

t<sub>t</sub> [min] = 0.33

#### Time of Concentration:

t<sub>c</sub> = t<sub>i</sub> + t<sub>t</sub> [min] = 5.52

t<sub>c</sub> (minimum) = 5 min

t<sub>c</sub> [min] = 5.5

Check for Urbanized Basins:

t<sub>c</sub><sup>5</sup> [min] = 6.35

<sup>5</sup> Boulder County "Storm Drainage Criteria Manual", Eqn 600.5

#### Rainfall Intensity<sup>6</sup>

I<sub>2</sub> [in/hr] = 2.61

I<sub>5</sub> [in/hr] = 3.53

I<sub>10</sub> [in/hr] = 4.49

I<sub>100</sub> [in/hr] = 8.92

<sup>6</sup> Boulder County "Storm Drainage Criteria Manual", Eqn 500.1, NOAA Atlas 14

#### Runoff - Rational Method Equation<sup>7</sup>

Q<sub>2</sub> [cfs] = 0.16

Q<sub>5</sub> [cfs] = 0.23

Q<sub>10</sub> [cfs] = 0.31

Q<sub>100</sub> [cfs] = 0.67

<sup>7</sup> Boulder County "Storm Drainage Criteria Manual", Eqn 600.1



## Design Point Summary



Project: 364 2nd Avenue  
SG Project I.D.: B1418

Prepared By: MLM  
Reviewed By: CCS  
Date: 09/19/22

Existing Conditions			
Design Point	Basin	Q5 [cfs]	Q100 [cfs]
	A1x	0.06	0.48
<b>DP 1</b>		<b>0.06</b>	<b>0.48</b>
	A2x	0.05	0.26
<b>DP 2</b>		<b>0.05</b>	<b>0.26</b>
<b>Overall Site</b>	<b>Total</b>	<b>0.11</b>	<b>0.74</b>

Proposed Conditions			
Design Point	Basin	Q5 [cfs]	Q100 [cfs]
<b>DP 1</b>	<b>Total</b>	<b>0.00</b>	<b>0.00</b>
	Rain Garden A*	0.00	0.21
	Rain Garden B*	0.01	0.26
<b>DP 2</b>	<b>Total</b>	<b>0.01</b>	<b>0.47</b>
<b>Overall Site</b>	<b>Total</b>	<b>0.01</b>	<b>0.47</b>

\* Rain garden/detention pond release rate

**APPENDIX C**  
Hydraulic Calculations

# Hydraulic Analysis Report

## Project Data

Project Title: B1418 - 364 2nd Avenue  
Designer:  
Project Date: Thursday, September 15, 2022  
Project Units: U.S. Customary Units  
Notes:

## Channel Analysis: 8" PVC @ 0.5%

Notes:

## Input Parameters

Channel Type: Circular  
Pipe Diameter: 0.6660 ft  
Longitudinal Slope: 0.0050 ft/ft  
Manning's n: 0.0130  
Flow: 0.2100 cfs

## Result Parameters

Depth: 0.2252 ft  
Area of Flow: 0.1037 ft<sup>2</sup>  
Wetted Perimeter: 0.8267 ft  
Hydraulic Radius: 0.1254 ft  
Average Velocity: 2.0252 ft/s  
Top Width: 0.6302 ft  
Froude Number: 0.8798  
Critical Depth: 0.2107 ft  
Critical Velocity: 2.2194 ft/s  
Critical Slope: 0.0064 ft/ft  
Critical Top Width: 0.62 ft  
Calculated Max Shear Stress: 0.0703 lb/ft<sup>2</sup>  
Calculated Avg Shear Stress: 0.0391 lb/ft<sup>2</sup>



## Channel Analysis: 12" PVC @ 0.5%

Notes:

### Input Parameters

Channel Type: Circular

Pipe Diameter: 1.0000 ft

Longitudinal Slope: 0.0050 ft/ft

Manning's n: 0.0130

Flow: 0.4700 cfs

### Result Parameters

Depth: 0.2926 ft

Area of Flow: 0.1914 ft<sup>2</sup>

Wetted Perimeter: 1.1430 ft

Hydraulic Radius: 0.1674 ft

Average Velocity: 2.4556 ft/s

Top Width: 0.9099 ft

Froude Number: 0.9436

Critical Depth: 0.2839 ft

Critical Velocity: 2.5605 ft/s

Critical Slope: 0.0056 ft/ft

Critical Top Width: 0.90 ft

Calculated Max Shear Stress: 0.0913 lb/ft<sup>2</sup>

Calculated Avg Shear Stress: 0.0522 lb/ft<sup>2</sup>

**APPENDIX D**  
Inspection and Maintenance Guide

***Permanent Stormwater Quality BMP  
Inspection and Maintenance Guide***

**Prepared For:**

Niles Properties LLC  
P.O. Box 294  
Florissant, CO 80816

Contact: Ashley Niles

**Prepared By:**

The Sanitas Group  
901 Front Street, Suite 350  
Louisville, CO 80027

Contact: Curtis C. Stevens, P.E., CFM



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## OWNER RESPONSIBILITIES

The owner of permanent stormwater quality features, also referred to as best management practices (BMPs), shall protect, inspect, maintain, repair, and reconstruct the BMPs and associated drainage infrastructure on the property to ensure full, functional operation in accordance with the specifications of this *Inspection and Maintenance Guide*. In instances where inspection and maintenance duties have been assigned to a delegated representative via an agreement or contract, the owner maintains responsibility in ensuring the specifications of this guide have been carried out. The specifications of this *Guide* are pursuant to the following Boulder County requirements:

- **Boulder County Maintenance Agreement**

## ONSITE FACILITIES

This Guide applies to the following BMPs on the property:

- **Rain Garden (bioretention):** There are two rain gardens: Rain Garden A is located on the southeast side of the parking lot, and Rain Garden B is located on the southwest side of the building. The rain gardens are designed for no infiltration and each rain garden contains a 4" slotted PVC underdrain. The outlet structures contain an orifice plate at the 4" PVC underdrain outlet along with a restrictor plate over the outlet pipe which discharges to the public storm sewer in 2<sup>nd</sup> Avenue.

## INSPECTION REQUIREMENTS

A documented visual inspection of each BMP on the property is required per the documented inspection frequency listed in Table 1. Inspections shall be documented using the forms provided in Attachment B. The documented inspection shall be performed between May and August, when vegetation is not dormant and snow does not cover the BMP. Completed inspection forms shall be kept by the owner or their delegated representative for a minimum of five years and provided to Boulder County upon request.

Boulder County personnel will conduct routine oversight inspections of each BMP on the property to ensure the facilities are functioning as designed. The County will correspond with the owner or delegated representative when corrective actions are required. Failure to implement corrective actions may result in enforcement actions including civil penalties and/or criminal prosecution.

**Table 1. Required BMP inspection frequency**

Name	BMP Type	Frequency
Rain Garden	Bioretention (Rain Garden)	Annually

## MAINTENANCE ACTIVITIES

Maintenance is essential for BMPs to be effective. Maintenance activities include both routinely scheduled activities and periodic larger efforts to repair or restore system components. An effective routine maintenance program can prevent more costly repairs later on. As part of routine maintenance efforts, BMPs should be visually inspected to identify build-up or blockages of trash, debris, or sediment; check for damage; and determine current

maintenance needs. BMPs should also be visually inspected after storms and snow melt to assess whether stormwater in the BMP is draining as expected.

The recommended maintenance schedule and description based on BMP type is provided in Attachment A. These recommendations are based on guidance from the Urban Drainage and Flood Control District (UDFCD) and the experience of the preparing engineer.

Inspection and maintenance personnel are recommended to reference the [Colorado Stormwater Center Inspection and Maintenance Field Guide](#) for visual depictions of maintenance actions.

## REFERENCES

- Colorado Stormwater Center. *Permanent Stormwater Quality Best Management Practice Inspection and Maintenance Field Guide*. n.d. Colorado State University. < [http://stormwatercenter.colostate.edu/wp-content/uploads/2018/04/BMP\\_I-M\\_Manual\\_med.pdf](http://stormwatercenter.colostate.edu/wp-content/uploads/2018/04/BMP_I-M_Manual_med.pdf)>
- Urban Drainage and Flood Control District (UDFCD). 2010. *Urban Storm Drainage Criteria Manual (USDCM) Volume 3 Stormwater Quality*. Chapter 6 BMP Maintenance. < <https://udfcd.org/wp-content/uploads/2014/07/Chapter-6-BMP-Maintenance.pdf>>



**ATTACHMENT A. MAINTENANCE SCHEDULE AND DESCRIPTION**

**Bioretention (Rain Garden)**  
Recommended Maintenance Schedule and Description

**Maintenance Schedule**

Category	Element	Recommended Frequency
Routine	Visual Inspection	Twice annually following precipitation
	Debris and Litter Removal	As needed, checked monthly
	Mowing and Plant Care	Every two weeks, seasonally dependent
	Irrigation Scheduling and Maintenance	As needed, checked monthly
	Replacement of Wood Mulch	As needed, checked annually
Rehabilitative	Sediment Removal and Growing Media Replacement	As needed
	Erosion and Structural Repairs	As needed

**Visual Inspection**

Inspect the infiltrating surface at least twice annually following precipitation events to determine if the bioretention area is providing acceptable infiltration. Bioretention facilities are designed with a maximum depth for the WQCV of one foot and soils that will typically drain the WQCV over approximately 12 hours. If standing water persists for more than 24 hours after runoff has ceased, clogging should be further investigated and remedied. Additionally, check for erosion and repair as necessary.

**Debris and Litter Removal**

Remove debris and litter from the infiltrating surface to minimize clogging of the media. Remove debris and litter from the overflow structure.

**Mowing and Plant Care**

- **All vegetation:** Maintain healthy, weed-free vegetation. Weeds should be removed before they flower. The frequency of weeding will depend on the planting scheme and cover. When the growing media is covered with mulch or densely vegetated, less frequent weeding will be required.
- **Grasses:** When started from seed, allow time for germination and establishment of grass prior to mowing. If mowing is required during this period for weed control, it should be accomplished with hand-held string trimmers to minimize disturbance to the seedbed. After established, mow as desired or as needed for weed control. Following this period, mowing of native/drought tolerant grasses may stop or be reduced to maintain a length of no less than 6 inches. Mowing of manicured grasses may vary from as frequently as weekly during the summer, to no mowing during the winter.

**Irrigation Scheduling and Maintenance**

Adjust irrigation throughout the growing season to provide the proper irrigation application rate to maintain healthy vegetation. Less irrigation is typically needed in early summer and fall, while more irrigation is needed during the peak summer months. Native grasses and other drought tolerant plantings should not typically require routine irrigation after establishment, except during prolonged dry periods.

Check for broken sprinkler heads and repair them, as needed. Completely drain the irrigation system before the first winter freeze each year. Upon reactivation of the irrigation system in the spring, inspect all components and replace damaged parts, as needed.

### **Replacement of Wood Mulch**

Replace wood mulch only when needed to maintain a mulch depth of up to approximately 3 inches. Excess mulch will reduce the volume available for storage.

### **Sediment Removal and Growing Media Replacement**

If ponded water is observed in a bioretention cell more than 24 hours after the end of a runoff event, check underdrain outfall locations and clean-outs for blockages. Maintenance activities to restore infiltration capacity of bioretention facilities will vary with the degree and nature of the clogging. If clogging is primarily related to sediment accumulation on the filter surface, infiltration may be improved by removing excess accumulated sediment and scarifying the surface of the filter with a rake. If the clogging is due to migration of sediments deeper into the pore spaces of the media, removal and replacement of all or a portion of the media may be required. The frequency of media replacement will depend on site-specific pollutant loading characteristics. Based on experience to date in the metro Denver area, the required frequency of media replacement is not known. To date UDFCD is not aware of any rain gardens constructed to the recommendations of these criteria that have required full replacement of the growing media. Although surface clogging of the media is expected over time, established root systems promote infiltration. This means that mature vegetation that covers the filter surface should increase the life span of the growing media, serving to promote infiltration even as the media surface clogs.

### **Erosion and Structural Repairs**

Repair basin inlets, outlets, and all other structural components required for the basin to operate as intended. Repair and vegetate eroded areas as needed following inspection.



**ATTACHMENT B. INSPECTION FORM**

# Bioretention (Rain Garden) Inspection Form

This inspection form shall be completed annually, kept for a minimum of five years, and made available to Boulder County upon request.

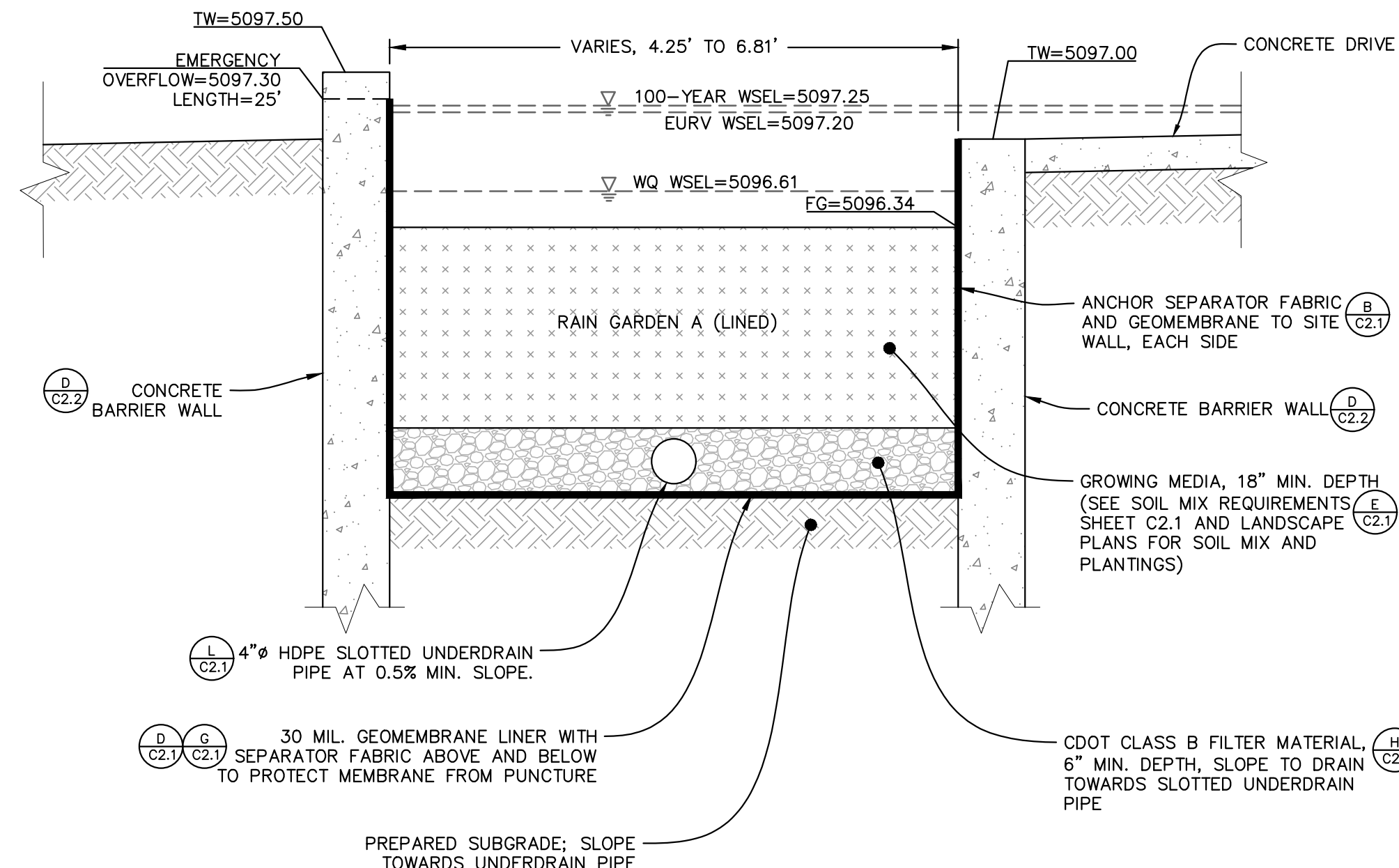
1. Facility Information			
Property Name:			
Address:			
Owner Name:		Owner Phone:	
Inspector Name:		Inspector Phone:	
Inspector Company:		Date:	
2. Inspection Findings			
For each inspection item, provide one of the following scores: 0: No deficiency identified, 1: Monitor (potential future problem), 2: Routine maintenance needed, 3. Immediate repair needed, N/A: Not applicable			
Inspection Item	Score	Comment/Description	
<b>1 Inflow Point</b>			
A Sediment/trash/debris removal			
B Runoff doesn't enter inlet due to elevation or obstruction			
C Erosion/structural damage			
<b>2 Forebay/Energy Dissipation</b>			
A Sediment/trash/debris removal			
B Drain pipe/weir clogged			
<b>3 Filter Media</b>			
A Evidence of clogged media			
B Uneven grading/mounding of landscape material			
<b>4 Underdrain</b>			
A Evidence of clogged underdrain			
B Cleanout caps missing/access obstructed			
C Underdrain orifice plate obstructed or missing			
<b>5 Outlet Structure</b>			
A Outlet overflow elevation/depth insufficient			
B Flow control/drain pipe clogged			
<b>6 Embankments/Containment Walls</b>			
A Sparse vegetation/erosion present			
B Structural damage			
C Encroachment into facility/easement by other activities			
<b>7 Vegetation</b>			
A Dead/unhealthy vegetation			
B Overgrowth of weeds			
C Irrigation system broken/inadequate			
<b>8 Other</b>			
A Nuisance observed (odor, insects, etc)			
B Complaints on facility condition received			
C Other:			
D Other:			
3. Maintenance Actions			
Maintenance actions completed or scheduled as part of inspection.			
Maintenance Action			Date
1			
2			
3			

Refer to the Colorado Stormwater Center (<http://stormwatercenter.colostate.edu>) Inspection and Maintenance Field Guide, Sand Filters/Bioretention section (p. 29 - 46) for further description on inspection items.

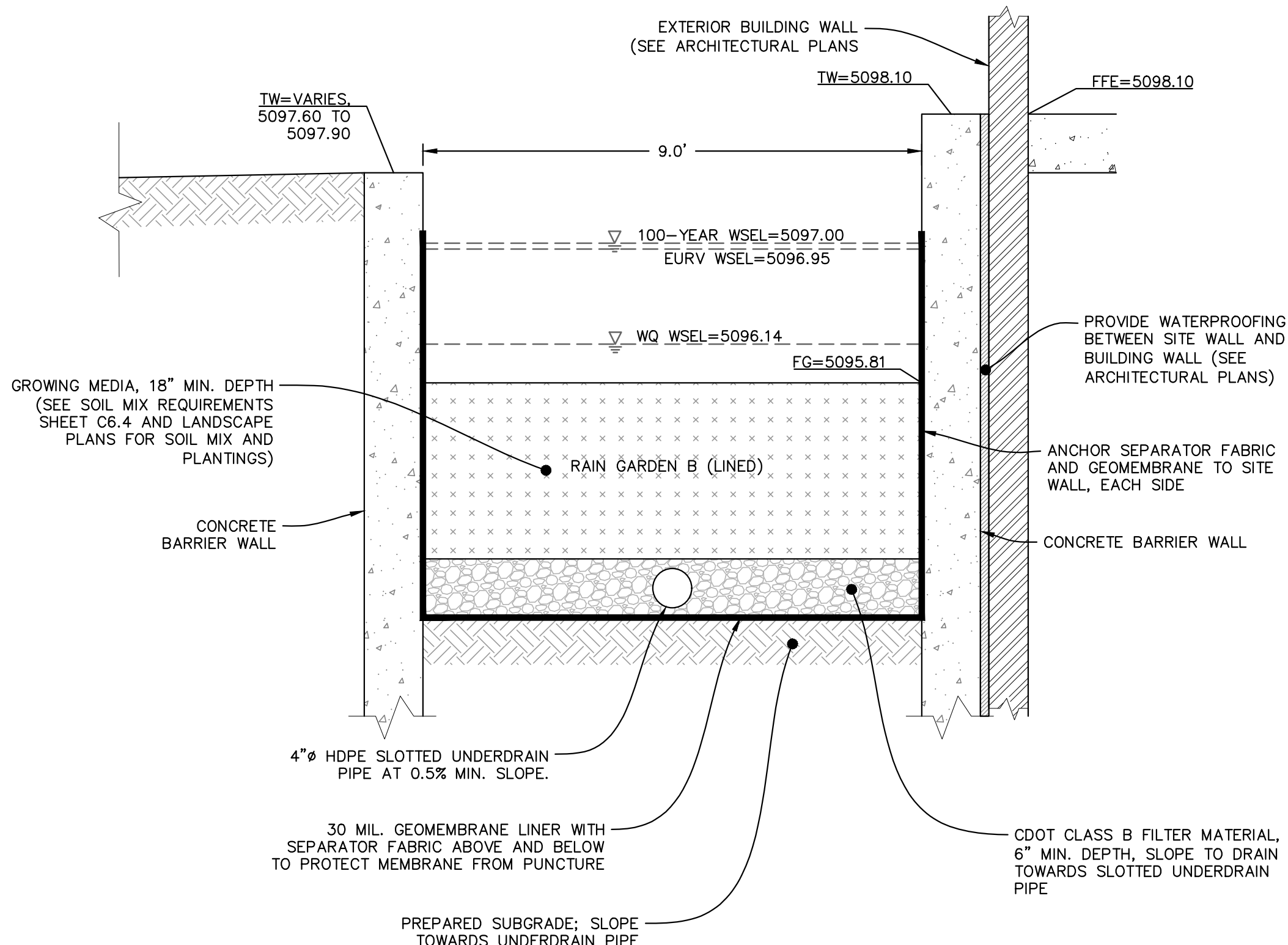
**ATTACHMENT C. BMP DETAIL DRAWINGS**



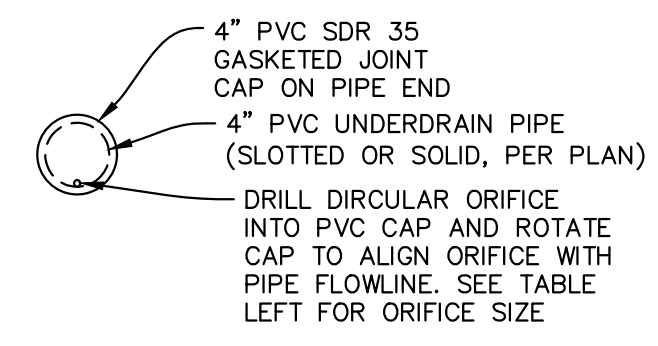




**RAIN GARDEN A SECTION THROUGH PLANTER**  
NO SCALE



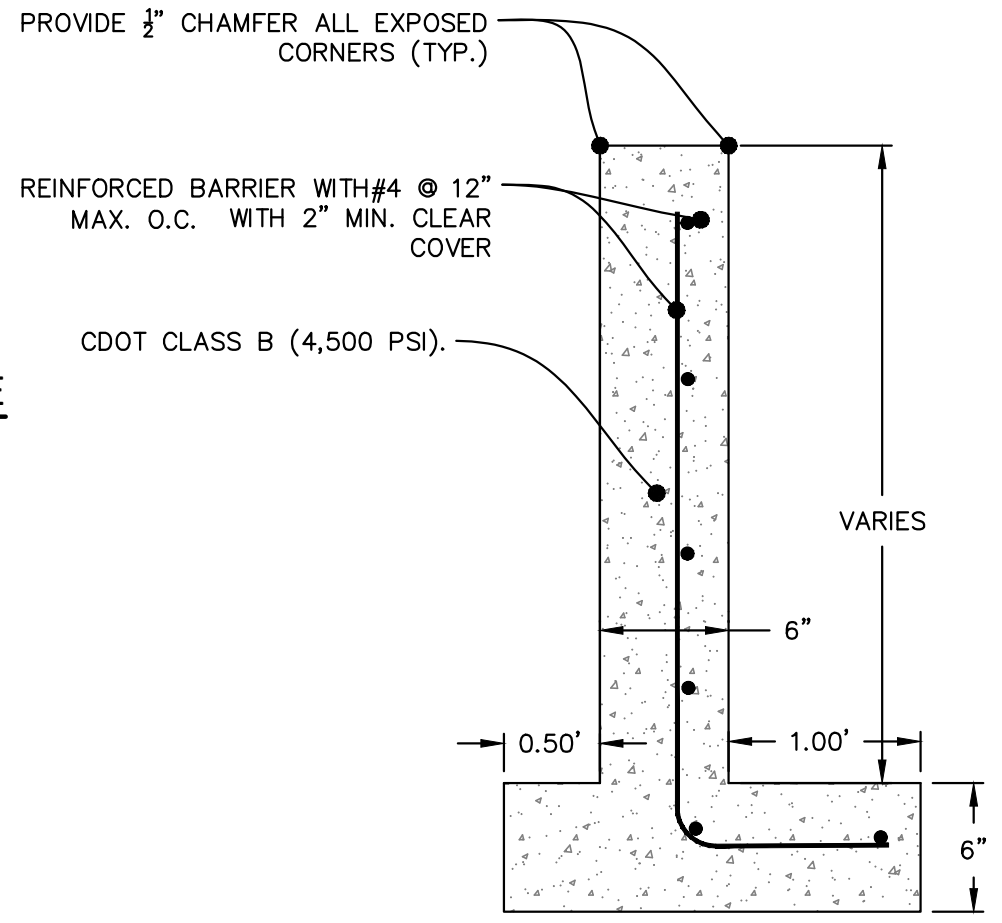
**RAIN GARDEN B SECTION THROUGH PLANTER**  
NO SCALE



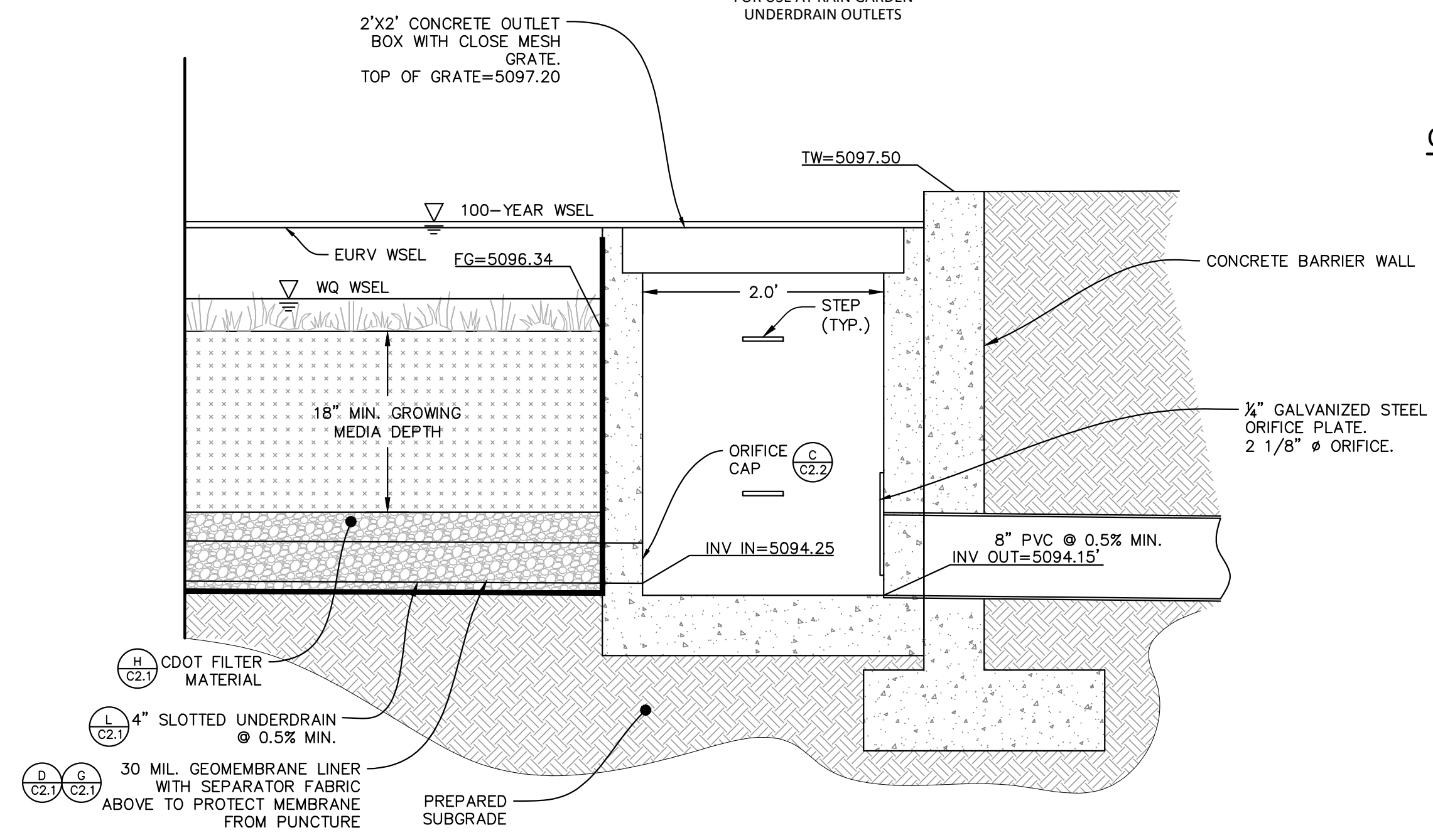
**ORIFICE SIZE TABLE**

RAIN GARDEN	ORIFICE DIA.
A	3/16"
B	1/4"

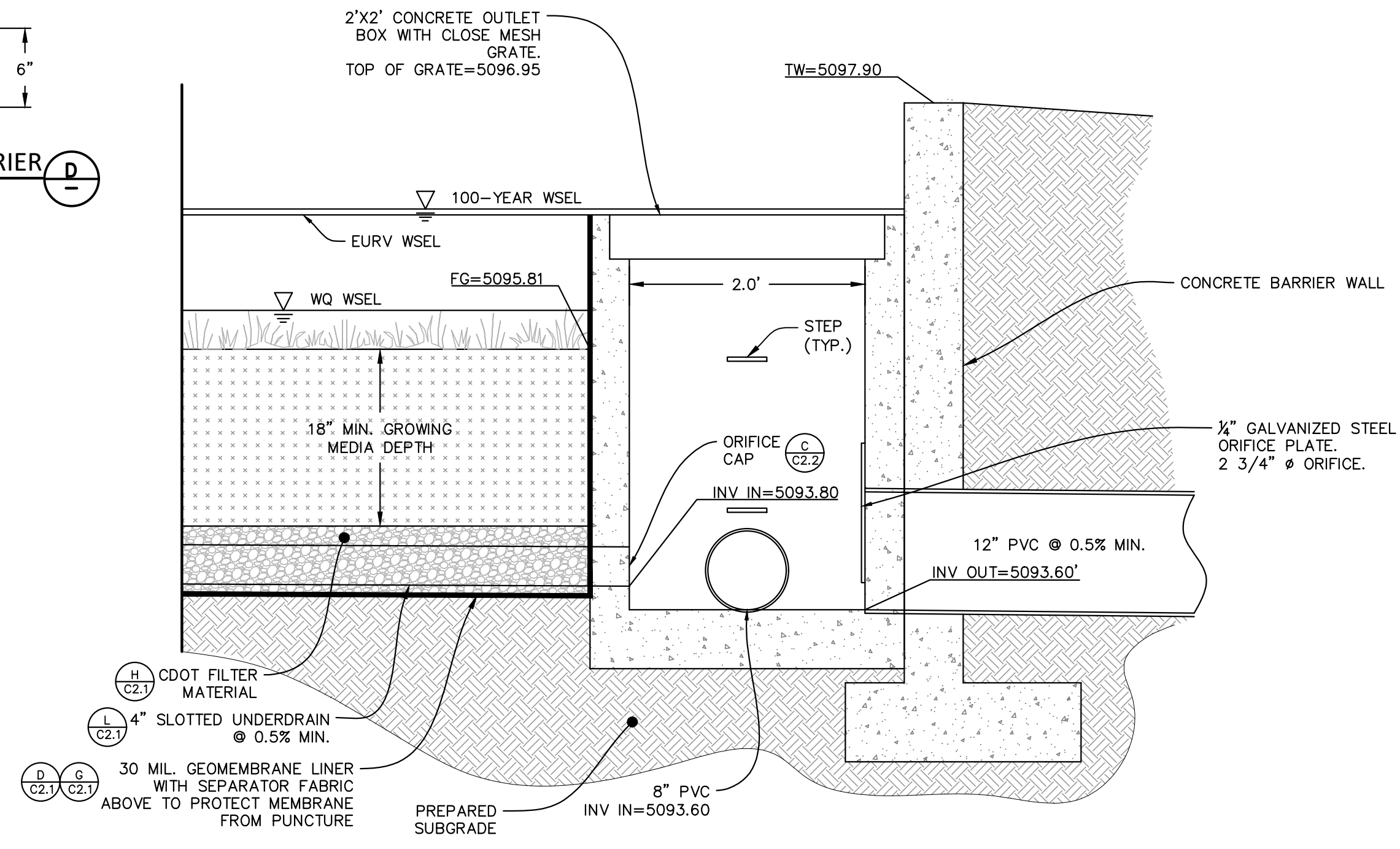
**ORIFICE CAP**  
NO SCALE  
FOR USE AT RAIN GARDEN UNDERDRAIN OUTLETS



**CONCRETE RAINGARDEN BARRIER**  
NO SCALE



**RAIN GARDEN A OUTLET STRUCTURE**  
NO SCALE



**RAIN GARDEN B OUTLET STRUCTURE**  
NO SCALE

PREPARED BY:  
  
**The Sanitas Group**  
 801 FRONT ST, SUITE  
 LOUISVILLE, CO 80027  
 720.481.2710  
 PROJECT CONTACT:  
 CURTIS C. STEVENS, P.E.  
 PREPARED FOR:  
**ASHLEY NILES PROPERTIES, LLC**  
 P.O. BOX 396  
 NIWOT, COLORADO

SPR DOCUMENTS FOR:  
**364 2ND AVE**  
 UNINCORPORATED BOULDER COUNTY  
 STATE OF COLORADO

ISSUE	DATE
SPR	9/19/2022
DESIGNED BY:	TSG
DRAWN BY:	TSG
CHECKED BY:	CCS

DRAWING SCALE:  
 HORIZONTAL: NONE  
 VERTICAL: NONE

**PRELIM STORM DETAILS**  
 (2 OF 2)  
 PROJECT NO. B1418

**C2.2**  
 SHEET: 5 OF 5

**APPENDIX E**  
Water Quality Calculations

# Detention Pond: Stage-Storage

## Basin A1: Rain Garden A



Project: 364 2nd Avenue  
 SG Project I.D.: B1418

Prepared By: MLM  
 Reviewed By: CCS  
 Date: 09/19/22

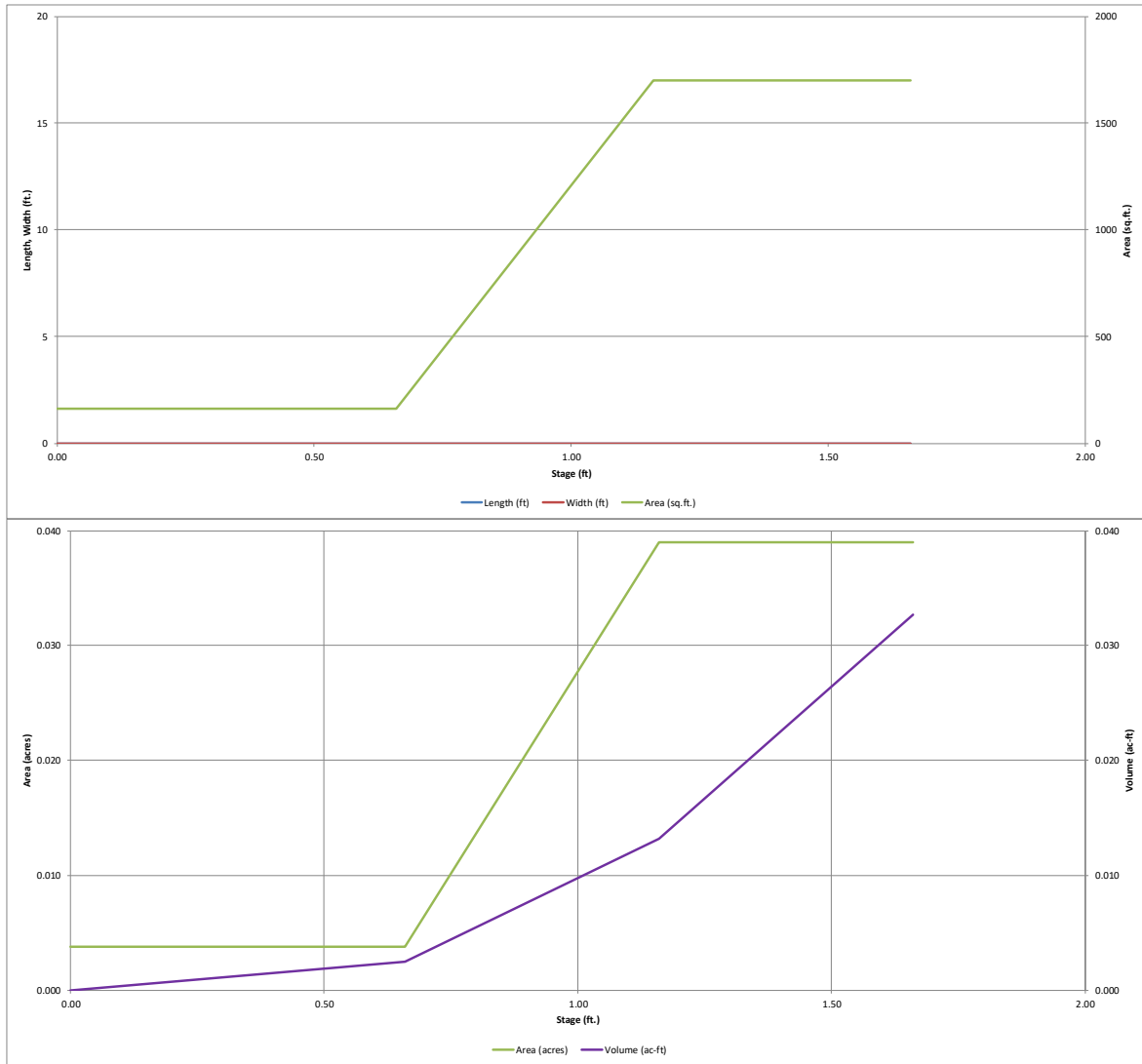
Stage [ft]	Elevation [ft]	Contour Area [sf]	Incremental Storage Volume [cf]	Cumulative Storage Volume [cf]	
0.00	5096.34	165	0	0	
0.06	5096.40	165	10	10	
0.11	5096.45	165	8	18	
0.16	5096.50	165	8	26	
0.21	5096.55	165	8	35	
0.26	5096.60	165	8	43	
<b>0.31</b>	<b>5096.65</b>	<b>165</b>	<b>8</b>	<b>51</b>	WSEL <sub>WQCV</sub> V <sub>WQCV</sub> =44-cf
0.36	5096.70	165	8	59	
0.41	5096.75	165	8	68	
0.46	5096.80	165	8	76	
0.51	5096.85	165	8	84	
0.56	5096.90	165	8	92	
0.61	5096.95	165	8	101	
0.66	5097.00	165	8	109	
0.71	5097.05	319	12	121	
0.76	5097.10	472	20	141	
0.81	5097.15	626	27	168	
<b>0.86</b>	<b>5097.20</b>	<b>779</b>	<b>35</b>	<b>203</b>	WSEL <sub>EURV</sub> V <sub>EURV</sub> =174-cf
					WSEL <sub>100YR</sub> V <sub>DET100</sub> =205-cf
0.91	5097.25	933	43	246	
0.96	5097.30	1086	50	297	
1.01	5097.35	1240	58	355	
1.06	5097.40	1393	66	421	Top of Wall
1.11	5097.45	1547	73	494	
1.16	5097.50	1700	81	575	
1.21	5097.55	1700	85	660	
1.26	5097.60	1700	85	745	
1.31	5097.65	1700	85	830	
1.36	5097.70	1700	85	915	
1.41	5097.75	1700	85	1000	
1.46	5097.80	1700	85	1085	
1.51	5097.85	1700	85	1170	
1.56	5097.90	1700	85	1255	
1.61	5097.95	1700	85	1340	
1.66	5098.00	1700	85	1425	





# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

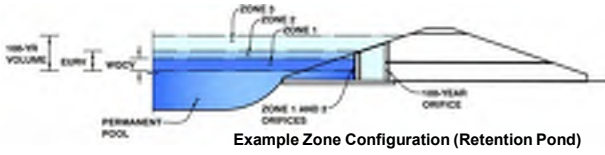
*MHFD-Detention, Version 4.05 (January 2022)*



# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD- Detention, Version 4.05 (January 2022)

**Project:** 364 2nd Avenue  
**Basin ID:** Basin A1 - Rain Garden A



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.28	0.001	Filtration Media
Zone 2 (EURV)	0.80	0.003	Circular Orifice
Zone 3 (100-year)	0.99	0.004	Weir&Pipe (Circular)
<b>Total (all zones)</b>		<b>0.007</b>	

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

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

**Calculated Parameters for Underdrain**  
 Underdrain Orifice Area =  ft<sup>2</sup>  
 Underdrain Orifice Centroid =  feet

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

Centroid of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
 Depth at top of Zone using Orifice Plate =  ft (relative to basin bottom at Stage = 0 ft)  
 Orifice Plate: Orifice Vertical Spacing =  inches  
 Orifice Plate: Orifice Area per Row =  sq. inches

**Calculated Parameters for Plate**  
 WQ Orifice Area per Row =  ft<sup>2</sup>  
 Elliptical Half-Width =  feet  
 Elliptical Slot Centroid =  feet  
 Elliptical Slot Area =  ft<sup>2</sup>

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

	Row 1 (optional)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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

**User Input: Vertical Orifice (Circular or Rectangular)**

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	<input type="text" value="0.28"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	<input type="text" value="0.80"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	<input type="text" value="0.38"/>	<input type="text" value="N/A"/>	inches

**Calculated Parameters for Vertical Orifice**

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	<input type="text" value="0.00"/>	<input type="text" value="N/A"/>	ft <sup>2</sup>
Vertical Orifice Centroid =	<input type="text" value="0.02"/>	<input type="text" value="N/A"/>	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	<input type="text" value="0.82"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	<input type="text" value="2.00"/>	<input type="text" value="N/A"/>	feet
Overflow Weir Grate Slope =	<input type="text" value="0.00"/>	<input type="text" value="N/A"/>	H:V
Horiz. Length of Weir Sides =	<input type="text" value="2.00"/>	<input type="text" value="N/A"/>	feet
Overflow Grate Type =	<input type="text" value="Close Mesh Grate"/>	<input type="text" value="N/A"/>	
Debris Clogging % =	<input type="text" value="0%"/>	<input type="text" value="N/A"/>	%

**Calculated Parameters for Overflow Weir**

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H <sub>g</sub> =	<input type="text" value="0.82"/>	<input type="text" value="N/A"/>	feet
Overflow Weir Slope Length =	<input type="text" value="2.00"/>	<input type="text" value="N/A"/>	feet
Grate Open Area / 100-yr Orifice Area =	<input type="text" value="127.86"/>	<input type="text" value="N/A"/>	
Overflow Grate Open Area w/o Debris =	<input type="text" value="3.16"/>	<input type="text" value="N/A"/>	ft <sup>2</sup>
Overflow Grate Open Area w/ Debris =	<input type="text" value="3.16"/>	<input type="text" value="N/A"/>	ft <sup>2</sup>

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

	Zone 3 Circular	Not Selected	
Depth to Invert of Outlet Pipe =	<input type="text" value="2.20"/>	<input type="text" value="N/A"/>	ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =	<input type="text" value="2.13"/>	<input type="text" value="N/A"/>	inches

**Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate**

	Zone 3 Circular	Not Selected	
Outlet Orifice Area =	<input type="text" value="0.02"/>	<input type="text" value="N/A"/>	ft <sup>2</sup>
Outlet Orifice Centroid =	<input type="text" value="0.09"/>	<input type="text" value="N/A"/>	feet
Half-Central Angle of Restrictor Plate on Pipe =	<input type="text" value="N/A"/>	<input type="text" value="N/A"/>	radians

**User Input: Emergency Spillway (Rectangular or Trapezoidal)**

Spillway Invert Stage =	<input type="text" value="1.15"/>	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	<input type="text" value="20.00"/>	feet
Spillway End Slopes =	<input type="text" value="0.00"/>	H:V
Freeboard above Max Water Surface =	<input type="text" value="0.10"/>	feet

**Calculated Parameters for Spillway**

Spillway Design Flow Depth =	<input type="text" value="0.02"/>	feet
Stage at Top of Freeboard =	<input type="text" value="1.27"/>	feet
Basin Area at Top of Freeboard =	<input type="text" value="0.04"/>	acres
Basin Volume at Top of Freeboard =	<input type="text" value="0.02"/>	acre-ft

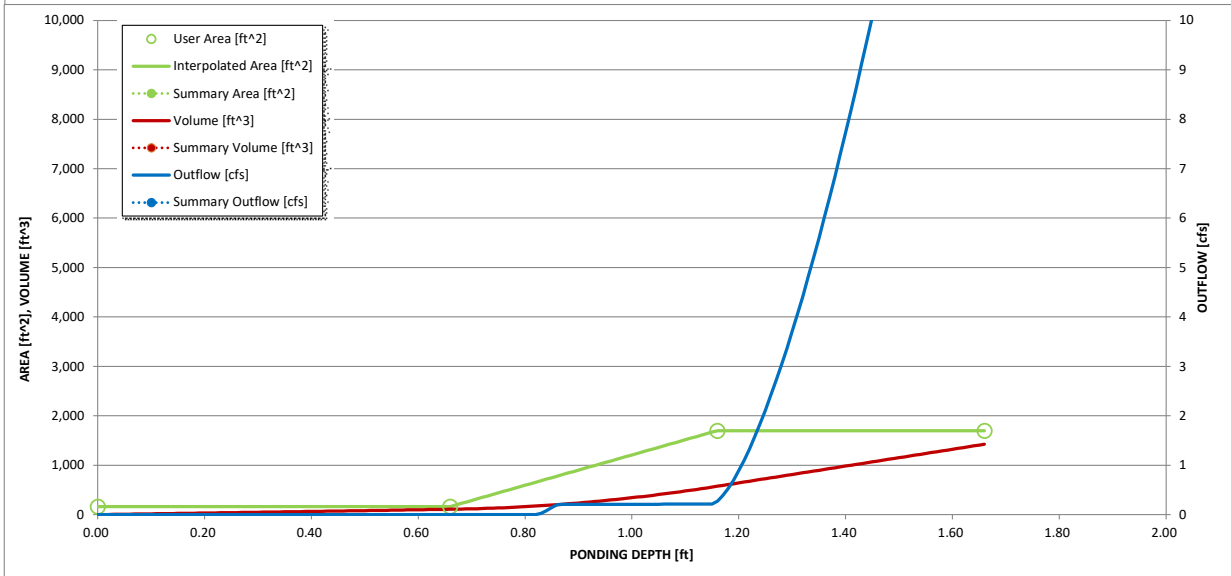
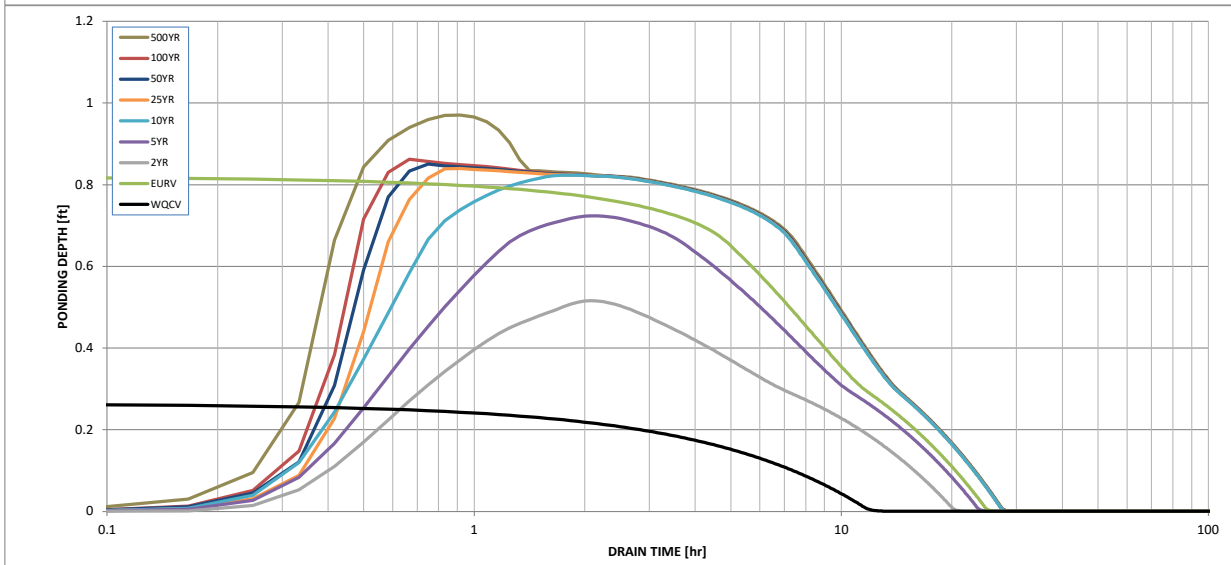
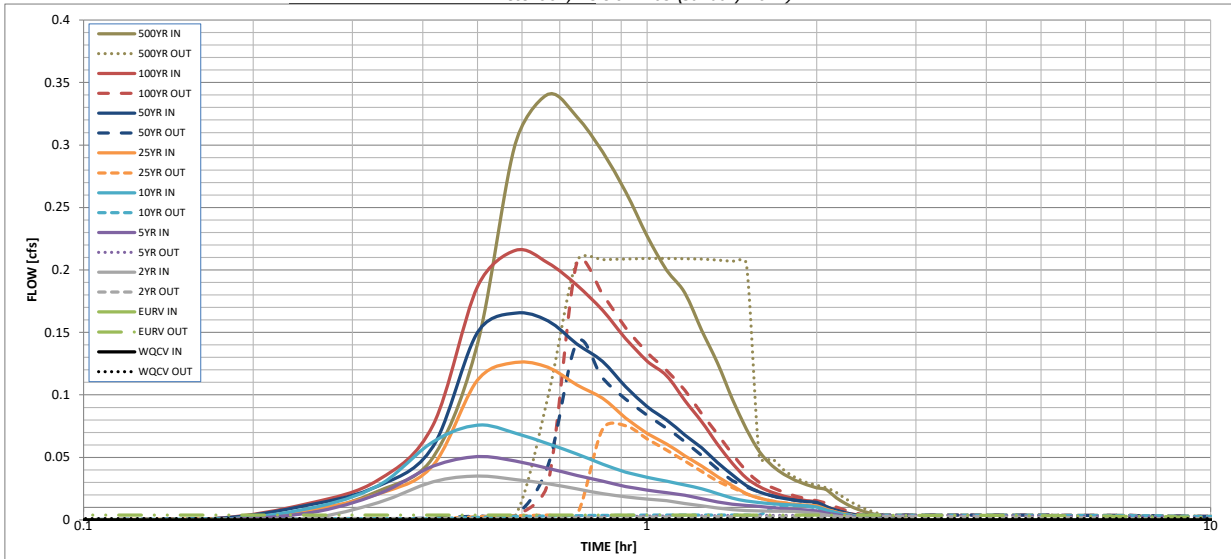
## Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	0.79	1.07	1.36	1.82	2.23	2.70	3.99
One-Hour Rainfall Depth (in) =	N/A	N/A	0.002	0.003	0.005	0.008	0.010	0.013	0.021
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.002	0.003	0.005	0.008	0.010	0.013	0.021
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.0	0.0	0.0	0.1	0.1	0.11	0.2
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.00	0.06	0.25	0.71	1.05	1.46	2.50
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	0.00	0.1	0.1	0.1	0.2	0.22	0.3
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.00	0.00	0.01	0.08	0.14	0.21	0.2
Peak Inflow Q (cfs) =	N/A	N/A	N/A	0.8	0.6	1.4	1.8	1.9	1.1
Peak Outflow Q (cfs) =	N/A	N/A	N/A	0.8	0.6	1.4	1.8	1.9	1.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.8	0.6	1.4	1.8	1.9	1.1
Structure Controlling Flow =	Filtration Media	Overflow Weir 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.0	0.0	0.1	0.1
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	12	24	20	23	26	25	24	23	20
Time to Drain 99% of Inflow Volume (hours) =	12	25	20	24	27	27	26	26	25
Maximum Ponding Depth (ft) =	0.27	0.82	0.52	0.72	0.82	0.84	0.85	0.86	0.97
Area at Maximum Ponding Depth (acres) =	0.00	0.02	0.00	0.01	0.02	0.02	0.02	0.02	0.03
Maximum Volume Stored (acre-ft) =	0.001	0.0040	0.002	0.003	0.004	0.004	0.004	0.0047	0.007

# DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.05 (January 2022)*



S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

# DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: \_\_\_\_\_

## Inflow Hydrographs

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

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]	
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	
	0:15:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02
	0:20:00	0.00	0.00	0.00	0.01	0.02	0.03	0.02	0.03	0.03	0.05
	0:25:00	0.00	0.00	0.00	0.03	0.04	0.06	0.04	0.06	0.08	0.14
	0:30:00	0.00	0.00	0.00	0.03	0.05	0.08	0.11	0.15	0.19	0.30
	0:35:00	0.00	0.00	0.00	0.03	0.05	0.07	0.13	0.17	0.22	0.34
	0:40:00	0.00	0.00	0.00	0.03	0.04	0.06	0.12	0.16	0.21	0.32
	0:45:00	0.00	0.00	0.00	0.02	0.04	0.05	0.11	0.14	0.19	0.29
	0:50:00	0.00	0.00	0.00	0.02	0.03	0.04	0.10	0.13	0.17	0.26
	0:55:00	0.00	0.00	0.00	0.02	0.03	0.04	0.08	0.11	0.14	0.23
	1:00:00	0.00	0.00	0.00	0.02	0.02	0.03	0.07	0.09	0.13	0.20
	1:05:00	0.00	0.00	0.00	0.02	0.02	0.03	0.06	0.08	0.12	0.18
	1:10:00	0.00	0.00	0.00	0.01	0.02	0.03	0.05	0.07	0.10	0.15
	1:15:00	0.00	0.00	0.00	0.01	0.02	0.02	0.04	0.06	0.08	0.13
	1:20:00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.05	0.06	0.10
	1:25:00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.04	0.05	0.07
	1:30:00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.05
	1:35:00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.03	0.04
	1:40:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.04
	1:45:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03
	1:50:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.03
	1:55:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.03
	2:00:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02
	2:05:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02
	2:10:00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
	2:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
	2:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	2:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	2:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	



# Detention Pond: Stage-Storage

## Basin A2: Rain Garden B



Project: 364 2nd Avenue  
 SG Project I.D.: B1418

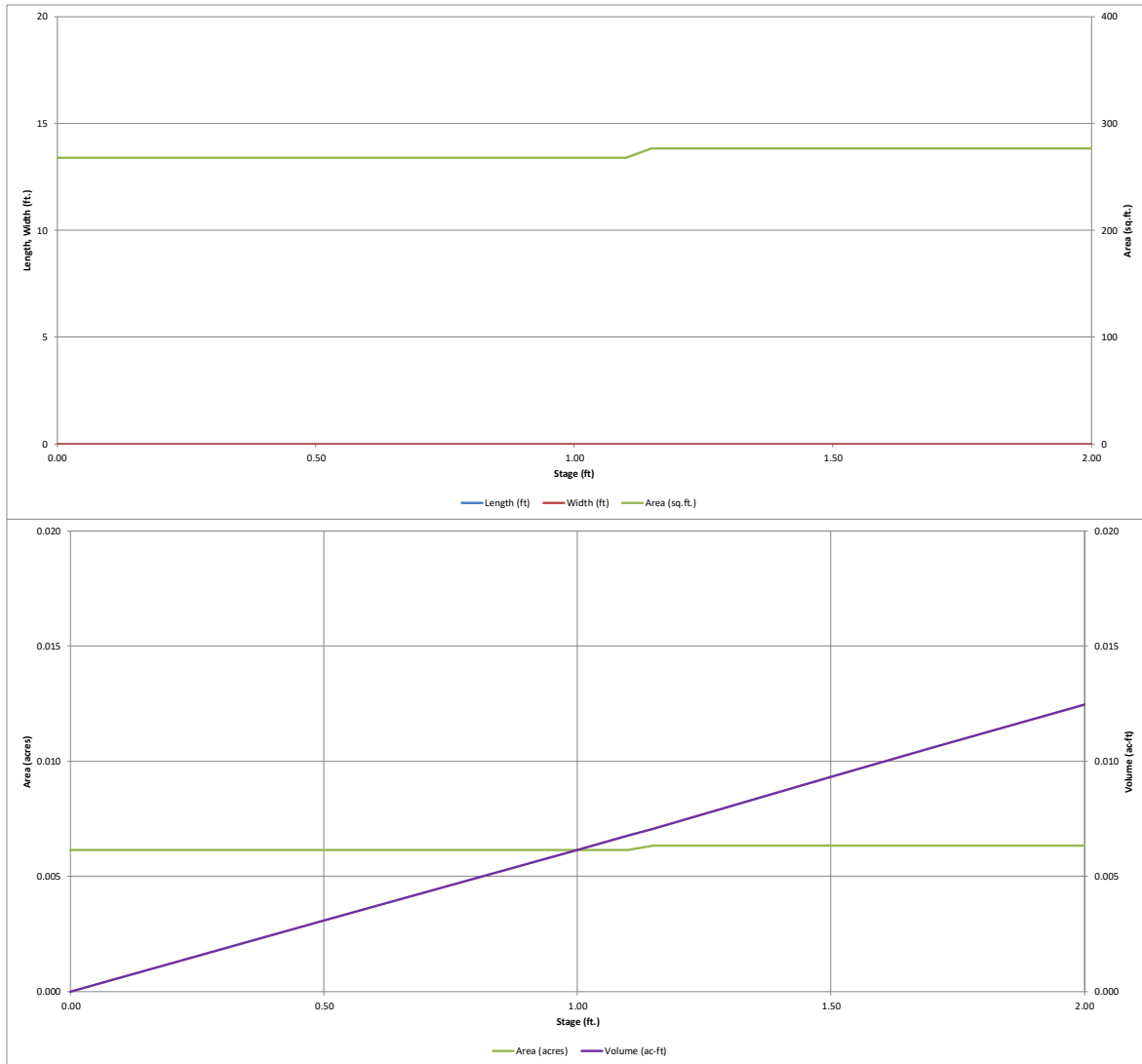
Prepared By: MLM  
 Reviewed By: CCS  
 Date: 09/19/22

Stage [ft]	Elevation [ft]	Contour Area [sf]	Incremental Storage Volume [cf]	Cumulative Storage Volume [cf]	
0.00	5095.90	268	0	0	
0.05	5095.95	268	13	13	
0.10	5096.00	268	13	27	
0.15	5096.05	268	13	40	
0.20	5096.10	268	13	54	
0.25	5096.15	268	13	67	
0.30	5096.20	268	13	80	
<b>0.35</b>	<b>5096.25</b>	<b>268</b>	<b>13</b>	<b>94</b>	WSEL <sub>WQCV</sub> V <sub>WQCV</sub> =87-cf
0.40	5096.30	268	13	107	
0.45	5096.35	268	13	121	
0.50	5096.40	268	13	134	
0.55	5096.45	268	13	147	
0.60	5096.50	268	13	161	
0.65	5096.55	268	13	174	
0.70	5096.60	268	13	188	
0.75	5096.65	268	13	201	
0.80	5096.70	268	13	214	
0.85	5096.75	268	13	228	
0.90	5096.80	268	13	241	
0.95	5096.85	268	13	255	
1.00	5096.90	268	13	268	
1.05	5096.95	268	13	281	
1.10	5097.00	268	13	295	
<b>1.15</b>	<b>5097.05</b>	<b>277</b>	<b>14</b>	<b>308</b>	WSEL <sub>EURV</sub> V <sub>EURV</sub> =305-cf
<b>1.20</b>	<b>5097.10</b>	<b>277</b>	<b>14</b>	<b>322</b>	WSEL <sub>100YR</sub> V <sub>DET100</sub> =318-cf
1.25	5097.15	277	14	336	
1.30	5097.20	277	14	350	
1.35	5097.25	277	14	364	
1.40	5097.30	277	14	378	
1.45	5097.35	277	14	392	
1.50	5097.40	277	14	405	
1.55	5097.45	277	14	419	
1.60	5097.50	277	14	433	
1.65	5097.55	277	14	447	
1.70	5097.60	277	14	461	Top of Wall



# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

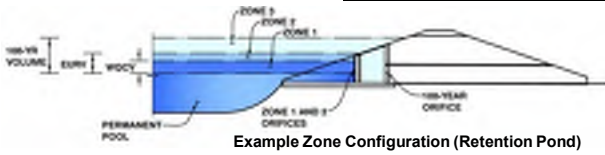
*MHFD-Detention, Version 4.05 (January 2022)*



# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD- Detention, Version 4.05 (January 2022)

**Project:** 364 2nd Avenue  
**Basin ID:** Basin A2 - Rain Garden B



**Example Zone Configuration (Retention Pond)**

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.32	0.002	Filtration Media
Zone 2 (EURV)	1.14	0.005	Circular Orifice
Zone 3 (100-year)	1.94	0.005	Weir&Pipe (Circular)
<b>Total (all zones)</b>		<b>0.012</b>	

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

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

**Calculated Parameters for Underdrain**  
 Underdrain Orifice Area =  ft<sup>2</sup>  
 Underdrain Orifice Centroid =  feet

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

Centroid of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
 Depth at top of Zone using Orifice Plate =  ft (relative to basin bottom at Stage = 0 ft)  
 Orifice Plate: Orifice Vertical Spacing =  inches  
 Orifice Plate: Orifice Area per Row =  sq. inches

**Calculated Parameters for Plate**  
 WQ Orifice Area per Row =  ft<sup>2</sup>  
 Elliptical Half-Width =  feet  
 Elliptical Slot Centroid =  feet  
 Elliptical Slot Area =  ft<sup>2</sup>

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

	Row 1 (optional)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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

**User Input: Vertical Orifice (Circular or Rectangular)**

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	<input type="text" value="0.32"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	<input type="text" value="1.14"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	<input type="text" value="0.41"/>	<input type="text" value="N/A"/>	inches

**Calculated Parameters for Vertical Orifice**

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	<input type="text" value="0.00"/>	<input type="text" value="N/A"/>	ft <sup>2</sup>
Vertical Orifice Centroid =	<input type="text" value="0.02"/>	<input type="text" value="N/A"/>	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	<input type="text" value="1.14"/>	<input type="text" value="N/A"/>	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	<input type="text" value="2.00"/>	<input type="text" value="N/A"/>	feet
Overflow Weir Grate Slope =	<input type="text" value="0.00"/>	<input type="text" value="N/A"/>	H:V
Horiz. Length of Weir Sides =	<input type="text" value="2.00"/>	<input type="text" value="N/A"/>	feet
Overflow Grate Type =	<input type="text" value="Close Mesh Grate"/>	<input type="text" value="N/A"/>	
Debris Clogging % =	<input type="text" value="0%"/>	<input type="text" value="N/A"/>	%

**Calculated Parameters for Overflow Weir**

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H <sub>g</sub> =	<input type="text" value="1.14"/>	<input type="text" value="N/A"/>	feet
Overflow Weir Slope Length =	<input type="text" value="2.00"/>	<input type="text" value="N/A"/>	feet
Grate Open Area / 100-yr Orifice Area =	<input type="text" value="76.71"/>	<input type="text" value="N/A"/>	
Overflow Grate Open Area w/o Debris =	<input type="text" value="3.16"/>	<input type="text" value="N/A"/>	ft <sup>2</sup>
Overflow Grate Open Area w/ Debris =	<input type="text" value="3.16"/>	<input type="text" value="N/A"/>	ft <sup>2</sup>

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

	Zone 3 Circular	Not Selected	
Depth to Invert of Outlet Pipe =	<input type="text" value="2.30"/>	<input type="text" value="N/A"/>	ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =	<input type="text" value="2.75"/>	<input type="text" value="N/A"/>	inches

**Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate**

	Zone 3 Circular	Not Selected	
Outlet Orifice Area =	<input type="text" value="0.04"/>	<input type="text" value="N/A"/>	ft <sup>2</sup>
Outlet Orifice Centroid =	<input type="text" value="0.11"/>	<input type="text" value="N/A"/>	feet
Half-Central Angle of Restrictor Plate on Pipe =	<input type="text" value="N/A"/>	<input type="text" value="N/A"/>	radians

**User Input: Emergency Spillway (Rectangular or Trapezoidal)**

Spillway Invert Stage =	<input type="text" value="1.80"/>	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	<input type="text" value="10.00"/>	feet
Spillway End Slopes =	<input type="text" value="0.00"/>	H:V
Freeboard above Max Water Surface =	<input type="text" value="1.00"/>	feet

**Calculated Parameters for Spillway**

Spillway Design Flow Depth =	<input type="text" value="0.04"/>	feet
Stage at Top of Freeboard =	<input type="text" value="2.84"/>	feet
Basin Area at Top of Freeboard =	<input type="text" value="0.01"/>	acres
Basin Volume at Top of Freeboard =	<input type="text" value="0.01"/>	acre-ft

**Routed Hydrograph Results**

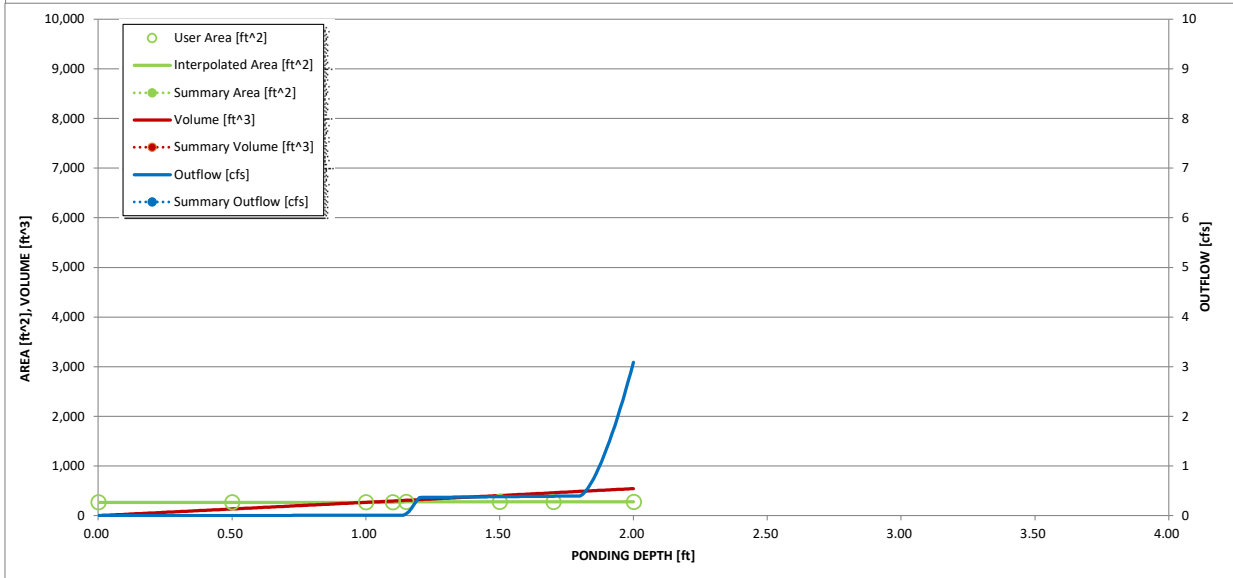
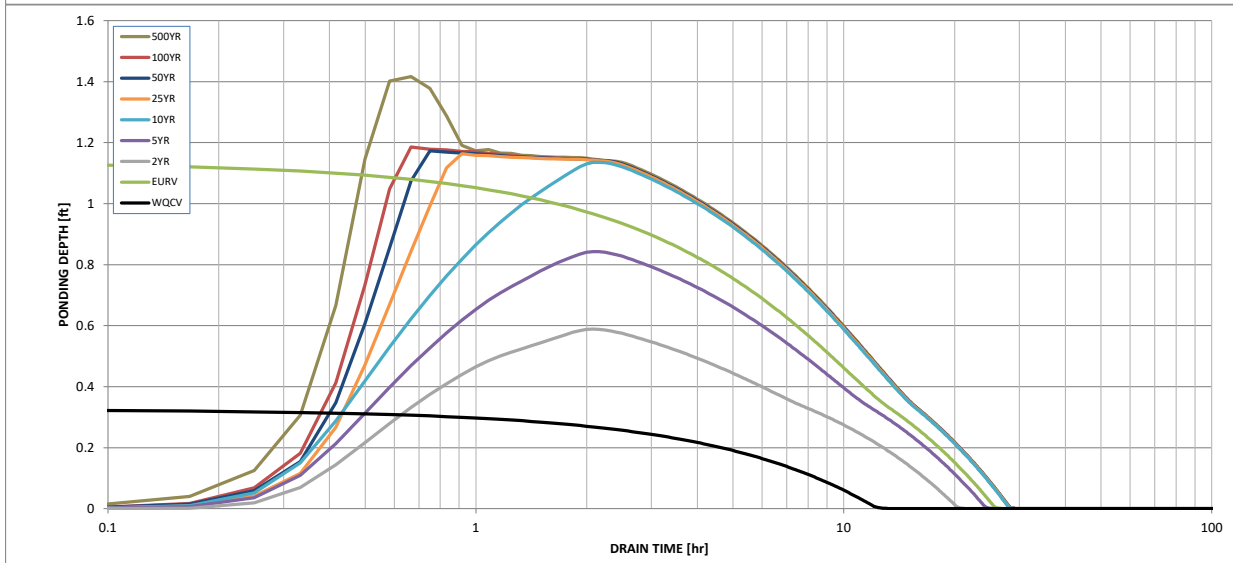
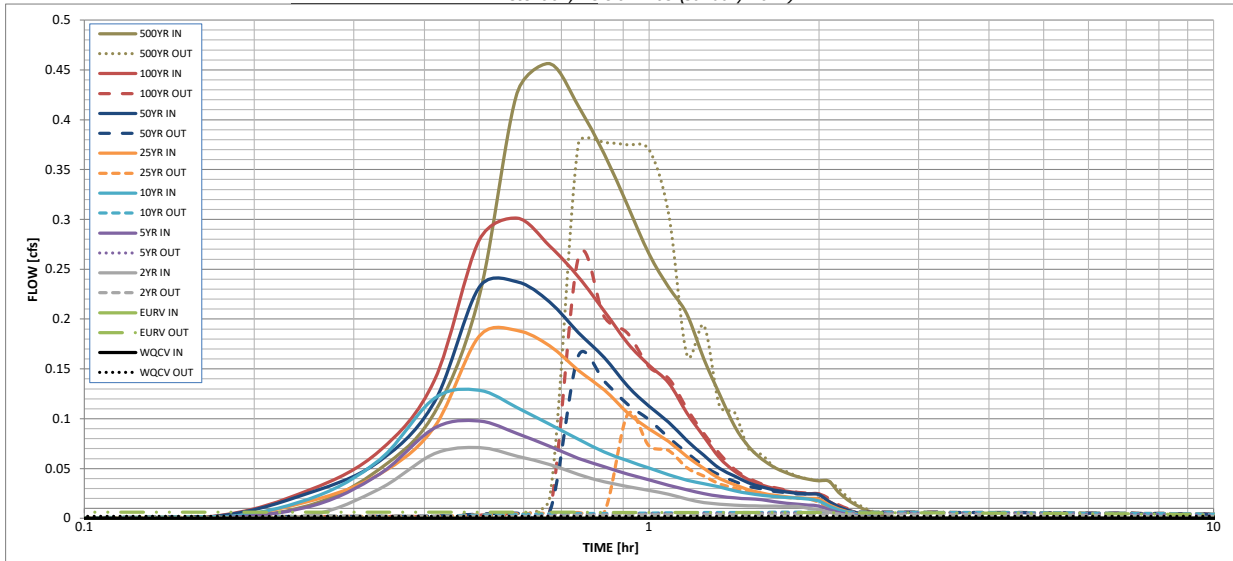
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =	N/A	N/A	0.79	1.07	1.36	1.82	2.23	2.70	3.99
One-Hour Rainfall Depth (in) =	N/A	N/A	0.004	0.006	0.008	0.011	0.014	0.018	0.027
CUHP Runoff Volume (acre-ft) =	N/A	N/A	0.004	0.006	0.008	0.011	0.014	0.018	0.027
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.0	0.0	0.0	0.1	0.1	0.1	0.2
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.0	0.0	0.1	0.1	0.1	0.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.0	0.0	0.1	0.1	0.1	0.2
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.00	0.05	0.23	0.66	0.98	1.38	2.37
Peak Inflow Q (cfs) =	N/A	N/A	0.1	0.1	0.1	0.2	0.2	0.30	0.5
Peak Outflow Q (cfs) =	0.0	0.0	0.00	0.01	0.01	0.10	0.16	0.26	0.38
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.2	0.3	1.8	1.9	2.2	1.8
Structure Controlling Flow =	Vertical Orifice 1	Overflow Weir 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	0.0	0.0	0.1	0.1
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	12	25	20	23	27	26	26	25	23
Time to Drain 99% of Inflow Volume (hours) =	13	26	20	24	28	28	28	27	27
Maximum Ponding Depth (ft) =	0.33	1.14	0.59	0.84	1.14	1.16	1.17	1.19	1.42
Area at Maximum Ponding Depth (acres) =	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Maximum Volume Stored (acre-ft) =	0.002	0.0070	0.004	0.005	0.007	0.007	0.007	0.0073	0.009



# DETENTION BASIN OUTLET STRUCTURE DESIGN

*MHFD-Detention, Version 4.05 (January 2022)*



S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

# DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: \_\_\_\_\_

## Inflow Hydrographs

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

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]	
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	
	0:15:00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.03	0.03	0.05
	0:20:00	0.00	0.00	0.03	0.04	0.06	0.06	0.04	0.06	0.07	0.11
	0:25:00	0.00	0.00	0.06	0.09	0.12	0.09	0.09	0.12	0.14	0.22
	0:30:00	0.00	0.00	0.07	0.10	0.13	0.13	0.18	0.23	0.28	0.43
	0:35:00	0.00	0.00	0.06	0.09	0.11	0.11	0.19	0.24	0.30	0.46
	0:40:00	0.00	0.00	0.05	0.07	0.09	0.09	0.17	0.22	0.27	0.41
	0:45:00	0.00	0.00	0.04	0.06	0.08	0.08	0.15	0.19	0.24	0.37
	0:50:00	0.00	0.00	0.04	0.05	0.07	0.07	0.13	0.16	0.21	0.31
	0:55:00	0.00	0.00	0.03	0.04	0.06	0.06	0.11	0.13	0.18	0.27
	1:00:00	0.00	0.00	0.03	0.04	0.05	0.05	0.09	0.11	0.15	0.23
	1:05:00	0.00	0.00	0.02	0.03	0.04	0.04	0.08	0.10	0.14	0.21
	1:10:00	0.00	0.00	0.02	0.03	0.03	0.04	0.06	0.08	0.11	0.16
	1:15:00	0.00	0.00	0.02	0.02	0.03	0.03	0.05	0.06	0.08	0.12
	1:20:00	0.00	0.00	0.01	0.02	0.03	0.03	0.04	0.05	0.06	0.09
	1:25:00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.04	0.05	0.07
	1:30:00	0.00	0.00	0.01	0.02	0.03	0.03	0.03	0.04	0.04	0.06
	1:35:00	0.00	0.00	0.01	0.02	0.02	0.02	0.03	0.03	0.03	0.05
	1:40:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.05
	1:45:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.04
	1:50:00	0.00	0.00	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.04
	1:55:00	0.00	0.00	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.04
	2:00:00	0.00	0.00	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.04
	2:05:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03
	2:10:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02
	2:15:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	2:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
	2:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	2:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
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5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

## **APPENDIX F**

Existing Conditions Drainage Plan [SHT DR-1]

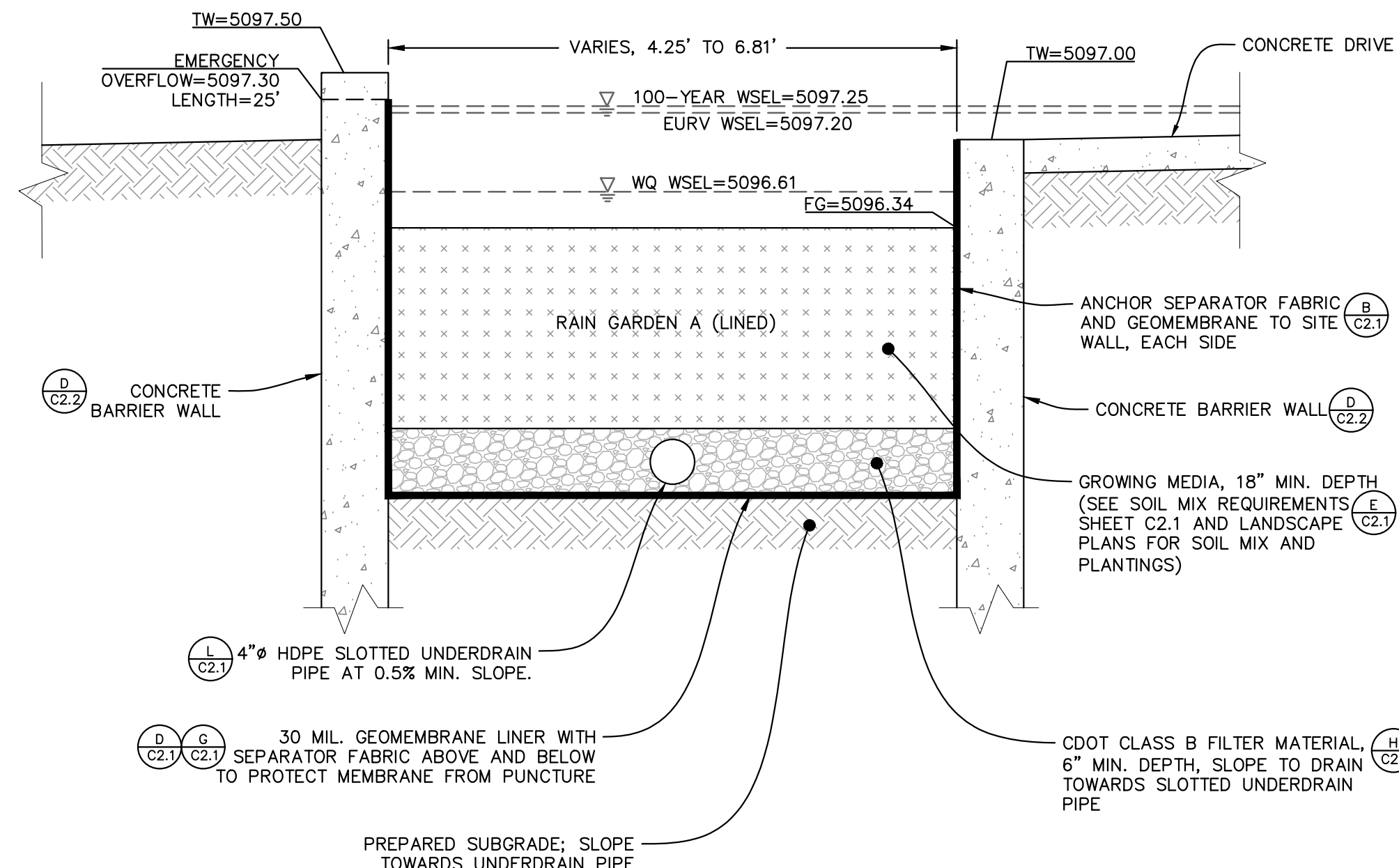
Proposed Conditions Drainage Plan [SHT DR-2]



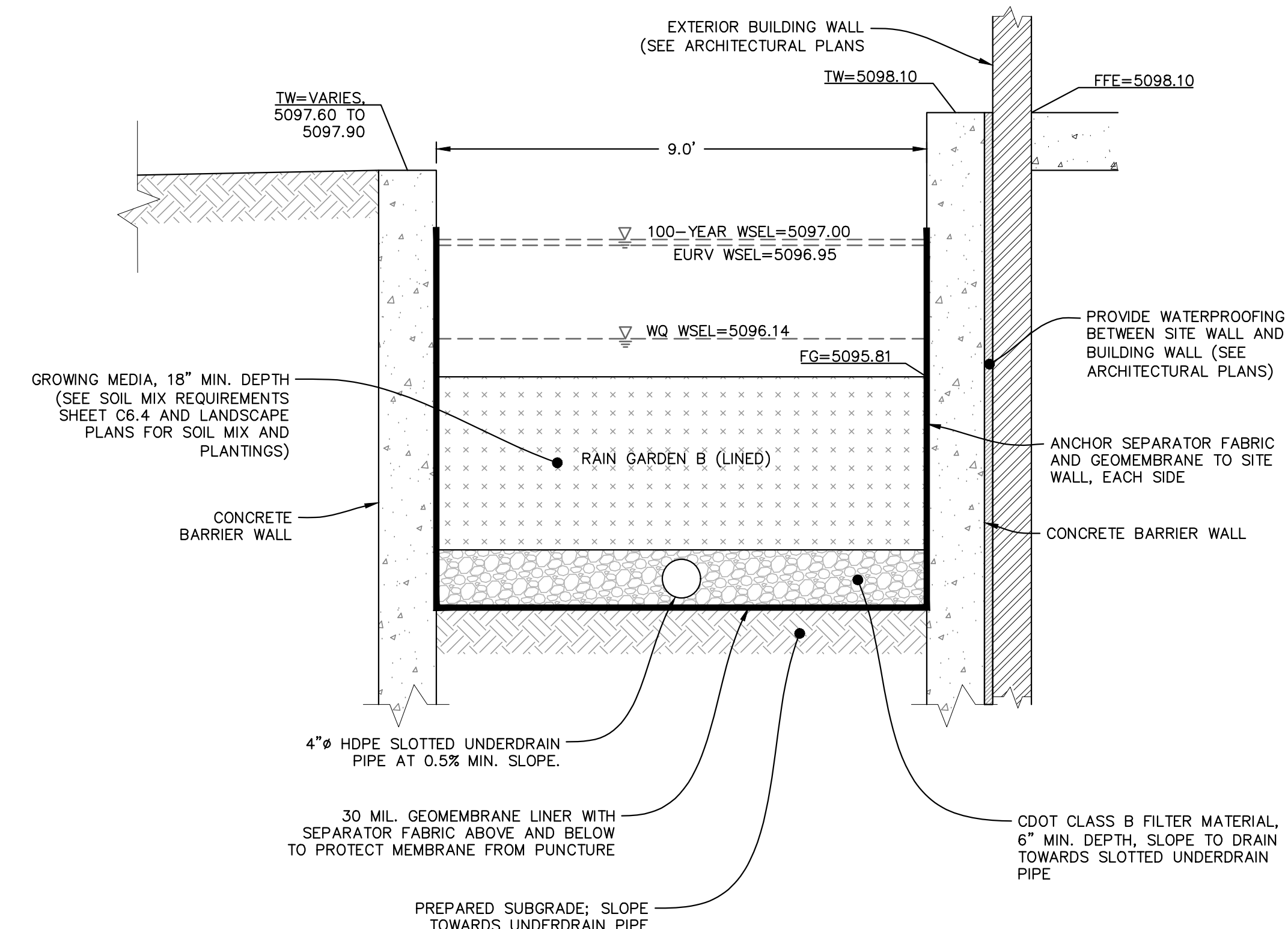




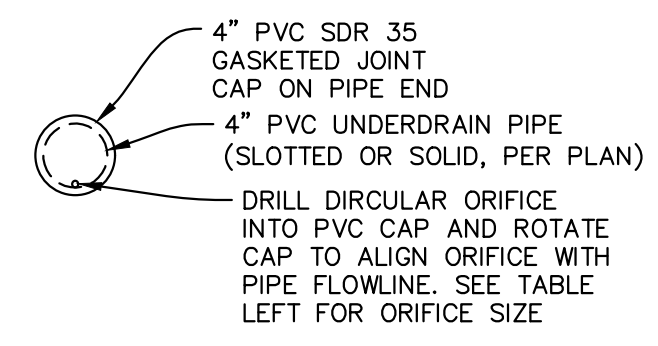




**RAIN GARDEN A SECTION THROUGH PLANTER**  
NO SCALE

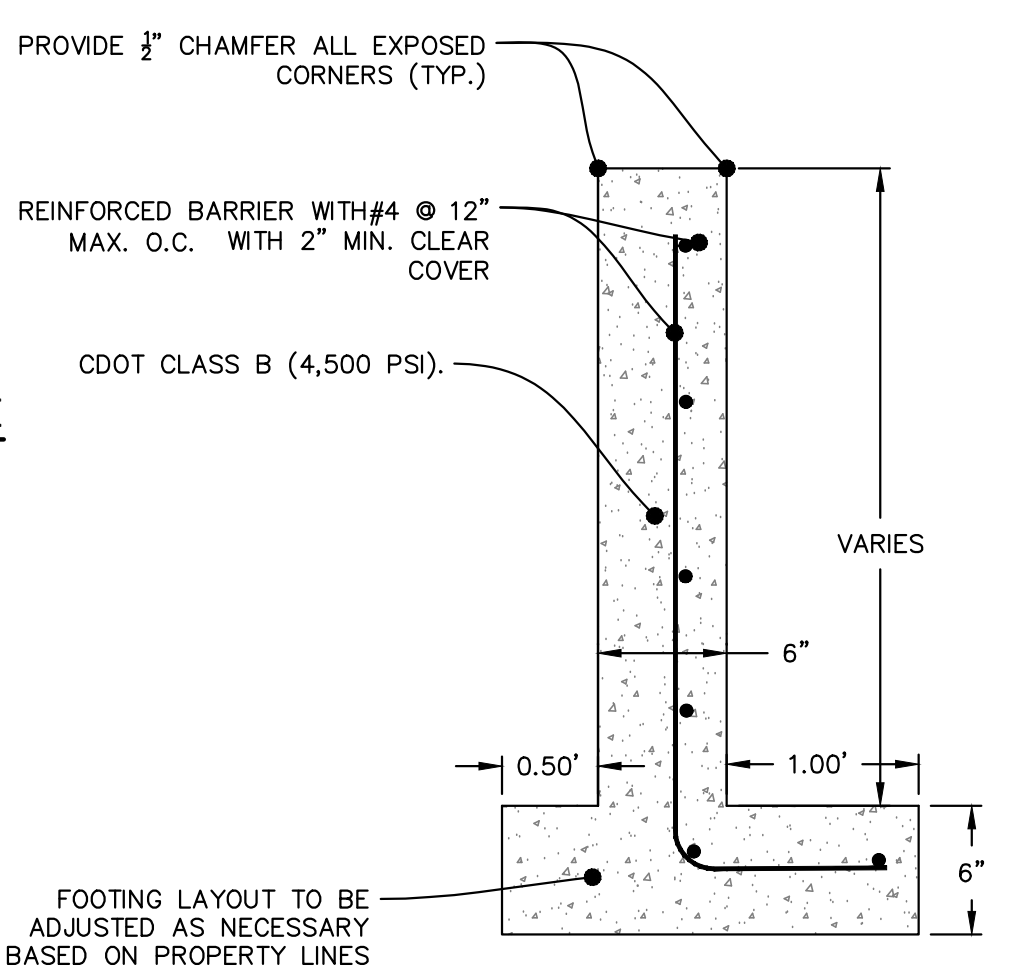


**RAIN GARDEN B SECTION THROUGH PLANTER**  
NO SCALE

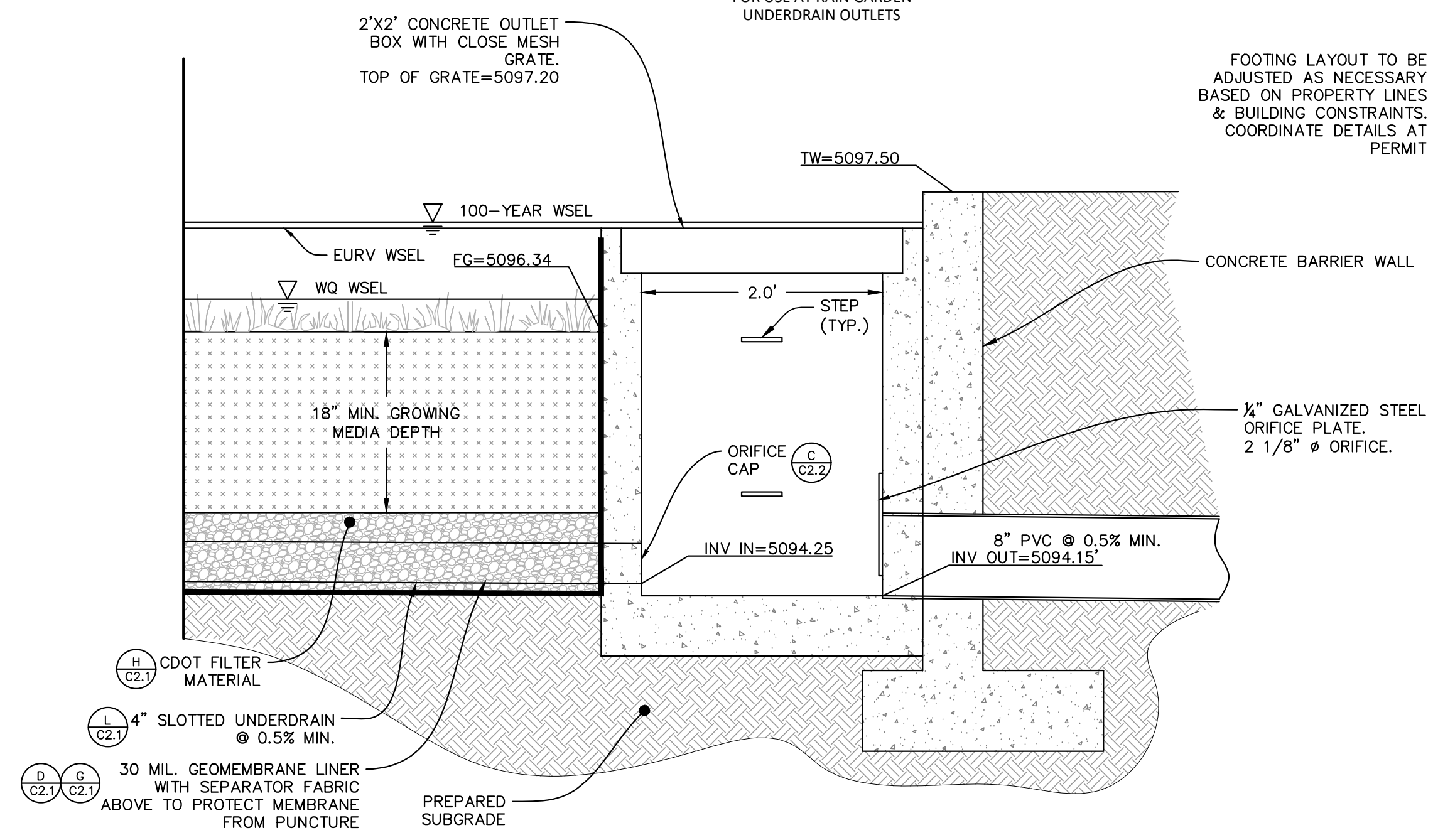


**ORIFICE SIZE TABLE**

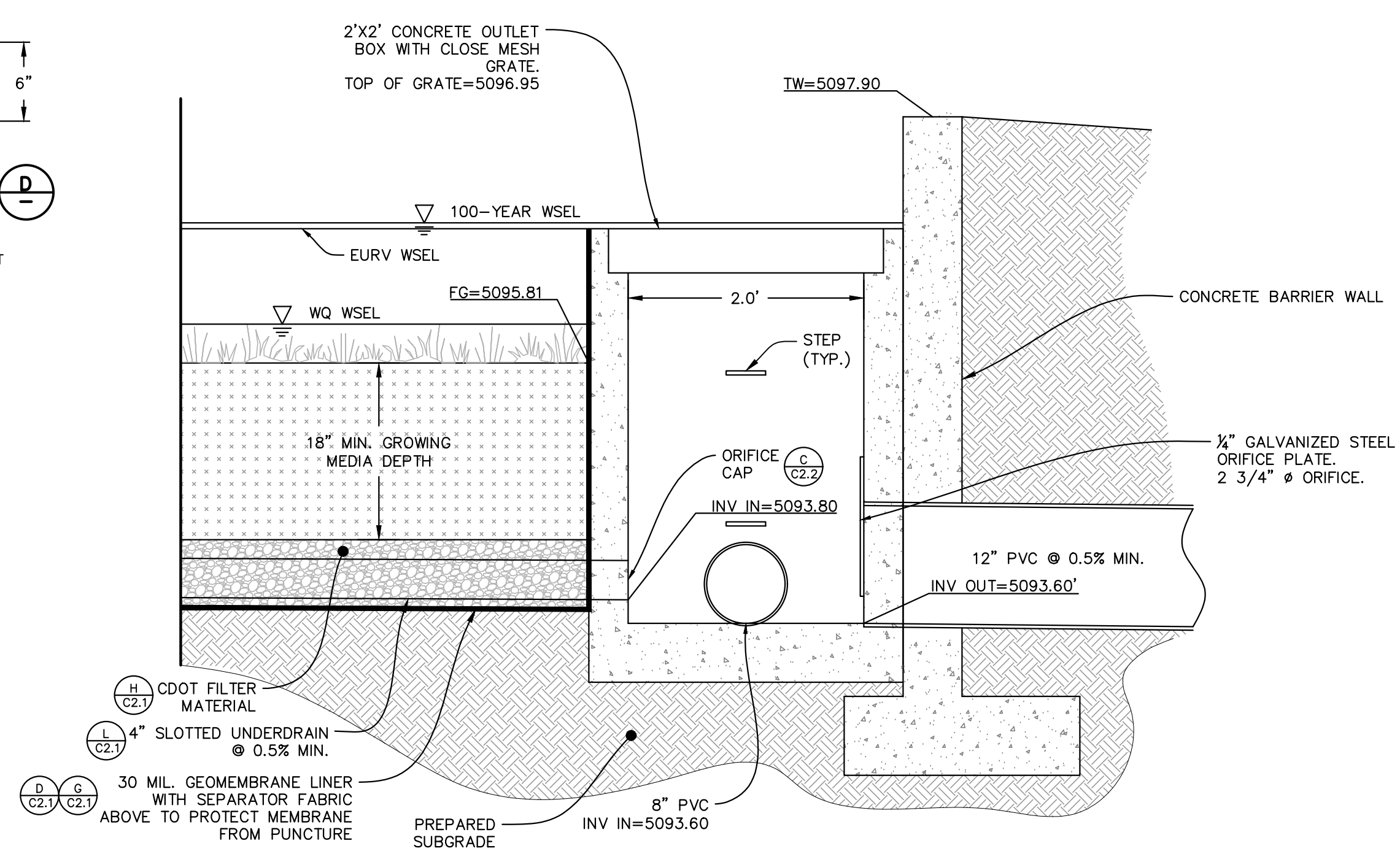
RAIN GARDEN	ORIFICE DIA.
A	3/16"
B	1/4"



**PRELIMINARY CONCRETE RAINGARDEN BARRIER**  
FINAL DESIGN TO BE COORDINATED WITH STRUCTURAL ENGINEER AT BUILDING PERMIT

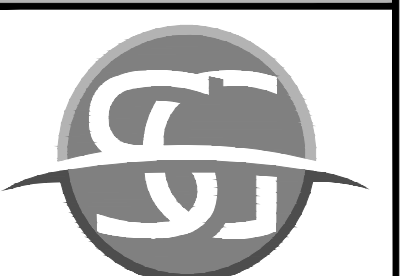


**RAIN GARDEN A OUTLET STRUCTURE**  
NO SCALE



**RAIN GARDEN B OUTLET STRUCTURE**  
NO SCALE

PREPARED BY:



**The Sanitas Group**  
101 FRONT ST, SUITE 350  
LOUISVILLE, CO 80027  
720.481.2710  
PROJECT CONTACT:  
CURTIS C. STEVENS, P.E.

PREPARED FOR:

**ASHLEY NILES PROPERTIES, LLC**  
P.O. BOX 396  
NIWOT, COLORADO

SPR DOCUMENTS FOR:  
**364 2ND AVE**  
UNINCORPORATED BOULDER COUNTY  
STATE OF COLORADO

ISSUE	DATE
SPR	9/22/2022
DESIGNED BY:	TSG
DRAWN BY:	TSG
CHECKED BY:	CCS

DRAWING SCALE:  
HORIZONTAL: NONE  
VERTICAL: NONE

**PRELIM STORM DETAILS (2 OF 2)**  
PROJECT NO. B1418

**C2.2**

SHEET: 5 OF 5