



Land Use

Courthouse Annex • 2045 13th Street • Boulder, Colorado 80302 • Tel: 303.441.3930
Mailing Address: P.O. Box 471 • Boulder, Colorado 80306 • www.bouldercounty.org

MEMO TO: Referral Agencies
FROM: Summer Frederick, AICP, Principal Planner
DATE: June 28, 2019
RE: Docket SU-19-0009

Docket SU-19-0009: Boulder Rifle Club, Inc.

Request: Special Use review to allow for the construction of 5 new ranges (300-yard, 200-yard, 100-meter, 50-meter, 25-meter), a 20,050-square-foot indoor range building, 5 3,132-square-foot range shelters, 3 144-square-foot bathroom facilities, and 1 1,612-square-foot existing range building on parcels #146307001001 and #146307001002.

Location: 4810 N. 26th Street, Parcel #s 146307001001 and 146307001002, at the northern terminus of N 26th Street, approximately 0.68 mile north of its intersection with US 36, in Section 7, Township 1N, Range 70W.

Zoning: Agricultural (A) Zoning District

Applicant/Property Owner: Boulder Rifle Club, Inc., c/o Steve Martin

Agent: Rosi Dennett, Front Range Land Solutions

Special Use Review / Site Specific Development Plan is required of uses which may have greater impacts on services, neighborhoods, or environment than those allowed with only Building Permit Review. This process will review compatibility, services, environmental impacts, and proposed site plan.

This process includes public hearings before the Boulder County Planning Commission and the Board of County Commissioners. Adjacent property owners and holders of liens, mortgages, easements or other rights in the subject property are notified of these hearings.

The Land Use staff, Planning Commission, and County Commissioners value comments from individuals and referral agencies. Please check the appropriate response below or send a letter. Late responses will be reviewed as the process permits; 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 review the entire file at the Land Use Department, 13th and Spruce, Boulder. If you have any questions regarding this application, please contact the Land Use Department office at 720-564-2603 or via email at sfrederick@bouldercounty.org.

Please return responses to the above address by **August 2, 2019**.

_____ We have reviewed the proposal and have no conflicts.
_____ Letter is enclosed.

Signed _____ PRINTED
Name _____
Agency or Address _____

Please note that all Land Use Department property owner's mailing lists and parcel maps are generated from the records maintained by the County Assessor and Treasurer Office. We are required to use this list to send notices to

Deb Gardner County Commissioner

Elise Jones County Commissioner

Matt Jones County Commissioner

the “property owner” of land in Boulder County. If you feel that you should not be considered a “property owner,” or if the mailing address used is incorrect, please contact the County Assessor’s Office at (303) 441-3530.

**Boulder County Land Use Department**

Courthouse Annex Building
2045 13th Street • PO Box 471 • Boulder, Colorado 80302
Phone: 303-441-3930 • Fax: 303-441-4856
Email: planner@bouldercounty.org
Web: 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.

41475-0611143/115 WEB

PAID

Shaded Areas for Staff Only

Intake Stamp

MAY 28 2019

**BOULDER COUNTY
LAND USE****Application Form**

Project Number SU-19-0009		Project Name BOULDER RIFLE SOUTH & WEST RANGES	
<input type="checkbox"/> Limited Impact Special Use <input type="checkbox"/> Limited Impact Special Use Waiver <input type="checkbox"/> Modification of Special Use <input type="checkbox"/> Site Plan Review <input type="checkbox"/> Site Plan Review Waiver <input type="checkbox"/> Subdivision Exemption <input type="checkbox"/> Exemption Plat <input type="checkbox"/> 1041 State Interest Review <input type="checkbox"/> Other:		Application Deadline: First Wednesday of the Month <input type="checkbox"/> Variance <input type="checkbox"/> Appeal	
		Application Deadline: Second Wednesday of the Month <input type="checkbox"/> Sketch Plan <input type="checkbox"/> Preliminary Plan <input type="checkbox"/> Final Plat <input checked="" type="checkbox"/> Resubdivision (Replat) <input checked="" type="checkbox"/> Special Use/SSDP	
Location(s)/Street Address(es) 4810 NORTH 26TH STREET, NORTH OF BOULDER, EAST OF US HIGHWAY 36 AND NORTH OF YARMOUTH AVENUE AT TERMINUS OF NORTH 26TH STREET.			
Subdivision Name TERMINUS OF NORTH 26TH STREET.			
Block(s)	Section(s)	Township(s)	Range(s)
	7	1 NORTH	70 WEST
Area In Acres TOTAL- 24.87	Existing Zoning AG	Existing Use of Property RIFLE RANGE + VACANT	Number of Proposed Lots 2 EXISTING LOTS
Proposed Water Supply WATER STORAGE TANKS		Proposed Sewage Disposal Method SEPTIC VAULTS	
OF 6.23 ACRES 18.64 AC PACELS			

Applicants:

Applicant/Property Owner BOULDER RIFLE CLUB, INC., c/o STEVEN MARTIN, PRESIDENT		Email Address PRESIDENT@BOULDERRIFLECLUB.COM	
Mailing Address PO BOX 21197			
City BOULDER	State CO	Zip Code 80308	Phone 303-449-9002
Applicant/Property Owner/Agent/Consultant BOULDER COUNTY PARKS + OPEN SPACE, c/o JANIS WHISMAN		Email Address JWHISMAN@BOULDERCOUNTY.ORG	
Mailing Address 5201 ST. VRAIN ROAD			
City LONGMONT	State CO	Zip Code 80503	Phone 303-678-6263
Agent/Consultant ROSL DENNETT, AICP, LAND SOLUTIONS		Email Address ROSDENNETT@GMAIL.COM	
Mailing Address 210 LINCOLN STREET			
City LONGMONT	State CO	Zip Code 80501	Phone 303-682-9729

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>[Signature]</i>	Printed Name Steven Martin President	Date 5/23/19
Signature of Property Owner <i>[Signature]</i>	Printed Name ERIK LANE, DIRECTOR PARKS & OPEN SPACE	Date 5/23/19

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

Form: P/01 - Rev. 04.28.16 - g:/publications/planning/P01PlanningApplicationForm.pdf

* Final approval may be subject to Conditions



Boulder County Land Use Department

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Vicinity

4923, 4810 N 26TH ST

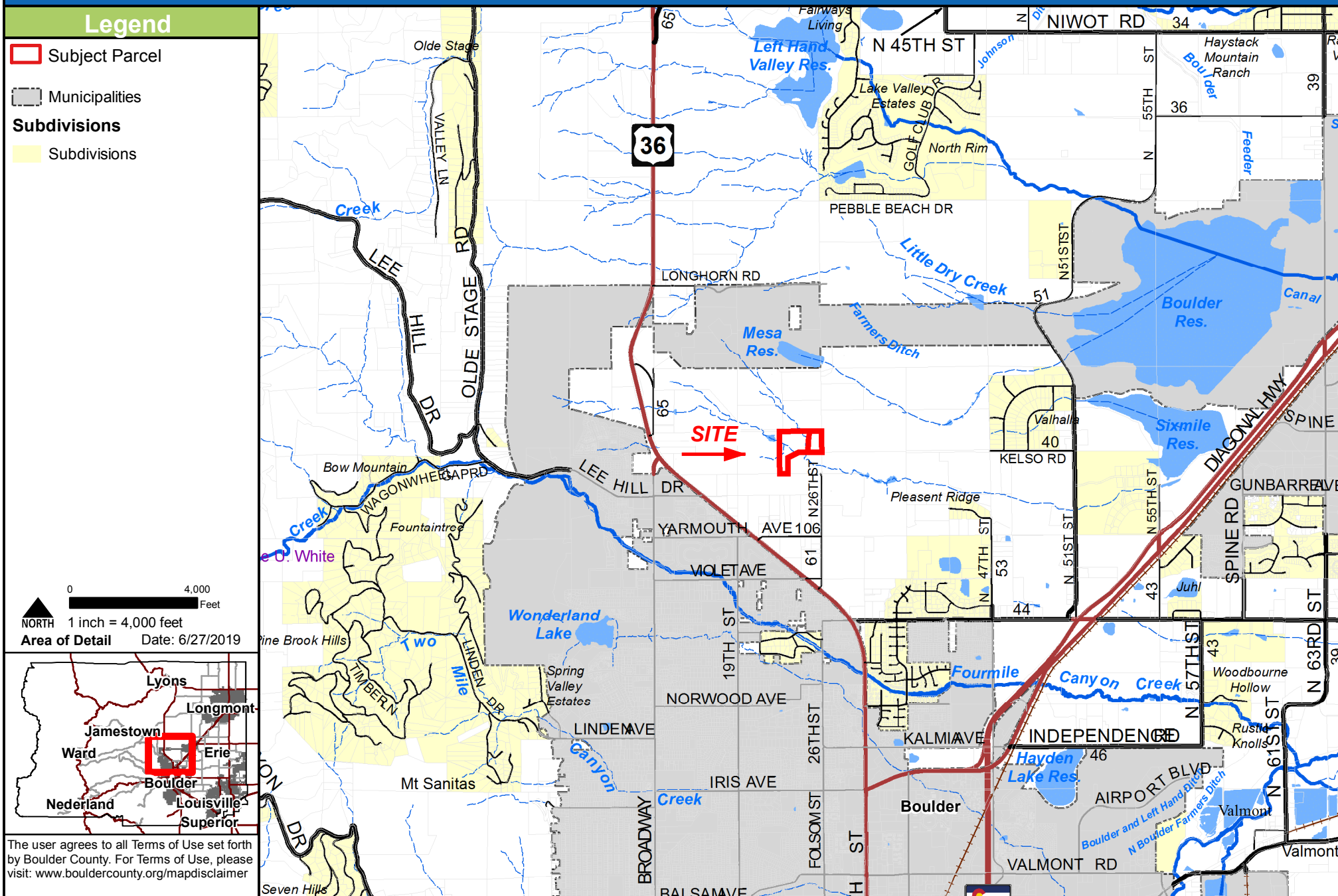
Legend

Subject Parcel

Municipalities

Subdivisions

Subdivisions



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Location

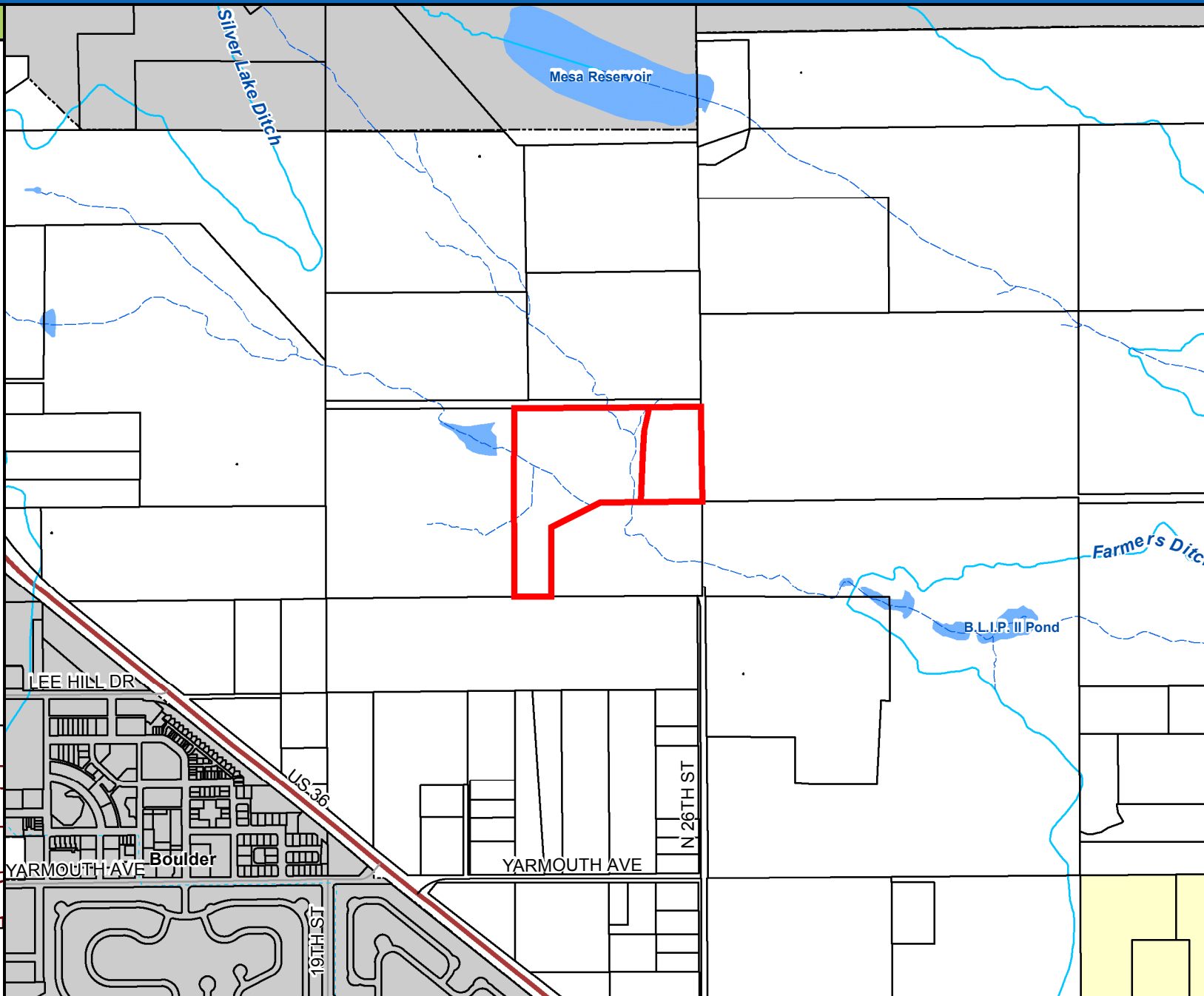
4923, 4810 N 26TH ST

Legend

 Subject Parcel

Subdivisions

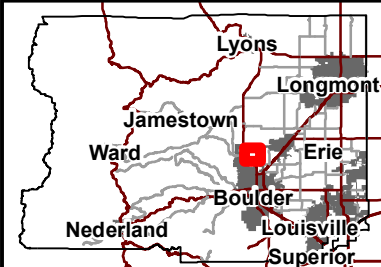
 Subdivisions



0 1,000
Feet

NORTH 1 inch = 1,000 feet

Area of Detail Date: 6/27/2019



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Aerial

4923, 4810 N 26TH ST

Legend

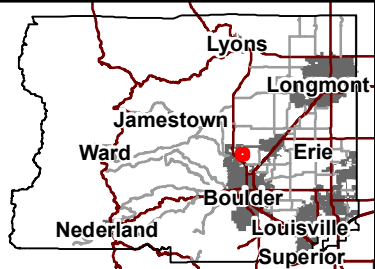
 Subject Parcel



0 300
Feet

NORTH 1 inch = 300 feet

Area of Detail Date: 6/27/2019



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Comprehensive Plan

4923, 4810 N 26TH ST

Legend

- Subject Parcel
- NLNA Buffer
- Critical Wildlife Habitats
- Environmental Conservation Areas
- Riparian Areas
- Wetlands
- Significant Natural Communities

High Biodiversity Areas

- B2: Very High Biodiversity Significance
- Natural Landmarks Natural Areas

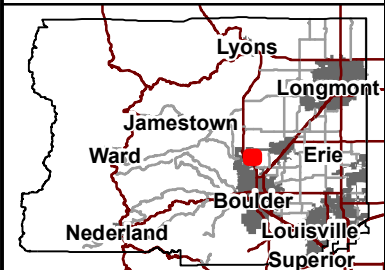
Significant Agricultural Land

- Ag of Statewide Importance
- Ag of Local Importance

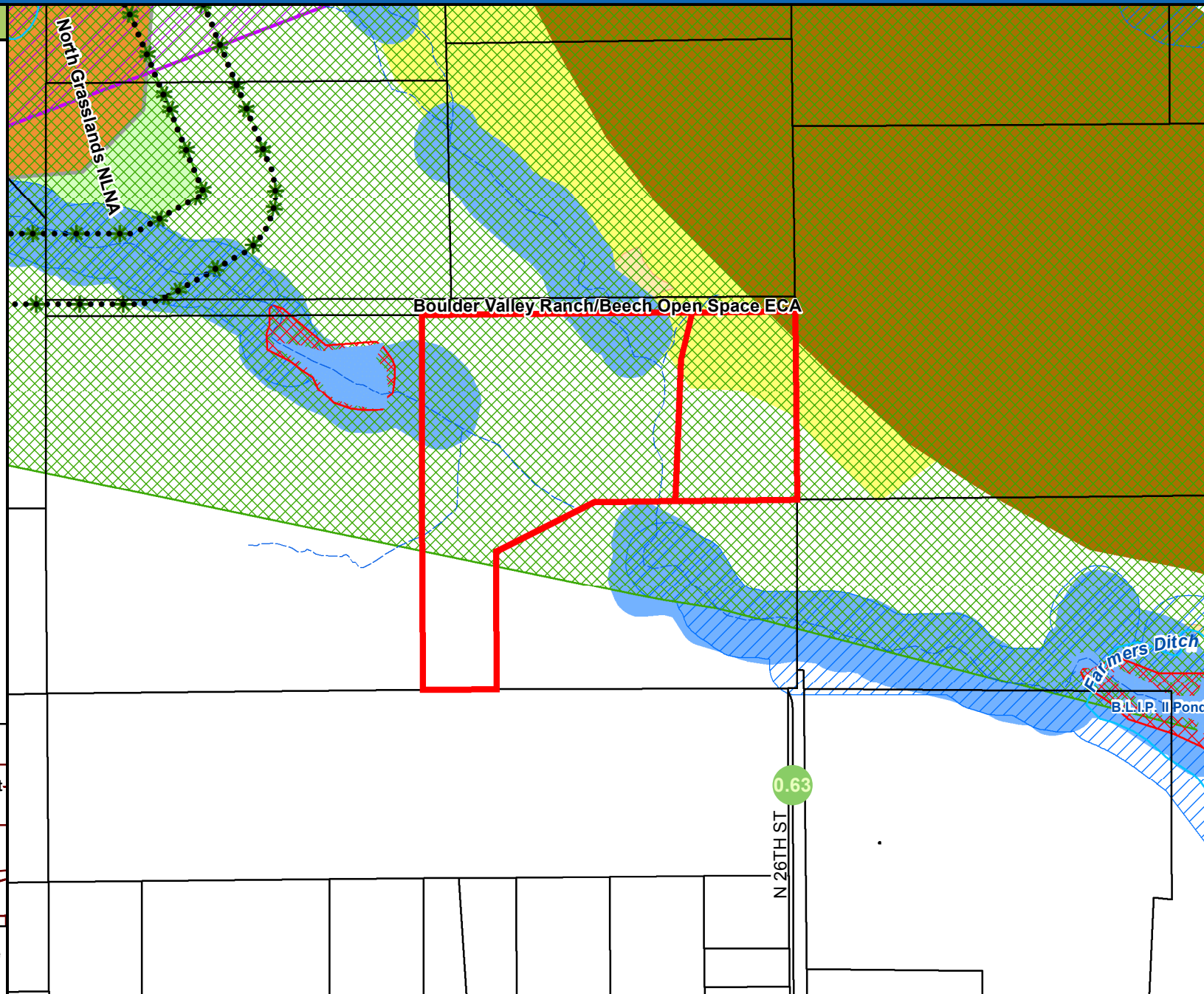
Rare Plant Areas

NORTH 1 inch = 500 feet

Area of Detail Date: 6/27/2019



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Public Lands & CE's

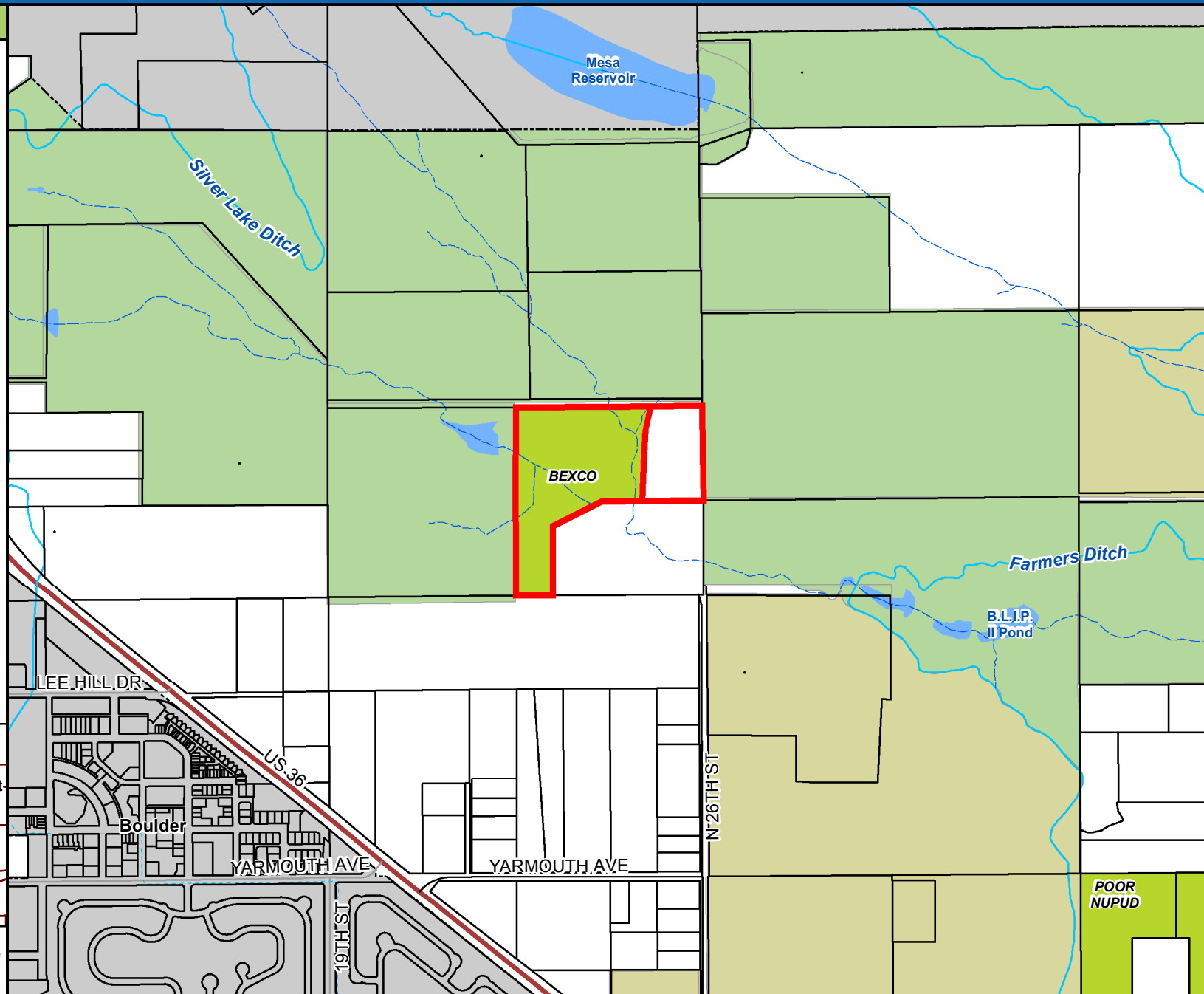
4923, 4810 N 26TH ST

Legend

Subject Parcel

Boulder County Open Space

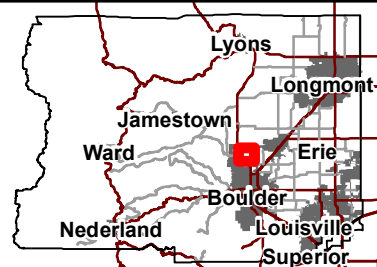
- County Conservation Easement
- City Parks and Open Space
- OSMP Properties



0 1,000 Feet

NORTH 1 inch = 1,000 feet

Area of Detail Date: 6/27/2019



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Geologic Hazards

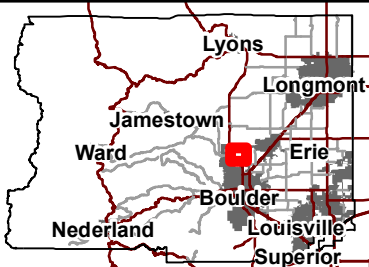
4923, 4810 N 26TH ST

Legend

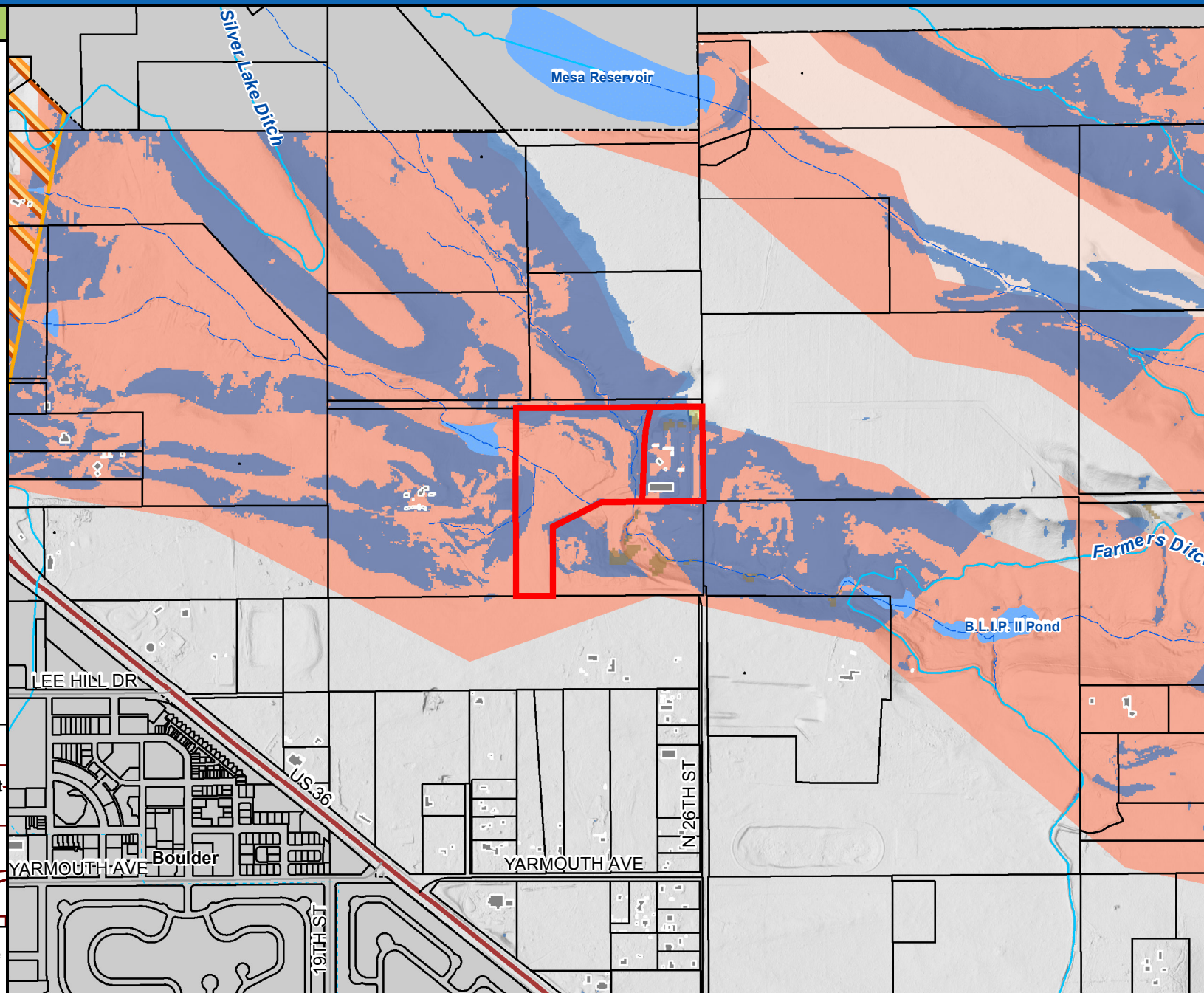
- Subject Parcel
- Steeply Dipping, Heaving Bedrock
- Debris flow susceptibility area
- Rockfall susceptibility area
- Landslide high susceptibility area
- High Swelling Soil Potential
- Moderate Swelling Soil Potential

0 1,000
Feet

NORTH 1 inch = 1,000 feet
Area of Detail Date: 6/27/2019



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Zoning

4923, 4810 N 26TH ST

Legend

Subject Parcel

Major Road Setbacks

110 feet

Zoning Districts

Agricultural

Commercial

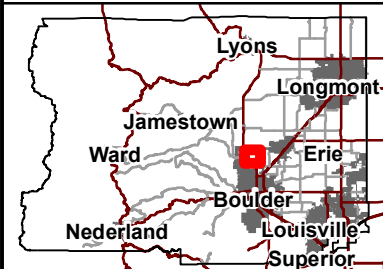
Rural Residential

Transitional

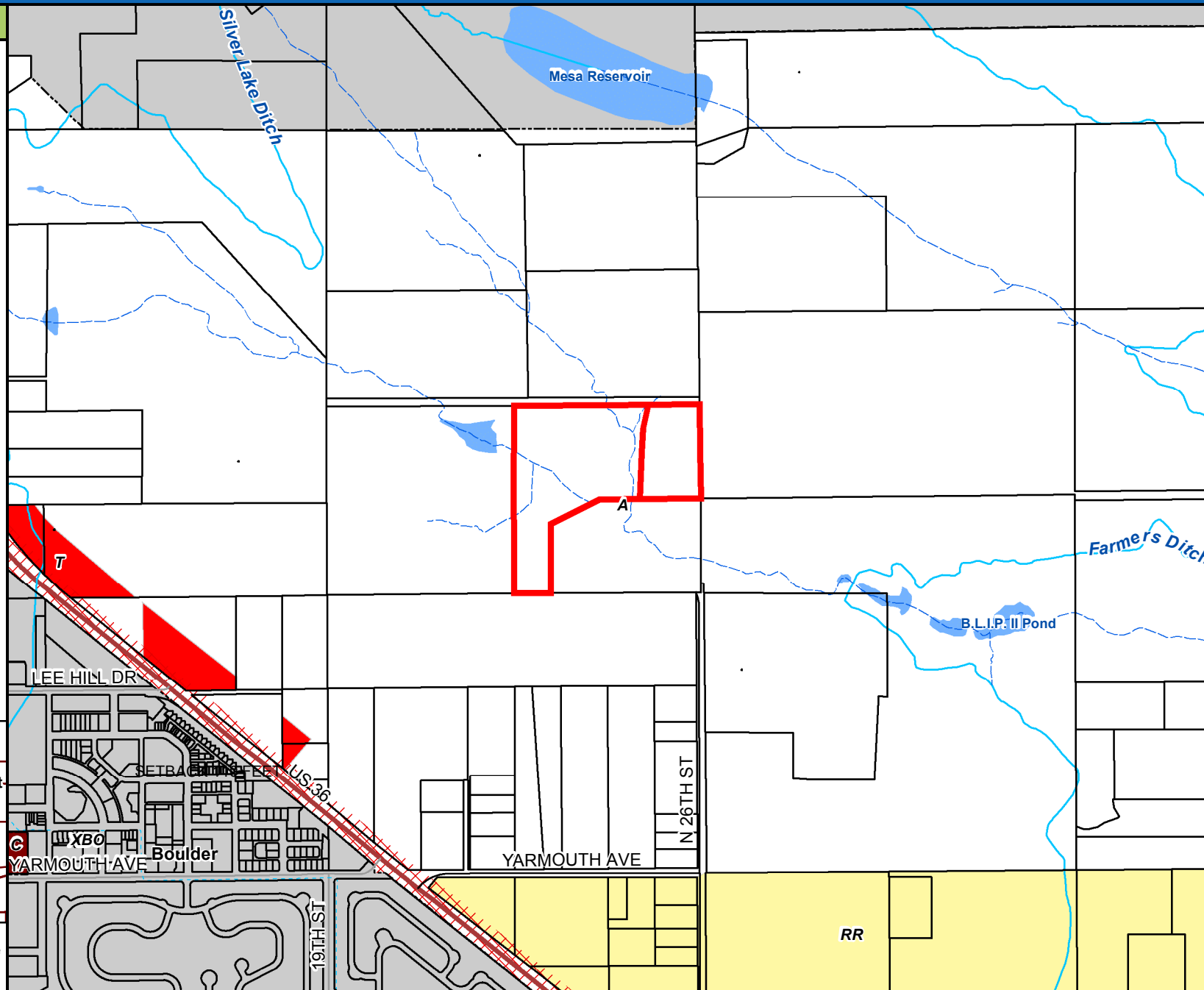
0 1,000
Feet

NORTH 1 inch = 1,000 feet

Area of Detail Date: 6/27/2019



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Boulder County Land Use Department

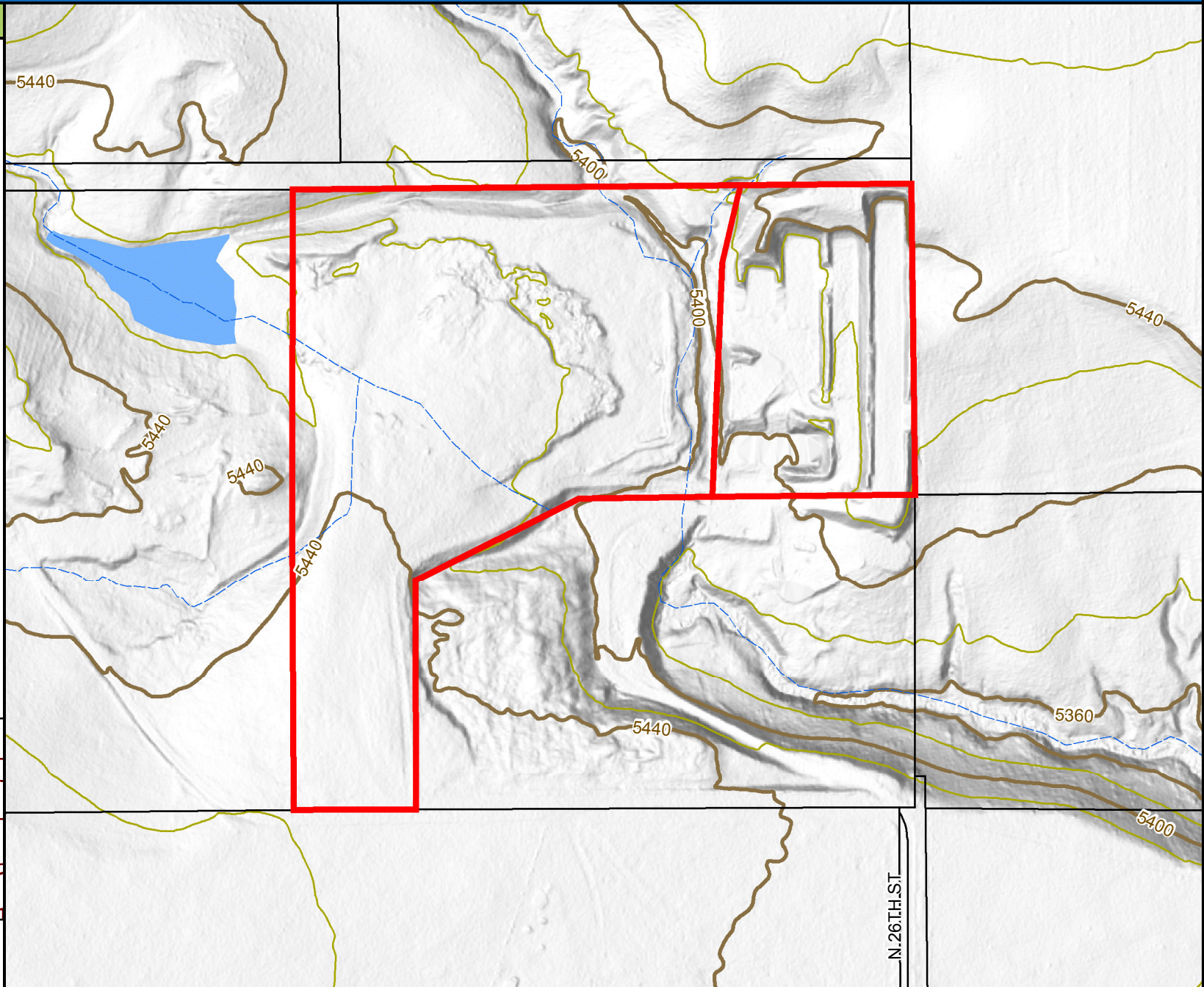
2045 13th Street, Boulder, CO 80302 303-441-3930 www.bouldercounty.org/lu

Elevation Contours

4923, 4810 N 26TH ST

Legend

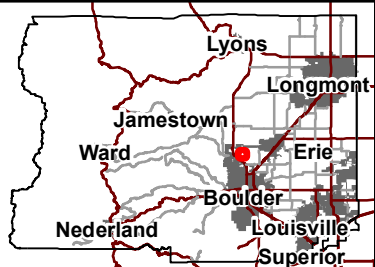
-  Subject Parcel
-  Contours 40'
-  Contours 20'



0 300
Feet

NORTH 1 inch = 300 feet

Area of Detail Date: 6/27/2019



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Parks & Open Space

5201 St. Vrain Road • Longmont, Colorado 80503
303.678.6200 • Fax: 303.678.6177 • www.bouldercounty.org

May 23, 2019

Rosi Dennett, AICP
Front Range Land Solutions
for **Boulder Rifle Club Inc.**
210 Lincoln St.
Longmont, CO 80501

Re: Conservation Easement Program approval to submit Special Use application to the Land Use Department for the Bexco CER conservation easement property at 4923 N. 26th Street, Unincorporated Boulder County

Dear Ms. Dennett,

Staff has reviewed the Boulder Rifle Club's Special Use Land Use application for an expansion of the shooting range over the property described above. The property is encumbered with a conservation easement that is recorded in the real estate records of Boulder County, Colorado at Reception No. 1942070 on May 24, 1999.

The applicants propose expanding the shooting range from the adjacent unencumbered parcel at 4810 N. 26th Street onto the conservation easement parcel at 4923 N. 26th Street. Although the proposal is in conflict with the terms of the existing conservation easement over the property, the attached letter from the Board of County Commissioners dated February 1, 2018 states that the county commits to work to revise the existing conservation easement on the property to allow a shooting range use; therefore, **the Conservation Easement Program at Parks & Open Space consents to the submission of this application to the Land Use Department.** Please note that this letter only serves as approval to submit the application to the Land Use Department for review and does not serve as final approval from Parks & Open Space. As a referral agency, Parks & Open Space will receive the submitted application directly from Land Use as a part of the formal review process and staff will continue to work with the applicants to allow a shooting range use on the conservation easement property. Final approval may be subject to conditions.

Please submit this letter with your application to the Land Use Department.

Thank you,
Melissa Arnold

Conservation Easement Program Manager
(303) 678-6266
marnold@bouldercounty.org



Board of County Commissioners

February 1, 2018

Colorado Parks and Wildlife
Jim Guthrie, SRDG Program Coordinator

Via e-mail @ jim.guthrie@state.co.us

Re: Support for Boulder Rifle Club's application for Shooting Range Design Funding

Dear Mr. Guthrie:

The Boulder County Commissioners are happy to provide this letter of support for the Boulder Rifle Club's (BRC) application for a Shooting Range Design grant from Colorado Department of Parks and Wildlife. This grant will be used for design of a public shooting facility adjacent to BRC's Boulder shooting range.

The Boulder County Commissioners have been part of the Northern Front Range Recreational Sport Shooting Management Partnership (the Partnership) for a number of years. The Partnership is working to develop a landscape-level, multi-jurisdictional strategy to provide safe, responsible and accessible recreational sport shooting opportunities while addressing conflicts near residential areas and with other recreation users across the northern Colorado Front Range. Boulder County's support for this grant application, as well as our commitment to work with BRC to develop a new public sport shooting facility is an exciting collaboration to further the work of the Partnership.

If the Rifle Club is successful in obtaining this grant, Boulder County commits to provide funding of up to \$15,625 toward the 25% match requirement and to work to revise the existing Conservation Easement on the Club's property to allow a shooting range use.

An expanded facility at BRC could provide a 300-yard range as well as other shorter distance ranges totaling approximately 30 lanes. This facility will support additional shooting opportunities that are safe and affordable to different types of shooters, increasing the variety of public shooting opportunities in Boulder County.

If you have any additional questions, please feel free to contact Michelle Krezek, Commissioners' Deputy, at Mkrezek@bouldercounty.org or 303-441-3561.

Sincerely,


Cindy Domenico, Chair
For the Board of County Commissioners

Cindy Domenico County Commissioner Deb Gardner County Commissioner Elise Jones County Commissioner

Boulder County Courthouse • 1325 Pearl Street • Boulder, Colorado 80302 • Tel: 303.441.3500 • Fax: 303.441.4525
Mailing Address: P.O. Box 471 • Boulder, Colorado 80306 • www.bouldercounty.org • commissioners@bouldercounty.org

**BOULDER RIFLE RANGE
Special Use**

DEVELOPMENT REPORT

May 28, 2019

Applicant/Property Owner:

**Boulder Rifle Club Inc.
Steven Martin, President
PO Box 21197
Boulder, CO 80308
303-499-9002
president@boulderrifleclub.com**

Prepared by:

**Rosi Dennett, AICP
Front Range Land Solutions
210 Lincoln Street
Longmont, CO 80501
303-682-9729
rosidennett@gmail.com**

**Boulder Rifle Range
Special Use
May 28, 2019**

DEVELOPMENT REPORT

This report is written to correspond to the application submittal requirements in Section 3 and the special use requirements in Section 4-600, 4-601 and 4-602 of the Boulder County Land Use Code.

Background

Boulder Rifle Club, Inc. is the owner of two adjacent properties (totaling 24.87 acres) that are located approximately ½ mile north of the intersection of Yarmouth Avenue and 26th Street, north of Boulder, in the East Quarter of Section 7, Township 1 North, Range 70 West. Both properties were used for years for informal recreational shooting before they became respectively a shooting range and construction debris landfill. The existing rifle range (known as the South Range) is located on the eastern parcel and is governed by Boulder County Special Use # SU-87-13. This parcel consists of 6.23 acres with an address of 4810 North 26th Street. A portion of the western parcel was used for years as a construction debris landfill. The western parcel is now vacant and comprises 18.64 acres. Both parcels are accessed via an existing road easement off North 26th Street.

The United States Forest Service has been working with Boulder, Larimer, Gilpin and Clear Creek Counties on the Recreational Sport Shooting Management Project to close down the informal target practice sites in the mountains, specifically in the Arapahoe National Forest, because of public safety concerns. To provide alternative shooting ranges for the public, each county has committed to supporting supervised and safe outdoor shooting ranges open to the general public that also provide gun safety education opportunities.

Unsupervised recreational shooting on USFS land within Boulder County has created significant safety concerns for years, and several wildfires have been attributed to casual shooting in Lefthand Canyon.

The existing South Range, operated by the Boulder Rifle Club, is a membership only facility with a long waiting list of interested potential members. Because the Boulder Rifle Club also owns the property adjacent to and west of the existing site, the opportunity exists to expand the operations to construct new ranges (indoor and outdoor) that can be open to the public. Boulder County currently has no public shooting ranges.

The subject properties are located within Boulder County's Agricultural zoning district which allows for a shooting range by special review. The vacant western parcel currently has a County conservation easement on it that will need to be removed or modified to allow for a shooting range.

The existing South Range consists of four outdoor ranges (25 yards, 50 yards, 100 yards and 200 yards) with firing shelters, side berms and backstops, a classroom and indoor firing range, two restroom buildings with vaulted toilets and a building for storage of targets.

Both properties are located within the southern edge of the Boulder Valley Ranch Environmental Conservation Area designation in the Boulder County Comprehensive Plan. The northeast portion of the site is designated as Significant Agricultural Land of Local Importance, and the extreme northeast corner is designated as Significant Agricultural Land of Statewide Importance. A wetland designation is also indicated on the northern portion of the drainage area that is located between the two subject properties. The subject properties are located within Area III of the Rural Preservation Area designation in the Boulder Valley Comprehensive Plan.

Proposal Description

This is a request for approval of a special use for a rifle range on the western subject property (known as the West Range) and a special use amendment to SU-87-13 for improvements to the existing South Range. A special review is also required for a use that generates traffic volumes in excess of 150 average daily trips per lot. In addition, more than 500 cubic yards of material will be necessary to move as part of the grading plan to ensure proper drainage which requires a limited impact special use.

To provide new and improved facilities for the public and Boulder Rifle Club members, five new outdoor ranges (300 yards, 200 yards, 100 meters, 50 meters and 25 meters) and an indoor range are proposed on the West Range property. These improvements will provide supervised, safe, and noise-mitigated shooting opportunities as well as opportunities for increased gun safety education classes, hunter safety classes, and training and practice facilities for local law enforcement officers.

Each outdoor range will have 8-foot tall ballistic barriers along the sides, a 20-foot tall ballistic backstop, and a firing shelter with ceiling baffles. These noise mitigation features also provide safe areas from one range to the other which reduces the size of the Surface Danger Zone of each range (as shown on the Site Plan).

The South Range currently averages 43 persons per weekday and 131 persons per weekend when mild weather permits. At total buildout, the proposed total of

11 ranges at both the West Range and South Range may average 95 persons per weekday and 288 persons per weekend when mild weather permits. Hours of operation will be 7 am or sunrise, whichever is later, to dusk, 7 days per week, with occasional after-dark training of law enforcement officials. The outdoor facilities will be available as weather permits with much less use anticipated during the winter months. The indoor facility may be used after dark, but essentially no noise will escape it.

Staffing at the West Range will include one employee per outdoor range plus one floater employee. The indoor range will have three employees for a total of 9 employees on site when all of the proposed facilities are constructed and available to the public for use.

Construction Phasing

The improvements will be constructed in phases as funds are acquired.

Phase 1 includes West Range construction of three outdoor ranges (25 meters, 50 meters and 100 meters) with side perms, backstops, firing shelters, vault toilets and parking lot. Access road improvements, property entrance gate, detention pond and water cisterns will also be constructed in the first phase. South Range improvements will also occur in the first phase and include construction of new firing structures on the 200-yard range and 100-yard range, side berm work on the 200-yard range, parking lot construction, gate installation at the west boundary of the South Range property and some regrading.

Phase 2 consists of West Range construction of the 200-yard range and 300-yard range with side berms, backstops, firing shelters, vault toilet and parking lot.

Phase 3 includes construction of the indoor range building, sewage system tank installation, parking lot and landscaping.

Water & Sewer

No public water or sewer services are available to this site. Two water cisterns will be installed, as shown on the Site Plan, for potable water and firefighting water. A water line will be extended to the indoor range building and the outdoor range vault toilets, as shown on the Utility Plan. The ADA-compliant vault toilets will have water-flushing toilets and hand-washing facilities.

The vault toilets will be pumped as needed. As described in the Preliminary Design Report by Engineer Ed Glassgow of Scott Cox & Associates, the sewage system for the indoor range building will be an enclosed vault with no leach field and will also be periodically pumped as needed. The location of this vault is noted on the Site Plan.

Access, Parking and Traffic

Historically, the access to the South Range was through City property with an access agreement, but an existing access through the western parcel will be the main access to both ranges. That access continues onto an existing road within a 30-foot wide easement for a distance of approximately 700 feet to 26th Street.

Small parking lots are dispersed throughout the site adjacent to each outdoor range and the indoor range and will provide a total of 209 parking spaces, including 18 ADA-accessible parking spaces. All roadways and parking lots on site will be gravel surfaces.

The Traffic Study was completed by Delich Associates and concludes the proposal is feasible from a traffic engineering standpoint. The total traffic generation full build out may be approximately 190 daily trip ends, 3 morning peak hour trip ends, and 38 afternoon peak hour trip ends. The existing street system is adequate to serve the proposed improvements. In addition, the closure of the informal recreational shooting areas throughout the canyons of Boulder County will reduce a significant amount of traffic to and from those mountain sites. The Boulder County Sheriff's Office and other law enforcement agencies with jurisdiction receive approximately 600 complaint calls per year regarding concerns with recreational shooting in the canyons.

Drainage and Grading

The drainage report and grading plans were completed by Rocky Ridge Civic Engineering. Surface drainage will be directed to the detention pond shown on the plans which will discharge stormwater drainage at a rate that does not exceed historic levels of drainage from this site. To minimize having to haul material offsite, the grading plans were designed to accommodate most of the soil onsite. The projected amount of material to be moved is 46,844 cubic yards of cut and 48,180 cubic yards of fill. All grading will be completed in accordance with County regulations, including the use of dust suppression methods.

Acoustics

Behrens and Associates, Inc. completed an extensive noise study which included a sound level survey at various locations within the residential area to the south of the site. The proposed firing structures mitigate noise levels to the acceptable range below the Land Use Code limit of 65 dB maximum impulse. Even though County approval of the existing South Range predates the Land Use Code sound requirement, this proposal includes adding the new firing shelters to the 100-yard and 200-yard ranges to reduce the existing noise levels as funds become available.

Architectural Design

The firing shelters and indoor range building were designed by Thomas Moore Architects to be functional while maintaining as low a profile on the landscape as possible. Elevation drawings of the proposed structures and floor plans are included with this application submittal. Photos of the existing structures at the South Range are also included.

The firing structures are three-sided structures of approximately 3,100 sq.ft. They are typically 15.5 ft. tall at the roof ridge and will be constructed with sound baffling and ballistic materials to absorb sound and negligent discharge. The exterior materials will be standing seam metal roofing in a dark or neutral color and fiber-cement board and batten siding, in tan or earth-tone colors.

The proposed two-story indoor range building has a footprint of 15,060 sq.ft. with a roof ridge height of approximately 38 feet above grade at the main entry. Exterior materials include standing seam metal roofing in a dark or neutral color, board and batten siding with a masonry wainscot at selected elevations. The color palette for this and all the new site buildings is a blend of warm earth-tones that will not stand out in sharp contrast with the surrounding environment. The building forms are "agrarian" in scale and form. Landscaping to screen the south side of the new indoor range building will be a wind-row of evergreens with a rock-mulch base. All disturbed areas will be seeded with native grasses and mowed for weed control.

The floor plans of the indoor range building specify the uses of the structure which include 16 firing lanes and lockers in the lower bulletproof level and classroom space, office space, restrooms and incidental-sales space in the upper level. The classroom space is primarily for public gun safety training, and the incidental-sales space is for those members of the public who would like to purchase guns or ammunition for use in the ranges. Gun repair service shall also be provided.

Outdoor Lighting

All outdoor lighting will be in accordance with Land Use Code requirements including the use of down-casting, dark sky cutoff fixtures. Lighting will be minimized to the building access points, at the gates and along the driveway as shown on the Site Plan and will be turned off when the facilities are closed.

Neighborhood Meeting

A neighborhood meeting will be held in June, and the neighbors in the residential area to the south were notified when the acoustics consultants were taking noise measurements for the Noise Study. Five of these neighbors offered properties

for the sound monitoring survey that was a part of the Noise Study. Most of the concerns expressed to date by neighbors center on noise and traffic levels.

Section 3-203.E.1. Development Report Submittal Requirement Standards

a. Address list of adjacent property owners

The adjacent property owners are as follows:

To the south: George Grandits & Ann Miller
 4725 N. 26th Street
 Boulder, CO 80301

To the west, north and east: Boulder Open Space and Mountain Parks
 PO Box 791
 Boulder, CO 80306

b. Description of site features

The western property slopes from southwest to northeast with a drainage channel along the northern and eastern perimeter of the parcel. The eastern property slopes from east to west toward the drainage channel. The southern portion of the western parcel is part of an old dump site of construction debris. The western parcel is vacant with sparse ground cover and the existing rifle range, as previously described, is located on the eastern property.

c. Soil characteristics

According to the Soil Survey of the Boulder County Area by the United States Department of Agriculture Soil Conservation Service, the soils on this property are classified as Terrace Escarpments, Te, in the majority of the South Range site and Renohill Loam, ReD, 3 to 9 percent slopes in the majority of the West Range site with the City Dump noted on the southern portion of the West Range site.

Terrace escarpments are on side slopes of old outwash fans and terraces and consist of undifferentiated shallow soils that have many cobbles and stones on the surface. Runoff is rapid, and the erosion hazard is high. Only limited moisture is available for plants because these undifferentiated soils are shallow. Terrace escarpments are not suited to cultivation.

Renohill loam is made up of moderately deep, well-drained soils, but the surface layer is a loam that is 3 to 4 inches thick. Runoff is rapid on this soil, and the erosion hazard is high. This soil is unsuited to cultivation.

In February, Soilogic completed a Preliminary Geotechnical Subsurface Exploration Report, which is included with this application. Test borings in the area of the proposed indoor range building indicate the subsurface materials consist of a thin mantle of sparse vegetation and topsoil underlain by lean clay approximately 13 to 15 feet below ground surface and sand containing construction debris approximately 31 to 39 feet below the surface. This debris is likely associated with the past usage of the site as part of the City's construction debris dump site. This level was underlain with claystone/siltstone bedrock approximately 35 to 40 feet below ground surface, and no groundwater was encountered. An engineered pier foundation system will be included in the construction of the indoor range building.

d. Flora and Fauna

The subject property has been significantly disturbed over the years with periodic grading and landfill dumping. The years of site disturbance have resulted in sparse vegetation with weedy plant species interspersed with native vegetation. Several mature trees on the south side of the existing classroom and indoor range building and one at the northwest corner of the building will remain. The intermittent shrubbery vegetation along the northern portion of the drainage area between the two properties will also be left undisturbed.

The vacant site had prairie dogs years ago, but none are currently present. The South Range is being colonized by prairie dogs from the adjacent City property to the east, but the prairie dogs won't be disturbed by the minimal proposed improvements to the existing range. The occasional typical wildlife can be seen passing through the nearby City Open Space area, but no known wildlife corridors are identified on the subject property.

e. Cultural Resources

No cultural resources have been identified on the property.

f. Potential Radiation Hazard

No known radiation hazards have been identified by the State or County Public Health Departments, but hazard mitigation measures will be taken if deemed necessary.

g. Service Abilities

No service providers have indicated a problem with the ability to serve this development. All required permits will be obtained by the appropriate agencies prior to commencement of operations.

h. Financial Guarantees

If the provision of financial guarantees is warranted for any of the proposed improvements, a bank-approved letter of credit will be provided as an attachment to the development agreement.

Section 4-602 Special Use Standards and Conditions

- (1) Except as otherwise noted, the use will comply with the minimum zoning requirements of the zoning district in which the use is to be established, and will also comply with all other applicable requirements;**

The proposal will comply with the applicable sections of the County Land Use Code. The proposed uses are allowed in the Agricultural zoning district, and the new structures will meet the bulk requirements (such as setbacks and maximum building height). The additional requirements for an outdoor shooting range (such as 8-foot tall ballistic side barriers and 20-foot tall backstops) will also be met.

Section 4-510.A.5.a.(i) allows for the 1320-foot setback from designated recreational trails to be reduced based on an engineered study and property mitigation which reduces the Surface Danger Zone as shown on the engineering plans. The closest public trail to the north of the subject property is the City's Hidden Valley Trail which is understood to be relocated farther north in the near future. The trail is currently approximately 600 feet north and outside of the Surface Danger Zone of the closest range.

- (2) Will be in harmony with the character of the neighborhood and compatible with the surrounding area;**

With the addition of noise mitigation features of the new firing shelters to be constructed at all of the new outdoor ranges and two of the existing ranges, the proposed use will be compatible with the surrounding area. City Open Space land surrounds the site on all sides with the exception of 267 feet along the southern boundary which is adjacent to the access road and a large residential lot is located to the south side of the access road.

- (3) Will be in accordance with the Comprehensive Plan;**

As previously stated, the properties have been significantly disturbed over the years with mostly disturbed environmental resources apparent today. The site is located on the southern edge of the Comprehensive Plan designations (Boulder Valley Ranch Environmental Conservation Area,

Significant Agricultural Land of Local Importance, and Wetland). Specifically, the wetland designation along the drainage area to the north of that site that extends slightly on the subject property was likely from years ago when overflow from the Silver Lake Ditch occurred which is no longer running in this area. The drainage area now acts as a natural drainage area that will continue to exist through the site.

The proposal furthers the goals in the Comprehensive Plan as follows:

Goal E.5. Adequate facilities and services which provide diverse educational, cultural, and social opportunities should be encouraged.

Goal E.6. Adequate facilities and services to assure the health safety and welfare of all citizens should be promoted.

Goal I.1 The County should encourage and promote coordination and cooperation between federal, state, and local government entities charged with making decisions which significantly affect land use in Boulder County.

The subject property is also located within the Area III – Rural Preservation Area designation in the Boulder Valley Comprehensive Plan. The proposed use is not an over-intensive use of the site in accordance with the criteria specified in Section 1.15 of the Boulder Valley Comprehensive Plan. The projected traffic generation can be adequately handled by the existing street system. The proposed structure footprints cover only 4% of the total land area of the vacant parcel. The proposed usage, including hours of operation and water/wastewater flows are easily accommodated onsite. The outside lighting will be minimal with down-casting cutoff fixtures and will be turned off when the ranges are closed. The noise and safety mitigation features of the firing structures, side barriers and backstops minimize impacts outside of property boundaries. These improvements enable the use to be compatible with the open space land surrounding the property on three sides, and the residential area to the south. No other sites that could be considered more appropriate are known in Boulder County.

(4) Will not result in an over-intensive use of land or excessive depletion of natural resources;

While the subject properties are located within an Environmental Conservation Area, substantial modification of the site has occurred over the years. Extensive grading has occurred on the west parcel by previous landowners with the relocation of the drainage area to the north around the construction debris landfill that encroaches onto the southern portion

of the site. Proposed improvements on the South Range are for noise mitigation only.

Sufficient space exists at the West Range for the proposed outdoor ranges, firing shelters and indoor range. Only 4% of the total land area will be covered with structures.

(5) Will not have a material adverse effect on community capital improvement programs;

No community capital improvement programs will be affected by this proposal.

(6) Will not require a level of community facilities and services greater than that which is available;

The proposed water and sewer storage tanks will be serviced as is necessary, and all necessary permits will be acquired prior to construction.

(7) Will not result in undue traffic congestion or traffic hazards;

As described in the attached traffic analysis, the proposed use will not create undue traffic congestion or traffic hazards and will gradually eliminate some existing public trips to the mountain dispersed shooting sites, and trips for law enforcement in those areas.

(8) Will not cause significant air, odor, water, or noise pollution;

The existing use does not create significant pollution. All outdoor lighting will be shielded with down-casting fixtures and will be turned off after operating hours. The Environmental Stewardship Plan will mitigate any potential lead pollution. As described in the Noise Study, proposed and existing ranges will meet the Land Use Code noise level requirements.

(9) Will not require amendment to the Regional Clean Water Plan;

The proposal will not require an amendment to the Regional Clean Water Plan.

(10) Will be adequately landscaped, buffered, and screened;

The proposed indoor range building will be screened with trees along the southern perimeter. The ranges and firing structures will be screened and buffered by being lowered in the ground with 8-foot tall side barriers and 20-foot tall backstops.

- (11) **Will not otherwise be detrimental to the health, safety, or welfare of the present or future inhabitants of Boulder County.**

No public shooting range currently exists in Boulder County. Providing this sound and danger mitigated range for public use provides a beneficial and safe alternative to continued recreational shooting in the foothills of Boulder County.

Section 4-602.F.1. Special Review Standards for Outdoor Firing Range

a. Range Design

(i) Pistol and rifle firing ranges

The range design is included in this submittal and provides 8-foot tall ballistic side barriers, 20-foot ballistic backstops, and firing structures that absorb sound and negligent discharge. These features baffle sound, maximize safety between the ranges and minimize the amount of area in the Surface Danger Zone (as shown on the Site Plan).

(ii) Shotgun ranges

No shotgun ranges are proposed.

b. Security

The entire property perimeter is fenced, and a controlled gate will manage the vehicular access onsite. Warning signs will be posted along the fence.

c. Noise

The improvements have been designed in accordance with recommendations for noise mitigation as stated in the Noise Study and will be in compliance with the County Land Use noise level requirements.

d. Range Orientation

All firing lines are aimed at target lines to the north.

e. Backstops and Bulletproof Barriers or Berms

The backstops and bulletproof side barriers will be constructed in accordance with the engineering plans included with this submittal.

f. Surface Danger Zone

No traveled roadways, trails, streams, ponds, lakes or wetlands are located within the Surface Danger Zones of the outdoor ranges as shown on the engineering plans.

g. Environmental Stewardship Plan

An Environmental Stewardship Plan will be provided to the Land Use Department prior to building permit stage and will include Best Management Practices for lead management. The backstops have been designed to permit a viable reclamation of lead.

h. Operational Requirements

(i) Hours

Hours of operation will be limited to the hours between 7 am or sunrise, whichever is later, to dusk (or 7 pm) with the exception of using the indoor facility and shooting for educational or law enforcement activities which will be until 9 pm one day per week.

(ii) No Alcohol or Drugs

No alcohol or drugs are allowed on site.

(iii) No Tracer or Incendiary Rounds

No tracer, incendiary rounds or exploding targets are allowed on site.

(iv) Fire Safety and Response Plan

A fire safety and response plan will be filed and approved by Boulder Rural Fire District and County Sheriff as part of the development agreement.

(v) Fire Extinguishers

Large fire extinguishers will be will be available for emergency at all shooting ranges in accordance with direction by the Boulder Rural Fire District.

(vi) Wildfire Mitigation

Appropriate wildfire mitigation measures will be followed in accordance with recommendations of the County Wildfire Mitigation Coordinator and Boulder Rural Fire District.

(vii) Onsite Emergency Communication System

An onsite emergency communication system will be installed.

(viii) Safety Plan and Range Rules

A safety plan will be filed with and approved by the Land Use Department and Sheriff, and range rules will be posted on site. At least one of the employees on site when open to the public will be a trained safety officer, and a range member who has passed the minimum training requirements of the range shall be present when the facility is open to members only.

(ix) Periodic BOCC Reviews

Periodic reviews will be accommodated, if the BOCC deems they are necessary.

i. Enforcement

Potential enforcement actions by the County of noise violations or other violations is understood.

j. Future Expansion

It is also understood that future expansion may considered a substantial modification which would require an amendment to the special use permit.

CONSULTANTS

Architect: Tom Moore
Thomas Moore Architects
525 Third Avenue, #205
Longmont, CO 80501
303-772-2533
tmoore@tmarchitects.net

Civil Engineers: Joel Seamons, PE & Garrett Walstad, PE
Rocky Ridge Civic Engineering
420 21st Avenue, #101
Longmont, CO 80501
303-651-6626
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garrett@rockyridgecivil.com

Septic Engineer: Ed Glassgow
Scott, Cox & Associates, Inc.
1530 55th Street
Boulder, CO 80303
303-444-3051
glassgow@scottcox.com

Traffic Engineers: Matt Delich, PE & Joseph Delich, PE
Delich Associates
2272 Glen Haven Drive
Loveland, CO 80538
970-669-2061
matt@delichassoc.com
joseph@delichassoc.com

Acoustics: Justin Puggioni & Tom Carter
Behrens & Associates, Inc.
9536 E. I-25 Frontage Road
Longmont, CO 80504
970-535-9000
jpuggioni@baenc.com 424-456-7055
tcarter@baenc.com 970-314-3915

Planner: Rosi Dennett, AICP
Front Range Land Solutions
210 Lincoln Street
Longmont, CO 80501
303-682-9729
rosidennett@gmail.com



May 24, 2019

Boulder Rifle Club, Inc.
PO Box 21197
Boulder, CO 80308

Reference: Earthwork Calculations
Boulder Rifle Range - Boulder County, Colorado
Rocky Ridge Civil Engineering Project No. 778-1

To whom it may concern:

Rocky Ridge Civil Engineering (RRCE) performed cut and fill volume calculations for the grading improvements associated with the proposed Boulder Rifle Range located at 4923 N. 26th Street, in Boulder County, Colorado. These calculations are based on the architectural plans prepared by Thomas Moore Architecture and the grading plans prepared by RRCE dated May 24, 2019.

Our calculations show the proposed site improvements will require approximately 46,844 cubic yards of cut and 48,180 cubic yards of fill. This earthwork volume does not include the Boulder County "Earthwork and Grading" standard exempt earthwork up to ten feet around the perimeter of the building foundations and roadbase material required for the proposed access. The total estimated quantity of qualified material to be moved is 95,024 cubic yards.

Our calculations show all building foundation excavations and incidental backfill will require approximately 8,881 cubic yards of cut and 2,434 cubic yards of fill. The required roadbase material for the proposed access road is calculated to be approximately 2,373 cubic yards. The existing site is known as a historic garbage dump and substantial amounts of waste material is expected to be encountered and will need to be removed from the site. This volume of material has not been calculated.

Autodesk Civil 3D 2019 was utilized to perform the cut and fill calculations.

Please let me know if you have any questions or comments.

Sincerely,

Garrett C. Walstad, P.E.
garrett@rockyridgecivil.com
Rocky Ridge Civil Engineering

Attachments:

Boulder County LISUR Fact Sheet
Earthwork Exhibit

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 Use Review (LISR) is required. A Limited Impact Special Use Review 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	7,196	3,488	10,684
Berm(s)	124	10,669	10,793
Other Grading	39,524	34,023	73,574
Subtotal	46,844	48,180	95,024 <small>Box 1</small>
* If the total in Box 1 is greater than 500 cubic yards, then a Limited Impact Special Review is required.			
	Cut	Fill	Total
Foundation	8,881	2,434	11,315
Material cut from foundation excavation that will be removed from the property			5,111

Excess Material will be Transported to the Following Location:

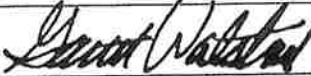
Excess Materials Transport Location:	Western Disposal
Ongoing efforts will be made to ensure overall earth work at the site is balanced throughout construction.	

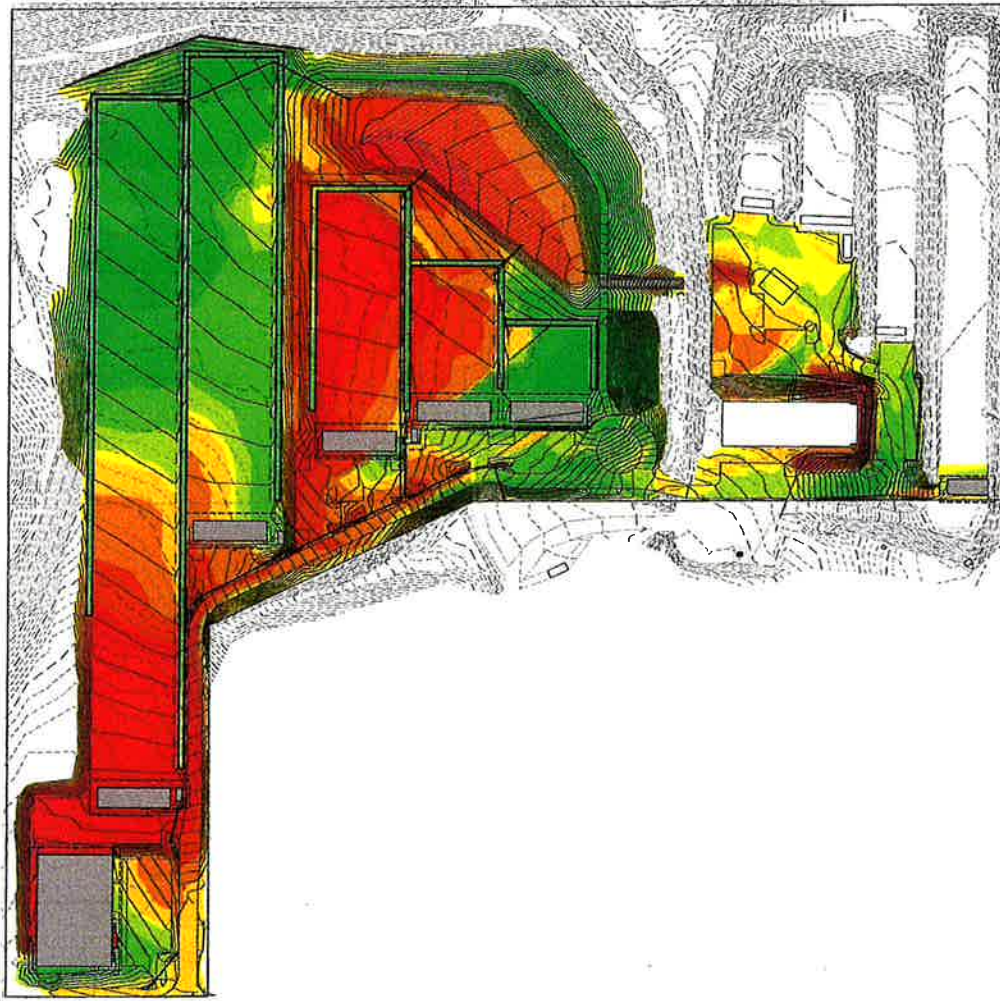
Is Your Property Gated and Locked?

Note: If county personnel cannot access the property, 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		Date	05/24/2019
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Elevation Table			
Number	Minimum Elevation	Maximum Elevation	Color
1	-10.00	-10.00	Red
2	-10.00	-10.00	Red
3	-10.00	-10.00	Red
4	-10.00	-10.00	Red
5	-10.00	-10.00	Red
6	-10.00	-10.00	Red
7	-10.00	-10.00	Red
8	-10.00	-10.00	Red
9	-10.00	-10.00	Red
10	-10.00	-10.00	Red



	
BOULDER RIFLE RANGE	
SHEET NO.	779-1
DATE	12/17/2018
EARTHWORK EXHIBIT	PREPARED BY
EW	27

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

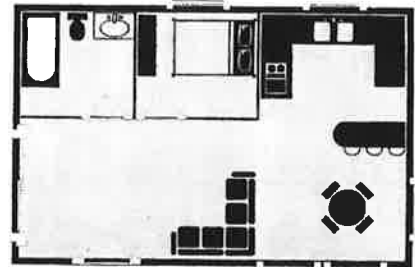
Type of Structure: (e.g. residence, studio, barn, etc.)		NEW PIT TOILET- TYP. OF 3	
Total Existing Floor Area: (Finished + Unfinished square feet including garage if attached.)		N/A sq. ft.	Deconstruction: sq. ft.
Are new floor areas being proposed where demolition will occur? <input checked="" type="checkbox"/> 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
Basement:	N/A sq. ft.	N/A sq. ft.	N/A sq. ft.
First Floor:	144 sq. ft.	N/A sq. ft.	144 sq. ft.
Second Floor:	N/A sq. ft.	N/A sq. ft.	N/A sq. ft.
Garage: <input type="checkbox"/> Detached <input type="checkbox"/> Attached	N/A sq. ft.	N/A sq. ft.	N/A sq. ft.
*Covered Porch:	N/A sq. ft.	N/A sq. ft.	N/A sq. ft.
Total:	144 sq. ft.	N/A sq. ft.	144 sq. ft.
Total Bedrooms			N/A

Project Identification:

Project Name:
BOULDER RIFLE CLUB-RANGE EXPANSION
SPECIAL USE APPLICATION
Property Address/Location:
4810 N. 26TH STREET, BOULDER, CO
Current Owner: BOULDER RIFLE CLUB, INC.
ATTN: STEVE MARTIN, PRESIDENT
Size of Property in Acres:
24.87 ACRES, TOTAL

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 not 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.)		RANGE SHELTER- TYPICAL OF 1 AT EXISTING OUTDOOR RANGE	
Total Existing Floor Area: (Finished + Unfinished square feet including garage if attached.)		N/A sq. ft.	Deconstruction: sq. ft.
Are new floor areas being proposed where demolition will occur? <input checked="" 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
Basement:	N/A sq. ft.	N/A sq. ft.	N/A sq. ft.
First Floor:	1,612 sq. ft.	N/A sq. ft.	1,612 sq. ft.
Second Floor:	N/A sq. ft.	N/A sq. ft.	N/A sq. ft.
Garage: <input type="checkbox"/> Detached <input type="checkbox"/> Attached	N/A sq. ft.	N/A sq. ft.	N/A sq. ft.
*Covered Porch:	N/A sq. ft.	N/A sq. ft.	N/A sq. ft.
Total:	1,612 sq. ft.	N/A sq. ft.	1,612 sq. ft.
Total Bedrooms			N/A

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, studies, 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.

Site Plan Review Fact Sheet

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Structure #1 Information

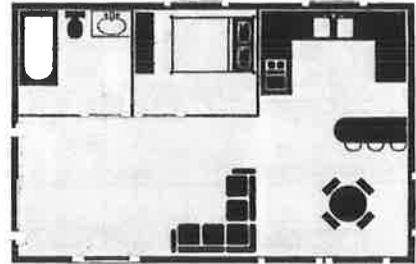
Type of Structure: (e.g. residence, studio, barn, etc.)		NEW INDOOR RANGE BUILDING	
Total Existing Floor Area: (Finished + Unfinished square feet including garage if attached.)		N/A sq. ft.	Deconstruction: sq. ft.
Are new floor areas being proposed where demolition will occur? <input checked="" type="checkbox"/> 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
WALK-OUT LOWER LEVEL Basement:	15,000 sq. ft.	N/A sq. ft.	15,000 sq. ft.
First Floor:	5,050 sq. ft.	N/A sq. ft.	5,050 sq. ft.
Second Floor:	N/A sq. ft.	N/A sq. ft.	sq. ft.
Garage: <input type="checkbox"/> Detached <input type="checkbox"/> Attached	N/A sq. ft.	N/A sq. ft.	sq. ft.
*Covered Porch:	N/A sq. ft.	N/A sq. ft.	sq. ft.
Total:	20,050 sq. ft.	sq. ft.	20,050 sq. ft.
Total Bedrooms			N/A
Height (above existing grade)		38'-0"	
Exterior Wall Material		BOARD/BATT. SIDING. CMU	
Exterior Wall Color		TAN WITH BROWN TRIM TAN CMU	
Roofing Material		METAL STANDING SEAM	
Roofing Color		BROWN-BRONZE	

Project Identification:

Project Name:
BOULDER RIFLE CLUB-RANGE EXPANSION
SPECIAL USE APPLICATION
Property Address/Location:
4810 N. 26TH STREET, BOULDER, CO
Current Owner: BOULDER RIFLE CLUB, INC.
ATTN: STEVE MARTIN, PRESIDENT
Size of Property in Acres:
24.87 ACRES, TOTAL

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 not 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.)		RANGE SHELTER- TYPICAL OF 5 AT NEW OUTDOOR RANGES	
Total Existing Floor Area: (Finished + Unfinished square feet including garage if attached.)		N/A sq. ft.	Deconstruction: sq. ft.
Are new floor areas being proposed where demolition will occur? <input checked="" 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
Basement:	N/A sq. ft.	N/A sq. ft.	sq. ft.
First Floor:	2,800 sq. ft.	N/A sq. ft.	2,800 sq. ft.
Second Floor:	N/A sq. ft.	N/A sq. ft.	sq. ft.
Garage: <input type="checkbox"/> Detached <input type="checkbox"/> Attached	N/A sq. ft.	N/A sq. ft.	sq. ft.
*Covered Porch:	332 sq. ft.	N/A sq. ft.	332 sq. ft.
Total:	3,132 sq. ft.	sq. ft.	3,132 sq. ft.
Total Bedrooms			N/A
Height (above existing grade)		15'-2"	
Exterior Wall Material		BOARD/BATT. SIDING	
Exterior Wall Color		TAN WITH BROWN TRIM	
Roofing Material		METAL STANDING SEAM	
Roofing Color		BROWN-BRONZE	

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, studies, 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.



SCOTT, COX & ASSOCIATES, INC.

consulting engineers • surveyors

May 23, 2019

Boulder Rifle Club Inc.
Steven Martin, President
P. O. Box 21197
Boulder, Colorado 80308

Project: 19258

Ladies and Gentlemen:

The purpose for this report is to present information regarding wastewater disposal for the proposed Boulder Rifle Club expansion on the property west and southwest of the existing range at 4810 North 26th Street in Boulder County, Colorado. The county has not yet assigned an address to this property, but the parcel number is 146307001002.

We have reviewed the plan for the proposed expansion, have reviewed borings completed on the property and have discussed this, in a very preliminary fashion, with the Boulder County Health Department.

The driving factor on this site is the presence of landfill materials. Two borings were completed to determine the depth of these materials and they found 31 to 39 feet to native soil through the landfill. This has a major impact on the wastewater disposal, as we will discuss below.

The Boulder County Health Department always prefers and generally requires the installation of a standard onsite wastewater treatment system that processes the wastewater through a septic tank and then disposes of the effluent by infiltration into the soil or by evaporation and transpiration or a combination of these. However, the presence of the landfill materials makes the installation of any type of system than involves infiltration impossible as landfill materials are

not suitable for this due to their variability and the depth to native soils is so deep that there is no practical way of accomplishing this. This leaves us with a fully lined evapotranspiration system option only. While this would suffice, it also dramatically increases the required area and some of these can occupy a very large area and likely impact the proposed use of the property. Therefore, my discussion with the health department focused on a possible alternative, that being the use of a vault (or vaults) and/or a vault privy (or multiple vault privies). They were receptive to this, given the factors that I have discussed in this report. It may be important to note that the existing rifle club structures, on the adjacent property, utilize vaults.

In summary, the presence of the landfill materials makes the construction of a standard onsite wastewater treatment system difficult to impossible and in our preliminary discussion with the Health Department, they have indicated that it is likely that they would allow the use of vaults or vault privies for this project.

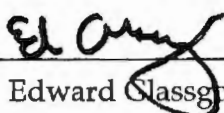
Thank you for consulting with us. If there are any questions or comments regarding this report, please do not hesitate to contact us.

Sincerely,

SCOTT, COX AND ASSOCIATES, INC.



By


M. Edward Glassgow, PE



February 6, 2019

Boulder Rifle Club
4810 North 26th Street
Boulder, Colorado 80301

Attn: Mr. Steve Martin

Re: Preliminary Geotechnical Subsurface Exploration Report
A portion of the Boulder Rifle Club property
4810 North 26th Street
Boulder County, Colorado
Soilogic Project # 18-1384

Mr. Martin:

Soilogic, Inc. (Soilogic) personnel have completed the preliminary geotechnical subsurface exploration you requested for a portion of the Boulder Rifle Club organization property, located on North 26th Street near Boulder, in unincorporated Boulder County, Colorado. The results of our preliminary exploration are included with this report.

The subsurface materials encountered in the completed test borings consisted of a thin mantle of sparse vegetation and topsoil underlain by brown/gray/rust/black lean clay with sand which contained concrete and asphalt fragments, gravel, rebar and other apparent construction debris. Based on discussion with the owner/client, we understand this material is likely associated with a past usage of the property as a municipal construction debris dump site. The lean clay fill varied from very stiff to hard in terms of consistency and extended to depths ranging from approximately 13 to 15 feet below ground surface, where it was underlain by trash and other debris which we understand is most likely associated with a landfill that occupied the property previous to the municipal dump. The trash and other unidentified debris appeared to extend to depths ranging from approximately 31 to 39 feet below ground surface, where it was underlain by dark gray/gray/blue-gray weathered to very hard claystone/siltstone bedrock. The bedrock extended to the maximum depths explored, approximately 35 and 40 feet below ground surface.

Groundwater was not encountered in either of the site borings to the depths explored when checked immediately after completion of drilling.

Preliminary Geotechnical Subsurface Exploration Report
A portion of Boulder Rifle Club Property
North 26th Street, Boulder, Colorado
Soilogic # 18-1384

2

Due to the presence of municipal construction debris fill underlain by trash and other miscellaneous debris extending to depths greater than 30 feet below ground surface at this site, deep foundation systems extended to bear on the underlying bedrock should be employed for support of any proposed buildings to be constructed on this property. Due to the depth which the existing fill was observed to extend, complete removal and replacement of existing trash/debris in order to develop suitable conditions for support of spread footing foundations is not considered a feasible alternative. Building floor slabs should be structurally supported independent of the subgrade materials. Deep foundation systems would extend the foundation elements through the landfill trash/debris of unknown engineering characteristics and found them in claystone/sandstone bedrock which underlies the site. Overexcavation/backfill procedures could be considered to redevelop a zone of low volume change potential material below exterior flatwork and pavement improvements, reducing the potential for total and differential settlement of those supported elements subsequent to construction. The risk of some movement cannot be eliminated and some limited movement of these improvements should be expected subsequent to construction. Installation of underground utilities within trash/debris landfill materials will most likely require special trench stabilization and overexcavation/backfill procedures. Preliminary recommendations concerning drilled pier design criteria for building foundations, structurally-supported floors, utility installation and overexcavation/backfill procedures for exterior flatwork and site pavement improvements can be provided to you upon request.

Preliminary Geotechnical Subsurface Exploration Report
A portion of Boulder Rifle Club Property
North 26th Street, Boulder, Colorado
Soilogic # 18-1384
2

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning the enclosed information or if we can be of further service to you in any way, please do not hesitate to contact us.

Very Truly Yours,
Soilogic, Inc.



Zach Gordon, E.I.
Project Engineer

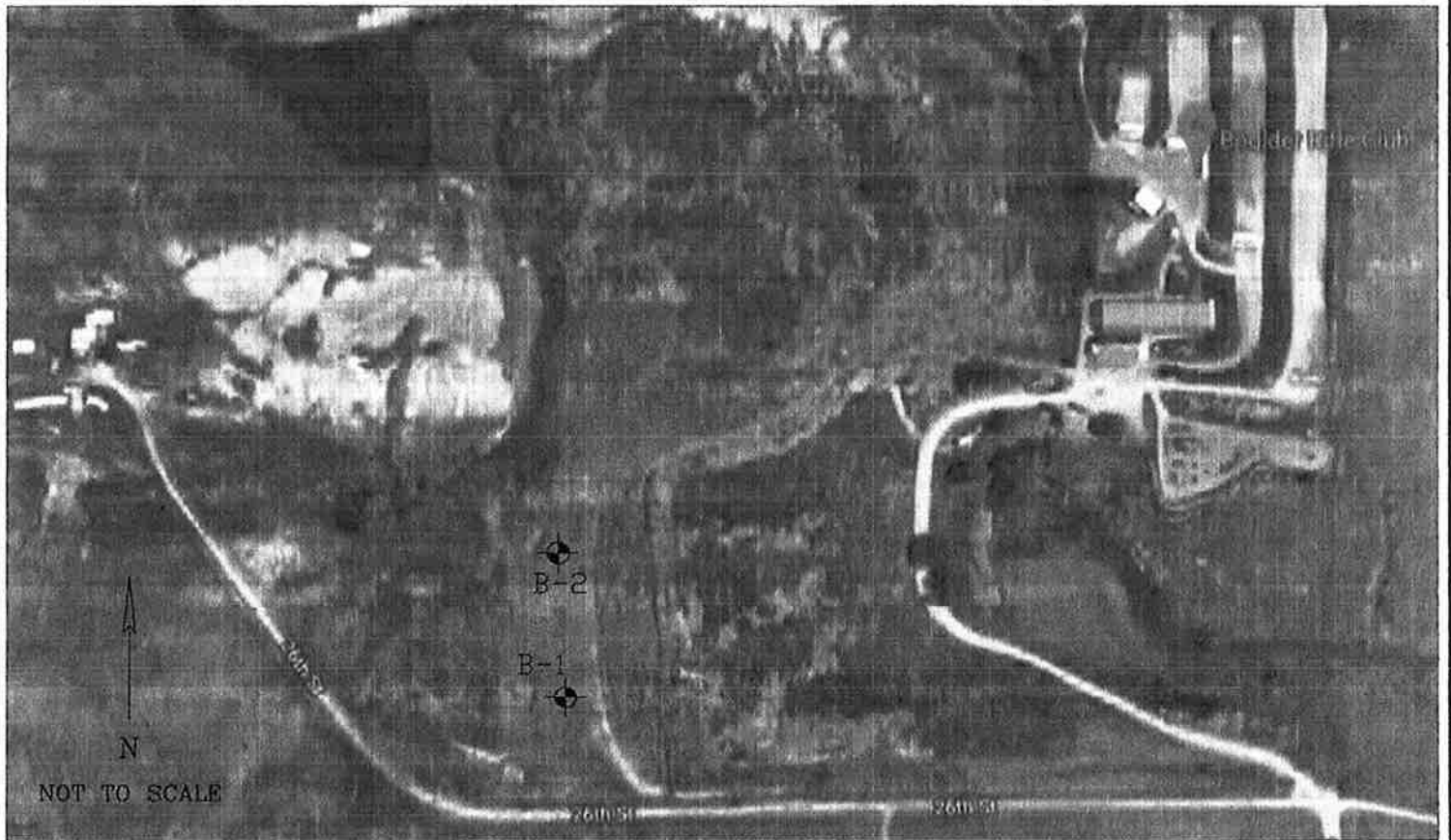
Reviewed by:



Darrel DiCarlo, P.E.
Senior Project Engineer

FEBRUARY 2019
PROJECT #18-1384

BORING LOCATION DIAGRAM



BOULDER RIFLE CLUB PROPERTY PRELIMINARY EXPLORATION/FILL EVALUATION
NORTH 26TH STREET, BOULDER COUNTY, COLORADO

BOULDER RIFLE CLUB FILL EVALUATION

4810 NORTH 26TH SREET, BOULDER, COLORADO

Project # 18-1384

January 2019



LOG OF BORING B-1

Sheet	1/2	Drilling Rig:	CME 45	Water Depth Information	
Start Date	1/10/2019	Auger Type:	4" CFA	During Drilling	None
Finish Date	1/10/2019	Hammer Type:	Automatic	After Drilling	None
Surface Elev.	-	Field Personnel:	JL / BM	24 Hours After Drilling	-

USCS	SOIL DESCRIPTION	Depth (ft)	Sampler	"N"	MC (%)	DD (pcf)	Estimated q_u (psf)	% Swell @ 500 psf	Swell Pressure (psf)	Atterberg Limits		% Passing # 200 Sieve (%)
										LL	PI	
	2 - 3" VEGETATION & TOPSOIL	-										
		1										
		2										
		3										
		4										
		5	SS	16	5.5	-	N/A	-	-	-	-	-
CL	EXISTING FILL MATERIAL: (ASSOCIATED WITH MUNICIPAL DUMP)	6										
	LEAN CLAY with SAND, containing	7										
	CONCRETE, ASPHALT fragments, REBAR	8										
	and GRAVEL, COBBLES and BOULDERS	9										
	brown, gray, rust, black	10	SS	23	16.3	-	N/A	-	-	-	-	-
	very stiff	11										
		12										
		13										
		14										
		15	SS	25	NR	-	N/A	-	-	-	-	-
N/A	EXISTING FILL MATERIAL: (ASSOCIATED WITH LANDFILL DUMP)	16										
	wood fibers, unidentified TRASH materials	17										
	dark brown, black	18										
		19										
		20	SS	17	15.6	-	N/A	-	-	-	-	-
		21										
		22										
		23										
		24										
		25	SS	19	NR	-	N/A	-	-	-	-	-
		26										
		27										
		28										
		29										
		30	SS	11	NR	-	N/A	-	-	-	-	-

CONTINUED ON NEXT PAGE

January 2019

SO LOGIC

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BOULDER RIFLE CLUB FILL EVALUATION

4810 NORTH 26TH SREET, BOULDER, COLORADO

Project # 18-1384

January 2019



LOG OF BORING B-2

Sheet	1/2	Drilling Rig:	CME 45	Water Depth Information	
Start Date	1/14/2019	Auger Type:	4" CFA	During Drilling	None
Finish Date	1/14/2019	Hammer Type:	Automatic	After Drilling	None
Surface Elev.	-	Field Personnel:	JL / BM	24 Hours After Drilling	-

USCS	SOIL DESCRIPTION	Depth (ft)	Sampler	"N"	MC (%)	DD (pcf)	Estimated q _u (psf)	% Swell @ 500 psf	Swell Pressure (psf)	Atterberg Limits		% Passing # 200 Sieve (%)
										LL	PI	
	2 - 3" VEGETATION & TOPSOIL	-										
		1										
		2										
		3										
		4										
		5	SS	33	13.6	-	N/A	-	-	-	-	-
CL	EXISTING FILL MATERIAL: (ASSOCIATED WITH MUNICIPAL DUMP) LEAN CLAY with SAND, containing CONCRETE, ASPHALT fragments, REBAR and GRAVEL, COBBLES and BOULDERS brown, gray, rust, black very stiff to hard	6										
		7										
		8										
		9										
		10	SS	19	9.7	-	N/A	-	-	35	15	46.0%
		11										
		12										
		13										
		14										
		15	SS	50/9	14.6	-	N/A	-	-	-	-	-
N/A	EXISTING FILL MATERIAL: (ASSOCIATED WITH LANDFILL DUMP) wood fibers, unidentified TRASH materials dark brown, black	16										
		17										
		18										
		19										
		20	SS	12	NR	-	N/A	-	-	-	-	-
		21										
		22										
		23										
		24										
		25	SS	18	NR	-	N/A	-	-	-	-	-
		26										
		27										
		28										
		29										
		30	SS	18	NR	-	N/A	-	-	-	-	-

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January 2019

SO LOGIC

[illegible]

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests^A

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A					Soil Classification		
					Group Symbol	Group Name ^B	
Coarse Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels	Cu ≥ 4 and 1 ≤ Cc ≤ 3 ^E		GW	Well graded gravel ^F	
		Less than 5% fines ^C	Cu < 4 and/or 1 > Cc > 3 ^E		GP	Poorly graded gravel ^F	
		Gravels with Fines More than 12% fines ^C	Fines classify as ML or MH		GM	Silty gravel ^{F,G,H}	
			Fines classify as CL or CH		GC	Clayey gravel ^{F,G,H}	
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands	Cu ≥ 6 and 1 ≤ Cc ≤ 3 ^E		SW	Well graded sand ^I	
		Less than 5% fines ^D	Cu < 6 and/or 1 > Cc > 3 ^E		SP	Poorly graded sand ^I	
		Sands with Fines More than 12% fines ^D	Fines classify as ML or MH		SM	Silty sand ^{G,H,I}	
			Fines classify as CL or CH		SC	Clayey sand ^{G,H,I}	
Fine-Grained Soils 50% or more passes the No. 200 sieve	Sils and Clays Liquid limit less than 50	Inorganic	PI > 7 and plots on or above "A" line ^J		CL	Lean clay ^{K,L,M}	
			PI < 4 or plots below "A" line ^J		ML	Silt ^{K,L,M}	
		Organic	Liquid limit - oven dried	< 0.75	OL	Organic clay ^{K,L,M,N}	
			Liquid limit - not dried			Organic silt ^{K,L,M,O}	
			Sils and Clays Liquid limit 50 or more	Inorganic	PI plots on or above "A" line		CH
		PI plots below "A" line				MH	Elastic silt ^{K,L,M}
	Organic	Liquid limit - oven dried		< 0.75	OH	Organic clay ^{K,L,M,P}	
		Liquid limit - not dried	Organic silt ^{K,L,M,Q}				
Highly organic soils	Primarily organic matter, dark in color, and organic odor				PT	Peat	

^ABased on the material passing the 3-in. (75-mm) sieve

^BIf field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^CGravels with 5 to 12% fines require dual symbols: GW-GM well graded gravel with silt, GW-GC well graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

^DSands with 5 to 12% fines require dual symbols: SW-SM well graded sand with silt, SW-SC well graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

$$^E Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

^FIf soil contains $\geq 15\%$ sand, add "with sand" to group name.

^GIf fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^HIf fines are organic, add "with organic fines" to group name.

^IIf soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

^JIf Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^KIf soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

^LIf soil contains $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" to group name.

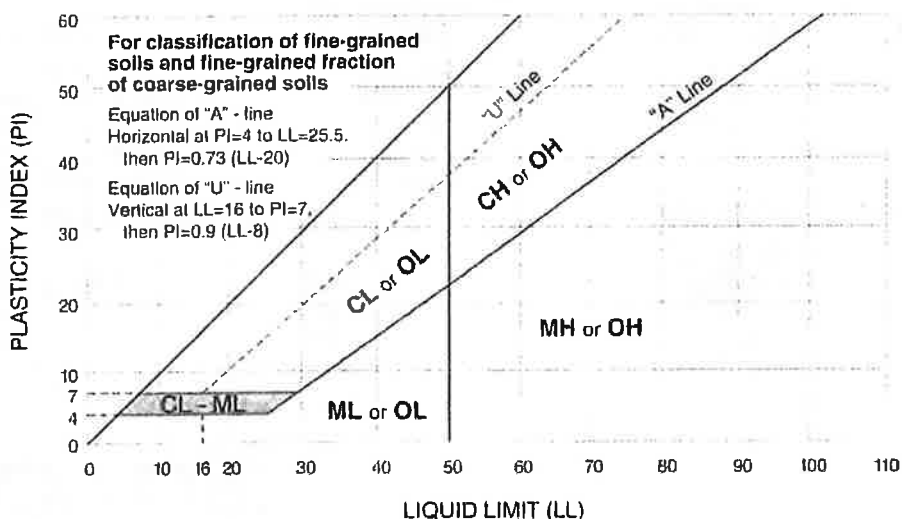
^MIf soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

^N $PI \geq 4$ and plots on or above "A" line.

^O $PI < 4$ or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.



GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1½" I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube - 2.5" O.D., unless otherwise noted	PA:	Power Auger
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
CS:	California Barrel - 1.92" I.D., 2.5" O.D., unless otherwise noted	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB:	Wash Boring or Mud Rotary

The number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the "Standard Penetration" or "N-value". For 2.5" O.D. California Barrel samplers (CB) the penetration value is reported as the number of blows required to advance the sampler 12 inches using a 140-pound hammer falling 30 inches, reported as "blows per inch," and is not considered equivalent to the "Standard Penetration" or "N-value".

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling
WCI:	Wet Cave in	WD:	While Drilling
DCI:	Dry Cave in	BCR:	Before Casing Removal
AB:	After Boring	ACR:	After Casing Removal

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

<u>FINE-GRAINED SOILS</u>			<u>COARSE-GRAINED SOILS</u>			<u>BEDROCK</u>		
<u>(CB)</u> <u>Blows/Ft.</u>	<u>(SS)</u> <u>Blows/Ft.</u>	<u>Consistency</u>	<u>(CB)</u> <u>Blows/Ft.</u>	<u>(SS)</u> <u>Blows/Ft.</u>	<u>Relative</u> <u>Density</u>	<u>(CB)</u> <u>Blows/Ft.</u>	<u>(SS)</u> <u>Blows/Ft.</u>	<u>Consistency</u>
< 3	0-2	Very Soft	0-5	< 3	Very Loose	< 24	< 20	Weathered
3-5	3-4	Soft	6-14	4-9	Loose	24-35	20-29	Firm
6-10	5-8	Medium Stiff	15-46	10-29	Medium Dense	36-60	30-49	Medium Hard
11-18	9-15	Stiff	47-79	30-50	Dense	61-96	50-79	Hard
19-36	16-30	Very Stiff	> 79	> 50	Very Dense	> 96	> 79	Very Hard
> 36	> 30	Hard						

RELATIVE PROPORTIONS OF SAND AND GRAVEL

<u>Descriptive Terms of</u> <u>Other Constituents</u>	<u>Percent of</u> <u>Dry Weight</u>
Trace	< 15
With	15 - 29
Modifier	> 30

RELATIVE PROPORTIONS OF FINES

<u>Descriptive Terms of</u> <u>Other Constituents</u>	<u>Percent of</u> <u>Dry Weight</u>
Trace	< 5
With	5 - 12
Modifiers	> 12

GRAIN SIZE TERMINOLOGY

<u>Major Component</u> <u>of Sample</u>	<u>Particle Size</u>
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75 mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

PLASTICITY DESCRIPTION

<u>Term</u>	<u>Plasticity Index</u>
Non-plastic	0
Low	1-10
Medium	11-30
High	30+

DELICH ASSOCIATES Traffic & Transportation Engineering
2272 Glen Haven Drive Loveland, Colorado 80538
Phone: (970) 669-2061 Fax: (970) 669-5034



November 9, 2018

Helene Levaufre
Boulder County Transportation Department
2525 13th Street, P.O. Box 471
Boulder, CO 80304

Dear Helene:

This Transportation Pre-Application Methodology Letter (TP-AML) addresses the proposed methodology for the transportation system impact analysis per the Boulder County Multimodal Transportation Standards for the expansion of the Boulder Rifle Club in Boulder County. This TP-AML will address the difference in the trip generation as well as other elements. An aerial photograph showing the site location is provided in Appendix A.

The Boulder Rifle Club is located at 4810 North 26th Street. The site access is currently located where 26th Street changes from a north-south street to an east-west street. Access to the site is on 26th Street via the US36/26th Street and US36/Yarmouth Avenue intersections. Twenty-Sixth Street is a two lane gravel road with a posted speed of 30 mph. Based on Boulder County data, the 2016 daily traffic on 26th Street was 320 vehicles just north of US 36. Yarmouth Avenue is a two lane gravel road with a posted speed of 30 mph. No daily traffic volume on Yarmouth Avenue was available. The 26th Street/Yarmouth Avenue intersection has stop sign control on Yarmouth Avenue. The US36/26th Street intersection has stop sign control on 26th Street. There is a southeast bound left-turn lane and a northwest bound right-turn the on US36 at the US36/26th Street intersection. The US36/Yarmouth Avenue intersection has stop sign control on Yarmouth Avenue. There is a southeast bound left-turn lane on US36 at the US36/Yarmouth Avenue intersection.

Currently the Boulder Rifle Club is approximately 6.23 acres with a 200 yard range, a 100 yard range, a 50 yard range, a 25 yard range, and an indoor 50 foot range on the site. A Rifle Club is not specifically addressed in **Trip Generation, 10th Edition**, ITE, which is the common reference document. The Boulder Rifle Club did a survey of users at each range between 4/4/2018 and 7/21/2018. Table 1 shows the average number of people using each range on a typical day. This reflects a mild weather month condition. Based on discussions with the Boulder Rifle Club, it was determined that approximately 20 percent of users carpool. Therefore, the number of users was reduced by 20% to determine the number of vehicles. The current weekday average daily traffic is 68 trips per day. The weekend average daily traffic is 210 trips per day. The average weekday trip ends per range is 13.6 $[(68)/(5)]$. The average weekend trip ends per range is 42.0 $[(210)/(5)]$.

The proposal is to develop into the 12 acre parcel to the west with a new indoor range, a 25 yard range, 50 yard range, 100 yard range, 200 yard range, and 300 yard range. This is an increase from 5 ranges to 11 ranges. The proposed site plan is provided in Appendix B. The access drive will be relocated approximately 1,135 feet west of the driveway to the current site. Table 2 shows the proposed trip generation based on the average trips per range. The weekday average daily traffic is expected to be 150 trips per day. The weekend average daily traffic is expected to be 462 trips per day.

The average daily traffic was based on mild weather months when outdoor use is highest. During the winter weather months, outdoor use decreases to approximately 25% of the mild weather use. The indoor range use increases by approximately 25% in the winter. Based on this the estimated winter weekday average daily traffic is 74 trips per day. The winter weekend average daily traffic is 90 trips per day.

The trip distribution for this use is a function of trip production locations in the general vicinity of the site. Preliminary trip distribution is estimated at: 50 percent to/from the south on US36 and 50 percent to/from the north on US36. Future traffic forecasts, if necessary, should be obtained from sources provided by Boulder County Transportation or agreed upon growth rates on the key roads/streets.

The primary travel mode is/will be by private automobile. There is a bus stop near the US36/Jay intersection. It is not likely that users would utilize public transportation and/or bikes. There are no bike lanes on 26th Street and Yarmouth Avenue. Highway 36 is a road with wide paved shoulders.

Using the Boulder County Multimodal Transportation Standards a Transportation System Impact Review would be required based on the average weekday daily traffic and a Transportation System Impact Study would be required based on the average weekend daily traffic for this land use proposal.

Do not hesitate to contact me if you have questions or desire additional information.

Sincerely,

Joseph M. Delich, P.E.

File: 1880LT01



TABLE 1
Number of Users at Each Range

Day of the Week	25 Yard Range	50 Yard Range	100 Yard Range	200 Yard Range	Indoor Range	Number of users	Number of vehicles	Trip Ends per day
Monday	9	4	5	2	0	20	16	32
Tuesday	20	8	7	0	6	41	33	66
Wednesday	17	12	23	1	1	54	43	86
Thursday	8	4	4	16	29	61	49	98
Friday	6	9	2	1	21	39	31	62
Saturday	52	31	15	61	5	164	131	262
Sunday	8	35	37	4	13	97	78	156
Weekday Average	12	8	8	4	11	43	34	68
Weekend Average	30	33	26	33	9	131	105	210

TABLE 2
Proposed Trip Generation

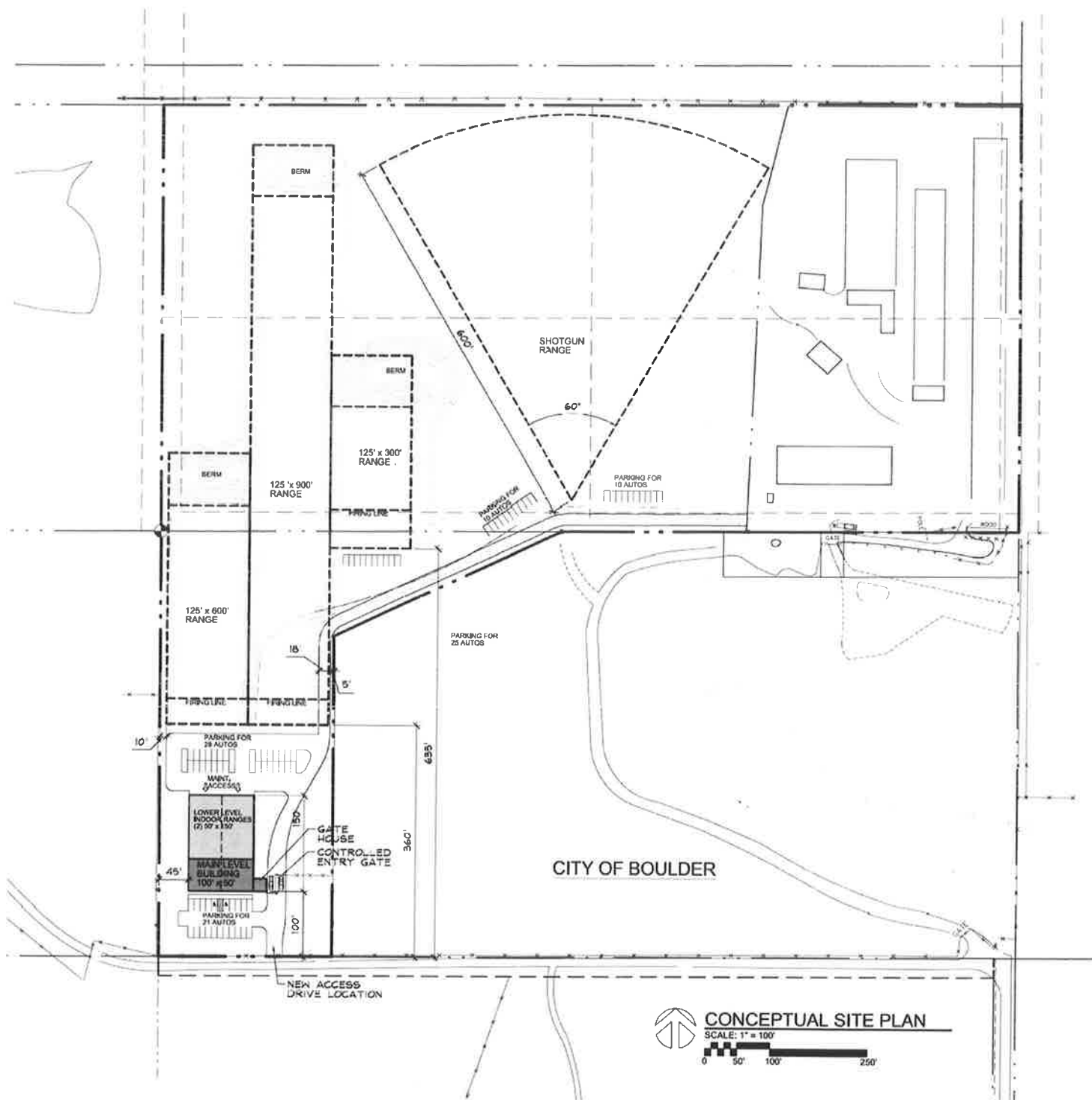
Day of the Week	Existing Trips per Day (5 Ranges)	Average Trips per Range	Proposed Trip Ends per Day (11 ranges)
Weekday average daily Traffic	68	13.6	150
Weekend Average daily Traffic	210	42.0	462

APPENDIX A

Proposed Boulder
Rifle Club
Expansion Area



APPENDIX B



BOULDER RIFLE CLUB
TRANSPORTATION SYSTEM IMPACT STUDY

BOULDER COUNTY, COLORADO

MARCH 2019

Prepared for:

Boulder Rifle Club
PO Box 21197
Boulder, CO 80308

Prepared by:

DELICH ASSOCIATES
2272 Glen Haven Drive
Loveland, CO 80538
Phone: 970-669-2061
FAX: 970-669-5034



Project #1880

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APPENDICES

- A. Transportation Pre-Application Methodology Letter
- B. Count Data
- C. Current Peak Hour Operation
- D. Short Range (2023) Total Peak Hour Operation
- E. Long Range (2040) Total Peak Hour Operation

I. PROJECT DESCRIPTION

This Transportation System Impact Study (TSIS) for the Boulder Rifle Club addresses the capacity, geometric, and traffic control requirements at and near the proposed development. The Boulder Rifle Club is located at 4810 North 26th Street in Boulder County, Colorado.

This study conforms to a Transportation System Impact Study per the Boulder County Multimodal Transportation Standards. A Transportation Pre-Application Methodology Letter was submitted on November 9, 2018. A copy of the Transportation Pre-Application Methodology Letter is provided in Appendix A. The scope of this study was discussed with the owner/developer and Boulder County staff.

Proposed Land Use

The site location is shown in Figure 1. Figure 2 shows a site plan of the proposed Boulder Rifle Club. Currently the Boulder Rifle Club is approximately 6.23 acres with a 200 yard range, a 100 yard range, a 50 yard range, a 25 yard range, and an indoor 50 foot range on the site.

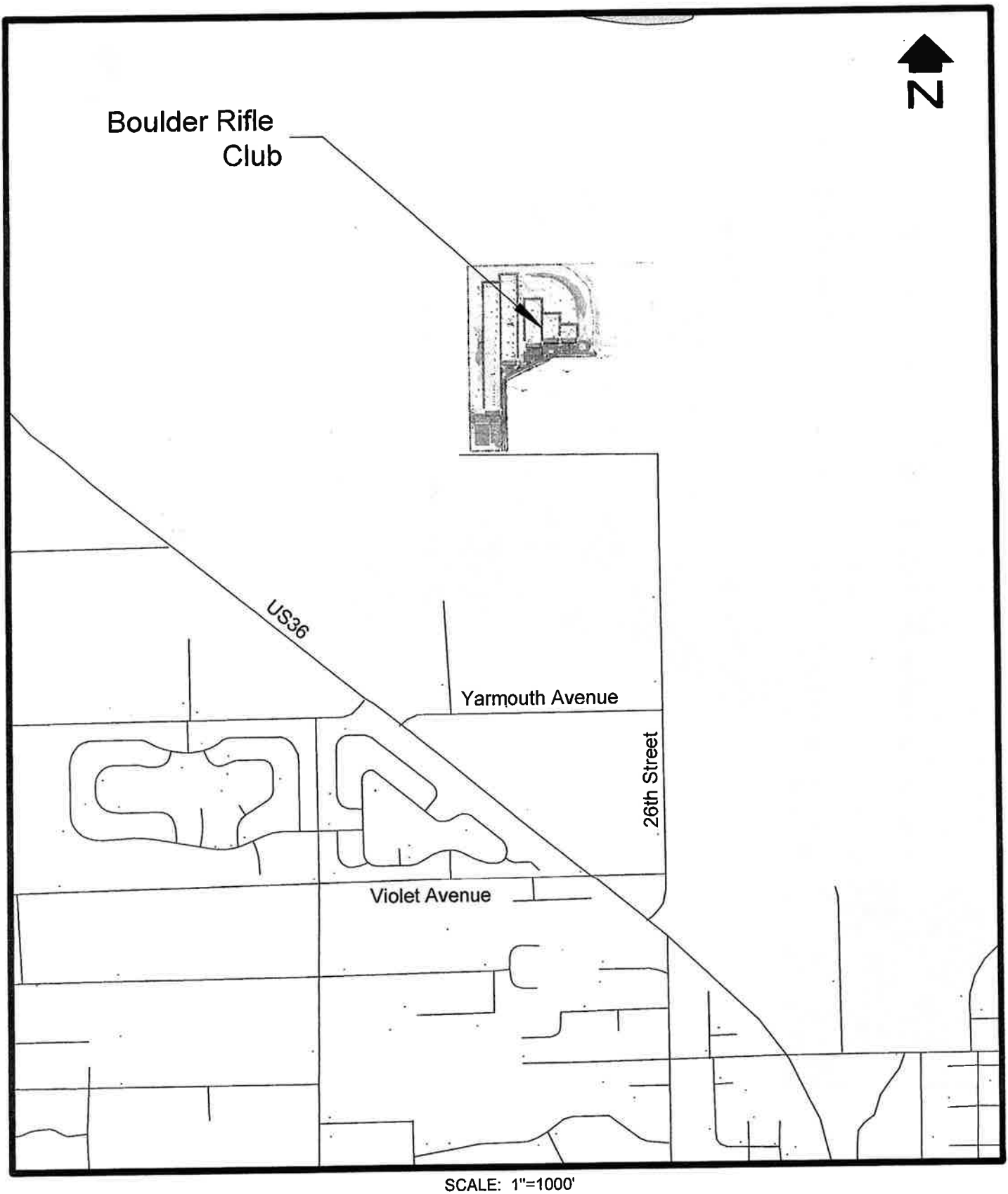
The proposal is to develop into the 12 acre parcel to the west with a new indoor range, a 25 yard range, 50 yard range, 100 yard range, 200 yard range, and 300 yard range. This is an increase from 5 ranges to 11 ranges. The proposed site plan is provided in Appendix B. The access drive will be relocated approximately 1,135 feet west of the driveway to the current site.

Pedestrian, Bicycle, and Transit Travel

Streets near the Boulder Rifle Club do not have sidewalks. Pedestrians will use the shoulders of the roads. Bicycles will share the roadways on 28th Street and Yarmouth Avenue. US36 has paved shoulders that bicycles can/do use. There are no trails in the area.

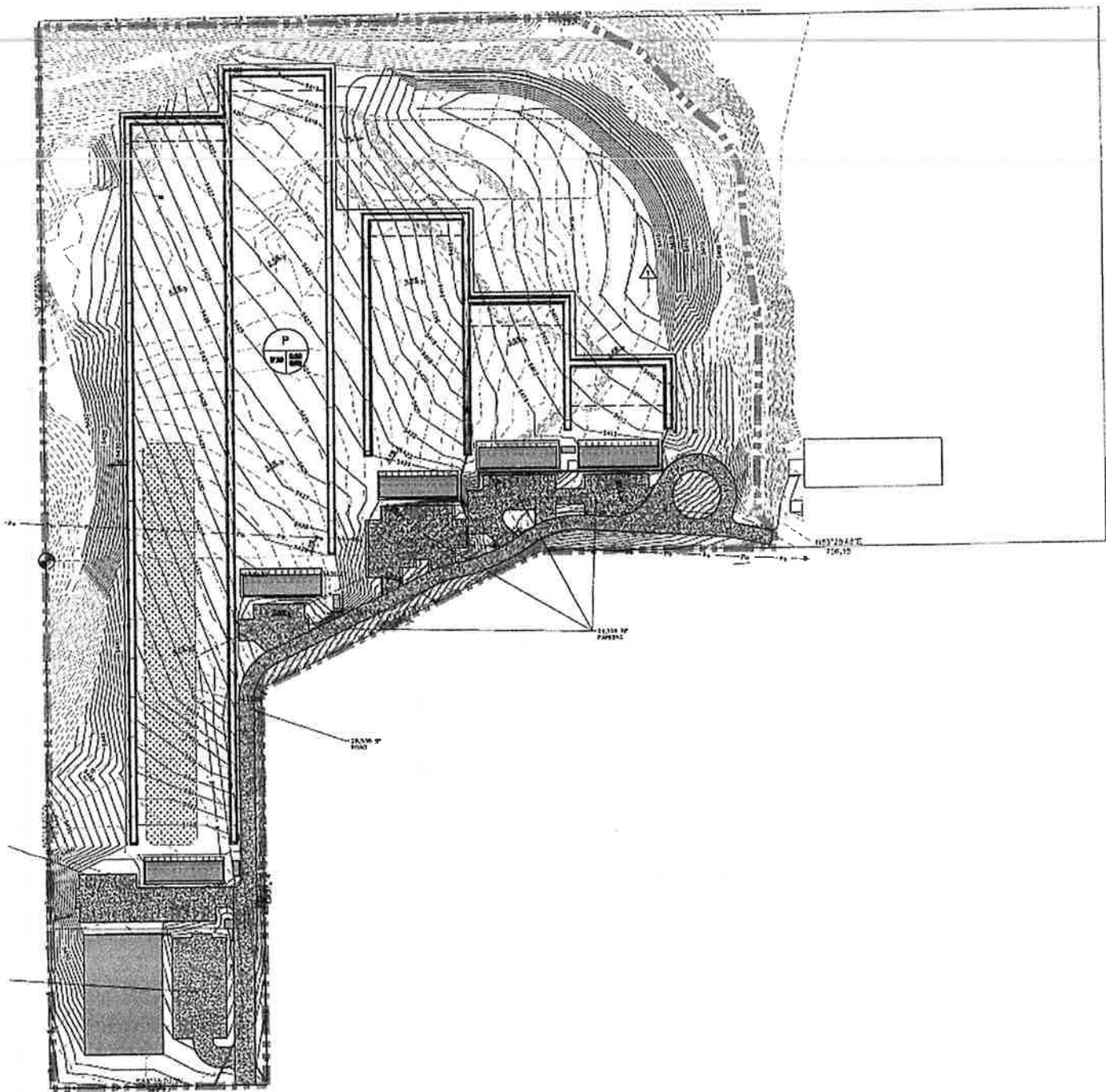
The Boulder Rifle Club is greater than mile from the closest RTD Route 205. There is a bus stop for Route 205 at the US36/Jay intersection to the south of the Boulder Rifle Club.

There are not many opportunities to encourage multimodal use, since this is a rifle club. The Boulder Rifle Club will encourage carpooling.



SITE LOCATION

Figure 1



SITE PLAN

Figure 2

II. STUDY AREA

The project site currently is vacant. The land surrounding the site consists of park/open space, a nursery, and a circus school, and park/open space uses. Harlequin's Garden Nursery and Boulder Circus Center are to the south of the site. There is a park/open space to the east, west, and north of the site.

The nearest signalized intersection in the area is the US36/Jay Road intersection (>1 mile away) and was determined to be outside of the project study area. Unsignalized intersections in the area are US36/26th Street and US36/Yarmouth Avenue intersections with stop control on 26th Street and Yarmouth Avenue, respectively.

III. EXISTING CONDITIONS

Figure 3 shows the existing geometry and multimodal facilities. United States Highway 36 (28th Street) is classified as a NR-A highway. Currently, US36 has a two-lane cross section with auxiliary turn lanes and a posted speed of 55 mph. At the US36/26th Street intersection, US36 has a southeastbound left-turn lane, a through lane in each direction, and a northwestbound right-turn lane. At the US36/Yarmouth intersection, US36 has a southeastbound left-turn lane, a southeastbound through lane, and a northwestbound through/right-turn lane.

26th Street is a local street with a two-lane gravel cross section and a posted speed of 30 mph. 26th Street only has a north leg at the US36/26th Street intersection. At the US36/26th Street intersection, 26th Street has all movements combined into a single lane.

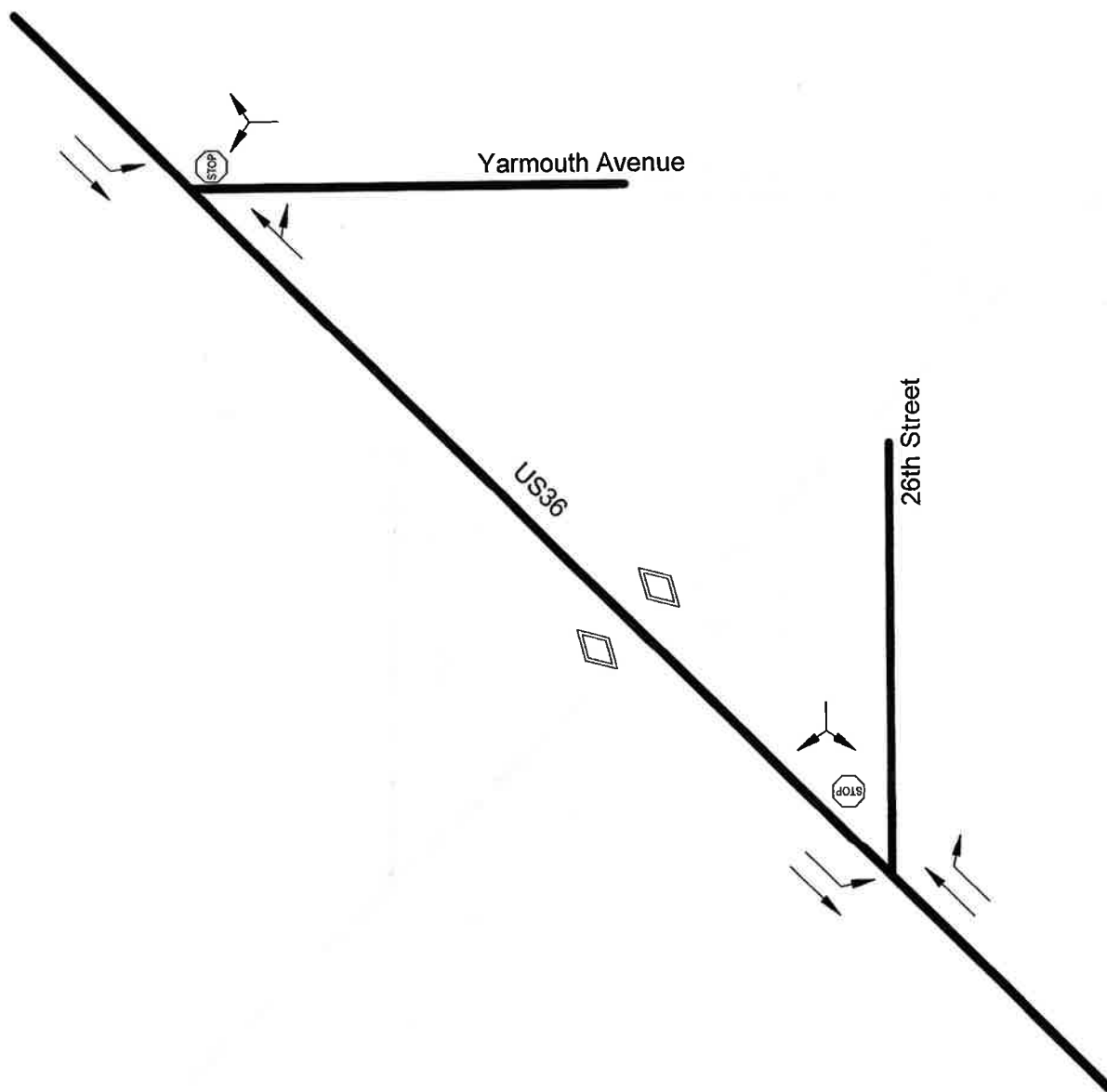
Yarmouth Avenue is a local street with a two-lane gravel cross section and a posted speed of 30 mph. Yarmouth Avenue only has an east leg at the US36/Yarmouth Avenue intersection. At the US36/Yarmouth Avenue intersection, Yarmouth Avenue has all movements combined into a single lane.

Recent daily, morning, and afternoon peak hour traffic counts at the US36/26th Street and US36/Yarmouth Avenue intersections are shown in Figure 4. Raw peak hour traffic counts are provided in Appendix B. The peak hour count data was obtained in March 2019. Using the volumes shown in Figure 4, the current peak hour operation at the US36/26th Street and US36/Yarmouth Avenue intersections are shown in Table 1. Calculation forms for these analyses are provided in Appendix C. The intersections were analyzed using the unsignalized intersection techniques from the 2016 Highway Capacity Manual (6th Edition HCM). At the US36/26th Street intersection, the calculated delay for the southbound approach was commensurate with level of service F. This is considered to be normal during the peak hours at stop sign controlled intersections along arterial streets.

TABLE 1			
Current Peak Hour Operation			
Intersection	Movement	Level of Service	
		AM	PM
US36/26 th Street (stop sign)	SEB LT	A (0.0 secs)	B (11.7 secs)
	SB LT/RT	F (90.9 secs)	F (60.0 secs)
	OVERALL	A (0.0 secs)	A (0.2 secs)
US36/Yarmouth Avenue (stop sign)	WB LT	D (34.2 secs)	C (23.6 secs)
	SEB LT	A (8.6 secs)	B (10.5 secs)
	OVERALL	A (0.1 secs)	A (0.1 secs)

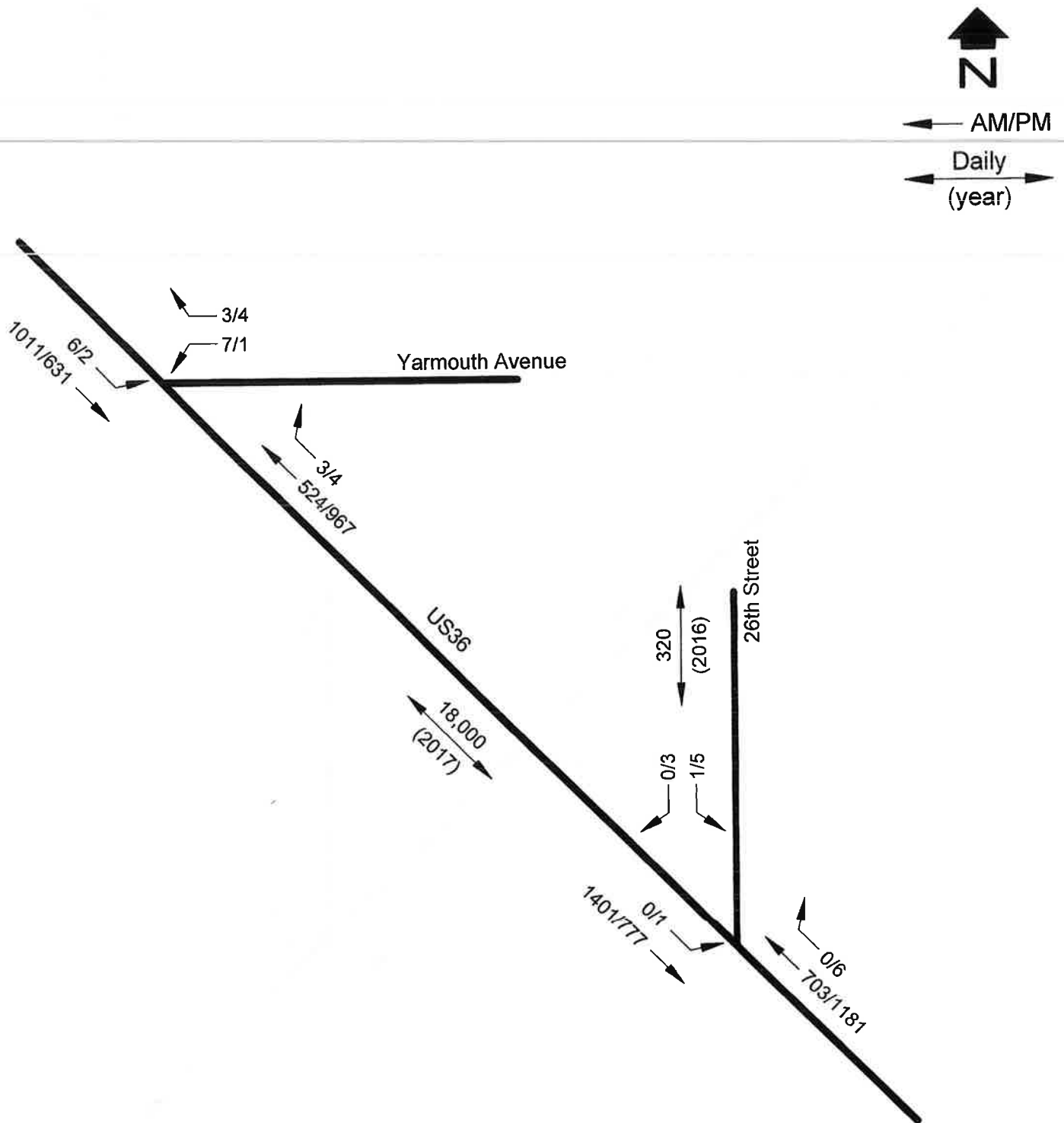


← - Denotes Lane



EXISTING GEOMETRY

Figure 3



RECENT DAILY AND PEAK HOUR TRAFFIC

Figure 4

Accident Data and Analysis

Accident data was obtained from the Boulder County for the US36/26th Street and US36/Yarmouth Avenue intersections for a five year period (2012 to 2017). At the US36/26th Street intersection there were two reported accidents: one rear-end accident and one head-on accident. At the US36/Yarmouth Avenue intersection, there were 14 reported accidents: two rear-end accidents, two approach turn accidents, one hitting the curb accident, one overtaking accident, one hitting a fence accident, one sideswipe accident, one accident with a bicycle, two in the embankment accidents, and three accidents hitting a wild animal. The number of accidents at the US36/26th Street and US36/Yarmouth Avenue intersections is typical and what would be expected at a stop sign controlled intersections.

IV. TRIP GENERATION

Trip generation is important in considering the impact of a development such as this upon the existing and proposed street system. Currently the Boulder Rifle Club is approximately 6.23 acres with a 200 yard range, a 100 yard range, a 50 yard range, a 25 yard range, and an indoor 50 foot range on the site. A Rifle Club is not specifically addressed in Trip Generation, 10th Edition, ITE, which is the common reference document. The Boulder Rifle Club did a survey of users at each range between 4/4/2018 and 7/21/2018. Table 2 shows the average number of people using each range on a typical day. This reflects a mild weather month condition. Based on discussions with the Boulder Rifle Club, it was determined that approximately 20 percent of users carpool. Therefore, the number of users was reduced by 20% to determine the number of vehicles. The current weekday average daily traffic is 68 trips per day. The weekend average daily traffic is 210 trips per day. The average weekday trip ends per range is 13.6 $[(68)/(5)]$. The average weekend trip ends per range is 42.0 $[(210)/(5)]$.

The proposal is to develop into the 12 acre parcel to the west with a new indoor range, a 25 yard range, 50 yard range, 100 yard range, 200 yard range, and 300 yard range. This is an increase from 5 ranges to 11 ranges. The proposed site plan is provided in Appendix B. The access drive will be relocated approximately 1,135 feet west of the driveway to the current site. Table 3 shows the proposed trip generation based on the average trips per range. The weekday average daily traffic is expected to be 150 trips per day. The weekend average daily traffic is expected to be 462 trips per day. To determine the peak hour trip ends, the number of persons using the ranges prior to the peak hour was assumed to be exiting and persons using the ranges during/after the peak hour were assumed to be entering. The expected total weekday person trip generation is: 190 daily trip ends; 3 morning peak hour trip ends; and 38 afternoon peak hour trip ends. The additional weekday person trip generation that is new site generated traffic is: 104 daily trip ends; 2 morning peak hour trip ends; and 20 afternoon peak hour trip ends.

TABLE 2
Number of Users at Each Range

Day of the Week	25 Yard Range	50 Yard Range	100 Yard Range	200 Yard Range	Indoor Range	Number of users	Number of Person Trip Ends per Day	Vehicle Trip Ends per day
Monday	9	4	5	2	0	20	40	32
Tuesday	20	8	7	0	6	41	82	66
Wednesday	17	12	23	1	1	54	108	86
Thursday	8	4	4	16	29	61	122	98
Friday	6	9	2	1	21	39	78	62
Saturday	52	31	15	61	5	164	328	262
Sunday	8	35	37	4	13	97	194	156
Weekday Average	12	8	8	4	11	43	86	68
Weekend Average	30	33	26	33	9	131	262	210

TABLE 3
Proposed Trip Generation

Day of the Week	Existing Person Trips per Day (5 Ranges)	Average Person Trips per Range	Proposed Person Trip Ends per Day (11 ranges)
Weekday average daily Traffic	86	17.2	190
Weekend Average daily Traffic	262	52.4	576
Day of the Week	Existing Vehicle Trips per Day (5 Ranges)	Average Vehicle Trips per Range	Proposed Vehicle Trip Ends per Day (11 ranges)
Weekday average daily Traffic	68	13.6	150
Weekend Average daily Traffic	210	42.0	462

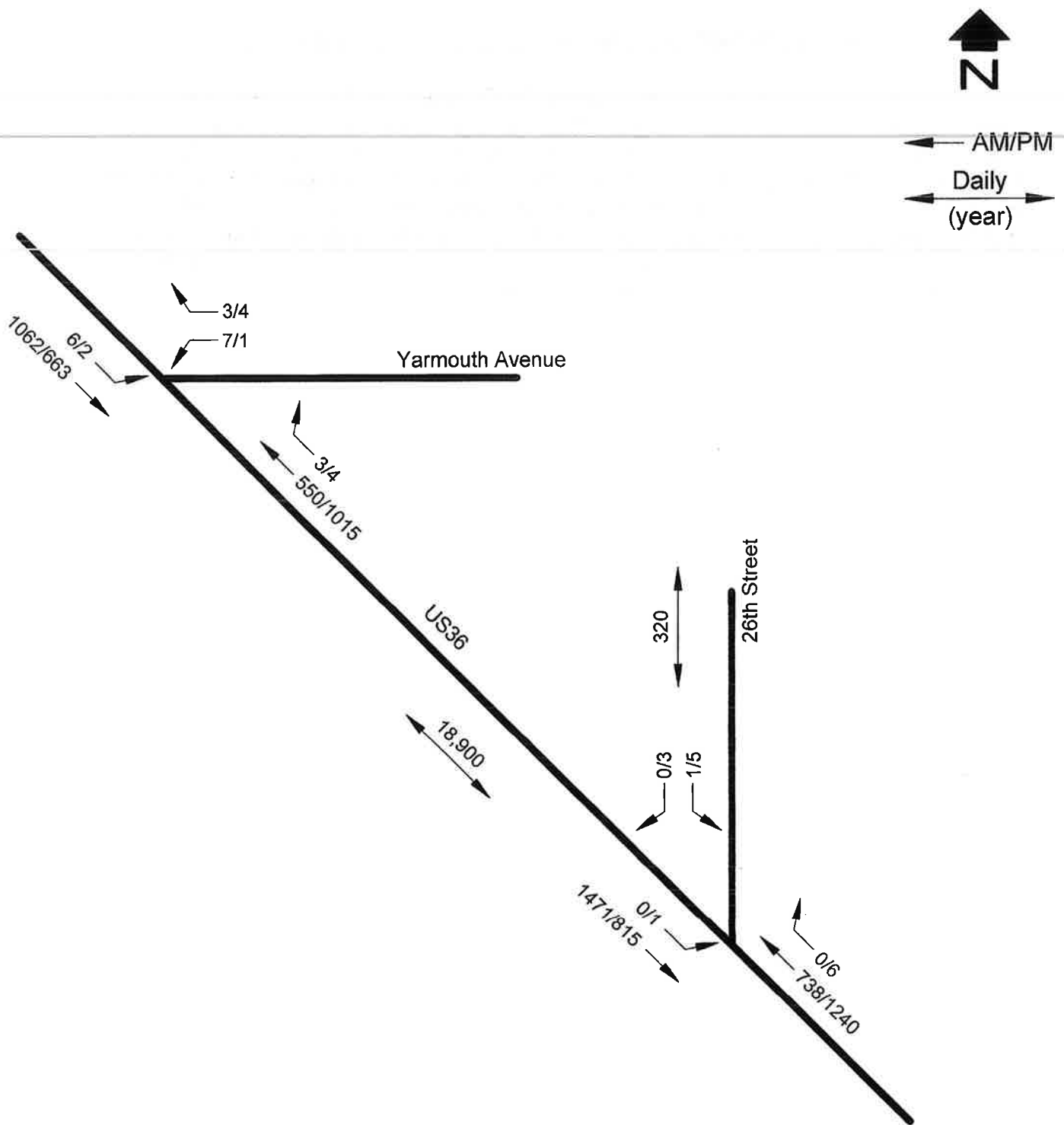
V. MODE SHARE

As mentioned before, there are not many opportunities to encourage multimodal use, since this is a rifle club. However, based on discussions with the Boulder Rifle Club it is expected that around 20 percent will carpool. Table 4 shows the person trips by travel mode for the Boulder Rifle Club. Using this information, the additional vehicle trip generation is 82 daily trip ends; 2 (2 in/0 out) morning peak hour trip ends; and 17 (6 in/11 out) afternoon peak hour trip ends.

TABLE 4			
Person Trips by Travel Mode			
Mode	Percent of trips	Number of person trips	
		AM (in/out)	PM (in/out)
Single occupant vehicle	80	2/0	5/9
Carpool	20	0/0	2/4
Bus	0	0/0	0/0
Bicycle	0	0/0	0/0
Walk	0	0/0	0/0
Total number of person trips		2/0	7/13
Total number of vehicle		2/0	6/11

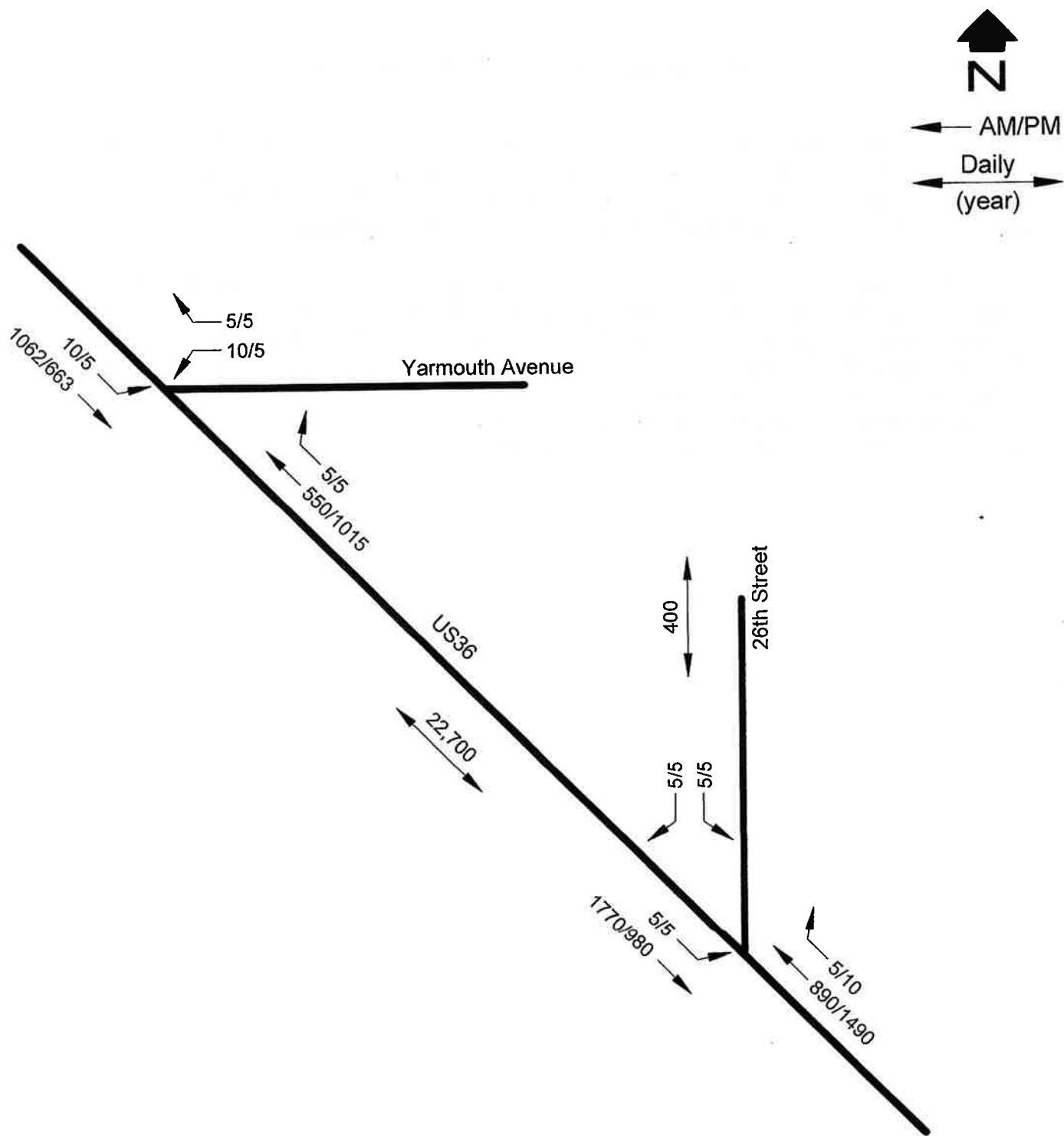
VI. BACKGROUND TRAFFIC & ADJACENT DEVELOPMENT

The traffic on US36 in the short range (2023) future and long range (2040) future was increased using the CDOT 20-year factor (1.25). Since 26th Street and Yarmouth Avenue are not through streets, it was determined that the short range (2023) future background traffic was not increased since there are no other proposed developments along 26th Street and Yarmouth Avenue. In the long range (2040) future, 26th Street and Yarmouth Avenue was increased using the CDOT 20-year factor. Figure 5 shows the short range (2023) background daily and peak hour traffic. Figure 6 shows the long range (2040) background daily and peak hour traffic.



SHORT RANGE (2023) BACKGROUND DAILY AND PEAK HOUR TRAFFIC

Figure 5



LONG RANGE (2040) BACKGROUND DAILY AND PEAK HOUR TRAFFIC

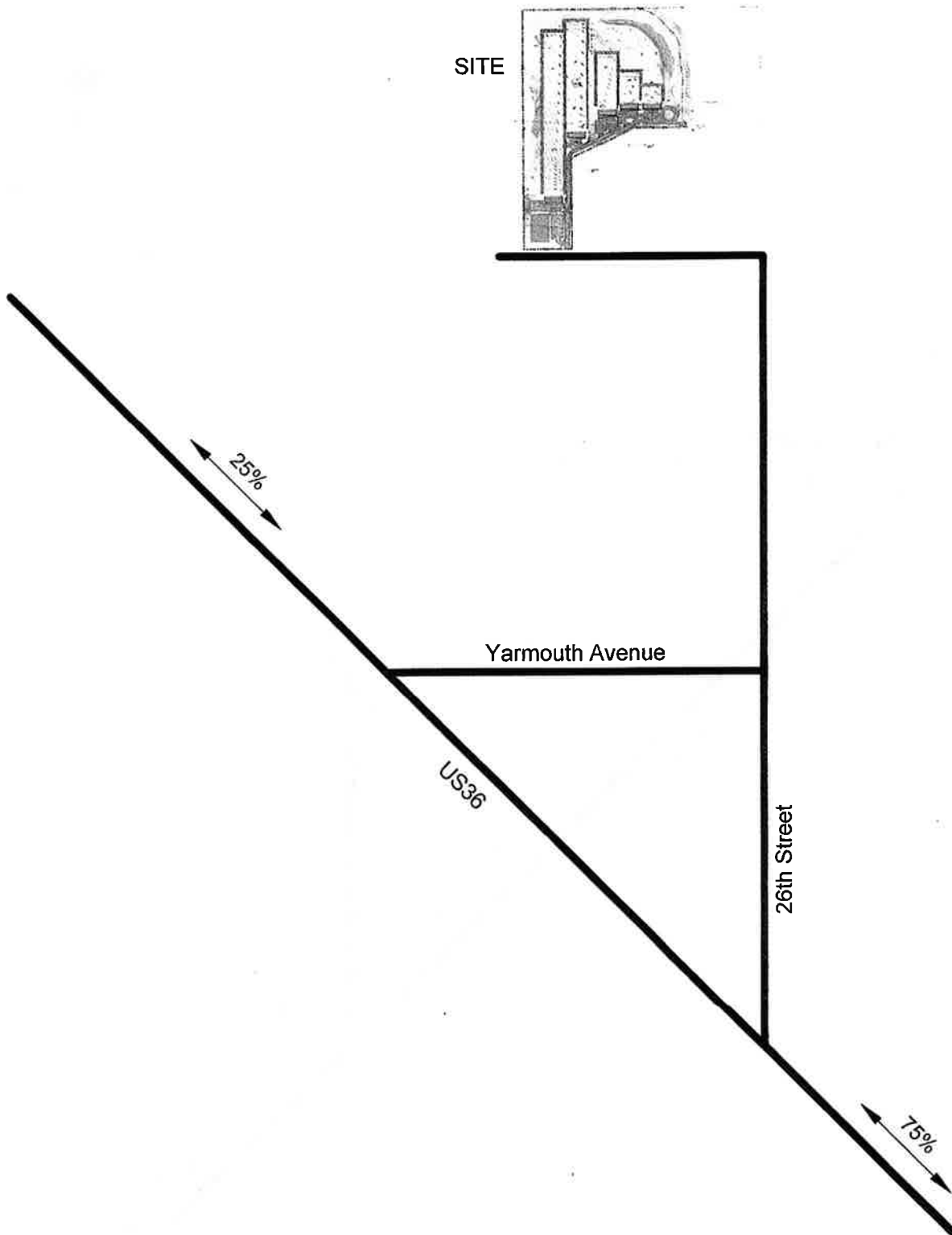
Figure 6

VII. TRIP DISTRIBUTION & ASSIGNMENT

Trip distribution for Boulder Rifle Club Project was based on existing/future travel patterns, land uses in the area, and consideration of trip attractions/productions for this land use. Figure 7 shows the trip distribution used for Boulder Rifle Club Project. This is a change from the 50/50 split in the TP-AML, based on the existing traffic counts.

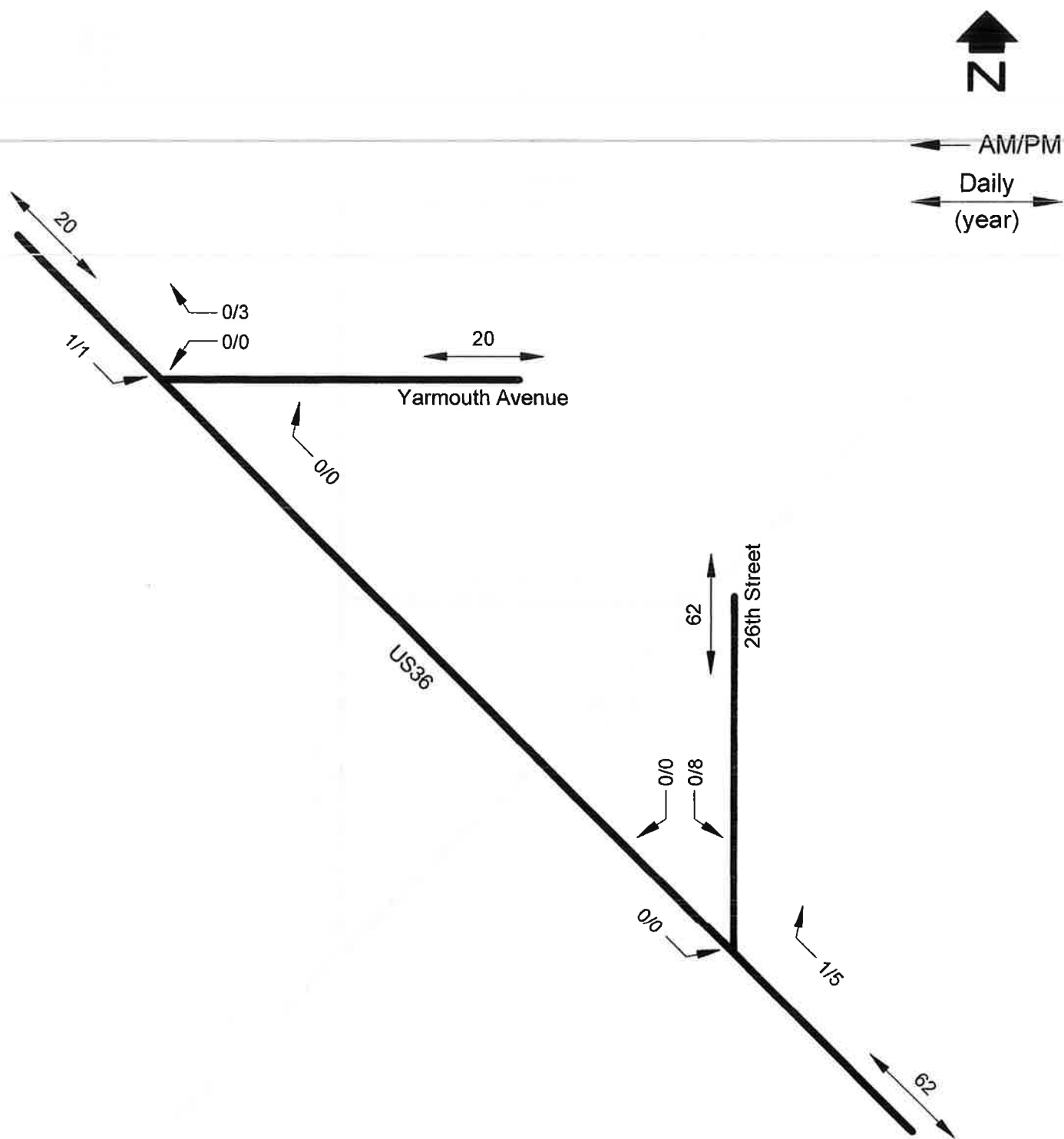
Trip assignment is how the generated and distributed trips are expected to be loaded on the street system. The assigned trips are the resultant of the trip distribution process. The site generated peak hour trip assignment for the Boulder Rifle Club Project is also shown in Figure 8. The site generated traffic was combined with the background traffic to determine the total forecasted traffic for the study area. Figures 9 and 10 show the respective short range (2023) and long range (2040) total peak hour traffic at the US36/26th Street and US36/Yarmouth intersections.

SITE



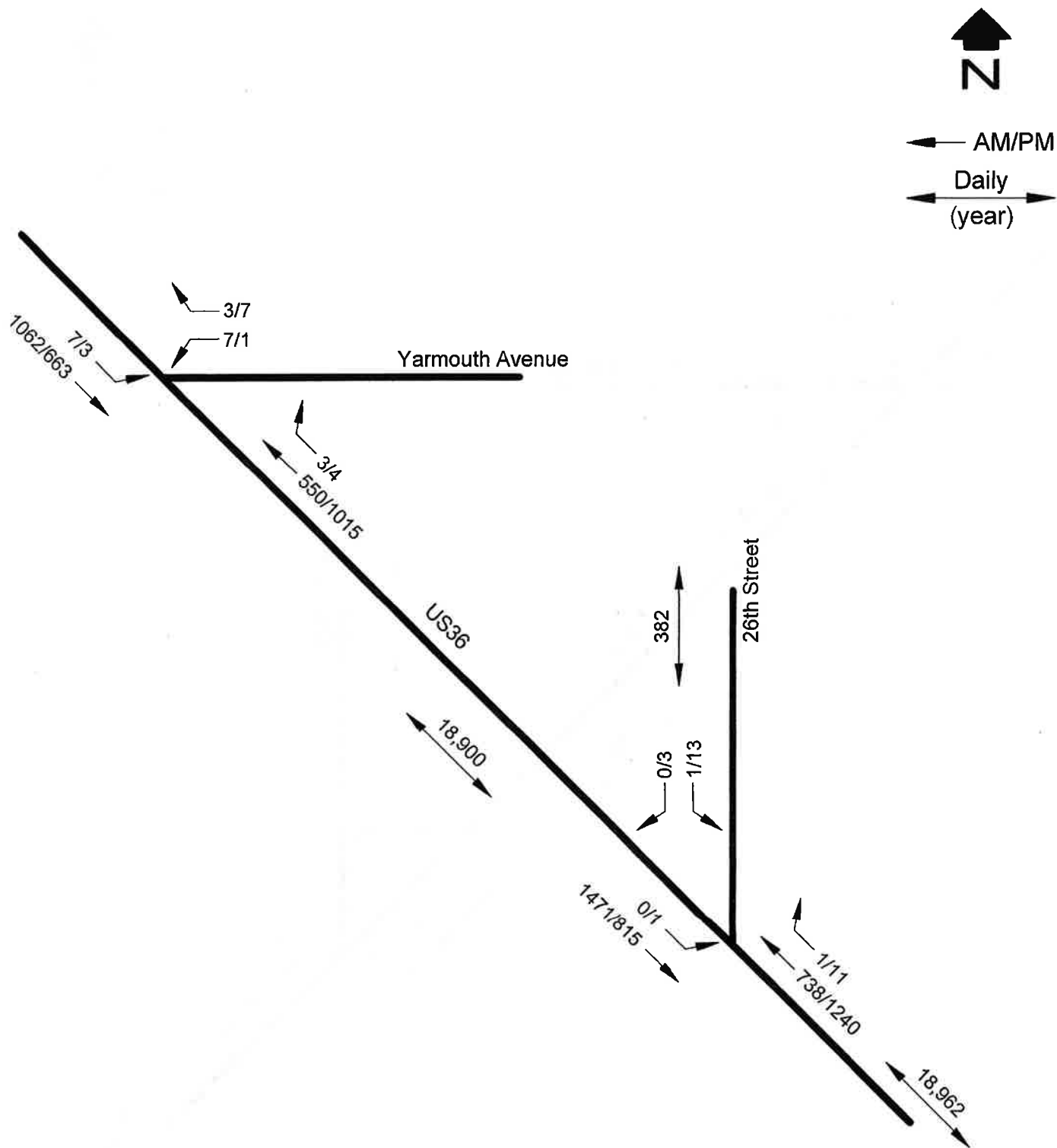
TRIP DISTRIBUTION

Figure 7



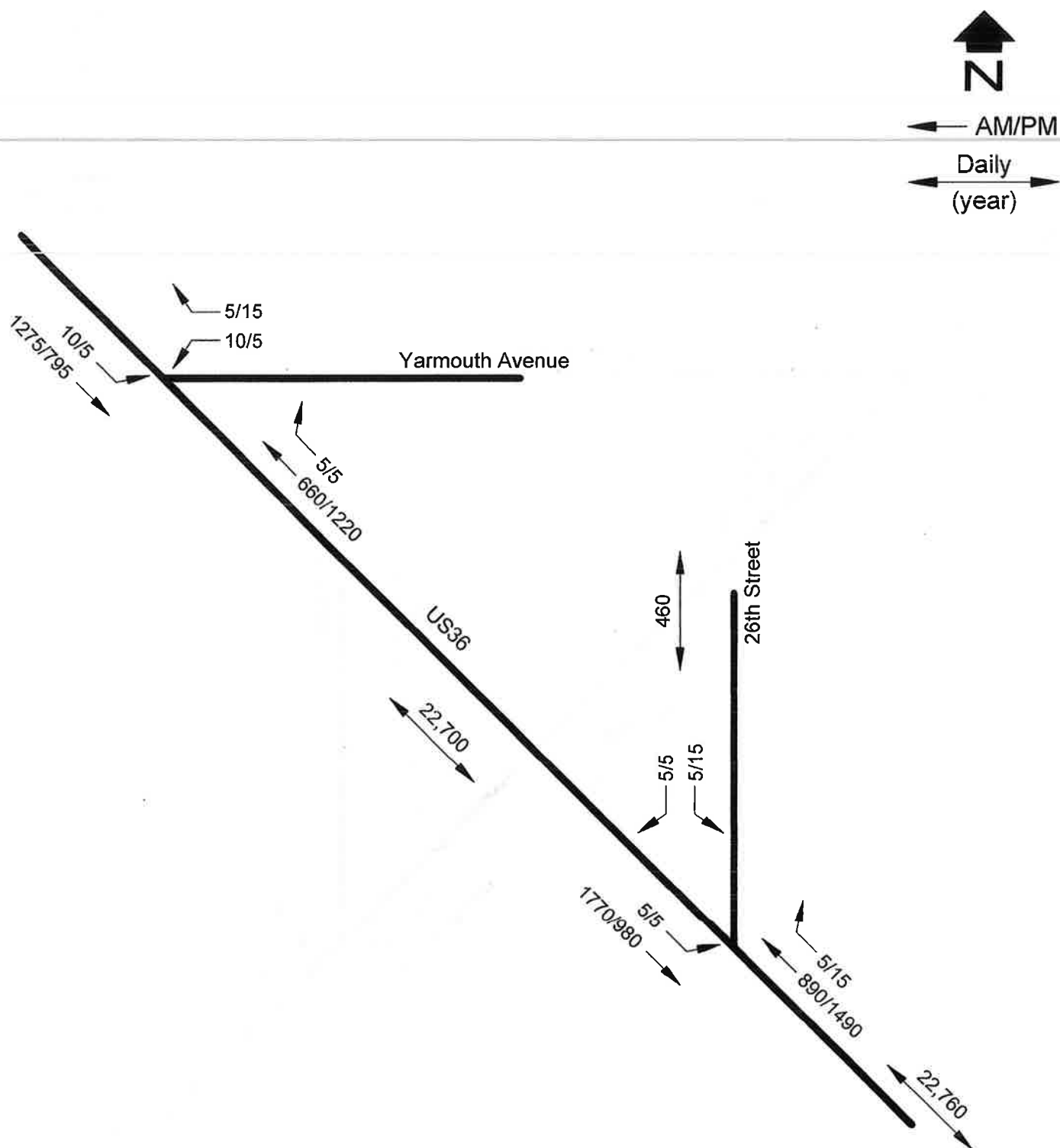
SITE GENERATED DAILY AND PEAK HOUR TRAFFIC

Figure 8



SHORT RANGE (2023) TOTAL DAILY AND PEAK HOUR TRAFFIC

Figure 9



LONG RANGE (2040) TOTAL DAILY AND PEAK HOUR TRAFFIC

Figure 10

VIII. FUTURE CONDITIONS ANALYSIS

Signal Warrants

As a matter of policy, traffic signals are not installed at any location unless warrants are met according to the Manual on Uniform Traffic Control Devices (MUTCD). There are nine signal warrants in the MUTCD. The peak hour warrant is the warrant was evaluated at the US36/26th Street and US36/Yarmouth intersections. This is the only warrant that could be reasonably evaluated in this transportation system impact study. The other warrants are beyond the scope of this study. According to the MUTCD, the standard for applying the peak hour warrant is: the peak hour signal warrant shall be applied only in unusual cases, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time. This intersection and the traffic characteristics do not fit this definition. If peak hour signal warrants will not be met at a given intersection, it is reasonable to conclude that it is not likely that other signal warrants would be met. Of peak hour signal warrants are met, it merely indicates that further evaluation should occur in the future as the development occurs. However, a judgment can be made that some intersection will likely meet other signal warrants.

Using the short range (2023) and long range (2035) peak hour traffic, the US36/26th Street and US3/Yarmouth Avenue intersections will not meet the lower threshold for the minor street in the peak hour volume signal warrant.

Operation Analysis

Operation analyses were performed at the US36/26th Street and US3/Yarmouth Avenue intersections. The operation analyses were conducted for the short range analysis, reflecting a year 2023 condition. The long range analysis reflects a year 2040 condition.

Table 5 shows the short range (2023) total peak hour operation at the US36/26th Street and US36/Yarmouth Avenue intersections with development of the Boulder Rifle Club. Calculation forms are provided in Appendix D. With stop sign control at the US36/26th Street intersection, the calculated delay in the morning and afternoon peak hours for the southbound approach was commensurate with level of service F. Level of service F is considered to be normal during the peak hours at stop sign controlled intersections along arterial streets.

Table 6 shows the long range (2040) total peak hour operation at the US36/26th Street and US36/Yarmouth Avenue intersections with development of the Boulder Rifle Club. Calculation forms are provided in Appendix E. With stop sign control at the US36/26th Avenue intersection, the calculated delay in the morning and afternoon peak hours for the southbound approach was commensurate with level of service F. Level of service F is considered to be normal during the peak hours at stop sign controlled intersections along arterial streets.

TABLE 5 Short Range (2023) Total Peak Hour Operation			
Intersection	Movement	Level of Service	
		AM	PM
US36/26 th Street (stop sign)	SEB LT	A (0.0 secs)	B (12.1 secs)
	SB LT/RT	F (105.2 secs)	F (98.2 secs)
	OVERALL	A (0.0 secs)	A (0.8 secs)
US36/Yarmouth Avenue (stop sign)	WB LT	E (37.7 secs)	C (23.4 secs)
	SEB LT	A (8.7 secs)	B (10.7 secs)
	OVERALL	A (0.3 secs)	A (0.1 secs)

TABLE 6 Long Range (2040) Total Peak Hour Operation			
Intersection	Movement	Level of Service	
		AM	PM
US36/26 th Street (stop sign)	SEB LT	B (10.1 secs)	A (14.2 secs)
	SB LT/RT	F (167.1 secs)	F (270.3 secs)
	OVERALL	A (0.6 secs)	A (2.2 secs)
US36/Yarmouth Avenue (stop sign)	WB LT	F (64.9 secs)	E (45.6 secs)
	SEB LT	A (9.1 secs)	B (12.0 secs)
	OVERALL	A (0.6 secs)	A (0.5 secs)

Geometry and Roadway Improvements

The short range (2019) and long range (2035) geometry is the same as the existing geometry.

Based on the 2016 daily count (320 vehicles per day) on 26th Avenue, the existing daily traffic is at 80 percent of the paving threshold (>400 ADT). The short range (2023) total average daily traffic with the Boulder Rifle Club is calculated at 382 ADT. This is near the paving threshold. This is a 16% increase in the daily traffic on 26th Avenue. The long range (2040) total average daily traffic with the Boulder Rifle Club is calculated at 460 ADT. This is over the paving threshold.

IX. CONCLUSIONS & MITIGATION RECOMMENDATIONS

This study assessed the impacts of Boulder Rifle Club development on the short range and long range street system in the vicinity of the proposed development. Boulder Rifle Club is located at 4810 North 26th Street in Boulder County, Colorado. As a result of this analysis, the following is concluded:

- The development of Boulder Rifle Club Project in Boulder County is feasible from a traffic engineering standpoint. The total Boulder Rifle Club will generate approximately 190 daily trip ends; 3 morning peak hour trip ends; and 38 afternoon peak hour trip ends. The additional weekday person trip generation that is now site generated traffic is: 104 daily trip ends; 2 morning peak hour trip ends; and 20 afternoon peak hour trip ends
- At the US36/26th Street intersection, the calculated delay for the southbound approach was commensurate with level of service F. This is considered to be normal during the peak hours at stop sign controlled intersections along arterial streets.
- It is unlikely that people will walk and bike to the Boulder Rifle Club. Pedestrians will use the shoulders of the roads within this area. Bicycles will share the roadways within this area. US36 has paved shoulders that bicycles can/do use.
- The area is not served by RTD. The nearest route (Route 205) is greater than a mile for the Boulder Rifle Club. There is a bus stop is at the US36/Jay Road intersection, approximately 1.2 miles to the south.
- The US36/26th Street and US3/Yarmouth Avenue intersections will not meet the lower threshold for the minor street in the peak hour volume signal warrant. Therefore, it is unlikely that the US36/26th Street and US3/Yarmouth Avenue intersections will required signalization in the.
- In the short range (2019) future, given the development of Boulder Rifle Club and an increase in background traffic, the US36/26th Street and US36/Yarmouth Avenue intersections operate as shown in Table 4. With stop sign control at the US36/26th Street intersection, the calculated delay in the morning and afternoon peak hours for the southbound approach was commensurate with level of service F. Level of service F is considered to be normal during the peak hours at stop sign controlled intersections along arterial streets.
- In the long range (2035) future, given development of Boulder Rifle Club Project, the US36/26th Street and US36/Yarmouth Avenue intersections operate as shown in Table 5. With stop sign control at the US36/26th Avenue intersection, the calculated delay in the morning and afternoon peak hours for the southbound

approach was commensurate with level of service F. Level of service F is considered to be normal during the peak hours at stop sign controlled intersections along arterial streets.

- The short range and long range geometry is the same as the existing geometry in Figure 3.
- Based on the 2016 daily count (320 vehicles per day) on 26th Avenue, the existing daily traffic is at 80 percent of the paving threshold (>400 ADT). The short range (2023) total average daily traffic with the Boulder Rifle Club is calculated at 382 ADT. This is near the paving threshold. This is a 16% increase in the daily traffic on 26th Avenue. The long range (2040) total average daily traffic with the Boulder Rifle Club is calculated at 460 ADT. This is over the paving threshold.



**Preliminary Drainage Report
Boulder Rifle Range
Boulder County, Colorado**

Prepared for:

Boulder Rifle Club
PO Box 21197
Boulder, CO 80308
(303) 548-2945

Prepared by:

Rocky Ridge Civil Engineering
420 21st Avenue, Suite 101
Longmont, Colorado 80501
(303) 651-6626

May 2019

RRCE Job#778-1

Engineer's Certification

"I hereby certify that this plan and report for the Preliminary Drainage design of the Boulder Rifle Club was prepared by me, or under my direct supervision, in accordance with the provisions of the Boulder County Storm Drainage Criteria Manual."



A handwritten signature of Garrett Walstad in cursive script.

Garrett C. Walstad
Registered Professional Engineer
State of Colorado No. 53303

Table of Contents

Vicinity Map

I. Introduction	1
II. General Location and Description	1
III. Existing Soil Conditions	1
IV. Existing Drainage Conditions	2
V. Drainage Facility Design	2
VI. Conclusions	4

FEMA - FIRMette

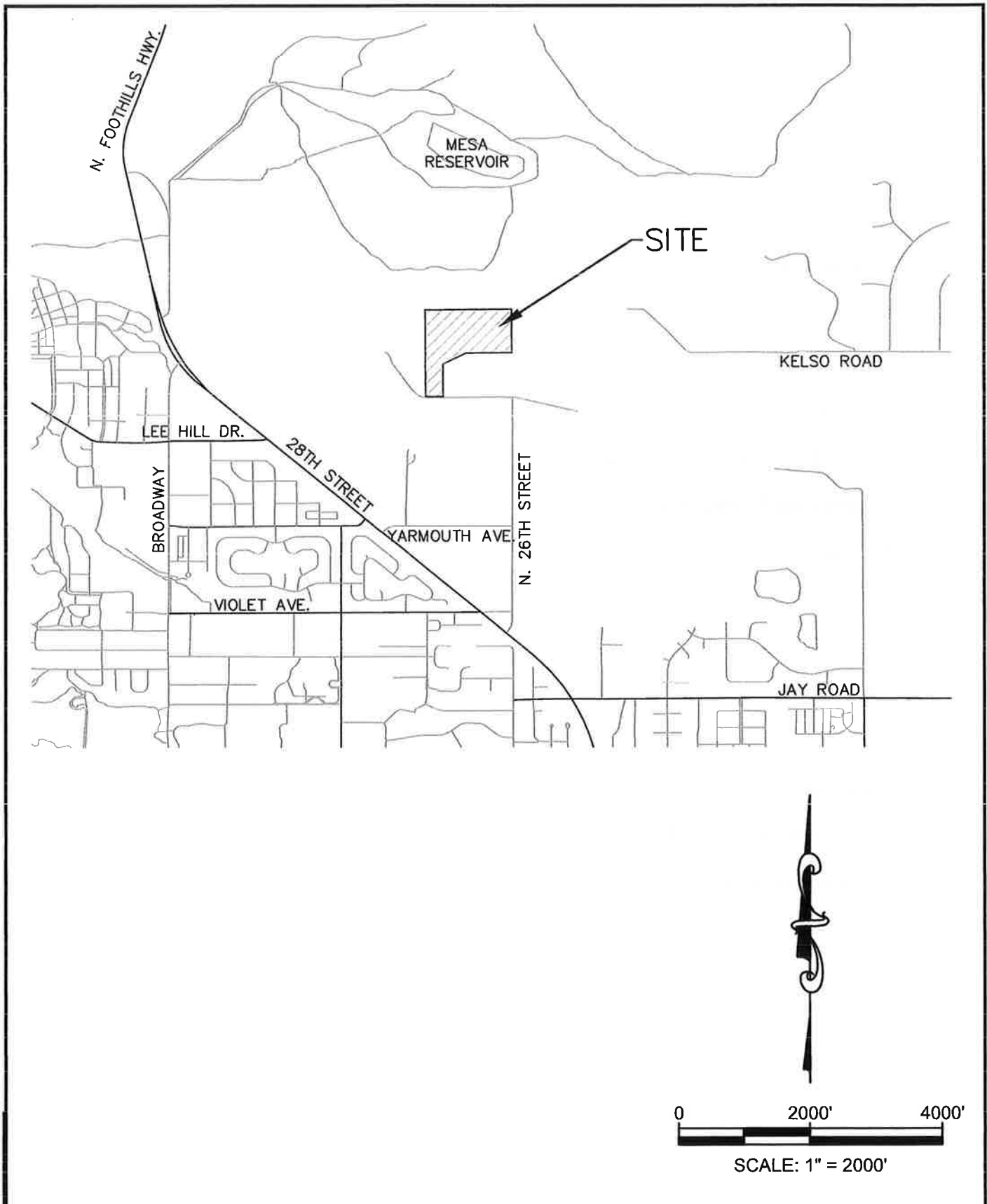
Appendix A- Hydrologic Calculations

Appendix B- Detention Calculations

Map Pocket

D1 - Historic Drainage Plan

D2 - Developed Drainage Plan



BOULDER RIFLE RANGE

VICINITY MAP

DATE
05/20/2019

CAD NO
7781EXHIBIT

JOB NO
778-1



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SHEET NO

1 OF 1

I. INTRODUCTION

This report is site specific for improvements to The Boulder Rifle Club, hereinafter called “the Site”. The Site will include the construction of a primary building with classroom space, indoor shooting range, and merchandise area, open air shooting ranges with shelters, parking and drive areas, utility services, and drainage infrastructure.

The drainage design concepts of this project are intended to be in conformance with Boulder County Storm Drainage Criteria Manual. Calculations for this report are based on the Major (100-year) and Minor (10-year) storm events.

II. GENERAL LOCATION AND DESCRIPTION

The site is located in the eastern half of Section 7, Township 1 North, Range 70 West of the 6th P.M. The site is bounded by N. 26th Street to the south, and agriculturally zoned City of Boulder property to the north, east and west.

The site includes approximately 24.87 acres and contains the Boulder Rifle Club facility existing structures, gravel parking/drive areas, and walkways.

There are no major or minor drainage ways on or near the site. The site is located within “Zone X - Area of Minimal Flood Hazard” according to FEMA Panel 08013CO385J effective December 18, 2012.

III. EXISTING SOIL CONDITIONS

The existing site topography varies significantly with slopes ranging from one to sixty percent grade. Existing ground cover includes mostly barren soils with native grasses, weeds and small shrubs and trees.

Existing soils are hydrologically classified as being primarily Type C and D.

Soilogic completed a Preliminary Geotechnical Subsurface Exploration Report in February 2019, with exploratory holes approximately 35 to 40 feet below ground surface.

The western portion of the site is historically known to have been used as a trash dump. Various debris and hazardous waste may be encountered during the planned construction activities. This material shall be removed from the site and measures taken to mitigate any additional hazardous health and environmental impacts associated with the removal.

The site does not contain any known irrigation infrastructure or encumbrances. There are no known significant geologic features at the site.

Groundwater was not encountered during the subsurface investigation.

IV. EXISTING DRAINAGE CONDITIONS

The existing site drains via sheetflow to an unnamed channel running through the site from the northwest to the southeast. Runoff is conveyed via open channel flow to an existing 48-inch steel culvert, where it is conveyed east via open channel flow, ultimately discharging to the Farmers Ditch. No offsite sheetflow enters the site. Concentrated offsite flows enter the site via open channel flow and are conveyed through the site to the existing outfall.

The primary drainage infrastructure including the open channel and existing outfall from the site are to be maintained throughout the proposed construction.

The existing site has been divided into two (2) drainage basins and have been labeled H1 and H2. An existing drainage plan can be found at the end of this report.

Basin H1 is in the western portion of the site and consists of a gravel access road and mostly barren native soils. Runoff drains via sheetflow northwest to the existing open channel running through the site where flows are conveyed through the existing 48-inch storm sewer outfall, ultimately being discharged to the Farmers Ditch.

Basin H2 is in the eastern portion of the site and consists of the existing Boulder Rifle Club facility buildings, gravel drives and open shooting range areas. Runoff drains via sheetflow northeast to the existing open channel running through the site where flows are conveyed through the existing 48-inch storm sewer outfall, ultimately being discharged to the Farmers Ditch.

Historic runoff values can be found in the Runoff Summary Table included in this report. Additional runoff calculations can be found in the Appendix.

V. DRAINAGE FACILITY DESIGN

Developed drainage patterns will remain consistent with the historic patterns. Runoff drains via sheetflow, open channel flow and storm sewer to the existing drainage channel running through the site where flows are conveyed through the existing 48-inch storm sewer outfall. Runoff from most of the proposed site improvements drains to a proposed detention pond where release is limited to historic rates.

The proposed site has been divided into four (4) drainage basins and have been labeled A1 through A4. A proposed drainage plan can be found at the end of this report.

Basin A1 is in the central portion of site and consists of proposed buildings and associated drives, parking areas, walks, shooting ranges, lawns and the proposed detention pond. Runoff drains via sheetflow, open channel flow and storm sewer to the proposed detention pond where runoff release is limited to historic rates. Release rates from the pond have been further reduced to account for portions runoff from the site that bypass the proposed pond. Runoff is released into the existing drainage swale where it is

conveyed through the existing 48" storm sewer outfall from the site, which is consistent with existing patterns.

Basin A2 is in the eastern portion of site and consists of the existing Boulder Rifle Club facility buildings and associated drives, parking areas, walks, shooting ranges, and lawns. Runoff drains via sheetflow, open channel flow and storm sewer to the existing drainage swale where it is conveyed through the existing 48" storm sewer outfall from the site, which is consistent with existing patterns.

Basin A3 is in the northern perimeter of the site and consists of the existing pervious areas. Runoff drains via sheetflow to the existing drainage swale where it is conveyed through the site to the existing 48" storm sewer outfall from the site, which is consistent with existing patterns.

Basin A4 is in the southern portion of site and consists of several proposed buildings and associated drives, parking areas, walks, and lawns. Runoff drains via sheetflow, open channel flow and storm sewer to the existing drainage swale south of the site where it is conveyed through the existing 72-inch storm sewer south of the site, which is consistent with existing patterns.

Developed runoff values can be found in the Runoff Summary Table included in this report. Additional runoff calculations can be found in the Appendix.

Runoff Summary Table			
Basins	Area (acres)	Q₁₀ (cfs)	Q₁₀₀ (cfs)
H (Overall Historic)	24.87	7.44	40.5
H1	17.83	4.52	27.7
H2	7.045	2.92	12.8
A (Overall Developed)	24.87	10.3	47.6
A1	11.85	4.27	20.3
A2	7.045	3.31	15.2
A3	4.803	1.16	7.32
A4	1.174	1.51	4.76

The principle form of water quality is the implementation of Extended Detention Basin. A detention pond has been included in the proposed development to mitigate additional runoff from the increased imperviousness of the site. Runoff from the majority of the proposed site will flow through the proposed detention pond where release will be limited. The proposed pond has been designed to provide the Water Quality Capture Volume (WQCV), 10-year detention volume and 100-year detention volume. Additional water quality features will be implemented in the form of grass buffers, grass-lined swales, and riprap rundowns at concentrated discharge locations.

The "Boulder County Storm Drainage Criteria Manual" (SDM) and "Urban Storm Drainage Criteria Manual" (UD) were used as a basis for the development of this drainage plan and report. The Rational Formula Method was used for runoff calculations.

The Modified FAA Method was used for the required pond volume calculations. Additional calculations can be found in the Appendix of this report.

VI. CONCLUSIONS

The drainage concepts for this project are consistent with current policies and practices for storm drainage management as outlined in the Boulder County Storm Drainage Criteria Manual and the Urban Drainage and Flood Control District's Storm Drainage Criteria Manual.

The concepts presented for this project are also consistent with current policy and practices that allow the continued release of historic runoff while mitigating hazards of flooding. The proposed detention pond was sized for the 100-year developed storm using an allowable (historic) release rate and accounting for those portions of runoff that bypass the site. The site will maintain the flow patterns and release rates as have been historically seen from this Site.

VII. REFERENCES

Boulder County, November 2016. Boulder County Storm Drainage Criteria Manual.

Urban Drainage and Flood Control District, March 2017. Urban Storm Drainage Criteria Manual – Volumes I, II, and III.

National Flood Hazard Layer FIRMette



40°4'11.47"N

105°16'10.21"W



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

1:6,000

40°3'43.93"N

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AP
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee, See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		Area of Minimal Flood Hazard Zone X
		Effective LOMRs
		Area of Undetermined Flood Hazard Zone D
GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		Cross Sections with 1% Annual Chance Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
MAP PANELS		Jurisdiction Boundary
		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped



The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/13/2019 at 5:47:49 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

Appendix A

Hydrologic Calculations



NOAA Atlas 14, Volume 8, Version 2
Location name: Boulder, Colorado, USA*
Latitude: 40.066°, Longitude: -105.2663°
Elevation: 5423.87 ft**

* source: ESRI Maps

** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffrey Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

[PF tabular](#) | [PF graphical](#) | [Maps & aeriels](#)

PF tabular

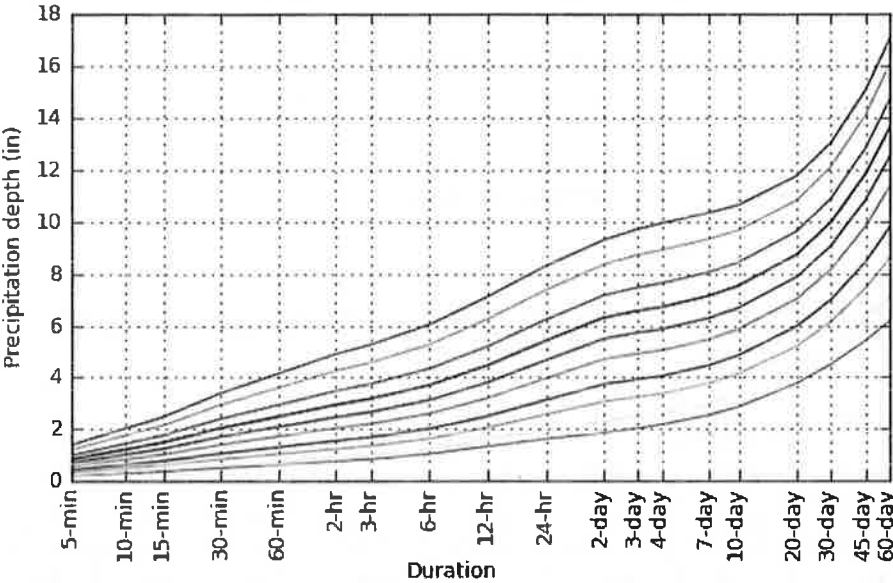
PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.207 (0.169-0.254)	0.255 (0.208-0.313)	0.346 (0.282-0.427)	0.435 (0.352-0.539)	0.576 (0.454-0.761)	0.699 (0.532-0.928)	0.835 (0.608-1.13)	0.987 (0.681-1.37)	1.21 (0.794-1.72)	1.39 (0.879-1.98)
10-min	0.303 (0.248-0.372)	0.373 (0.305-0.459)	0.507 (0.413-0.626)	0.637 (0.515-0.789)	0.843 (0.665-1.11)	1.02 (0.779-1.36)	1.22 (0.890-1.66)	1.45 (0.998-2.01)	1.77 (1.16-2.52)	2.03 (1.29-2.90)
15-min	0.369 (0.302-0.454)	0.455 (0.372-0.560)	0.618 (0.503-0.763)	0.777 (0.628-0.963)	1.03 (0.811-1.36)	1.25 (0.950-1.66)	1.49 (1.09-2.03)	1.76 (1.22-2.45)	2.15 (1.42-3.07)	2.48 (1.57-3.54)
30-min	0.508 (0.416-0.624)	0.624 (0.510-0.768)	0.847 (0.689-1.05)	1.06 (0.859-1.32)	1.41 (1.11-1.86)	1.71 (1.30-2.27)	2.04 (1.49-2.77)	2.41 (1.67-3.35)	2.95 (1.94-4.20)	3.40 (2.15-4.85)
60-min	0.634 (0.519-0.780)	0.775 (0.633-0.953)	1.04 (0.850-1.29)	1.31 (1.06-1.62)	1.72 (1.36-2.28)	2.09 (1.59-2.78)	2.49 (1.82-3.39)	2.95 (2.04-4.10)	3.60 (2.37-5.13)	4.15 (2.63-5.92)
2-hr	0.761 (0.627-0.928)	0.925 (0.761-1.13)	1.24 (1.02-1.52)	1.55 (1.26-1.90)	2.04 (1.62-2.67)	2.47 (1.90-3.26)	2.95 (2.17-3.97)	3.48 (2.43-4.80)	4.26 (2.83-6.02)	4.90 (3.14-6.94)
3-hr	0.845 (0.699-1.03)	1.02 (0.843-1.24)	1.36 (1.12-1.65)	1.69 (1.38-2.06)	2.21 (1.77-2.88)	2.67 (2.06-3.50)	3.18 (2.35-4.26)	3.74 (2.63-5.14)	4.57 (3.06-6.43)	5.26 (3.39-7.41)
6-hr	1.05 (0.872-1.26)	1.25 (1.04-1.51)	1.64 (1.36-1.98)	2.01 (1.66-2.44)	2.61 (2.10-3.36)	3.13 (2.43-4.06)	3.70 (2.76-4.91)	4.34 (3.07-5.90)	5.26 (3.56-7.34)	6.03 (3.93-8.43)
12-hr	1.34 (1.12-1.59)	1.59 (1.33-1.90)	2.06 (1.72-2.46)	2.50 (2.08-3.01)	3.20 (2.59-4.08)	3.80 (2.98-4.88)	4.46 (3.35-5.86)	5.19 (3.71-7.00)	6.24 (4.27-8.63)	7.11 (4.68-9.87)
24-hr	1.62 (1.37-1.92)	1.97 (1.66-2.33)	2.57 (2.16-3.06)	3.13 (2.61-3.73)	3.96 (3.21-4.97)	4.66 (3.67-5.90)	5.41 (4.09-7.01)	6.22 (4.48-8.28)	7.36 (5.08-10.1)	8.29 (5.53-11.4)
2-day	1.86 (1.58-2.18)	2.30 (1.96-2.71)	3.07 (2.60-3.61)	3.73 (3.14-4.42)	4.70 (3.82-5.80)	5.48 (4.33-6.85)	6.30 (4.79-8.06)	7.16 (5.20-9.41)	8.35 (5.81-11.3)	9.29 (6.27-12.7)
3-day	2.03 (1.74-2.37)	2.48 (2.11-2.90)	3.25 (2.76-3.80)	3.93 (3.31-4.62)	4.91 (4.02-6.04)	5.72 (4.55-7.11)	6.57 (5.03-8.37)	7.46 (5.46-9.77)	8.71 (6.11-11.7)	9.71 (6.60-13.2)
4-day	2.18 (1.87-2.54)	2.62 (2.24-3.05)	3.38 (2.87-3.94)	4.05 (3.43-4.75)	5.04 (4.14-6.18)	5.85 (4.67-7.26)	6.71 (5.16-8.53)	7.63 (5.61-9.96)	8.91 (6.28-12.0)	9.93 (6.79-13.5)
7-day	2.54 (2.19-2.94)	2.99 (2.57-3.46)	3.77 (3.23-4.37)	4.45 (3.79-5.18)	5.45 (4.50-6.62)	6.27 (5.04-7.71)	7.13 (5.52-8.99)	8.04 (5.96-10.4)	9.31 (6.62-12.4)	10.3 (7.12-13.9)
10-day	2.86 (2.47-3.29)	3.33 (2.88-3.84)	4.14 (3.56-4.77)	4.84 (4.14-5.61)	5.85 (4.84-7.05)	6.67 (5.38-8.15)	7.52 (5.85-9.42)	8.42 (6.27-10.8)	9.66 (6.90-12.8)	10.6 (7.38-14.3)
20-day	3.77 (3.28-4.29)	4.30 (3.74-4.91)	5.20 (4.50-5.94)	5.96 (5.13-6.84)	7.02 (5.85-8.35)	7.87 (6.40-9.49)	8.73 (6.85-10.8)	9.62 (7.23-12.2)	10.8 (7.81-14.2)	11.8 (8.26-15.6)
30-day	4.50 (3.93-5.10)	5.12 (4.47-5.81)	6.14 (5.34-6.98)	6.99 (6.04-7.99)	8.16 (6.81-9.61)	9.06 (7.39-10.8)	9.97 (7.86-12.2)	10.9 (8.23-13.8)	12.1 (8.80-15.8)	13.0 (9.23-17.3)
45-day	5.40 (4.74-6.09)	6.18 (5.41-6.97)	7.42 (6.48-8.39)	8.43 (7.32-9.58)	9.79 (8.19-11.4)	10.8 (8.85-12.8)	11.8 (9.35-14.4)	12.8 (9.73-16.1)	14.1 (10.3-18.2)	15.0 (10.7-19.8)
60-day	6.16 (5.42-6.92)	7.09 (6.23-7.97)	8.57 (7.51-9.66)	9.75 (8.50-11.0)	11.3 (9.49-13.1)	12.5 (10.2-14.7)	13.6 (10.8-16.5)	14.7 (11.2-18.3)	16.0 (11.8-20.6)	17.0 (12.2-22.4)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

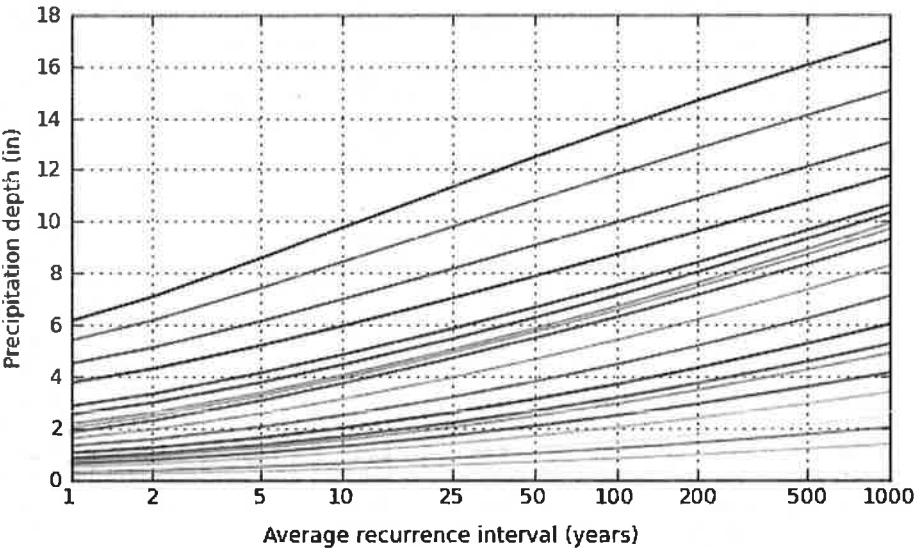
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PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 40.0660°, Longitude: -105.2663°



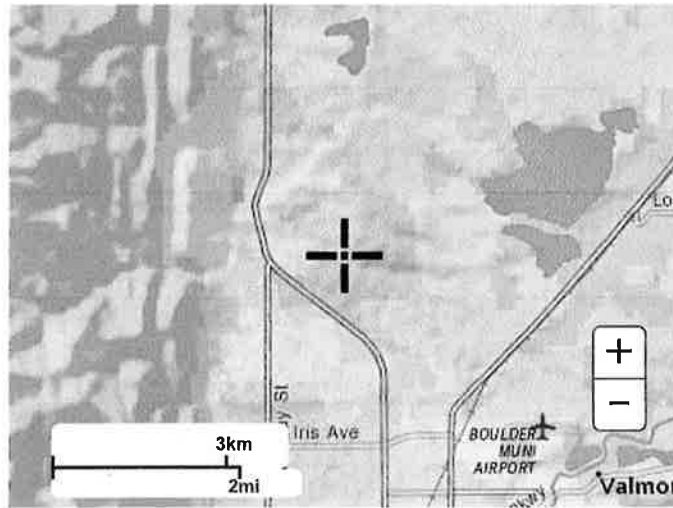
Average recurrence interval (years)	
1	
2	
5	
10	
25	
50	
100	
200	
500	
1000	



Duration	
5-min	2-day
10-min	3-day
15-min	4-day
30-min	7-day
60-min	10-day
2-hr	20-day
3-hr	30-day
6-hr	45-day
12-hr	60-day
24-hr	

Maps & aerals

Small scale terrain



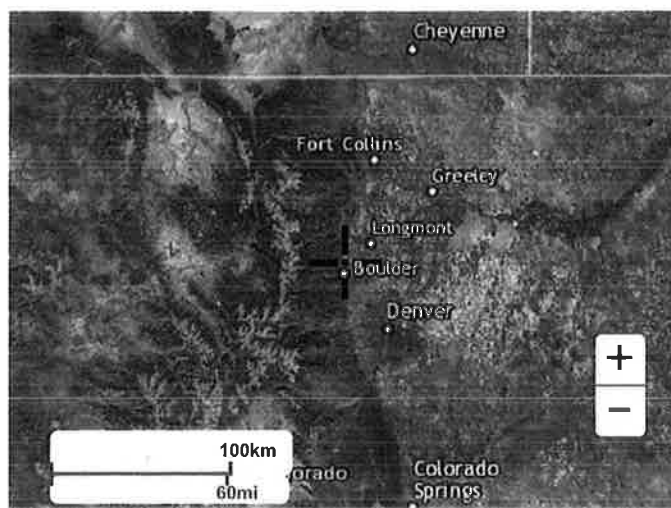
Large scale terrain



Large scale map



Large scale aerial

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1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov


[Disclaimer](#)

Soil Map—Boulder County Area, Colorado
(Boulder Rifle Club)



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

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

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 15, Sep 10, 2018

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

Date(s) aerial images were photographed: Aug 28, 2012—Sep 18, 2014

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
DU	Dumps	6.9	27.2%
NdD	Nederland very cobbly sandy loam, 1 to 12 percent slopes	0.1	0.3%
ReD	Renohill loam, 3 to 9 percent slopes	13.6	53.4%
Te	Terrace escarpments	4.8	19.1%
Totals for Area of Interest		25.4	100.0%

Report—Engineering Properties

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007 (<http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba>). Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Engineering Properties—Boulder County Area, Colorado														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			<i>In</i>				<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>
NdD—Nederland very cobbly sandy loam, 1 to 12 percent slopes														
Nederland	80	B	0-7	Very cobbly sandy loam	GC, GC-GM, SC, SC-SM	A-1, A-2	0-13- 25	30-45- 60	45-68- 90	40-63- 85	25-43- 60	15-25- 35	25-28- 30	5-8 -10
			7-20	Very cobbly sandy clay loam	GC, GC-GM, SC, SC-SM	A-1, A-2, A-4, A-6	0-13- 25	50-60- 70	45-68- 90	40-63- 85	30-53- 75	15-30- 45	25-30- 35	5-10-15
			20-60	Very cobbly sandy loam	GC, GC-GM, SC, SC-SM	A-1, A-2	0-13- 25	50-60- 70	45-68- 90	40-63- 85	25-43- 60	15-25- 35	25-28- 30	5-8 -10

Engineering Properties--Boulder County Area, Colorado														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			<i>In</i>				<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>
ReD--Renohill loam, 3 to 9 percent slopes														
Renohill	85	D	0-5	Loam	CL, CL-ML	A-4	0- 0- 0	0- 0- 0	100-100-100	100-100-100	85-90-95	60-68-75	25-28-30	5-8 -10
			5-15	Silty clay	MH, ML	A-7	0- 0- 0	0- 0- 0	100-100-100	100-100-100	95-98-100	90-93-95	45-50-55	15-20-25
			15-20	Silty clay loam	ML	A-4, A-7	0- 0- 0	0- 0- 0	100-100-100	100-100-100	95-98-100	85-90-95	30-40-50	5-10-15
			20-24	Weathered bedrock	—	—	—	—	—	—	—	—	—	—
Te--Terrace escarpments														
Terrace escarpments	100	A	0-6	Gravelly sand	SP, SP-SM	A-1	0- 0- 0	0- 0- 0	55-68-80	50-63-75	25-38-50	0- 5- 10	—	NP
			6-60	Gravelly sand, very gravelly sand, gravelly coarse sand	GW, GW-GM, SW, SW-SM	A-1	0- 0- 0	0- 3- 5	45-55-65	40-50-60	20-25-30	0- 5- 10	—	NP

Data Source Information

Soil Survey Area: Boulder County Area, Colorado

Survey Area Data: Version 15, Sep 10, 2018



Table 6-3. Recommended percentage imperviousness values

Land Use or Surface Characteristics	Percentage Imperviousness (%)
Business:	
Downtown Areas	95
Suburban Areas	75
Residential lots (lot area only):	
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
Industrial:	
Light areas	80
Heavy areas	90
Parks, cemeteries	10
Playgrounds	25
Schools	55
Railroad yard areas	50
Undeveloped Areas:	
Historic flow analysis	2
Greenbelts, agricultural	2
Off-site flow analysis (when land use not defined)	45
Streets:	
Paved	100
Gravel (packed)	40
Drive and walks	90
Roofs	90
Lawns, sandy soil	2
Lawns, clayey soil	2

Table 6-4. Runoff coefficient equations based on NRCS soil group and storm return period

NRCS Soil Group	Storm Return Period						
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
A	$C_A =$ $0.84i^{1.302}$	$C_A =$ $0.86i^{1.276}$	$C_A =$ $0.87i^{1.232}$	$C_A =$ $0.88i^{1.124}$	$C_A =$ $0.85i+0.025$	$C_A =$ $0.78i+0.110$	$C_A =$ $0.65i+0.254$
B	$C_B =$ $0.84i^{1.169}$	$C_B =$ $0.86i^{1.088}$	$C_B =$ $0.81i+0.057$	$C_B =$ $0.63i+0.249$	$C_B =$ $0.56i+0.328$	$C_B =$ $0.47i+0.426$	$C_B =$ $0.37i+0.536$
C/D	$C_{C/D} =$ $0.83i^{1.122}$	$C_{C/D} =$ $0.82i+0.035$	$C_{C/D} =$ $0.74i+0.132$	$C_{C/D} =$ $0.56i+0.319$	$C_{C/D} =$ $0.49i+0.393$	$C_{C/D} =$ $0.41i+0.484$	$C_{C/D} =$ $0.32i+0.588$

Where:

i = % imperviousness (expressed as a decimal)

C_A = Runoff coefficient for Natural Resources Conservation Service (NRCS) HSG A soils

C_B = Runoff coefficient for NRCS HSG B soils

$C_{C/D}$ = Runoff coefficient for NRCS HSG C and D soils.

The values for various catchment imperviousness and storm return periods are presented graphically in Figures 6-1 through 6-3, and are tabulated in Table 6-5. These coefficients were developed for the Denver region to work in conjunction with the time of concentration recommendations in Section 2.4. Use of these coefficients and this procedure outside of the semi-arid climate found in the Denver region may not be valid. The UD-Rational Excel workbook performs all the needed calculations to find the runoff coefficient given the soil type and imperviousness and the reader may want to take advantage of this macro-enabled Excel workbook that is available for download from the UDFCD's website www.udfcd.org.

See Examples 7.1 and 7.2 that illustrate the Rational Method.

Basin Calculations
Boulder Rifle Club

5/22/2019

HYDROLOGIC SOIL TYPE: D

HISTORIC

LAND USE	AREA (sf)	AREA (AC)	% IMPERV	C2	C5	C10	C100
ROOF	13,565	0.31	90%	0.74	0.77	0.80	0.85
DRIVE/WALK	-	0.00	90%	0.74	0.77	0.80	0.85
GRAVEL STREET	85,988	1.97	40%	0.30	0.36	0.43	0.65
HISTORIC	983,950	22.59	2%	0.01	0.05	0.15	0.49
TOTAL	1,083,503	24.874	6.1%	0.04	0.09	0.18	0.51

DEVELOPED

LAND USE	AREA (sf)	AREA (AC)	% IMPERV	C2	C5	C10	C100
ROOF	42,361	0.97	90%	0.74	0.77	0.80	0.85
DRIVE/WALK	7,843	0.18	90%	0.74	0.77	0.80	0.85
GRAVEL STREET	128,158	2.94	40%	0.30	0.36	0.43	0.65
LAWN	905,141	20.78	2%	0.01	0.05	0.15	0.49
TOTAL	1,083,503	24.874	10.6%	0.08	0.12	0.21	0.53

BASIN H1

LAND USE	AREA (sf)	AREA (AC)	% IMPERV	C2	C5	C10	C100
ROOF	-	0.00	90%	0.74	0.77	0.80	0.85
DRIVE/WALK	-	0.00	90%	0.74	0.77	0.80	0.85
GRAVEL STREET	20,301	0.47	40%	0.30	0.36	0.43	0.65
HISTORIC	756,306	17.36	2%	0.01	0.05	0.15	0.49
TOTAL	776,607	17.828	3.0%	0.02	0.06	0.15	0.50

BASIN H2

LAND USE	AREA (sf)	AREA (AC)	% IMPERV	C2	C5	C10	C100
ROOF	13,565	0.31	90%	0.74	0.77	0.80	0.85
DRIVE/WALK	-	0.00	90%	0.74	0.77	0.80	0.85
GRAVEL STREET	65,687	1.51	40%	0.30	0.36	0.43	0.65
HISTORIC	227,644	5.23	2%	0.01	0.05	0.15	0.49
TOTAL	306,896	7.045	14.0%	0.10	0.15	0.24	0.54

BASIN A1

LAND USE	AREA (sf)	AREA (AC)	% IMPERV	C2	C5	C10	C100
ROOF	23,226	0.53	90%	0.74	0.77	0.80	0.85
DRIVE/WALK	5,949	0.14	90%	0.74	0.77	0.80	0.85
GRAVEL STREET	51,405	1.18	40%	0.30	0.36	0.43	0.65
LAWN	435,645	10.00	2%	0.01	0.05	0.15	0.49
TOTAL	516,224	11.851	10.8%	0.08	0.12	0.21	0.53

BASIN A2

LAND USE	AREA (sf)	AREA (AC)	% IMPERV	C2	C5	C10	C100
ROOF	13,697	0.31	90%	0.74	0.77	0.80	0.85
DRIVE/WALK	-	0.00	90%	0.74	0.77	0.80	0.85
GRAVEL STREET	50,243	1.15	40%	0.30	0.36	0.43	0.65
LAWN	242,956	5.58	2%	0.01	0.05	0.15	0.49
TOTAL	306,896	7.045	12.1%	0.09	0.13	0.22	0.53

BASIN A3

LAND USE	AREA (sf)	AREA (AC)	% IMPERV	C2	C5	C10	C100
ROOF	-	0.00	90%	0.74	0.77	0.80	0.85
DRIVE/WALK	-	0.00	90%	0.74	0.77	0.80	0.85
GRAVEL STREET	1,788	0.04	40%	0.30	0.36	0.43	0.65
LAWN	207,437	4.76	2%	0.01	0.05	0.15	0.49
TOTAL	209,225	4.803	2.3%	0.01	0.05	0.15	0.49

BASIN A4

LAND USE	AREA (sf)	AREA (AC)	% IMPERV	C2	C5	C10	C100
ROOF	5,438	0.12	90%	0.74	0.77	0.80	0.85
DRIVE/WALK	1,894	0.04	90%	0.74	0.77	0.80	0.85
GRAVEL STREET	24,722	0.57	40%	0.30	0.36	0.43	0.65
LAWN	19,103	0.44	2%	0.01	0.05	0.15	0.49
TOTAL	51,158	1.174	33.0%	0.25	0.31	0.38	0.62

Calculation of Peak Runoff using Rational Method

Designer: Green Valley Version: 3.0 (October 2017)
 Company: Peak Flow Engineering
 Date: 10/10/2017
 Project: Green Valley Dam
 Location: Green Valley

Catchment Area: 1000 ha
 Time of Concentration: 10 min
 Rainfall Intensity: 100 mm/hr
 Runoff Coefficient: 0.8
 Peak Runoff: 100 m³/s

Formula: $Q_p = C_p \times I \times A$
 Where: Q_p = Peak Runoff (m³/s), C_p = Runoff Coefficient, I = Rainfall Intensity (mm/hr), A = Catchment Area (ha)

Calculated Peak Runoff: $Q_p = 0.8 \times 100 \times 1000 = 80000$ m³/s

Peak Runoff (m³/s) vs Time (min)

Time (min)	Peak Runoff (m³/s)
0	0
10	80000
20	80000
30	80000
40	80000
50	80000
60	80000
70	80000
80	80000
90	80000
100	80000
110	80000
120	80000
130	80000
140	80000
150	80000
160	80000
170	80000
180	80000
190	80000
200	80000
210	80000
220	80000
230	80000
240	80000
250	80000
260	80000
270	80000
280	80000
290	80000
300	80000
310	80000
320	80000
330	80000
340	80000
350	80000
360	80000
370	80000
380	80000
390	80000
400	80000
410	80000
420	80000
430	80000
440	80000
450	80000
460	80000
470	80000
480	80000
490	80000
500	80000

Appendix B

Detention Calculations

Allowable Release

5/22/2019

Boulder Rifle Club
Boulder County, CO

OVERALL SITE ALLOWABLE RELEASE RATE			
UDFCD, Volume 2, Chapter 12		$q = P_1 C_1 S^{C_2} \left(\frac{L^2}{A} \right)^{C_3}$	
Soil Type: D			
Q ₁₀ =	0.309 cfs/acre	Q ₁₀₀ =	1.595 cfs/acre
P1 =	1.31 inches	P1 =	2.49 inches
S =	0.055 ft/ft	S =	0.055 ft/ft
L =	1454 ft	L =	1454 ft
A =	24.874 ac	A =	24.874 ac
A =	1083503 ft ²	A =	1083503 ft ²
C1 =	0.5375	C1 =	1.3053
C2 =	0.1901	C2 =	0.1651
C3 =	-0.4055	C3 =	-0.3490
90% Historic		90% Historic	
Q ₁₀ =	6.93 cfs	Q ₁₀₀ =	35.70 cfs
Q ₁₀ =	0.28 cfs/acre	Q ₁₀₀ =	1.44 cfs/acre

PROPOSED BASIN RELEASE RATES (FROM RATIONAL CALCS)				
BASIN ID	AREA (AC)	Q10	Q100	DISCHARGE LOCATION
BASIN A1	11.85	4.27	20.30	PROPOSED POND
BASIN A2	7.045	3.31	15.21	FREE RELEASE
BASIN A3	4.803	1.16	7.32	FREE RELEASE
BASIN A4	1.174	1.51	4.76	FREE RELEASE

DETENTION POND PROPOSED ALLOWABLE RELEASE RATE (OVERALL MINUS FREE RELEASE)			
Q ₁₀ =	0.95 cfs	Q ₁₀₀ =	8.41 cfs
Q ₁₀ =	0.04 cfs/acre	Q ₁₀₀ =	0.34 cfs/acre

WQCV Calculation

5/22/2019

Boulder Rifle Club
Boulder County, CO

WATER QUALITY CAPTURE VOLUME		
UDFCD, Volume 3, Chapter 3		
Drain time:	40 hrs	$WQCV = a(0.91I^3 - 1.19I^2 + 0.78I)$
a=	1.0 cfs/acre	
I=	0.11 %/100	
WQCV=	0.070 inches	
WQCV=	0.146 ac-ft	
WQCV=	6342 ft ³	

DETENTION VOLUME BY THE MODIFIED FAA METHOD
(See USDCM Volume 2 Storage Chapter for description of method)

Project: Boulder Rifle Club

Basin ID: Overall

(For catchments less than 160 acres only. For larger catchments, use hydrograph routing method)
(NOTE: for catchments larger than 90 acres, CUHP hydrograph and routing are recommended)

Determination of MINOR Detention Volume Using Modified FAA Method										Determination of MAJOR Detention Volume Using Modified FAA Method									
Design Information (Input): Catchment Drainage Imperviousness Catchment Drainage Area Predevelopment NRCS Soil Group Return Period for Detention Control Time of Concentration of Watershed Allowable Unit Release Rate One-hour Precipitation Design Rainfall IDF Formula $I = C_1 \cdot P_d / (C_2 + T_d)^{C_3}$ Coefficient One Coefficient Two Coefficient Three										Design Information (Input): Catchment Drainage Imperviousness Catchment Drainage Area Predevelopment NRCS Soil Group Return Period for Detention Control Time of Concentration of Watershed Allowable Unit Release Rate One-hour Precipitation Design Rainfall IDF Formula $I = C_1 \cdot P_d / (C_2 + T_d)^{C_3}$ Coefficient One Coefficient Two Coefficient Three									
$I_p = 10.60$ percent $A = 24.874$ acres $Type = D$ A, B, C, or D $T = 10$ years (2, 5, 10, 25, 50, or 100) $T_c = 33$ minutes $q = 0.04$ cfs/acre $P_1 = 1.31$ inches $C_1 = 28.50$ $C_2 = 10$ $C_3 = 0.789$										$I_p = 10.60$ percent $A = 24.874$ acres $Type = D$ A, B, C, or D $T = 100$ years (2, 5, 10, 25, 50, or 100) $T_c = 33$ minutes $q = 0.34$ cfs/acre $P_1 = 2.49$ inches $C_1 = 28.50$ $C_2 = 10$ $C_3 = 0.789$									
Determination of Average Outflow from the Basin (Calculated): Runoff Coefficient Inflow Peak Runoff Allowable Peak Outflow Rate Mod. FAA Minor Storage Volume = 47,202 cubic feet Mod. FAA Minor Storage Volume = 1.084 acre-ft 50 Enter Rainfall Duration Incremental Increase Value Here (e.g., 5 for 5-Minutes)										Determination of Average Outflow from the Basin (Calculated): Runoff Coefficient Inflow Peak Runoff Allowable Peak Outflow Rate Mod. FAA Major Storage Volume = 107,167 cubic feet Mod. FAA Major Storage Volume = 2.460 acre-ft									
Rainfall Duration minutes (input)	Rainfall Intensity inches / hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor "m" (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)	Rainfall Duration minutes (input)	Rainfall Intensity inches / hr (output)	Inflow Volume cubic feet (output)	Adjustment Factor "m" (output)	Average Outflow cfs (output)	Outflow Volume cubic feet (output)	Storage Volume cubic feet (output)						
5	4.41	10,196	1.00	0.99	298	9,897	5	8.38	33,132	1.00	8.48	2,537	30,596						
55	1.39	35,285	0.80	0.80	2,627	32,659	55	2.63	114,602	0.80	0.77	22,327	92,275						
105	0.88	42,921	0.66	0.65	4,119	38,802	105	1.68	139,481	0.66	0.56	35,013	104,469						
155	0.66	47,855	0.61	0.60	5,612	42,044	155	1.26	154,665	0.61	0.53	47,698	107,167						
205	0.54	51,149	0.58	0.58	7,104	44,045	205	1.03	166,216	0.58	0.49	60,384	105,833						
255	0.46	53,948	0.56	0.56	8,596	45,351	255	0.87	175,314	0.56	0.47	73,070	102,244						
305	0.40	56,300	0.55	0.55	10,089	46,211	305	0.76	182,957	0.55	0.46	85,756	97,202						
355	0.36	58,338	0.55	0.54	11,581	46,757	355	0.68	189,582	0.55	0.42	98,441	91,140						
405	0.32	60,144	0.54	0.54	13,074	47,070	405	0.61	195,448	0.54	0.45	111,127	84,321						
455	0.29	61,768	0.54	0.53	14,566	47,202	455	0.56	200,728	0.54	0.44	123,813	76,915						
505	0.27	63,248	0.53	0.53	16,059	47,190	505	0.51	205,538	0.53	0.43	136,499	69,040						
555	0.25	64,610	0.53	0.53	17,551	47,059	555	0.48	209,963	0.53	0.42	149,184	60,779						
605	0.24	65,873	0.53	0.52	19,044	46,829	605	0.45	214,067	0.53	0.41	161,870	52,197						
655	0.22	67,052	0.53	0.52	20,536	46,516	655	0.42	217,897	0.53	0.40	174,556	43,342						
705	0.21	68,166	0.52	0.52	22,028	46,130	705	0.40	221,492	0.52	0.43	187,242	34,251						
755	0.20	69,201	0.52	0.52	23,521	45,680	755	0.38	224,882	0.52	0.41	199,927	24,955						
805	0.19	70,189	0.52	0.52	25,013	45,175	805	0.36	228,092	0.52	0.40	212,613	15,479						
855	0.18	71,127	0.52	0.52	26,506	44,621	855	0.34	231,141	0.52	0.39	225,299	5,842						
905	0.17	72,021	0.52	0.52	27,998	44,023	905	0.33	234,048	0.52	0.38	237,984	-3,937						
955	0.16	72,876	0.52	0.51	29,491	43,386	955	0.31	236,825	0.52	0.37	250,670	-13,845						
1005	0.16	73,695	0.52	0.51	30,983	42,712	1005	0.30	239,487	0.52	0.37	263,356	-23,869						
1055	0.15	74,481	0.52	0.51	32,475	42,006	1055	0.29	242,042	0.52	0.36	276,042	-34,000						
1105	0.15	75,238	0.51	0.51	33,968	41,270	1105	0.28	244,500	0.51	0.35	288,727	-44,227						
1155	0.14	75,967	0.51	0.51	35,460	40,507	1155	0.27	246,870	0.51	0.35	301,413	-54,543						
1205	0.14	76,671	0.51	0.51	36,953	39,718	1205	0.26	249,157	0.51	0.34	314,099	-64,942						
1255	0.13	77,352	0.51	0.51	38,445	38,906	1255	0.25	251,369	0.51	0.34	326,785	-75,416						
1305	0.13	78,010	0.51	0.51	39,938	38,073	1305	0.25	253,510	0.51	0.34	339,470	-85,960						
1355	0.13	78,649	0.51	0.51	41,430	37,219	1355	0.24	255,586	0.51	0.33	352,156	-96,570						
1405	0.12	79,269	0.51	0.51	42,923	36,347	1405	0.23	257,600	0.51	0.33	364,842	-107,242						
1455	0.12	79,871	0.51	0.51	44,415	35,456	1455	0.23	259,558	0.51	0.32	377,528	-117,970						
1505	0.12	80,457	0.51	0.51	45,907	34,550	1505	0.22	261,462	0.51	0.32	390,213	-128,752						
1555	0.11	81,028	0.51	0.51	47,400	33,628	1555	0.21	263,315	0.51	0.32	402,899	-139,584						
1605	0.11	81,583	0.51	0.51	48,892	32,691	1605	0.21	265,121	0.51	0.32	415,585	-150,464						
1655	0.11	82,125	0.51	0.51	50,385	31,741	1655	0.20	266,882	0.51	0.31	428,271	-161,389						
1705	0.10	82,654	0.51	0.51	51,877	30,777	1705	0.20	268,601	0.51	0.31	440,956	-172,356						
1755	0.10	83,171	0.51	0.51	53,370	29,801	1755	0.19	270,279	0.51	0.31	453,642	-183,363						
1805	0.10	83,675	0.51	0.51	54,862	28,813	1805	0.19	271,920	0.51	0.31	466,328	-194,408						
1855	0.10	84,169	0.51	0.51	56,355	27,815	1855	0.19	273,524	0.51	0.30	479,014	-205,490						
1905	0.10	84,652	0.51	0.51	57,847	26,805	1905	0.18	275,094	0.51	0.30	491,699	-216,606						
1955	0.09	85,125	0.51	0.51	59,339	25,786	1955	0.18	276,631	0.51	0.30	504,385	-227,754						
2005	0.09	85,589	0.51	0.51	60,832	24,757	2005	0.18	278,137	0.51	0.30	517,071	-238,934						
2055	0.09	86,043	0.51	0.51	62,324	23,719	2055	0.17	279,613	0.51	0.29	529,757	-250,144						
2105	0.09	86,488	0.51	0.51	63,817	22,671	2105	0.17	281,060	0.51	0.29	542,442	-261,382						
2155	0.09	86,925	0.51	0.51	65,309	21,616	2155	0.17	282,480	0.51	0.29	555,128	-272,648						
2205	0.09	87,354	0.51	0.50	66,802	20,553	2205	0.16	283,874	0.51	0.29	567,814	-283,940						
2255	0.08	87,775	0.51	0.50	68,294	19,481	2255	0.16	285,243	0.51	0.29	580,499	-295,257						
2305	0.08	88,189	0.51	0.50	69,786	18,403	2305	0.16	286,587	0.51	0.29	593,185	-306,598						
2355	0.08	88,596	0.51	0.50	71,279	17,317	2355	0.15	287,909	0.51	0.29	605,871	-317,982						
2405	0.08	88,996	0.51	0.50	72,771	16,224	2405	0.15	289,208	0.51	0.29	618,557	-329,349						
2455	0.08	89,389	0.51	0.50	74,264	15,125	2455	0.15	290,486	0.51	0.29	631,242	-340,757						
2505	0.08	89,776	0.51	0.50	75,756	14,019	2505	0.15	291,743	0.51	0.28	643,928	-352,185						
2555	0.08	90,156	0.51	0.50	77,249	12,908	2555	0.14	292,980	0.51	0.28	656,614	-363,634						
2605	0.08	90,531	0.51	0.50	78,741	11,790	2605	0.14	294,198	0.51	0.28	669,300	-375,102						
2655	0.07	90,900	0.51	0.50	80,234	10,668	2655	0.14	295,397	0.51	0.28	681,985	-386,598						
2705	0.07	91,264	0.51	0.50	81,726	9,538	2705	0.14	296,579	0.51	0.28	694,671	-398,093						
2755	0.07	91,622	0.51	0.50	83,218	8,403	2755	0.14	297,743	0.51	0.28	707,357	-409,614						
2805	0.07	91,975	0.51	0.50	84,711	7,264	2805	0.13	298,890	0.51	0.28	720,043	-421,153						
2855	0.07	92,323	0.51	0.50	86,203	6,120	2855	0.13	300,021	0.51	0.28	732,728	-432,707						
2905	0.07	92,666	0.51	0.50	87,696	4,970	2905	0.13	301,136	0.51	0.28	745,414	-444,278						
2955	0.07	93,005	0.51	0.50	89,188	3,816	2955	0.13	302,237	0.51	0.28	758,100	-455,883						
3005	0.07	93,339	0.51	0.50	90,681	2,658	3005	0.13	303,322	0.51	0.28	770,786	-467,464						
Mod. FAA Minor Storage Volume (cubic ft.) = 47,202							Mod. FAA Major Storage Volume (cubic ft.) = 107,167												
Mod. FAA Minor Storage Volume (acre-ft.) = 1.0836							Mod. FAA Major Storage Volume (acre-ft.) = 2.4602												

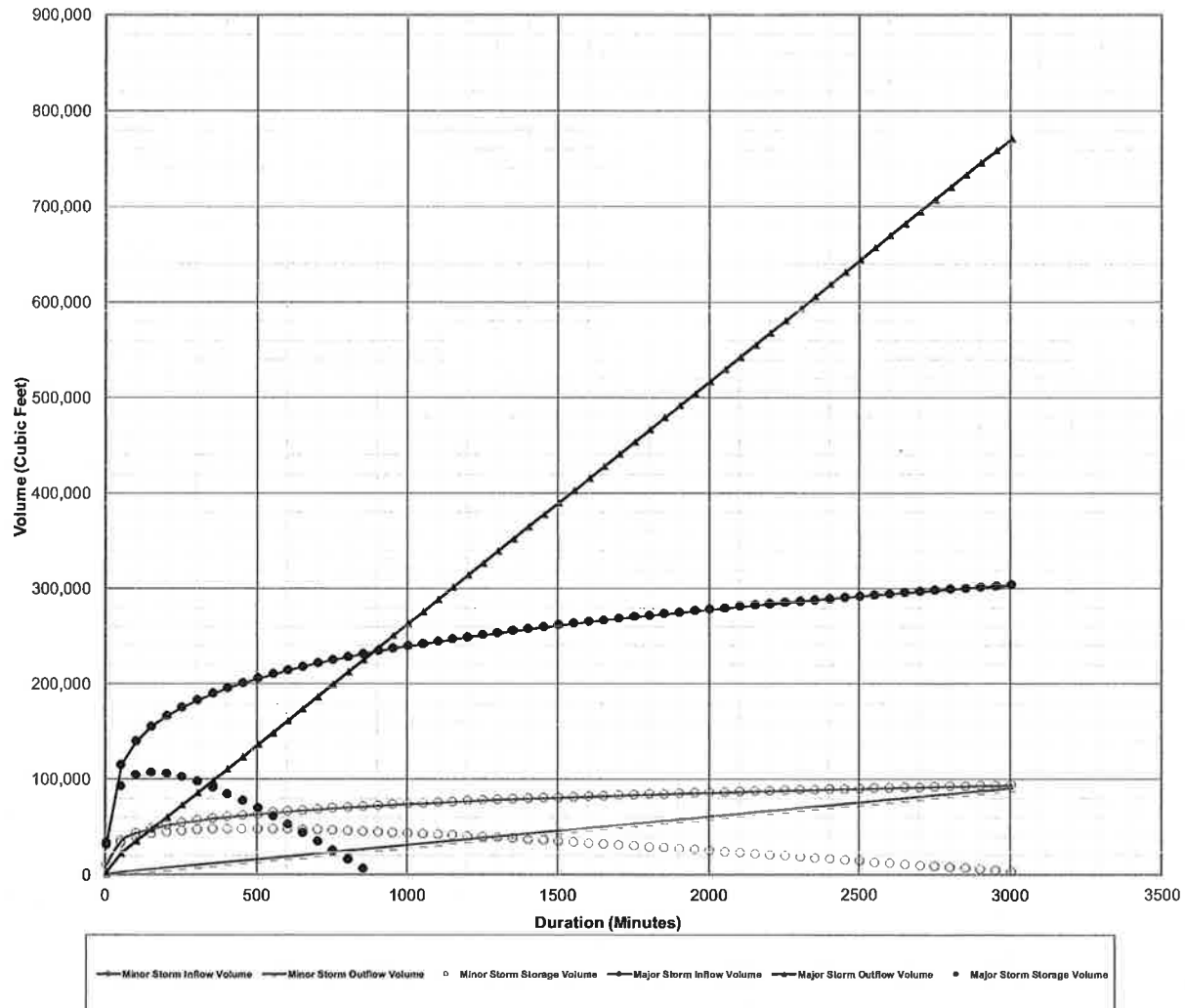
UDFCD DETENTION VOLUME ESTIMATING WORKBOOK Version 2.03a, Released March 2008

DETENTION VOLUME BY THE MODIFIED FAA METHOD
(See USDCM Volume 2 Storage Chapter for description of method)

Boulder Rifle Club

Basin ID: Overall

Inflow and Outflow Volumes vs. Rainfall Duration



Detention/Water Quality Pond Volume
Boulder Rifle Club
 Boulder County, CO

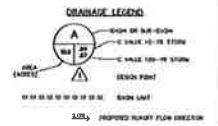
5/22/2019

PROPOSED POND					
STAGE-STORAGE TABLE					
Stage	WSE feet	A ft²	V_{incremental} ft³	V_{cumulative}	
				ft³	ac-ft
	5,405.75	268	-	-	-
	5,406.00	867	142	142	0.003
	5,406.25	1,526	299	441	0.010
	5,406.50	2,324	481	922	0.021
	5,406.75	3,267	699	1,621	0.037
	5,407.00	4,373	955	2,576	0.059
	5,407.25	5,651	1,253	3,829	0.088
	5,407.50	7,081	1,592	5,421	0.124
WQCV	5,407.75	8,583	1,958	7,379	0.169
	5,408.00	10,084	2,333	9,712	0.223
	5,408.25	11,670	2,719	12,431	0.285
	5,408.50	13,345	3,127	15,558	0.357
	5,408.75	15,108	3,557	19,115	0.439
	5,409.00	16,957	4,008	23,123	0.531
	5,409.25	18,803	4,470	27,593	0.633
	5,409.50	20,732	4,942	32,535	0.747
	5,409.75	22,767	5,437	37,972	0.872
	5,410.00	24,901	5,959	43,931	1.009
10-YEAR	5,410.25	27,084	6,498	50,429	1.158
	5,410.50	29,295	7,047	57,477	1.319
	5,410.75	31,312	7,576	65,052	1.493
	5,411.00	33,219	8,066	73,119	1.679
	5,411.25	35,046	8,533	81,652	1.874
	5,411.50	36,850	8,987	90,639	2.081
	5,411.75	38,687	9,442	100,081	2.298
100-YEAR	5,412.00	40,648	9,917	109,998	2.525

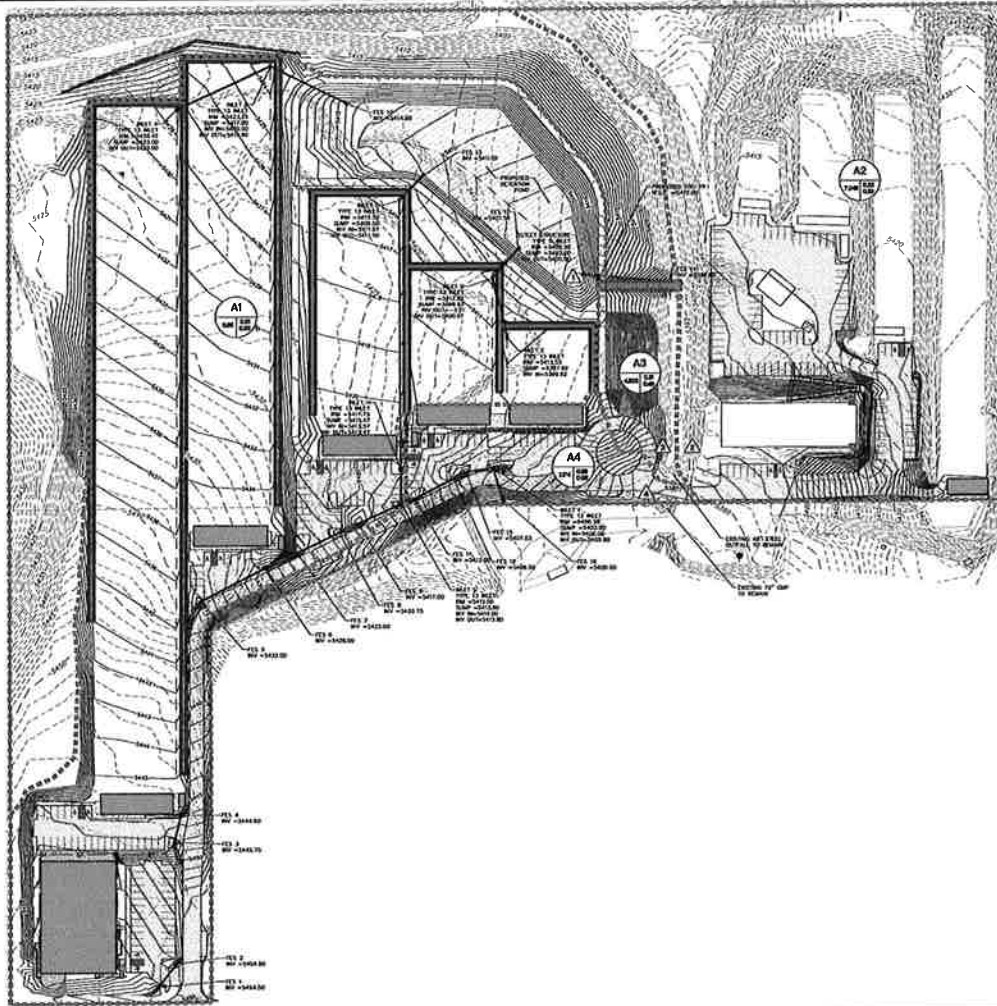


HISTORIC BASIN FLOWS

BASIN	AREA (Acres)	Q_{50} (cfs)	Q_{100} (cfs)
OVERALL	24.87	7.44	40.5
H1	17.83	4.52	23.7
H2	7.045	2.92	12.8



Rocky Ridge Civil Engineering 1000 N. 10th St. Suite 100 Fort Collins, CO 80504 Phone: 970.225.1111 Fax: 970.225.1112 Email: info@rockyridgeeng.com	SHEET NO. D1
	PROJECT NO. 1708-1
	DATE 09/24/2019
	DRAWING NO. 7708-1-1



POND SUMMARY TABLE

POND	POND AREA (AC)	VOLUME (CU FT)		ALLOWABLE RELEASE (CU FT)	
		EXIST	PROPOSED	EXIST	PROPOSED
101	1.47	1,350	1,350	100	100
102	1.10	1,000	1,000	100	100
103	0.15	135	135	10	10

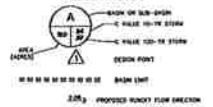
DEVELOPED BASIN FLOWS

BASIN	AREA (ACRES)	Q ₁₀ (CFS)	Q ₅₀ (CFS)
OVERALL	24.87	10.3	47.6
A1	11.85	4.27	20.3
A2	7.045	3.31	15.2
A3	4.803	1.16	7.32
A4	1.174	1.51	4.76

HISTORIC BASIN FLOWS

BASIN	AREA (ACRES)	Q ₁₀ (CFS)	Q ₅₀ (CFS)
OVERALL	24.87	7.44	40.5
H1	17.85	4.52	27.7
H2	7.045	2.92	12.8

DRAINAGE LEGEND



Rocky Ridge
Civil Engineering

BOULDER RIFLE RANGE
DRAINAGE PLAN

D2

Boulder Rifle Club Noise Study

May 22, 2019

Prepared for:

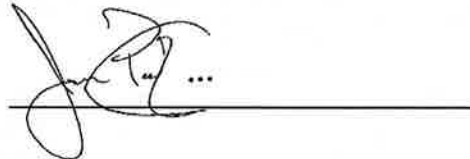
Boulder Rifle Club Inc
P.O. Box 21197
Boulder, CO 80308

Prepared by:

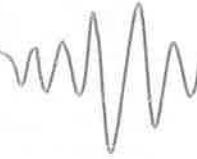
Behrens and Associates, Inc.
13806 Inglewood Avenue
Hawthorne California, 90250



Justin Puggioni
Acoustical Technical Director



Jason Peetz
Engineering Manager



1. Introduction

The following report provides a noise study of the Boulder Rifle Club (40° 3'57.39"N, 105°15'50.59"W) located in Boulder, Colorado. The Boulder Rifle Club is proposing to expand by adding 5 outdoor firing ranges and one indoor firing range to the west of the current facility. The length of the proposed outdoor firing ranges will be 25 meters, 50 meters, 100 meters, 200 yards and 300 yards, adding to the existing 50-yard, 100-yard and 200-yard outdoor ranges as shown in Figure 1-1. A sound level survey was performed at various locations within residential areas to the south of the site to analyze the noise impact of Boulder Rifle Club operations on the local environment. The proposed area of the Boulder Rifle Club is subject to the Boulder County Land Use Code, which will be used to assess the expected noise levels from each outdoor firing range.

The following is provided in this report:

- An introduction to the fundamentals of noise and a summary of the noise standards used in the assessment.
- Presentation of sound level survey results.
- Discussion of noise modeling methodology, results and analysis of proposed mitigation.

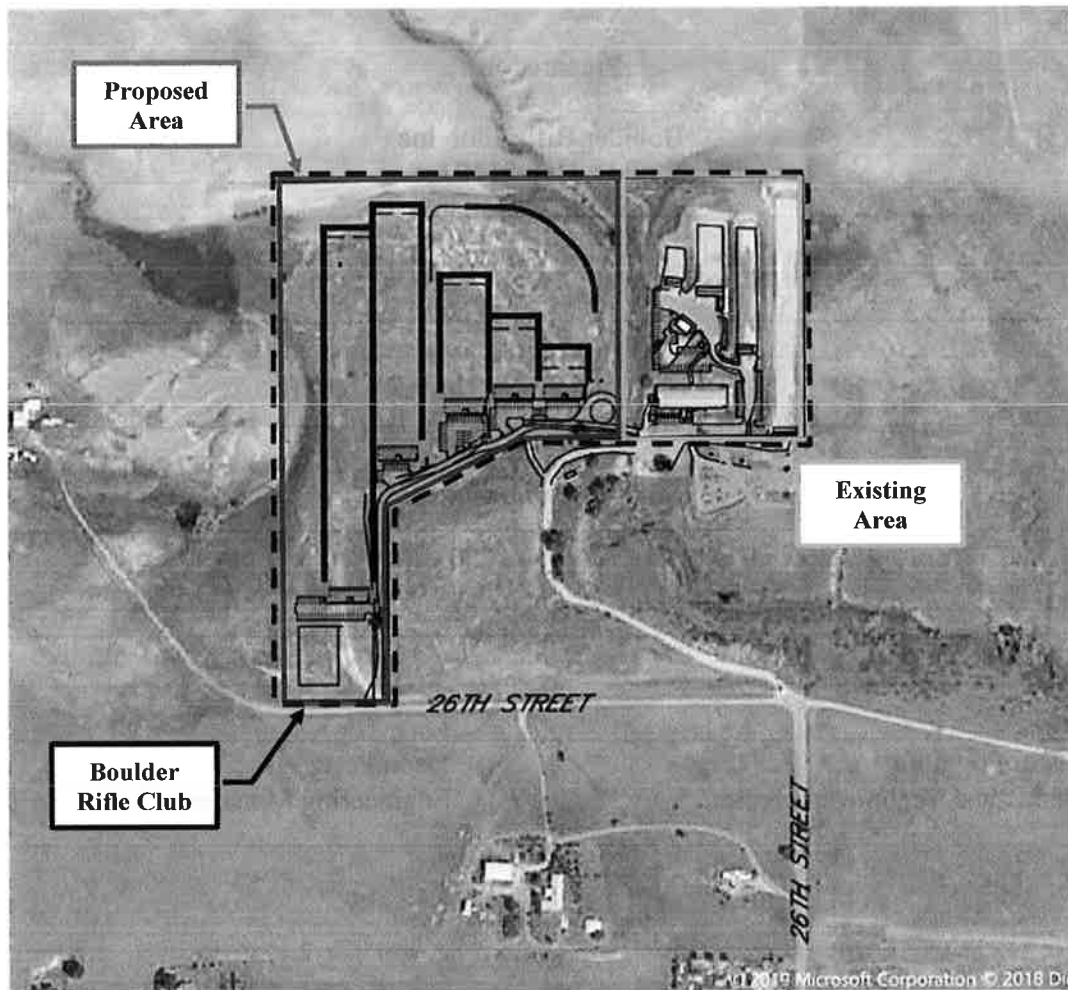
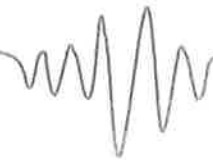


Figure 1-1 Boulder Rifle Club Location



2. Noise Fundamentals

2.1 Environmental Noise

Sound is most commonly experienced by people as pressure waves passing through air. These rapid fluctuations in air pressure are processed by the human auditory system to produce the sensation of sound. The rate at which sound pressure changes occur is called the frequency. Frequency is usually measured as the number of oscillations per second or Hertz (Hz). Frequencies that can be heard by a healthy human ear range from approximately 20 Hz to 20,000 Hz. Toward the lower end of this range are low-pitched sounds, including those that might be described as a “rumble” or “boom”. At the higher end of the range are high-pitched sounds that might be described as a “screech” or “hiss”.

Environmental noise generally derives, in part, from a combination of distant noise sources. Such sources may include common experiences such as distant traffic, wind in trees, and distant industrial or farming activities. These distant sources create a low-level “background noise” in which no particular individual source is identifiable. Background noise is often relatively constant from moment to moment, but varies slowly from hour to hour as natural forces change or as human activity follows its daily cycle.

Superimposed on this low-level, slowly varying background noise is a succession of identifiable noisy events of relatively brief duration. These events may include the passing of single-vehicles, aircraft flyovers, screeching of brakes, and other short-term events. The presence of these short-term events causes the noise level to fluctuate. Typical indoor and outdoor sound levels are shown in Figure 2-1. The outdoor sound levels in Figure 2-1 are shown as examples only to conceptualize the decibel scale and should not be applied to any specific location. Detailed acoustical definitions have been provided in Appendix A.

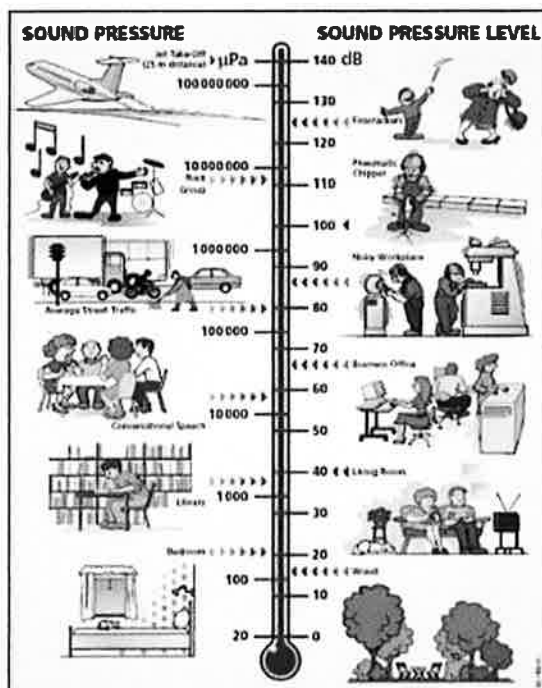
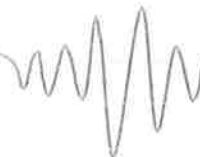


Figure 2-1 Typical Indoor and Outdoor Sound Levels



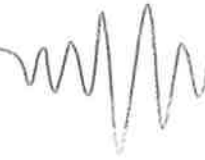
2.2 Relative Loudness Perception

The relative loudness of environmental correlates a decibel change in sound levels with a perceived relative loudness shown in Table 2-1. The sound level change is applicable in the field as opposed to a quiet laboratory environment where smaller sound level differences could be perceived. A decrease of 10 dB is perceived as half as loud and similarly a decrease of 20 dB is perceived as $\frac{1}{4}$ as loud. Sound level increases are perceived similarly, with a 10 dB increase perceived as a doubling of loudness and a 20 dB increase perceived as 4 times as loud.

Table 2-1 Relative Loudness of Environmental Noise

Sound Level Change	Relative Loudness	Acoustic Energy Loss
0 dB(A)	Reference	0
-3 dB(A)	Barely Perceptible Change	50%
-5 dB(A)	Readily Perceptible Change	67%
-10 dB(A)	Half as Loud	90%
-20 dB(A)	1/4 as Loud	99%
-30 dB(A)	1/8 as Loud	99.9%

*Table adapted from FHWA Highway Traffic Noise: Analysis and Abatement Guidance, revised December 2010.



3. Noise Standards

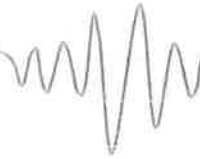
The noise standards applicable to the Boulder Rifle Club are shown in this section.

3.1 Boulder County Land Use Code

The proposed area of the Boulder Rifle Club is subject to Boulder County Land Use Code 4-602 Special Provisions F. Special Review for Firing Range Outdoor 1.c. Noise. This section states, "All firing line locations shall be located and maintained such that the sound levels generated by the discharge of firearms on the range do not exceed a 65 dB peak impulse response at existing residential structures (whether permanent or seasonal), lodging or other occupiable or occupied structures not on the subject property. The applicant shall submit a noise study proving the proposed range will meet this standard at time of application. All noise studies shall be performed by a professional engineer registered in the State of Colorado or other equally qualified individual and shall take the topography of the surrounding area into account."

The noise metric is stated in the Land Use Code as "peak impulse response" however, there is conflicting technical terminology used in this phrase. The "peak" sound level is a measurement of the instantaneous sound level with no time weighted average applied. It does not include an RMS (root-mean squared) average as does other acoustic metrics which are averaged over a specific time period. In contrast, the "impulse response" is a time weighted RMS average over 35 milliseconds. The maximum level of a sound measurement is the highest RMS average sound level recorded within a specific time period. As the peak sound level is not an RMS average, it is not technically possible to have a peak impulse response metric. For the purpose of this assessment, the metric described in the Boulder County Land Use Code has been interpreted as a maximum impulse response assuming that the word "peak" was used incorrectly instead of the word "maximum".

The applicable noise limit for the proposed area of the Boulder Rifle Club based on the Land Use Code is therefore interpreted as 65 dB maximum impulse response measured at the existing residential structures. There is currently no applicable noise limit for the existing area of the Boulder Rifle Club as the code was not in effect during development of this area and cannot be applied retroactively.



4. Sound Level Survey

4.1 Sound Level Survey Procedure

Prior to construction of the Boulder Rifle Club expansion, a sound level survey of the existing operations was conducted south of the Boulder Rifle Club where the closest residences and businesses are located to measure and document the sound levels in the area. Four Type 1 sound level meters were deployed nearby the site at the locations shown in Figure 4-1.

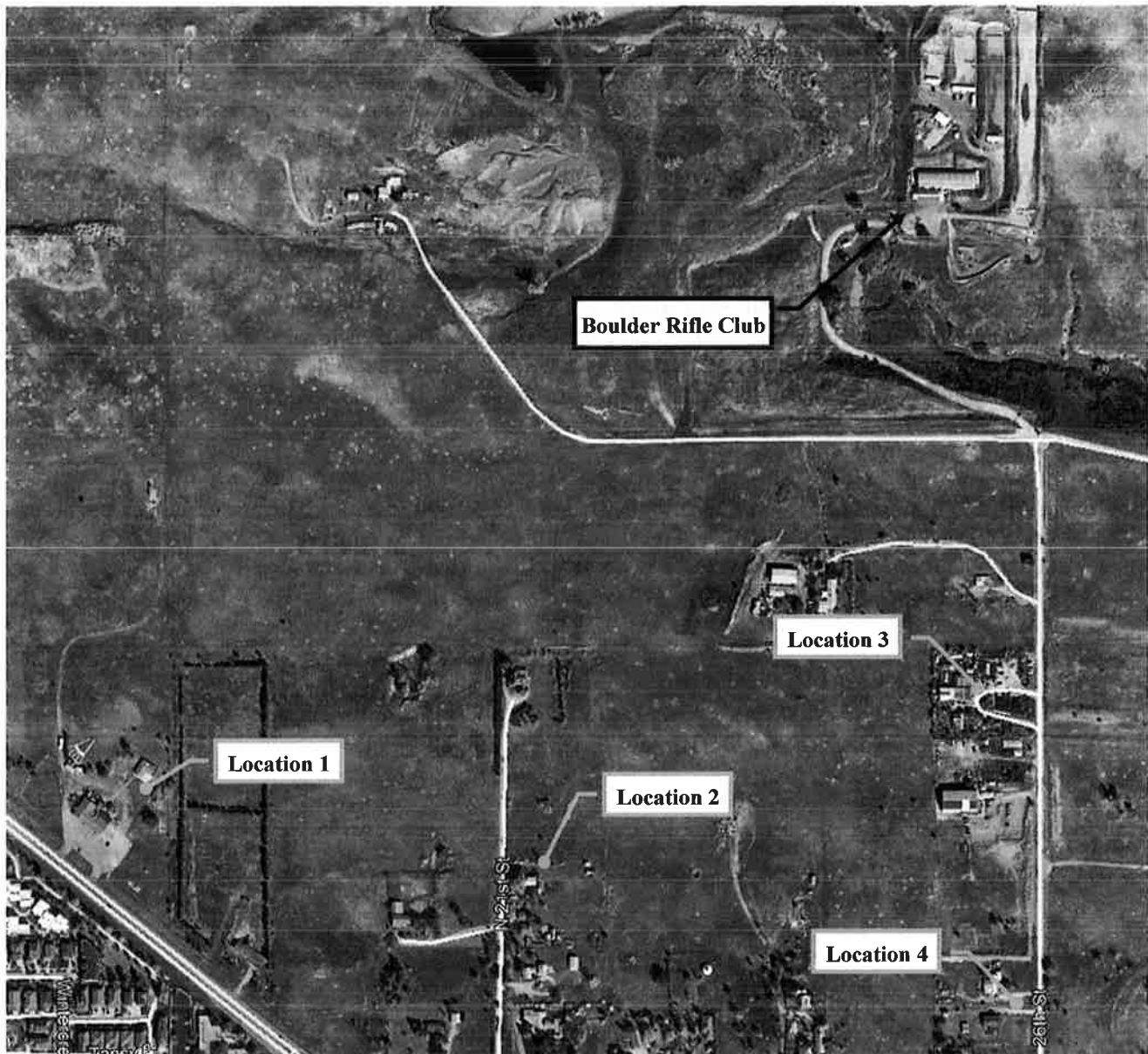
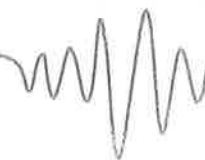


Figure 4-1 Sound Level Survey Locations

Behrens and Associates, Inc.

Environmental Noise Control



The monitoring locations were chosen based on availability of permission from other properties in the area. Location 1 was placed at the American Legion Club property at 4760 28th Street, Boulder approximately 0.5 miles southwest of the Boulder Rifle Club. Location 2 was placed on a residential property at 2133 Yarmouth Avenue, Boulder approximately 0.4 miles south of the Boulder Rifle Club. Location 3 was placed at the Harlequin's Gardens property at 4795 N 26th Street, Boulder approximately 0.3 miles south of the Boulder Rifle Club. Location 4 was placed on a residential property at 4725 26th Street, Boulder approximately 0.4 miles south of the Boulder Rifle Club.

Each sound level meter utilized conforms to Type 1 as per ANSI S1.4 *Specification for Sound Level Meters*. The meters were calibrated before and after the measurement period. The instrumentation details are presented in Table 4-1.

Table 4-1 Instrumentation Details

Location	Instrument	Manufacturer/Model	Serial Number
1	Sound Level Meter	SVANTEK SVAN 971 Sound Level Meter	44563
2	Sound Level Meter	SVANTEK SVAN 971 Sound Level Meter	51620
3	Sound Level Meter	SVANTEK SVAN 971 Sound Level Meter	61561
4	Sound Level Meter	SVANTEK SVAN 971 Sound Level Meter	56158

The sound level meters were deployed on Friday, February 8, 2019 and programmed to continuously monitor and record unweighted maximum impulse sound levels. The meters were retrieved on Monday, February 11, 2019.

4.2 Sound Level Survey Results

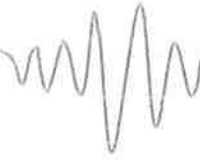
Figure 4-2 and Figure 4-3 show the 5-minute unweighted maximum impulse sound levels on graphs for the duration of the monitoring period. For each day of the measurement period when the Boulder Rifle Club is operating between 7 am and 7 pm, statistical averages of the 5-minute unweighted maximum impulse sound level were calculated and shown in Table 4-2.

Table 4-2 Statistical Average 5-minute Maximum Impulse Sound Levels from 7 am to 7 pm (dB)

Day	Location 1	Location 2	Location 3	Location 4
9:00 am to 7:00pm February 8	80	78	77	78
7:00 am to 7:00pm February 9	84	81	79	80
7:00 am to 7:00pm February 10	83	80	81	80
7:00 am to 12:00pm February 11	91	91	90	90

Locations 1 and 4 show a lot of variability in maximum impulse sound levels at all hours. With such frequent sound level spikes during the day, more than the amount of gunshots over the same period (confirmed by Boulder Rifle Club), it is reasonable to assume that sources such as traffic, environmental noise and other human activity unrelated to the Boulder Rifle Club dominate the sound environment.

As shown in Figure 4-2 and Figure 4-3, most of the measured 5-minute maximum impulse sound levels during the hours of 7 pm to 7 am exceed the Boulder Land Use Code noise limit of 65 dB. During these hours, the Boulder Rifle Club is closed showing that the ambient levels are already higher than the stated limit. As a result, it would be difficult



to measure shooting noise in isolation for comparison against the 65 dB limit. The noise modeling conducted in the next section calculates only the shooting noise in isolation and can be used to determine the contribution of shooting noise on the overall noise environment.

The temperature, humidity, wind speed, wind direction and precipitation data were sourced using the Ft Collins Regional weather station located approximately 25 miles northeast of the site (www.wunderground.com). The temperatures recorded nearby the site ranged between 5 degrees and 39 degrees Fahrenheit for the measurement period. Wind was mostly calm with only short periods above 10 mph. There was no recorded precipitation for the duration of the monitoring period. A table showing of the temperature, humidity, wind speed and wind direction is included in Appendix B.

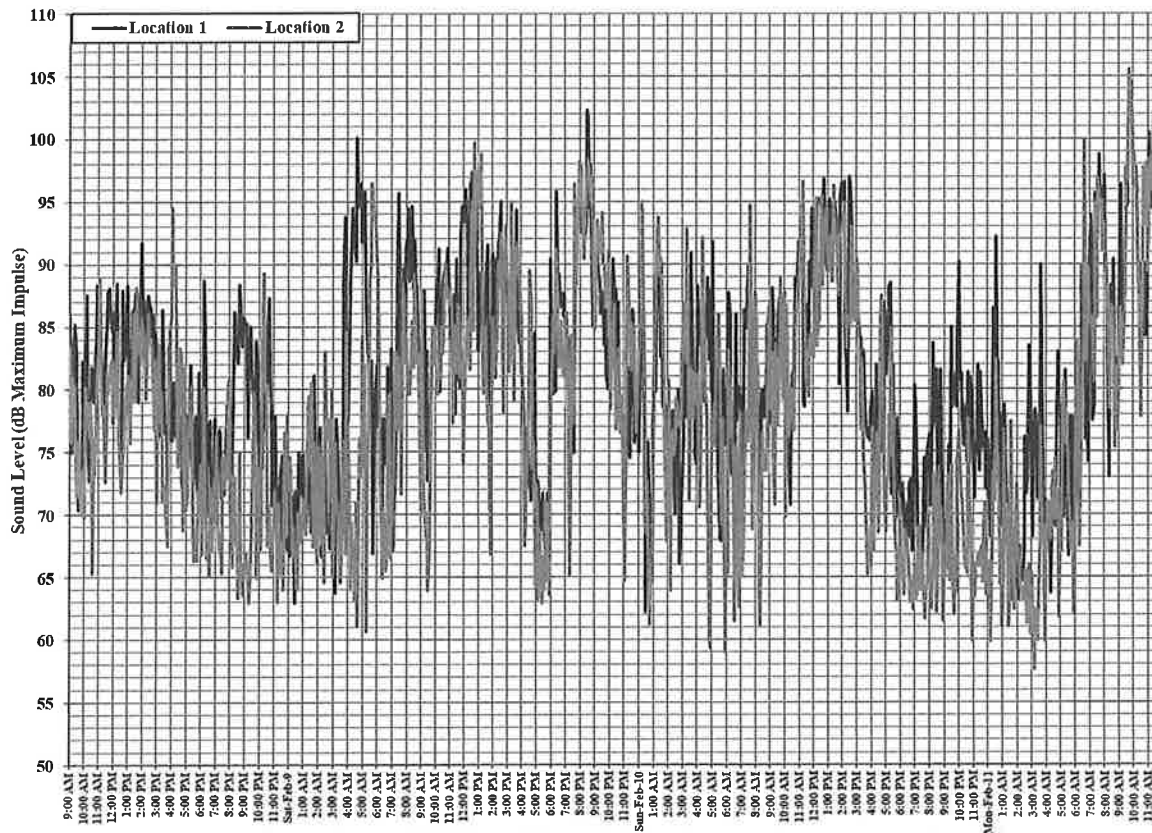
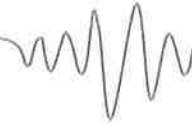


Figure 4-2 Location 1 and 2 Measured Sound Pressure Levels (dB Maximim Impulse, 5-min)

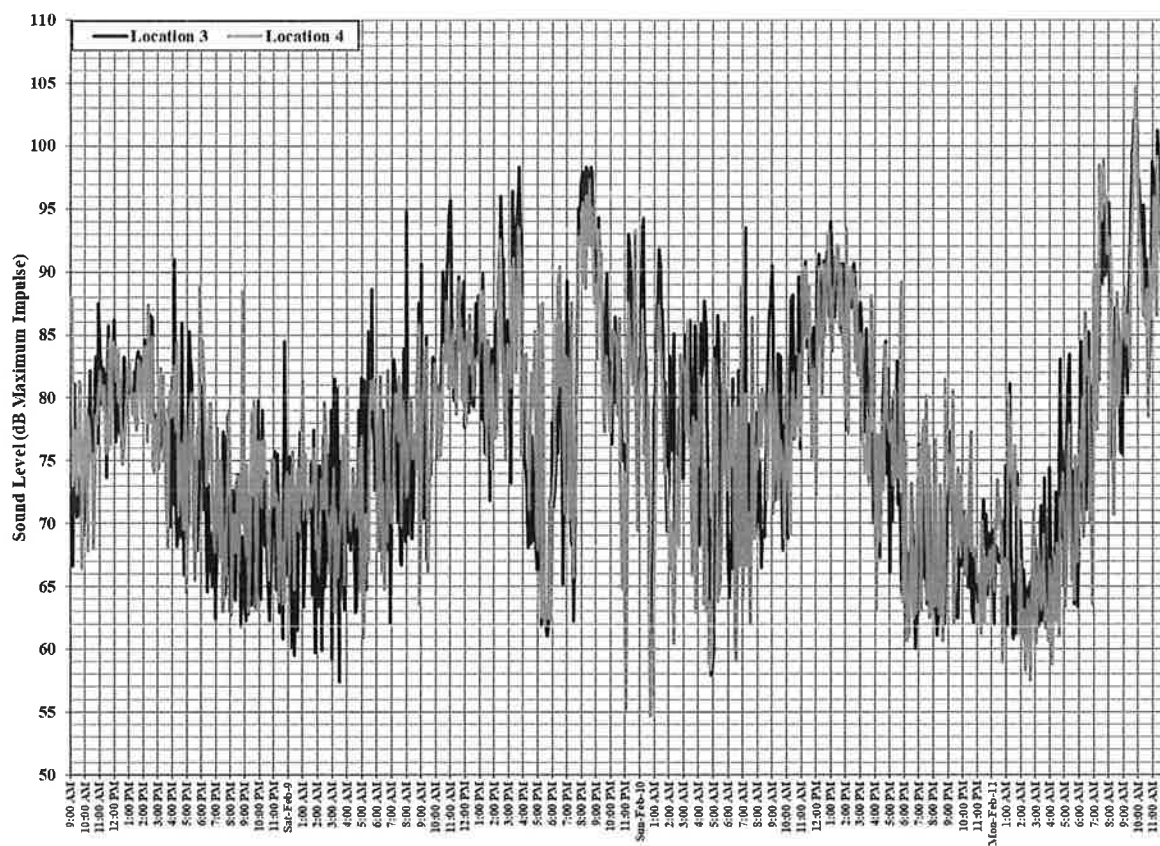
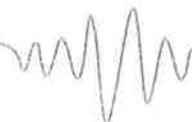
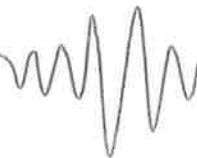


Figure 4-3 Location 3 and 4 Measured Sound Pressure Levels (dB Maximim Impulse, 5-min)



5. Boulder Rifle Club Noise Modeling

5.1 Noise Modeling Methodology

The noise modeling was completed with use of three-dimensional computer noise modeling software. All models in this report were developed with SoundPLAN 8.0 software using the ISO 9613-2 standard. Noise levels are predicted based on the locations, noise levels and frequency spectra of the noise sources, and the geometry and reflective properties of the local terrain, buildings and barriers. To ensure a conservative assessment and compliance with ISO 9613-2 standards, light to moderate winds are assumed to be blowing from the source to receptor. The predicted noise levels represent only the contribution of shooting noise from the Boulder Rifle Club and do not include ambient noise or noise from other facilities. Actual field sound level measurements may vary from the modeled noise levels due to other noise sources such as traffic, other facilities, other human activity, or environmental factors.

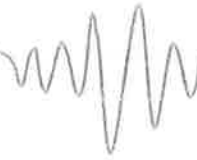
5.2 Noise Sources

Sound measurements were conducted at the Boulder Rifle Club on the morning of Friday, February 8, 2019 using a Type 1 SVANTEK SVAN 979 Sound Level Meter (serial number 69426) set to record unweighted maximum pulse sound levels. Individual shots were fired from a 0.22 caliber long rifle (22LR) and a 0.300 Winchester Magnum (300WM) at the existing 200 yard range. During the test firing, noise measurements were conducted at varying angles and distances to quantify each firearm as a noise source.

As shooting noise is highly directional, with louder sound levels in the direction of fire, varying angles during the measurement period allowed directionality to be included in the model. Using the noise measurement data, sound power levels were calculated in SoundPLAN for the operation of each firearm and shown in Table 5-1.

Table 5-1 Calculated Sound Power Levels from Noise Measurements

Source	Sound Power Level (dB)
22LR	152
300WM	168



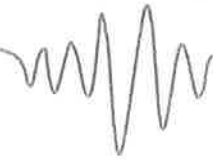
An appropriate caliber firearm out of the two firearms tested was selected by Boulder Rifle Club and used as the sound source for each range modeled individually at the respective firing bay. Each unmitigated scenario and the noise source included in the model are summarized in Table 5-2.

Table 5-2 Unmitigated Noise Sources Modeled

Range	Noise Source
Existing- 25 yard	22LR
Existing- 50 yard	22LR
Existing- 100 yard	300WM
Existing- 200 yard	300WM
Proposed- 25 meters	22LR
Proposed- 50 meters	22LR
Proposed- 100 meters	300WM
Proposed- 200 yard	300WM
Proposed- 300 yard	300WM

As the metric for assessment is the maximum impulse measured within 35 milliseconds, it is assumed that multiple shots within this period are highly unlikely and therefore not included in the modeling. As a result, only one noise source was assumed for each existing and proposed range included in the modeling.

Distance measurements at the locations shown in Figure 4-1 were also used to calculate sound levels from the shooting testing on February 8. For the shots that were distinguishable from the ambient sound environment, an excess attenuation correction applicable to distance calculations was determined. Excess attenuation is due to atmospheric effects over large distances that are unique to the environment where the sound is propagating into. The sound modeling calculation method used, ISO 9613-2, calculates a steady state noise level over predictable weather conditions. When calculating sound sources such as shooting noise from actual sound measurements, the local atmospheric effects can cause sound levels to vary highly, therefore an overall correction is applied to the distance measurements based on the measurements of noise at distance in the direction of interest. This correction was calculated at -18 dB and used in the calculation of noise levels at the receptors in Figure 5-1.



5.3 Receptors

Receptors 1 to 3 have been chosen to evaluate noise at the closest residential structures as per the Boulder County Land Use Code. An additional receptor was added, Receptor 4, to evaluate noise at the Harlequin's Gardens property at the request of the Boulder Rifle Club. As the property is a business and not a residence, Receptor 4 is not subject to the Boulder County Land Use Code and there are no regulatory noise limits applicable to this property. Figure 5-1 shows the receptor locations on a map.

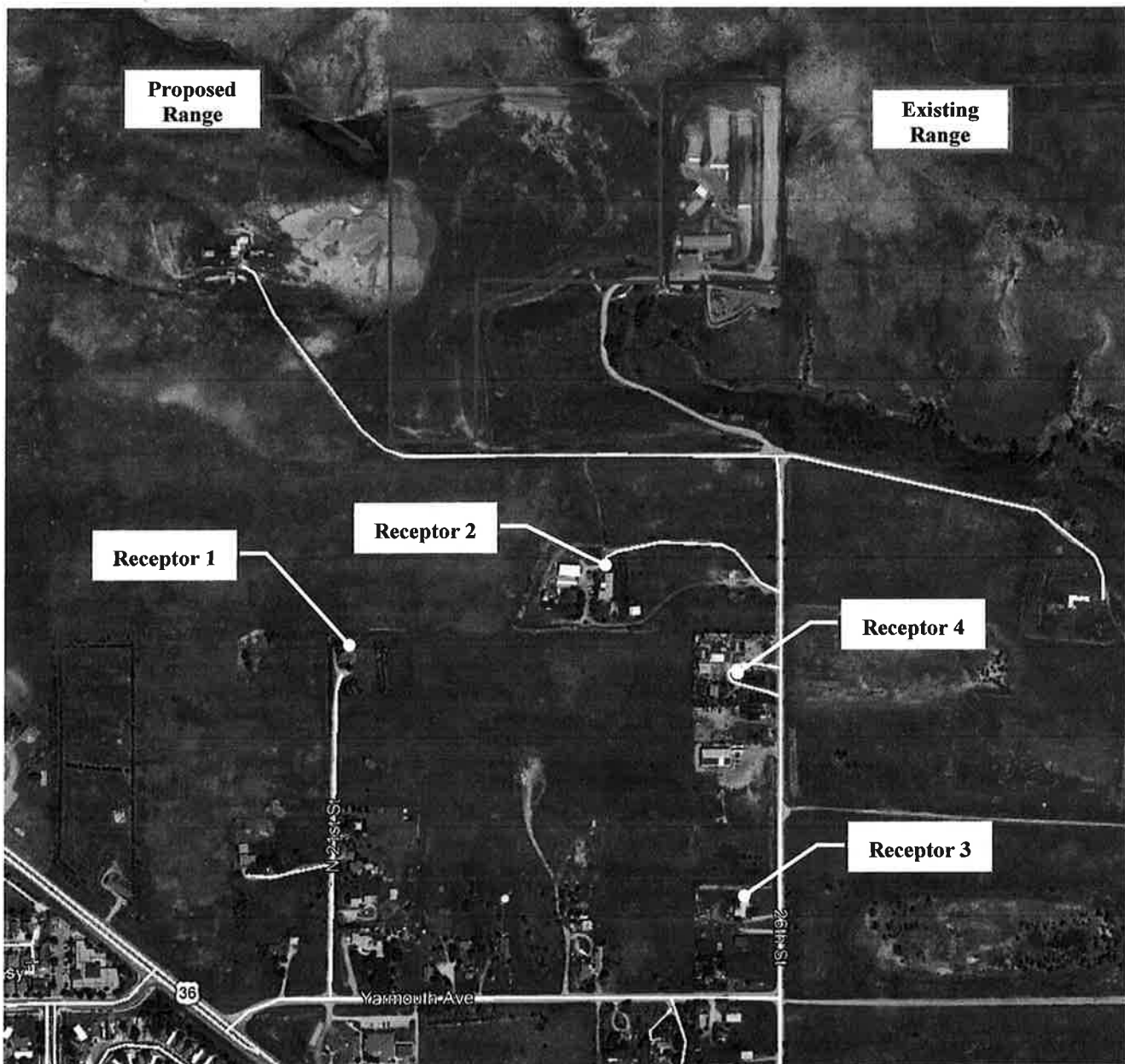
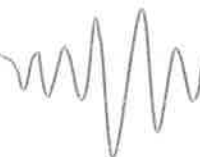


Figure 5-1 Map of Receptor Locations



5.4 Unmitigated Noise Modeling Results

Unmitigated scenarios were modeled at each range for the existing and proposed areas. The results of the unmitigated noise modeling for the existing ranges are presented in Table 5-3. The locations in the tables correspond to the receptor locations identified in Figure 5-1.

Table 5-3 Predicted Existing Unmitigated Noise Modeling Results

Receptor	Predicted Sound Pressure Level (dB Maximum Impulse)			
	25-yard range (22LR)	50-yard range (22LR)	100-yard range (300WM)	200-yard range (300WM)
1	36	35	68	70
2	37	38	72	71
3	28	30	66	67
4	30	33	70	71

The predicted unmitigated sound pressure levels for the existing ranges are between 28 dB and 37 dB for the 25 yard range, between 30 dB and 38 dB for the 50 yard range, between 66 dB and 72 dB at the 100 yard range and between 67 and 71 at the 200 yard range at the receptors. The results show that the 22LR modeled for the 25 yard and 50 yard ranges is significantly quieter than the 300WM modeled for the 100 yard and 200 yard ranges.

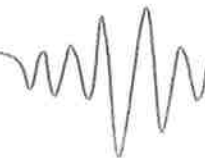
To determine the impact on the noise environment of the existing range, the calculated statistical average maximum impulse sound levels at the closest locations for Receptor 3 and 4 are compared with the loudest calculated modeling results in Table 5-3.

Table 5-4 Comparison of Measured and Modeled Maximum Impulse Sound Levels (dB)

Day	Location 3	Location 4
9:00 am to 7:00pm February 8	77	78
7:00 am to 7:00pm February 9	79	80
7:00 am to 7:00pm February 10	81	80
7:00 am to 12:00pm February 11	90	90
Loudest modeled sound level at closest receptor	71 Receptor 4	67 Receptor 3

The modeled sound levels at Receptor 3 are at least 11 dB less than the measured average maximum impulse sound levels showing that for most of a typical day, gunshot noise does not significantly contribute to the noise environment at this location. Similarly, the modeled sound levels at Receptor 4 are at least 6 dB less than the measured average maximum impulse sound levels showing that for most of a typical day, gunshot noise does not dominate the noise environment at this location. As the modeled sound pressure levels of the gunshot noise in isolation are below the daytime sound levels measured in Table 4-2, the ambient sound levels unrelated to the Boulder Rifle Club generally dominate over the gunshot noise from the range.

The results of the noise modeling are also shown as noise contour maps in Appendix C. The noise contours are provided in 5 dB increments with the color scale indicating the sound level of each contour.



The results of the unmitigated noise modeling for the proposed range are presented in Table 5-5.

Table 5-5 Predicted Proposed Unmitigated Noise Modeling Results

Receptor	Predicted Sound Pressure Level (dB Maximum Impulse)				
	25-meter range (22LR)	50-meter range (22LR)	100-meter range (300WM)	200-yard range (300WM)	300-yard range (300WM)
1	37	37	70	71	74
2	38	38	73	74	74
3	31	32	66	66	67
4	33	34	69	69	70
Boulder County noise limit at residential structures (Receptors 1 to 3)	65				

The predicted unmitigated sound pressure levels at the proposed range are between 31 dB and 38 dB for the 25 meter range, between 32 dB and 38 dB for the 50 meter range, between 66 dB and 73 dB for the 100 meter range, between 66 and 74 for the 200 yard range and between 67 and 74 for the 300 yard range at the receptors. The predicted unmitigated noise modeling results show that the 25 meter and 50 meter ranges comply with the Boulder County Land Use Code and the 100 meter, 200 yard and 300 yard ranges exceed the Boulder County Land Use Code. Noise mitigation is therefore required for the proposed 100 meter, 200 yard and 300 yard ranges.

5.5 Mitigation Scenarios

Noise mitigation was included in the modeling for the existing and proposed areas of the Boulder Rifle Club. Despite no regulation requiring noise mitigation at the existing range, noise mitigation for the 100 yard and 200 yard ranges were included at the request of the Boulder Rifle Club. The proposed ranges included in the mitigation modeling were the 100 meter, 200 yard and 300 yard ranges. The noise mitigation scenarios included in the modeling are summarized in Table 5-6.

Table 5-6 Mitigation Scenarios Modeled

Scenario	Description
1	Existing 100y range with firing shelter
2	Existing 200y range with firing shelter
3	Proposed 100m range with firing shelter
4	Proposed 200y range with firing shelter
5	Proposed 300y range with firing shelter

The firing shelter mentioned in Table 5-6 is designed to shield noise in all directions except the line of fire. Baffles separate the firing bays and the entrance includes a 90 degree bend to shield noise in the southern direction. The firing bay drawings and acoustical specifications used in the analysis are shown in Appendix D.

BOULDER RIFLE CLUB
CURRENT FACILITY

50 Yd & 25 Yd
100 Yd Rifle Range
High Power Rifle Range

Scenario 1 Firing Shelter

45 AUTOS

EXISTING INDOOR RANGE BUILDING
170'x60'x20'

Scenario 2 Firing Shelter

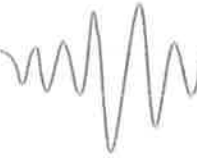
9 AUTOS

N89°29'48"E
706.15'

GATE

Figure 5-2 Location of Firing Shelters on Existing Ranges (Scenario 1 and Scenario 2)





5.6 Mitigated Noise Modeling Results

The results of the noise modeling and the predicted reduction achieved by the mitigation for the existing 100 yard and 200 yard ranges are presented in Table 5-7 and Table 5-8. The locations in the tables correspond to the receptor locations identified in Figure 5-1.

Table 5-7 Existing 100y Range Preliminary Mitigated Noise Modeling Results

Receptor	Predicted Sound Pressure Level (dB Maximum Impulse)		
	Unmitigated	Mitigated Scenario 1	Reduction
1	68	60	8
2	72	64	8
3	66	57	9
4	70	61	9

Table 5-8 Existing 200y Range Preliminary Mitigated Noise Modeling Results

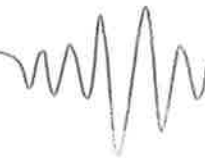
Receptor	Predicted Sound Pressure Level (dB Maximum Impulse)		
	Unmitigated	Mitigated Scenario 2	Reduction
1	70	61	9
2	71	65	6
3	67	58	9
4	71	63	8

The predicted mitigated sound pressure levels for the existing ranges are between 57 dB and 64 dB for the 100 yard range and between 58 dB and 65 dB for the 200 yard range at the receptors. With the inclusion of the mitigation in Scenario 1, the predicted sound level reduction is between 8 dB and 9 dB. With the inclusion of the mitigation in Scenario 2, the predicted sound level reduction is between 6 dB and 9 dB.

The results of the noise modeling and the predicted reduction achieved by the mitigation for the proposed 100 meter, 200 yard and 300 yard ranges are presented in Table 5-9 to Table 5-11.

Table 5-9 Proposed 100m Range Preliminary Mitigated Noise Modeling Results

Receptor	Predicted Sound Pressure Level (dB Maximum Impulse)		
	Unmitigated	Mitigated Scenario 3	Reduction
1	70	59	11
2	73	62	11
3	66	55	11
4	69	58	11
Boulder County noise limit at residential structure	65		

**Table 5-10 Proposed 200y Range Preliminary Mitigated Noise Modeling Results**

Receptor	Predicted Sound Pressure Level (dB Maximum Impulse)		
	Unmitigated	Mitigated Scenario 4	Reduction
1	71	60	11
2	74	63	11
3	66	55	11
4	69	58	11
Boulder County noise limit at residential structure	65		

Table 5-11 Proposed 300y Range Preliminary Mitigated Noise Modeling Results

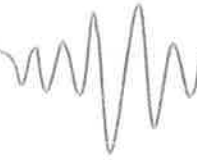
Receptor	Predicted Sound Pressure Level (dB Maximum Impulse)		
	Unmitigated	Mitigated Scenario 5	Reduction
1	74	64	10
2	74	65	9
3	67	56	11
4	70	59	11
Boulder County noise limit at residential structure	65		

The predicted mitigated sound pressure levels from the proposed 100 meter range are between 55 dB and 62 dB for Scenario 3 at the receptors. With the inclusion of the mitigation in Scenario 3, the predicted sound level reduction is 11 dB.

The predicted mitigated sound pressure levels from the proposed 200 yard range are between 55 dB and 63 dB for Scenario 4 at the receptors. With the inclusion of the mitigation in Scenario 4, the predicted sound level reduction is 11 dB.

The predicted mitigated sound pressure levels from the proposed 300 yard range are between 56 dB and 65 dB for Scenario 5 at the receptors. With the inclusion of the mitigation in Scenario 5, the predicted sound level reduction is between 9 dB and 11 dB.

The results of the noise modeling are also shown as noise contour maps in Appendix E. The noise contours are provided in 5 dB increments with the color scale indicating the sound level of each contour.



6. Conclusion

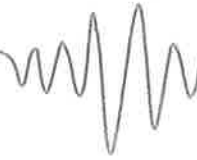
A noise study of the Boulder Rifle Club was conducted which included noise monitoring while the range was operating and noise modeling of the existing and proposed ranges. A sound level survey was performed at various locations within the residential areas to the south of the site to analyze the effect of Boulder Rifle Club operations on the local environment. The proposed area of the Boulder Rifle Club is subject to Boulder County Land Use Code, which was used to assess the expected noise levels from each outdoor firing range.

The applicable noise limit for the proposed area of the Boulder Rifle Club based on the Land Use Code is interpreted as 65 dB maximum impulse response measured at the existing residential structures. There is currently no applicable noise limit for the existing area of the Boulder Rifle Club as the code was not in effect during development of this area and cannot be applied retrospectively.

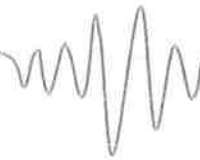
The results of the sound level survey show that that sources such as traffic, environmental noise and other human activity unrelated to the Boulder Rifle Club dominated the sound environment at the monitoring locations. For most of the monitoring period, the measured ambient levels when the firing range was not in operation were already higher than the stated limit.

The predicted unmitigated sound pressure levels at the proposed range are between 31 dB and 38 dB for the 25 meter range, between 32 dB and 38 dB for the 50 meter range, between 66 dB and 73 dB for the 100 meter range, between 66 and 74 for the 200 yard range and between 67 and 74 for the 300 yard range at the receptors. The predicted unmitigated noise modeling results show that the 25 meter and 50 meter ranges comply with the Boulder County Land Use Code and the 100 meter, 200 yard and 300 yard ranges exceed the Boulder County Land Use Code. Noise mitigation is therefore required for the proposed 100 meter, 200 yard and 300 yard ranges.

With the inclusion of the firing structure at the proposed ranges and the 100 yard and 200 yard existing ranges, the sound levels due to the Boulder Rifle Club at the nearest residences are below the Boulder County Land Use Code limit of 65 dB maximum impulse.



Appendix A - Glossary of Acoustical Terms

**Ambient Noise**

The all-encompassing noise associated with a given environment at a specified time, usually a composite of sound from many sources both near and far.

Average Sound Level

See Equivalent-Continuous Sound Level

Decibel (dB)

The basic unit of measurement for sound level.

Direct Sound

Sound that reaches a given location in a direct line from the source without any reflections.

Energy Basis

This refers to the procedure of summing or averaging sound pressure levels on the basis of their squared pressures. This method involves the conversion of decibels to pressures, then performing the necessary arithmetic calculations, and finally changing the pressure back to decibels.

Equivalent-Continuous Sound Level (Leq)

The average sound level measured over a specified time period. It is a single-number measure of time-varying noise over a specified time period. It is the level of a steady sound that, in a stated time period and at a stated location, has the same sound energy as the time-varying sound. For example, a person who experiences an Leq of 60 dB for a period of 10 minutes standing next to a busy street is exposed to the same amount of sound energy as if he had experienced a constant noise level of 60 dB for 10 minutes rather than the time-varying traffic noise level.

Fast Response

A setting on the sound level meter that determines how sound levels are averaged over time. A fast sound level is always more strongly influenced by recent sounds, and less influenced by sounds occurring in the distant past, than the corresponding slow sound level. For the same non-steady sound, the maximum fast sound level is generally greater than the corresponding maximum slow sound level. Fast response is typically used to measure impact sound levels.

Frequency

The number of oscillations per second of a sound wave

Hourly Average Sound Level (HNL)

The equivalent-continuous sound level, Leq, over a 1-hour time period.

Impact Noise

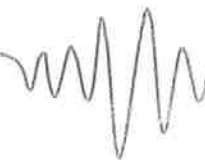
The noise that results when two objects collide.

Impulse Noise

Noise of a transient nature due to the sudden impulse of pressure like that created by a gunshot or balloon bursting.

Insertion Loss

The decrease in sound power level measured at the location of the receiver when an element (e.g., a noise barrier) is inserted in the transmission path between the sound source and the receiver.

**Inverse Square Law**

A rule by which the sound intensity varies inversely with the square of the distance from the source. This results in a 6dB decrease in sound pressure level for each doubling of distance from the source.

Masking

The process by which the threshold of hearing for one sound is raised by the presence of another sound.

Maximum Sound Level (L_{max})

The greatest sound level measured on a sound level meter during a designated time interval or event.

Noise Reduction

The difference in sound pressure level between any two points.

Octave

The frequency interval between two sounds whose frequency ratio is 2. For example, the frequency interval between 500 Hz and 1,000 Hz is one octave.

Octave-Band Sound Level

For an octave frequency band, the sound pressure level of the sound contained within that band.

One-Third Octave

The frequency interval between two sounds whose frequency ratio is $2^{(1/3)}$. For example, the frequency interval between 200 Hz and 250 Hz is one-third octave.

One-Third-Octave-Band Sound Level

For a one-third-octave frequency band, the sound pressure level of the sound contained within that band.

Peak Sound Level (L_{pk})

The maximum instantaneous sound level during a stated time period or event.

Point Source

A source that radiates sound as if from a single point.

Receiver

A person (or persons) or equipment which is affected by noise.

Reflected Sound

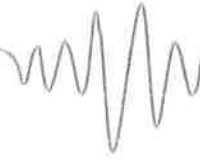
Sound that persists in an enclosed space as a result of repeated reflections or scattering. It does not include sound that travels directly from the source without reflections.

Reverberation

The persistence of a sound in an enclosed or partially enclosed space after the source of the sound has stopped, due to the repeated reflection of the sound waves.

Slow Response

A setting on the sound level meter that determines how measured sound levels are averaged over time. A slow sound level is more influenced by sounds occurring in the distant past than the corresponding fast sound level.

**Sound**

A physical disturbance in a medium (e.g., air) that is capable of being detected by the human ear.

Sound Absorption Coefficient

A measure of the sound-absorptive property of a material.

Sound Insulation

The capacity of a structure or element to prevent sound from reaching a receiver room either by absorption or reflection.

Sound Level Meter (SLM)

An instrument used for the measurement of sound level, with a standard frequency-weighting and standard exponentially weighted time averaging.

Sound Power Level

A physical measure of the amount of power a sound source radiates into the surrounding air. It is measured in decibels.

Sound Pressure Level

A physical measure of the magnitude of a sound. It is related to the sound's energy. The terms sound pressure level and sound level are often used interchangeably.

Sound Transmission Class (STC)

A single number rating used to compare the sound insulation properties of walls, floors, ceilings, windows, or doors. This rating is designed to correlate with subjective impressions of the ability of building elements to reduce the overall loudness of speech, radio, television, and similar noise sources in offices and buildings.

Spectrum

The spectrum of a sound wave is a description of its resolution into components, each of different frequency and usually different amplitude.

Tone

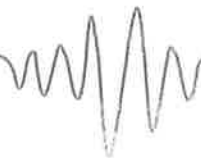
A sound with a distinct pitch

Transmission Loss (TL)

A property of a material or structure describing its ability to reduce the transmission of sound at a particular frequency from one space to another. The higher the TL value the more effective the material or structure is in reducing sound between two spaces. It is measured in decibels.

Windscreen

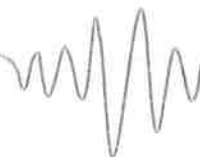
A porous covering for a microphone, designed to reduce the noise generated by the passage of wind over the microphone.



Appendix B - Weather Data

Behrens and Associates, Inc.

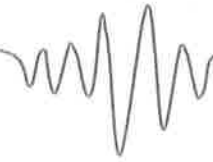
Environmental Noise Control



Time	Temperature	Humidity	Wind	Wind Speed	Wind Gust	Precip.	Precip Accum
Friday February 8, 2019							
8:56 AM	26 F	51 %	E	6 mph	0 mph	0.0 in	0.0 in
9:56 AM	25 F	53 %	E	5 mph	0 mph	0.0 in	0.0 in
10:56 AM	24 F	55 %	E	3 mph	0 mph	0.0 in	0.0 in
11:56 AM	19 F	65 %	CALM	0 mph	0 mph	0.0 in	0.0 in
12:56 PM	17 F	68 %	CALM	0 mph	0 mph	0.0 in	0.0 in
1:56 PM	17 F	68 %	CALM	0 mph	0 mph	0.0 in	0.0 in
2:56 PM	14 F	77 %	CALM	0 mph	0 mph	0.0 in	0.0 in
3:56 PM	14 F	80 %	SW	3 mph	0 mph	0.0 in	0.0 in
4:56 PM	13 F	81 %	CALM	0 mph	0 mph	0.0 in	0.0 in
5:56 PM	12 F	77 %	S	6 mph	0 mph	0.0 in	0.0 in
6:56 PM	9 F	84 %	CALM	0 mph	0 mph	0.0 in	0.0 in
7:56 PM	13 F	84 %	CALM	0 mph	0 mph	0.0 in	0.0 in
8:56 PM	9 F	88 %	CALM	0 mph	0 mph	0.0 in	0.0 in
9:56 PM	10 F	87 %	SE	3 mph	0 mph	0.0 in	0.0 in
10:56 PM	10 F	76 %	E	3 mph	0 mph	0.0 in	0.0 in
11:56 PM	6 F	80 %	CALM	0 mph	0 mph	0.0 in	0.0 in
Saturday, February 9, 2019							
12:56 AM	5 F	84 %	NNE	7 mph	0 mph	0.0 in	0.0 in
1:56 AM	6 F	87 %	N	7 mph	0 mph	0.0 in	0.0 in
2:56 AM	14 F	84 %	N	7 mph	0 mph	0.0 in	0.0 in
3:56 AM	23 F	68 %	NE	6 mph	0 mph	0.0 in	0.0 in
4:56 AM	28 F	58 %	E	5 mph	0 mph	0.0 in	0.0 in
5:56 AM	31 F	54 %	VAR	5 mph	0 mph	0.0 in	0.0 in
6:56 AM	33 F	50 %	NE	7 mph	0 mph	0.0 in	0.0 in
7:56 AM	34 F	48 %	NE	7 mph	0 mph	0.0 in	0.0 in
8:56 AM	34 F	56 %	E	14 mph	0 mph	0.0 in	0.0 in
9:56 AM	33 F	61 %	E	8 mph	0 mph	0.0 in	0.0 in
10:56 AM	30 F	72 %	E	7 mph	0 mph	0.0 in	0.0 in
11:56 AM	28 F	75 %	NE	6 mph	0 mph	0.0 in	0.0 in
12:56 PM	26 F	81 %	NNE	12 mph	0 mph	0.0 in	0.0 in
1:56 PM	24 F	81 %	NE	8 mph	0 mph	0.0 in	0.0 in
2:56 PM	24 F	81 %	NE	8 mph	0 mph	0.0 in	0.0 in
3:52 PM	23 F	86 %	E	5 mph	0 mph	0.0 in	0.0 in
3:56 PM	23 F	81 %	E	5 mph	0 mph	0.0 in	0.0 in
4:56 PM	22 F	85 %	SE	7 mph	0 mph	0.0 in	0.0 in
5:56 PM	21 F	88 %	E	10 mph	0 mph	0.0 in	0.0 in
6:56 PM	20 F	89 %	E	8 mph	0 mph	0.0 in	0.0 in
7:21 PM	19 F	93 %	E	7 mph	0 mph	0.0 in	0.0 in
7:35 PM	19 F	86 %	ESE	8 mph	0 mph	0.0 in	0.0 in
7:56 PM	19 F	88 %	ESE	8 mph	0 mph	0.0 in	0.0 in
8:56 PM	19 F	88 %	SSE	8 mph	0 mph	0.0 in	0.0 in

Behrens and Associates, Inc.

Environmental Noise Control



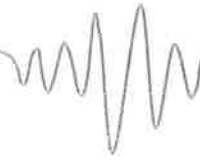
9:07 PM	19 F	86 %	SSE	9 mph	0 mph	0.0 in	0.0 in
9:56 PM	17 F	88 %	SE	10 mph	0 mph	0.0 in	0.0 in
10:23 PM	16 F	93 %	SSE	8 mph	0 mph	0.0 in	0.0 in
10:56 PM	17 F	92 %	SE	6 mph	0 mph	0.0 in	0.0 in
11:56 PM	17 F	92 %	SSE	5 mph	0 mph	0.0 in	0.0 in

Sunday, February 10, 2019

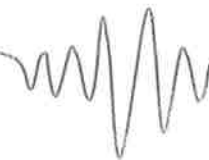
12:56 AM	17 F	92 %	ESE	6 mph	0 mph	0.0 in	0.0 in
1:31 AM	18 F	93 %	ESE	6 mph	0 mph	0.0 in	0.0 in
1:38 AM	18 F	93 %	VAR	3 mph	0 mph	0.0 in	0.0 in
1:41 AM	18 F	93 %	ESE	7 mph	0 mph	0.0 in	0.0 in
1:51 AM	18 F	93 %	SE	5 mph	0 mph	0.0 in	0.0 in
1:54 AM	18 F	93 %	S	3 mph	0 mph	0.0 in	0.0 in
1:56 AM	18 F	92 %	S	7 mph	0 mph	0.0 in	0.0 in
2:11 AM	18 F	93 %	SW	7 mph	0 mph	0.0 in	0.0 in
2:44 AM	19 F	93 %	SSE	5 mph	0 mph	0.0 in	0.0 in
2:49 AM	19 F	93 %	S	5 mph	0 mph	0.0 in	0.0 in
2:56 AM	19 F	92 %	CALM	0 mph	0 mph	0.0 in	0.0 in
3:33 AM	19 F	93 %	ESE	5 mph	0 mph	0.0 in	0.0 in
3:45 AM	21 F	93 %	S	7 mph	0 mph	0.0 in	0.0 in
3:56 AM	21 F	92 %	CALM	0 mph	0 mph	0.0 in	0.0 in
4:12 AM	23 F	93 %	VAR	3 mph	0 mph	0.0 in	0.0 in
4:56 AM	23 F	88 %	SSE	5 mph	0 mph	0.0 in	0.0 in
5:56 AM	23 F	85 %	VAR	3 mph	0 mph	0.0 in	0.0 in
6:56 AM	26 F	81 %	VAR	5 mph	0 mph	0.0 in	0.0 in
7:28 AM	34 F	75 %	VAR	6 mph	0 mph	0.0 in	0.0 in
8:14 AM	28 F	69 %	E	5 mph	0 mph	0.0 in	0.0 in
8:56 AM	30 F	69 %	ENE	5 mph	0 mph	0.0 in	0.0 in
9:56 AM	29 F	67 %	CALM	0 mph	0 mph	0.0 in	0.0 in
10:56 AM	29 F	69 %	NE	6 mph	0 mph	0.0 in	0.0 in
11:56 AM	25 F	75 %	NNE	6 mph	0 mph	0.0 in	0.0 in
12:56 PM	23 F	78 %	NNE	6 mph	0 mph	0.0 in	0.0 in
1:56 PM	24 F	75 %	NNE	5 mph	0 mph	0.0 in	0.0 in
2:56 PM	20 F	85 %	CALM	0 mph	0 mph	0.0 in	0.0 in
3:56 PM	20 F	81 %	NE	8 mph	0 mph	0.0 in	0.0 in
4:56 PM	17 F	84 %	NE	6 mph	0 mph	0.0 in	0.0 in
5:56 PM	15 F	84 %	NNE	6 mph	0 mph	0.0 in	0.0 in
6:56 PM	16 F	84 %	NNE	5 mph	0 mph	0.0 in	0.0 in
7:56 PM	14 F	84 %	N	6 mph	0 mph	0.0 in	0.0 in
8:56 PM	13 F	84 %	ENE	5 mph	0 mph	0.0 in	0.0 in
9:56 PM	12 F	88 %	NE	3 mph	0 mph	0.0 in	0.0 in
10:46 PM	9 F	92 %	E	6 mph	0 mph	0.0 in	0.0 in
10:56 PM	9 F	88 %	ESE	6 mph	0 mph	0.0 in	0.0 in
11:03 PM	9 F	92 %	ESE	6 mph	0 mph	0.0 in	0.0 in
11:06 PM	9 F	92 %	ESE	5 mph	0 mph	0.0 in	0.0 in

Behrens and Associates, Inc.

Environmental Noise Control



11:10 PM	10 F	92 %	E	5 mph	0 mph	0.0 in	0.0 in
11:25 PM	9 F	92 %	E	6 mph	0 mph	0.0 in	0.0 in
11:56 PM	11 F	92 %	NE	6 mph	0 mph	0.0 in	0.0 in
Monday, February 11, 2019							
1:56 AM	12 F	92 %	NE	6 mph	0 mph	0.0 in	0.0 in
2:52 AM	12 F	92 %	N	12 mph	0 mph	0.0 in	0.0 in
2:56 AM	13 F	92 %	N	12 mph	0 mph	0.0 in	0.0 in
3:00 AM	12 F	92 %	N	12 mph	0 mph	0.0 in	0.0 in
3:11 AM	14 F	93 %	NNE	12 mph	0 mph	0.0 in	0.0 in
3:17 AM	14 F	93 %	NNE	8 mph	0 mph	0.0 in	0.0 in
3:46 AM	16 F	93 %	NNE	9 mph	0 mph	0.0 in	0.0 in
3:56 AM	16 F	92 %	NE	8 mph	0 mph	0.0 in	0.0 in
4:16 AM	18 F	93 %	E	9 mph	0 mph	0.0 in	0.0 in
4:56 AM	21 F	92 %	CALM	0 mph	0 mph	0.0 in	0.0 in
5:40 AM	23 F	93 %	CALM	0 mph	0 mph	0.0 in	0.0 in
5:56 AM	23 F	92 %	WSW	6 mph	0 mph	0.0 in	0.0 in
6:44 AM	27 F	93 %	SSW	6 mph	0 mph	0.0 in	0.0 in
6:56 AM	28 F	96 %	CALM	0 mph	0 mph	0.0 in	0.0 in
7:56 AM	39 F	96 %	S	3 mph	0 mph	0.0 in	0.0 in
8:56 AM	34 F	61 %	SSW	9 mph	0 mph	0.0 in	0.0 in
9:56 AM	32 F	66 %	SSW	8 mph	0 mph	0.0 in	0.0 in
10:56 AM	31 F	69 %	SSW	10 mph	0 mph	0.0 in	0.0 in
11:56 AM	27 F	69 %	VAR	5 mph	0 mph	0.0 in	0.0 in
12:56 PM	25 F	72 %	SSE	9 mph	0 mph	0.0 in	0.0 in



Appendix C - Unmitigated Noise Contour Maps

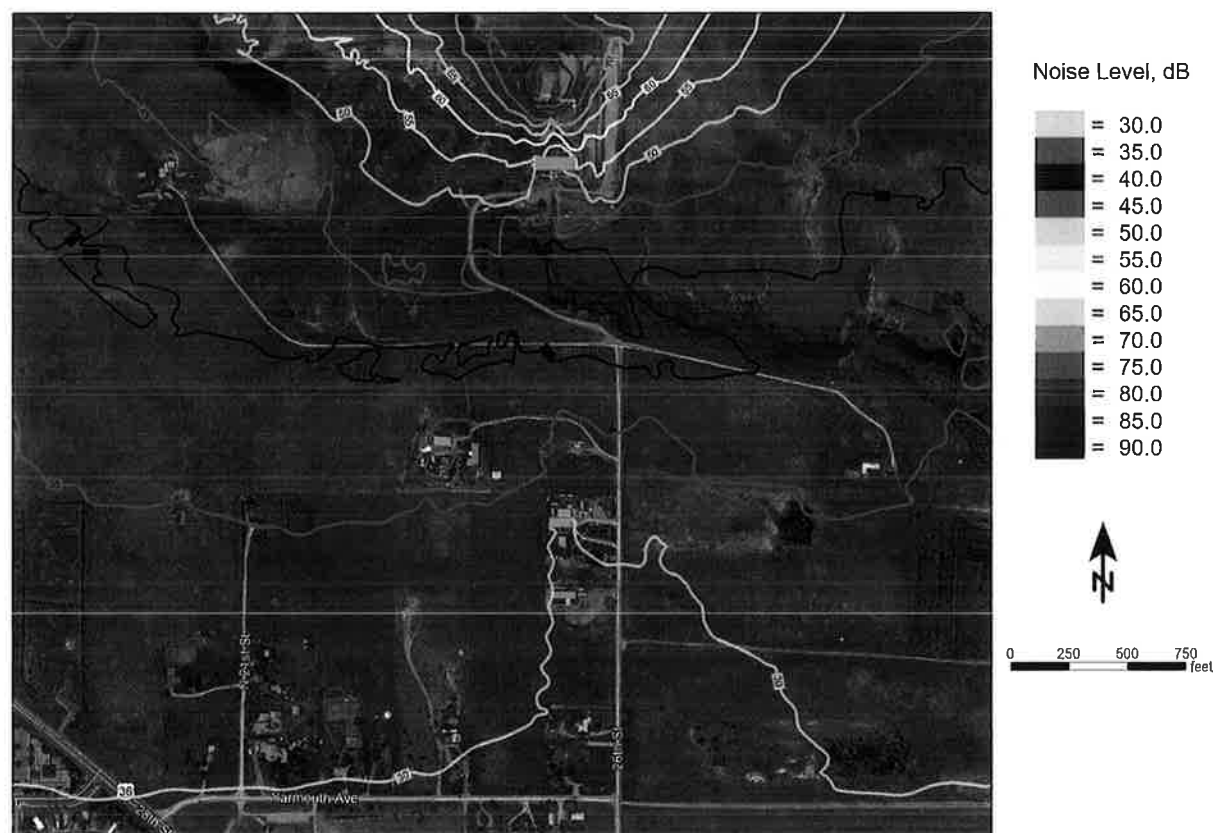
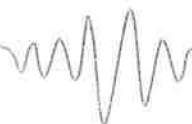


Figure C-1 Noise Contour Map of Existing 25-yard Range (dB Maximum Impulse)

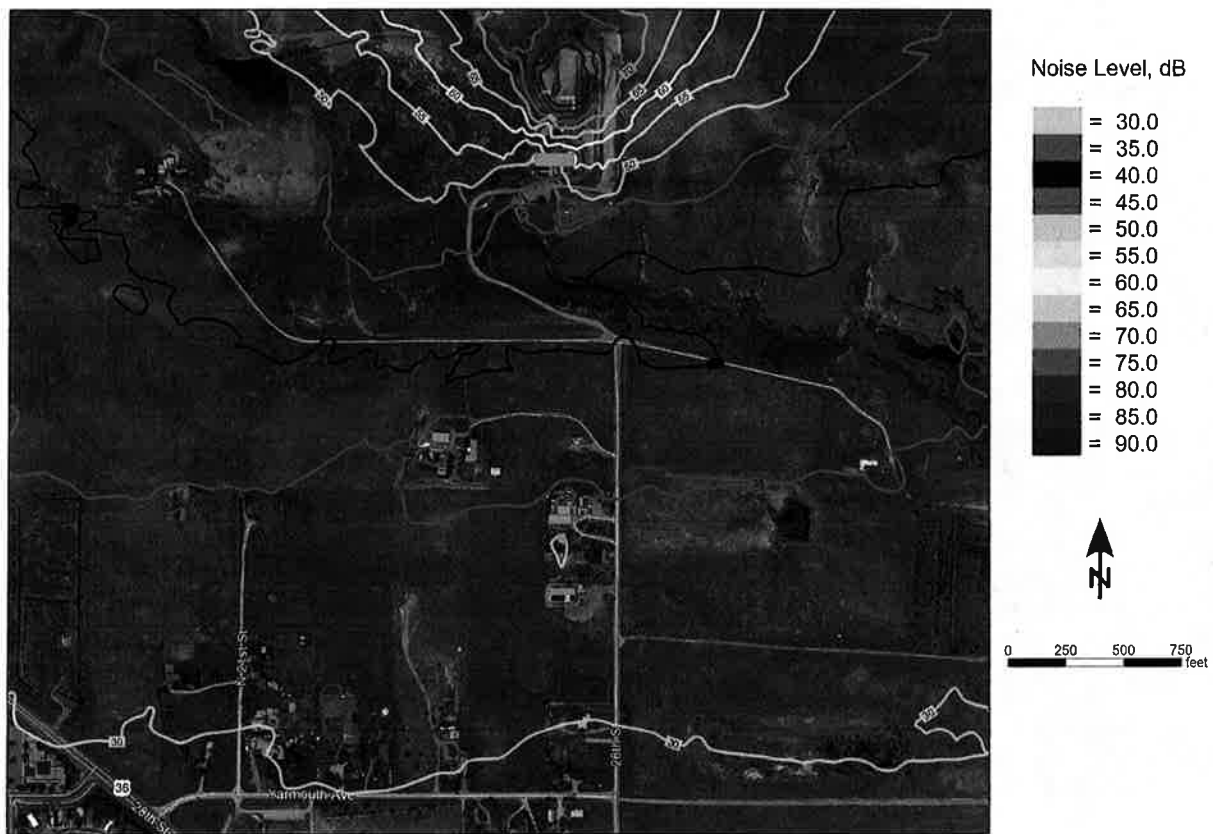


Figure C-2 Noise Contour Map of Existing 50-yard Range (dB Maximum Impulse)

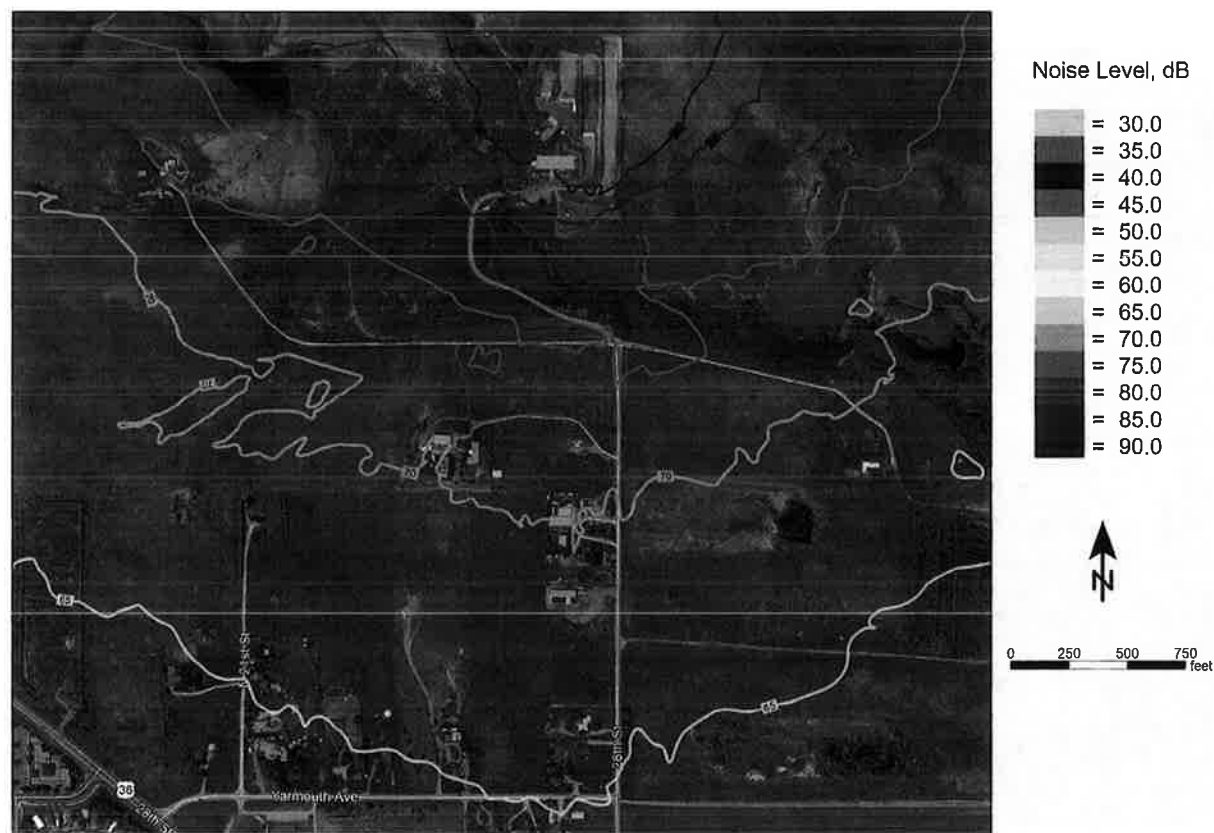
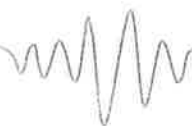


Figure C-3 Noise Contour Map of Existing 100-yard Range (dB Maximum Impulse)

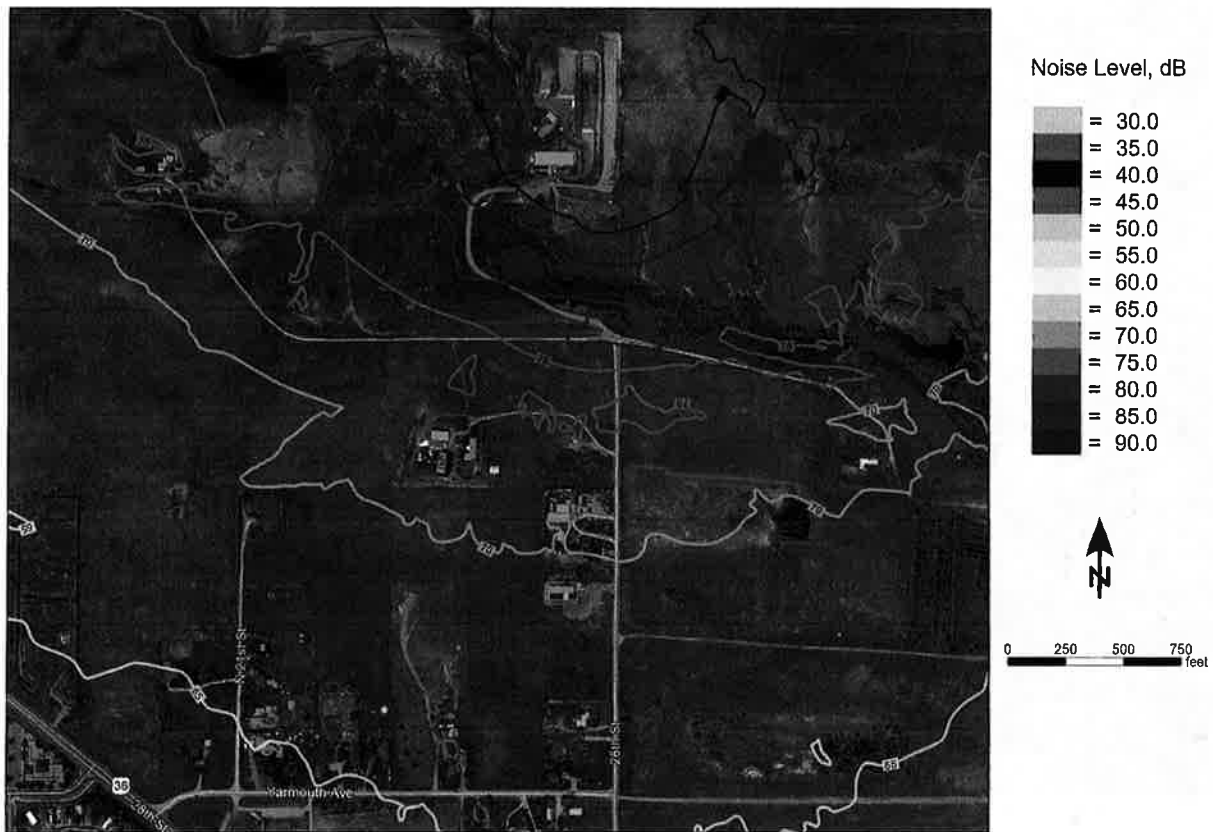


Figure C-4 Noise Contour Map of Existing 200-yard Range (dB Maximum Impulse)

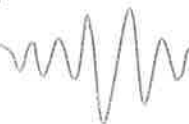


Figure C-5 Noise Contour Map of Proposed 25-meter Range (dB Maximum Impulse)

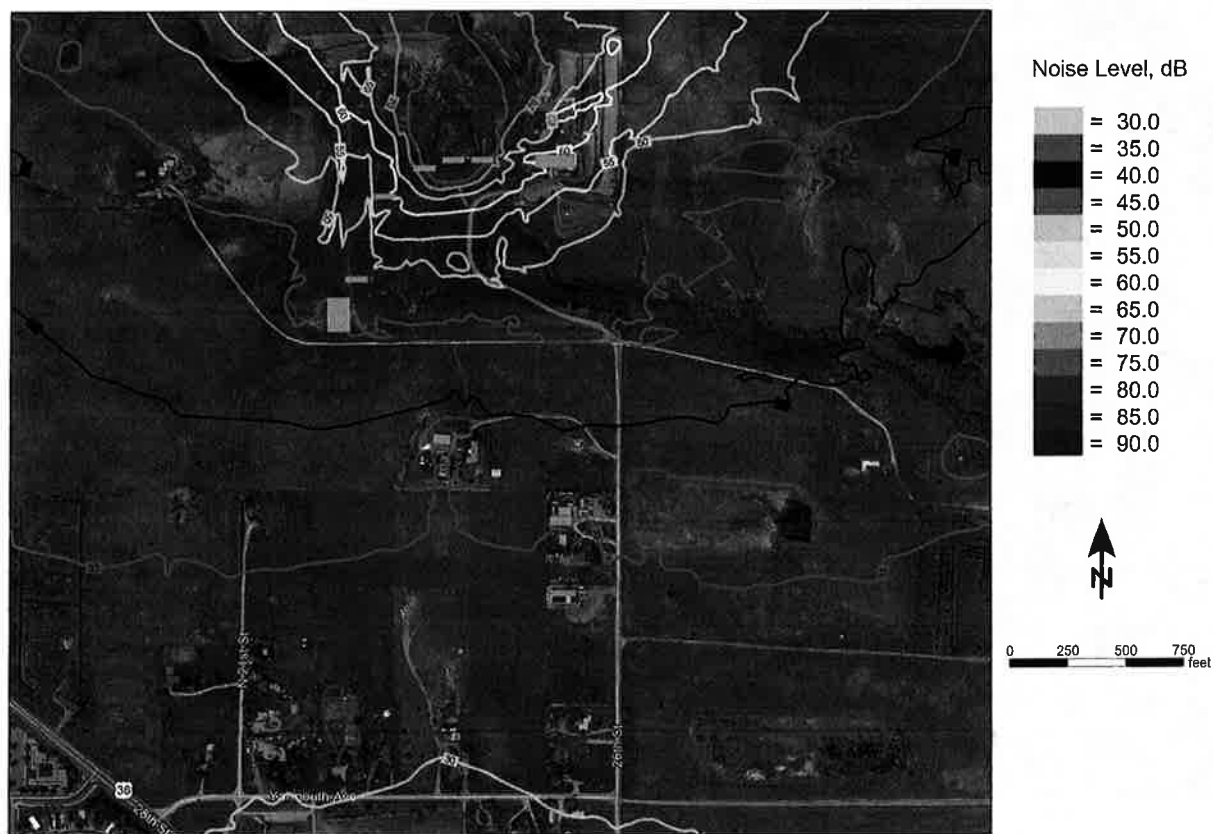


Figure C-6 Noise Contour Map of Proposed 50-meter Range (dB Maximum Impulse)

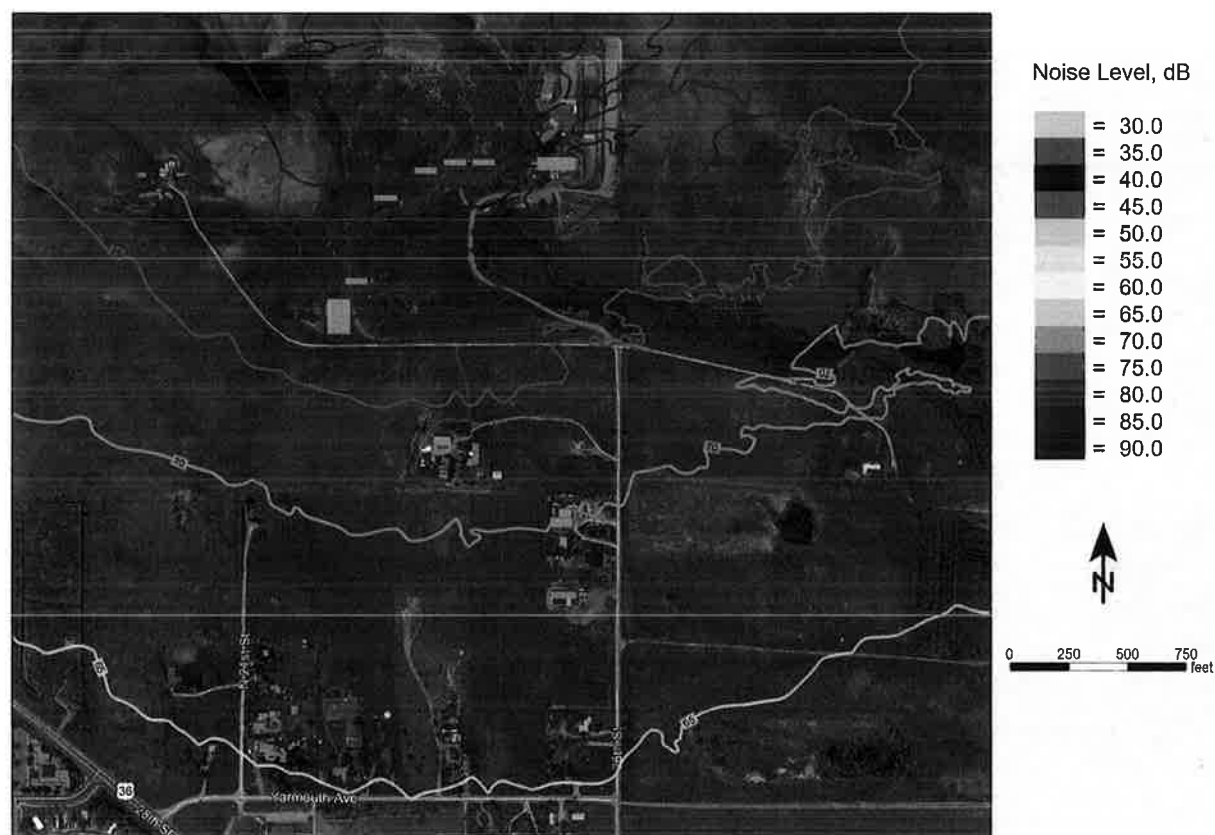
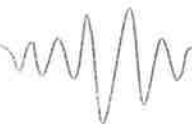


Figure C-7 Noise Contour Map of Proposed 100-meter Range (dB Maximum Impulse)

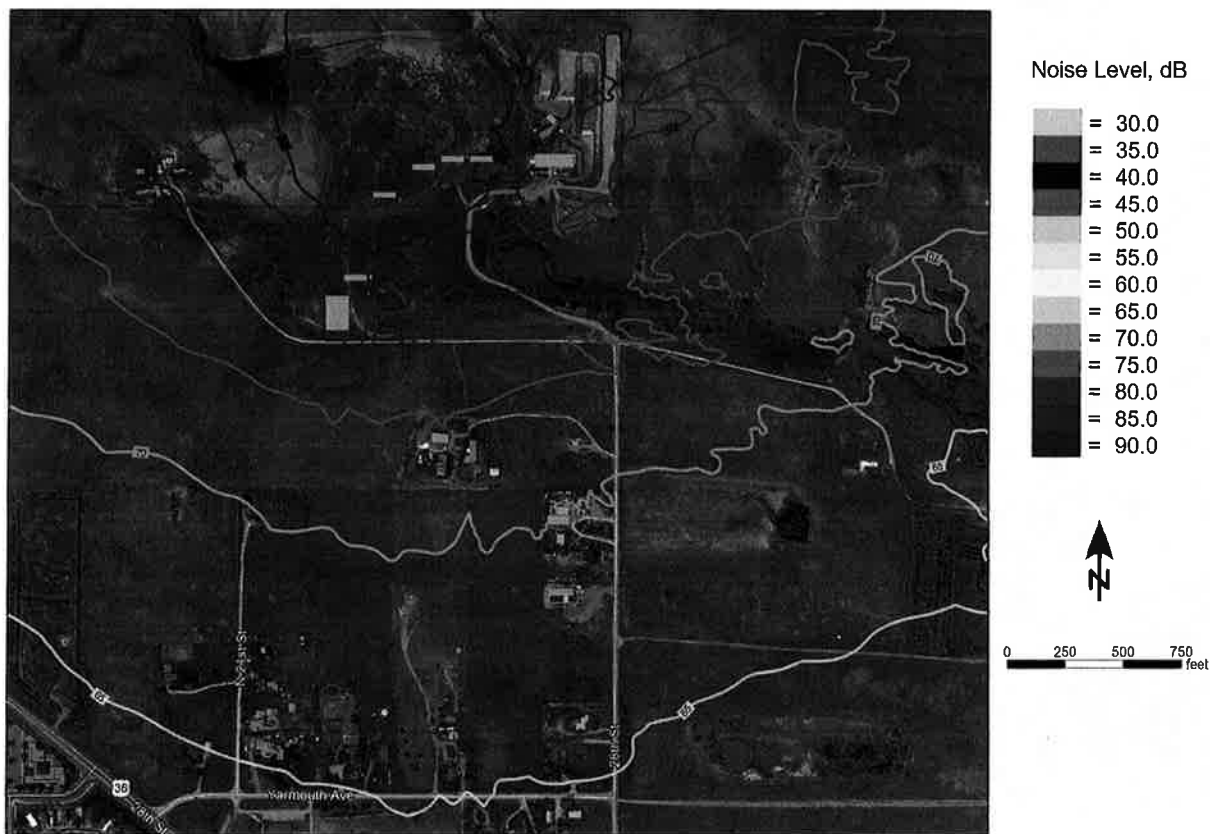
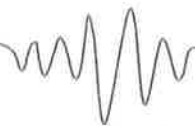


Figure C-8 Noise Contour Map of Proposed 200-yard Range (dB Maximum Impulse)

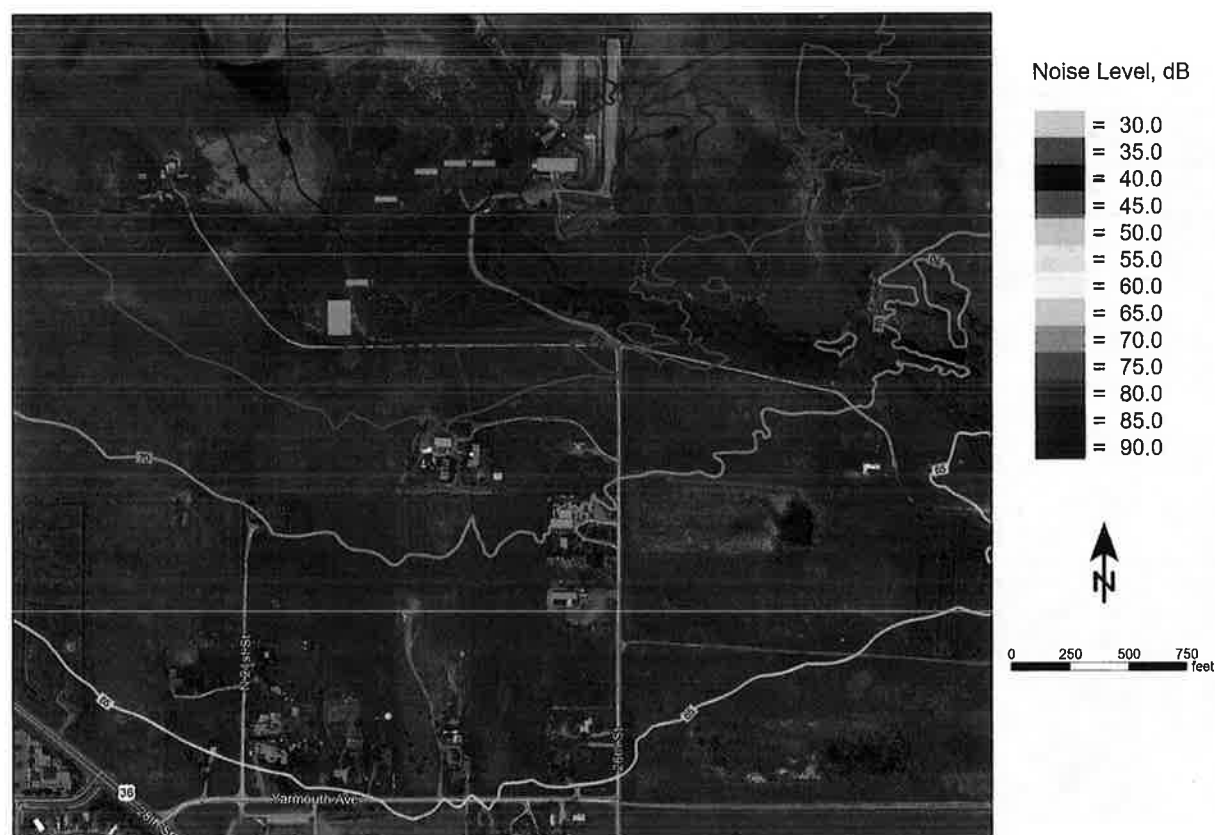
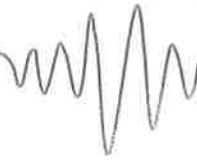
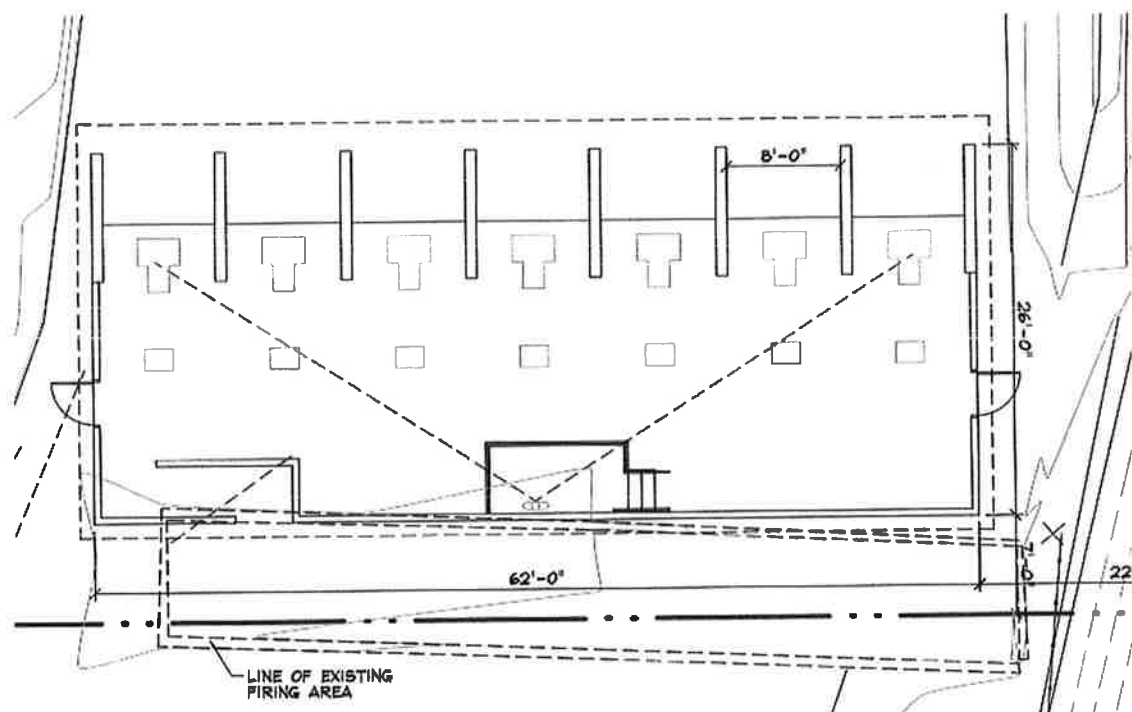


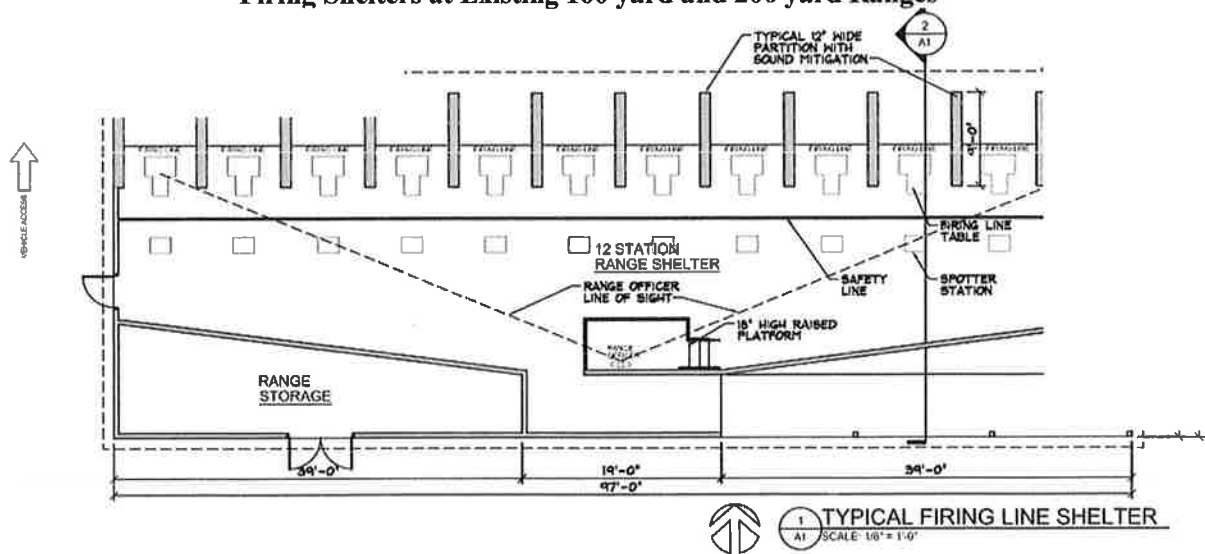
Figure C-9 Noise Contour Map of Proposed 300-yard Range (dB Maximum Impulse)



Appendix D - Firing Shelter Drawings and Specifications



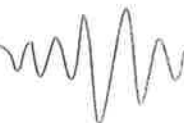
Firing Shelters at Existing 100 yard and 200 yard Ranges



Firing Shelters at Proposed Ranges

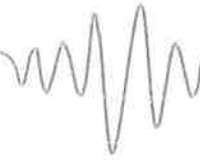
Behrens and Associates, Inc.

Environmental Noise Control



Transmission Loss of Firing Shelter Building Assemblies

Building Assembly	1/3 Octave Band Transmission Loss (dB)																				
	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k
Walls	14	15	16	17	18	20	21	23	22	28	31	35	38	39	32	32	35	38	42	44	47
Roof	28	28	26	28	30	31	32	32	27	23	38	44	48	50	49	51	55	56	60	64	68
Bay Partition	-	-	-	-	-	-	9	8	5	7	13	18	24	28	32	34	36	37	39	41	43
Door	-	-	-	16	20	27	30	32	34	34	33	31	31	34	37	39	39	40	39	38	39



Appendix E - Mitigated Noise Contour Maps

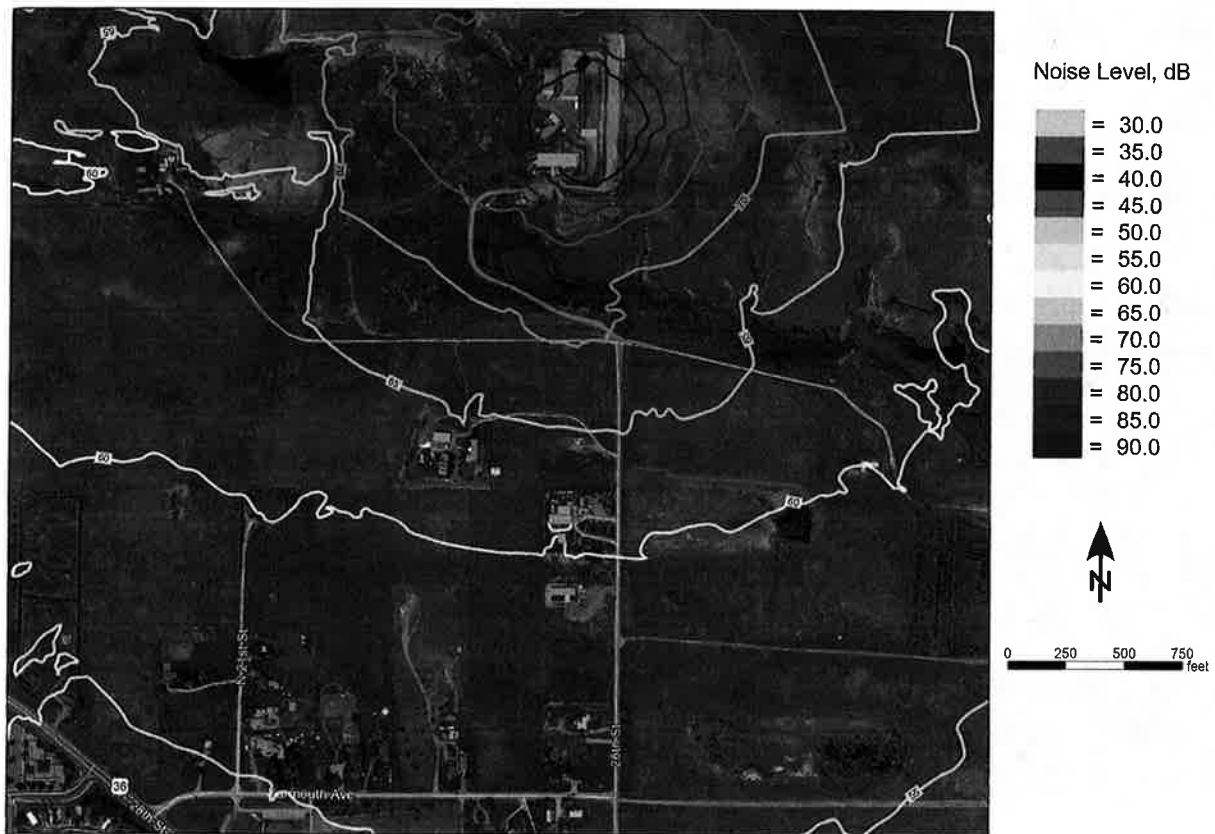


Figure E-10 Noise Contour Map of Existing Mitigated 100-yard Range (dB Maximum Impulse)

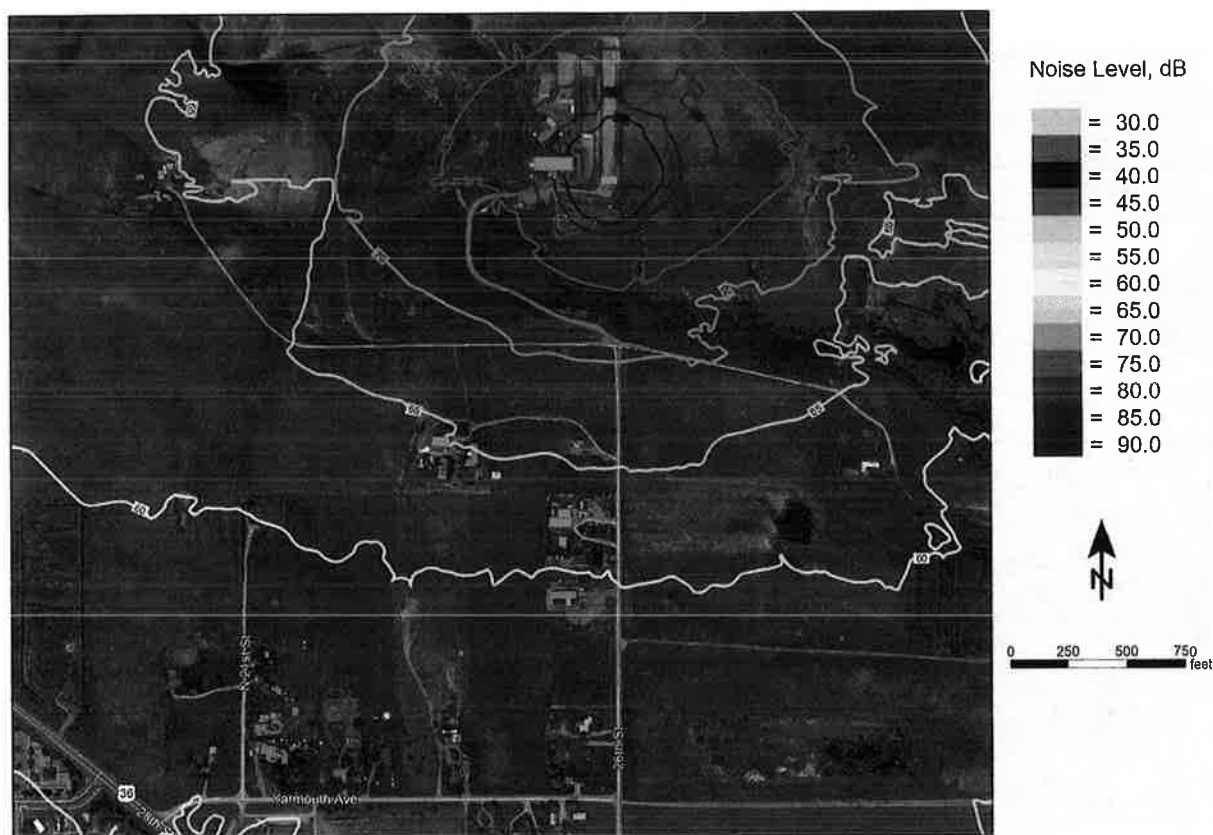


Figure E-11 Noise Contour Map of Existing Mitigated 200-yard Range (dB Maximum Impulse)

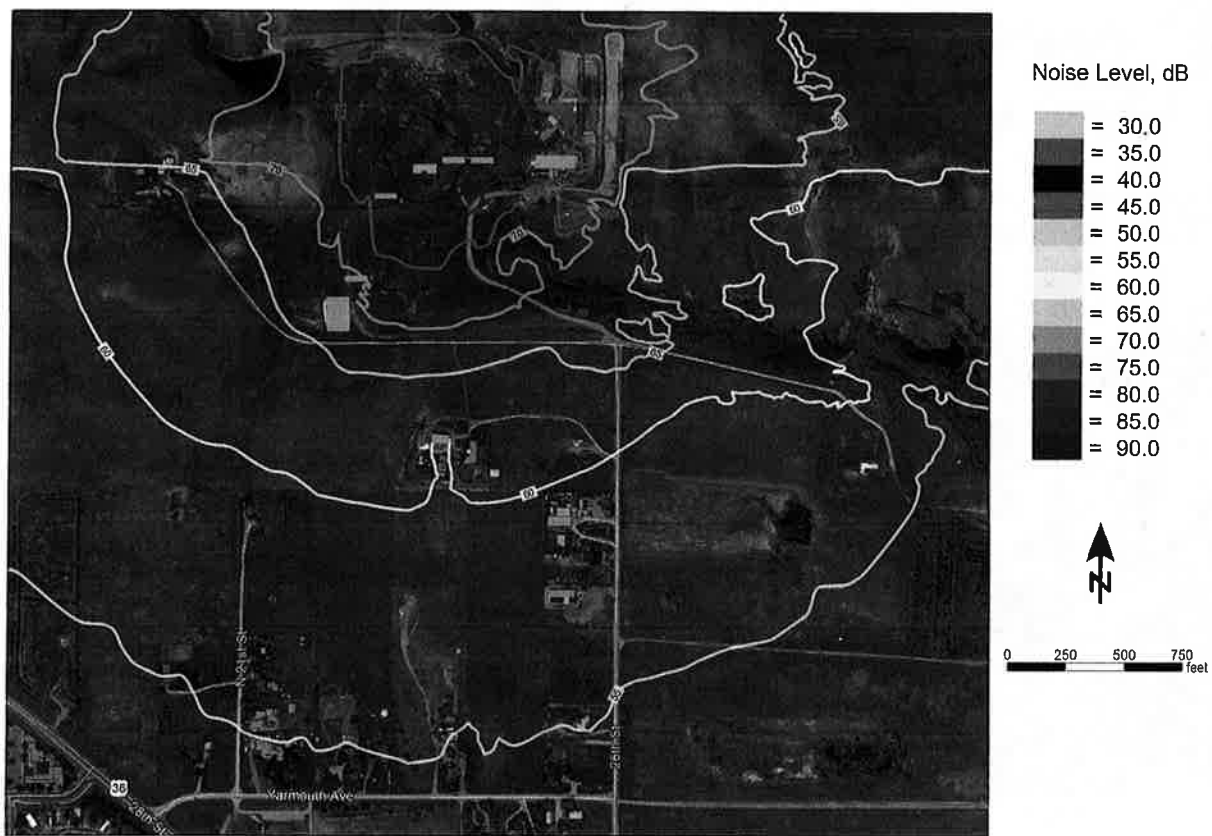


Figure E-12 Noise Contour Map of Proposed Mitigated 100-meter Range (dB Maximum Impulse)

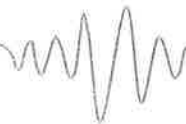


Figure E-13 Noise Contour Map of Proposed Mitigated 200-yard Range (dB Maximum Impulse)

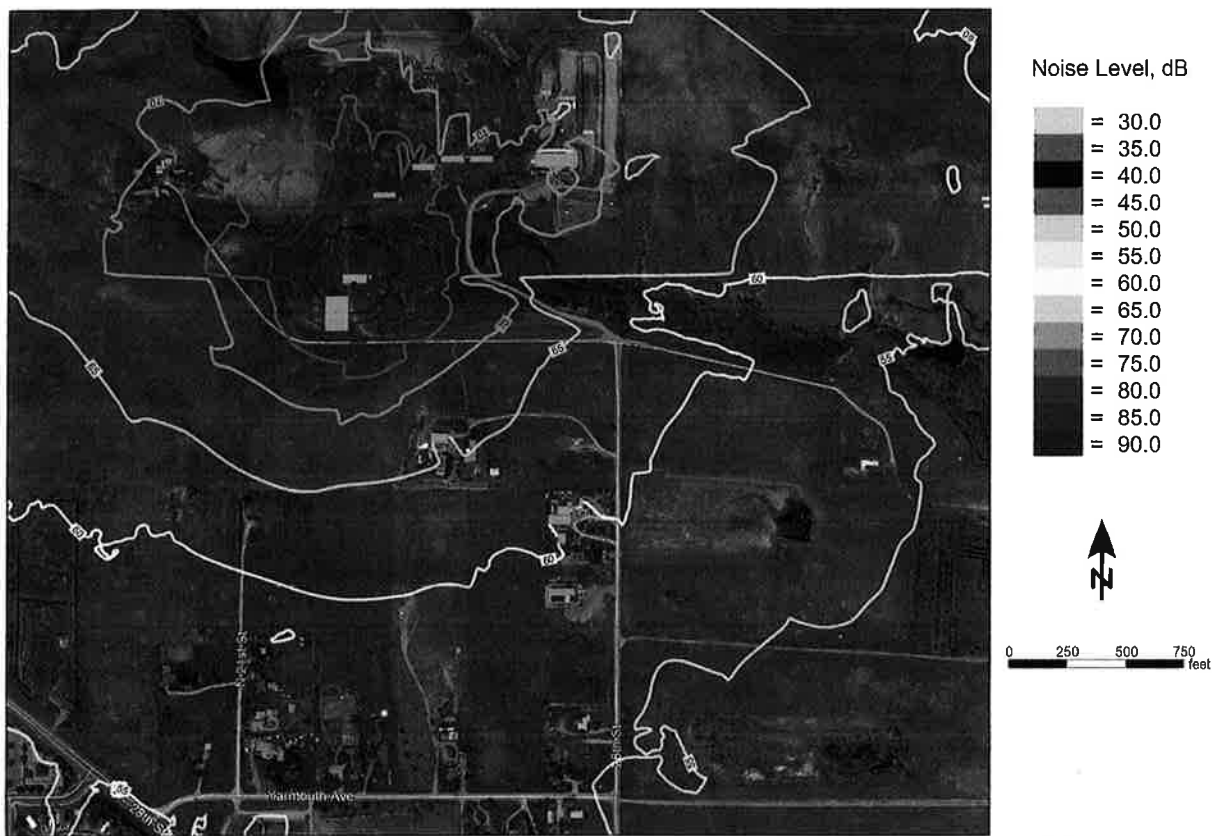


Figure E-14 Noise Contour Map of Proposed Mitigated 300-yard Range (dB Maximum Impulse)

THIS PROJECT ENCOMPASSES TWO LAND PARCELS OWNED BY THE BOULDER RIFLE CLUB:
PARCEL NO. 148307001001
ADDRESS: 4810 N. 26TH ST, UNINCORPORATED BOULDER COUNTY
6.12 ACS SE1/4 NE1/4 7-1N-70 AKA PT LOTS 118 & 120 WELLINGTON GARDENS

PARGEL NO. 146307001002
ADDRESS: 4923 N. 26TH ST, UNINCORPORATED BOULDER COUNTY
5 AC N 1/2 NE 1/4 SE 1/4 7-1N-70 LESS 15 AC TO CITY OF BOULDER & LOTS 103 104 & PT 119
120 PER DEED 890011 11/23/87 BCR CONSERVATION EASEMENT #1942070

A CONDITIONAL USE FOR THE EXPANSION OF THE EXISTING BOULDER RIFLE CLUB FROM THE EXISTING PRIVATE GUN CLUB TO INCLUDE NEW OUTDOOR AND INDOOR RANGES AVAILABLE TO THE PUBLIC.

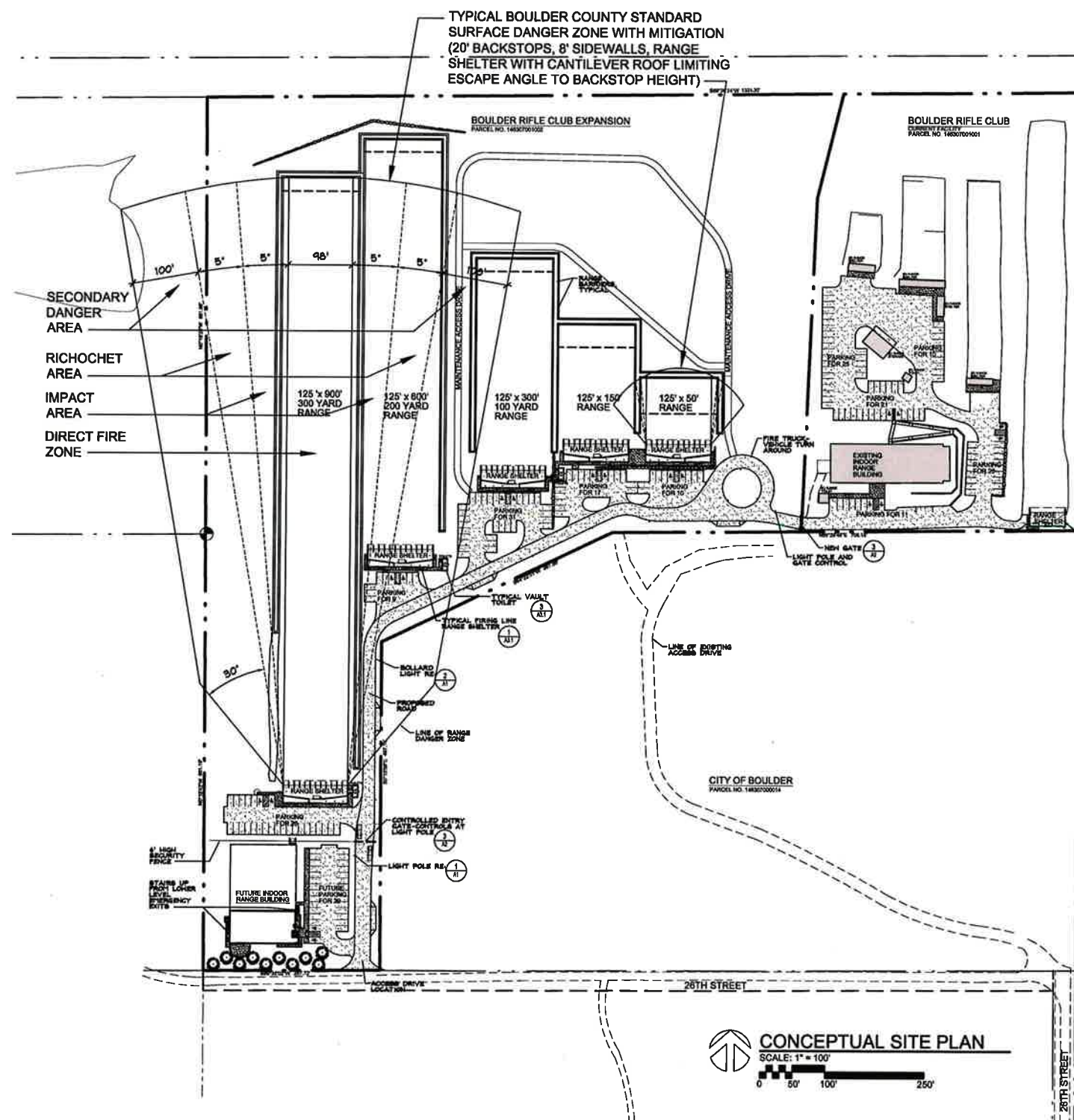
THE EXISTING PRIVATE CLUB WILL HAVE SITE AND PARKING IMPROVEMENTS. THE NEW PUBLIC USE FACILITIES INCLUDE FIVE NEW OUTDOOR RANGES WITH RANGE SHELTERS, NEW TOILET FACILITIES, NEW PARKING AND SITE LIGHTING, NEW PERIMETER FENCING, NEW SECURITY GATES, AND A NEW INDOOR RANGE FACILITY.

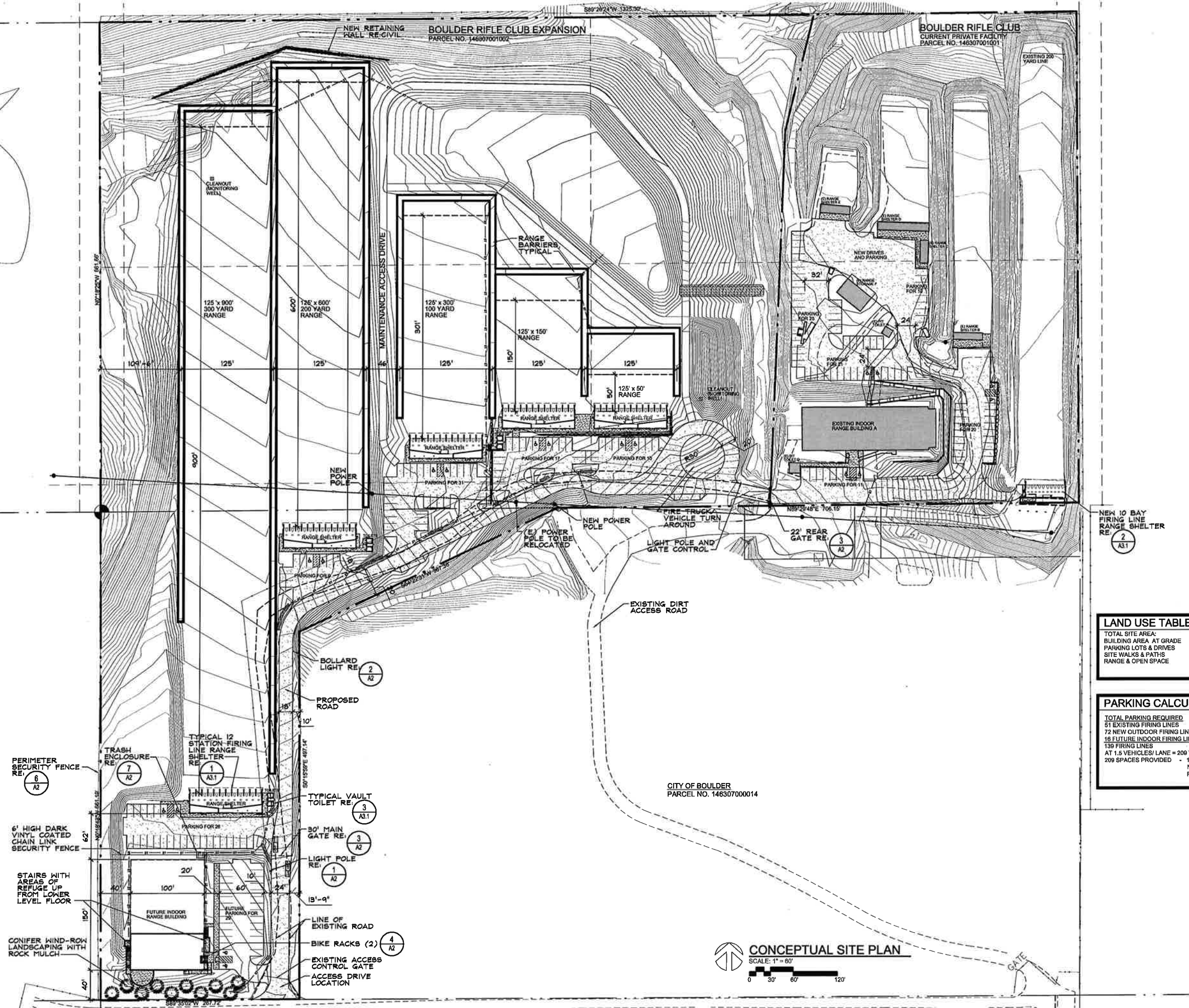
<p>PROJECT OWNER BOULDER RIFLE CLUB, INC. 4810 NORTH 28TH STREET BOULDER, CO</p>	<p>ARCHITECT THOMAS MOORE ARCHITECTS 253 THIRD AVENUE, SUITE 205 LONGMONT, CO 80501</p>
<p>PHONE: 303.442.8729 E-MAIL: info@boulderclub.com CONTACT: STEVE MARTIN</p>	<p>PHONE: 303.772.2533 E-MAIL: info@thomasmoores.com CONTACT: TOM MOORE, RA</p>
<p>PLANNER FRONT RANGE LAND SOLUTIONS 210 LINCOLN STREET LONGMONT, CO 80501</p>	<p>CIVIL ENGINEER ROCKY RIDGE CIVIL ENGINEERING 420 21 ST. Ave, Suite 101 Longmont, Colorado 80501</p>
<p>PHONE: 303.442.8729 E-MAIL: info@frontrange.com CONTACT: ROSI DENNETT, AICP</p>	<p>PHONE: 303.651.6026 E-MAIL: info@rockyridgecivil.com CONTACT: JOEL SEAMORE, P.E.</p>

G0	COVER SHEET
A1	SITE PLAN
A2	SITE DETAILS
A3.1	RANGE SHELTER PLANS & ELEVATIONS
	PIT TOILET PLAN AND ELEVATIONS
A3.2	FUTURE INDOOR RANGE PLANS
A3.3	FUTURE INDOOR RANGE ELEVATIONS
A3.4	EXISTING PRIVATE CLUB BUILDINGS AND SHELTERS

- | | |
|-------|--------------------------------------|
| C1.01 | VICINITY MAP AND SURFACE DANGER ZONE |
| C1.02 | UTILITY CONNECTION PLAN |
| C2.01 | EXISTING CONDITIONS/DEMOLITION PLAN |
| C2.02 | CIVIL SITE PLAN |
| C2.03 | OVERALL UTILITY PLAN |
| C2.04 | OVERALL GRADING PLAN |
| C2.05 | EROSION CONTROL PLAN |
| C3.01 | DETAILED GRADING PLAN 1 |
| C3.02 | DETAILED GRADING PLAN 2 |
| C3.03 | DETAILED GRADING PLAN 3 |
| C3.04 | DETAILED GRADING PLAN 4 |
| C3.05 | DETAILED GRADING PLAN 5 |
| C3.06 | DETAILED GRADING PLAN 6 |
| C3.07 | DETAILED GRADING PLAN 7 |
| C4.01 | ACCESS ROAD PLAN & PROFILE 1 |
| C4.02 | ACCESS ROAD PLAN & PROFILE 2 |
| C4.03 | ACCESS ROAD PLAN & PROFILE 3 |
| C4.04 | ACCESS ROAD PLAN & PROFILE 4 |
| C5.01 | ACCESS ROAD CROSS SECTIONS 1 |
| C5.02 | ACCESS ROAD CROSS SECTIONS 2 |

- | | |
|------|----------------------------------|
| PH-1 | SITE PHOTMETRIC PLAN & SCHEDULES |
| PH-2 | LUMINAIRE DATA |
| PH-3 | LUMINAIRE DATA |

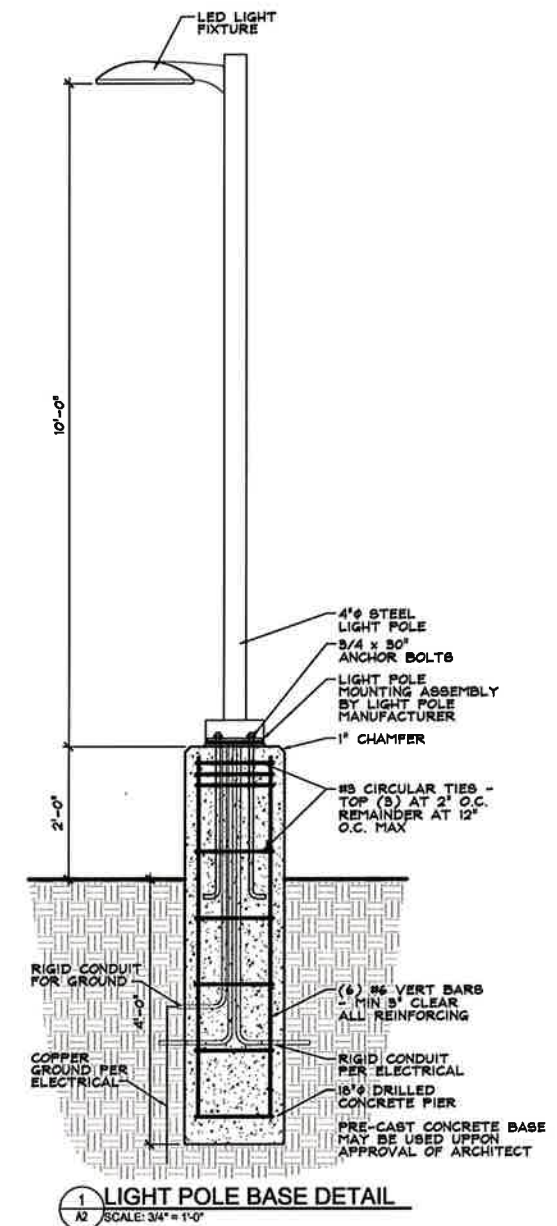
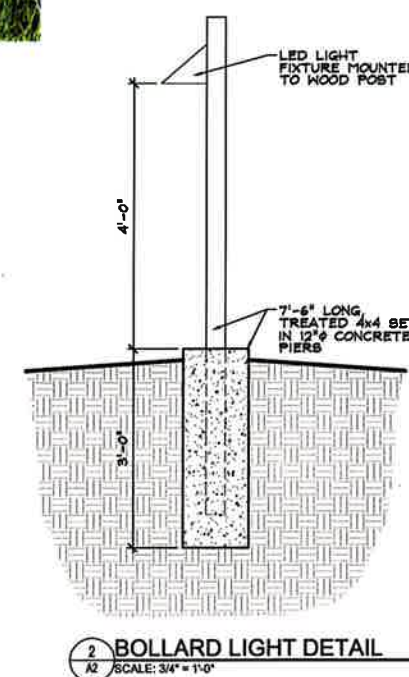
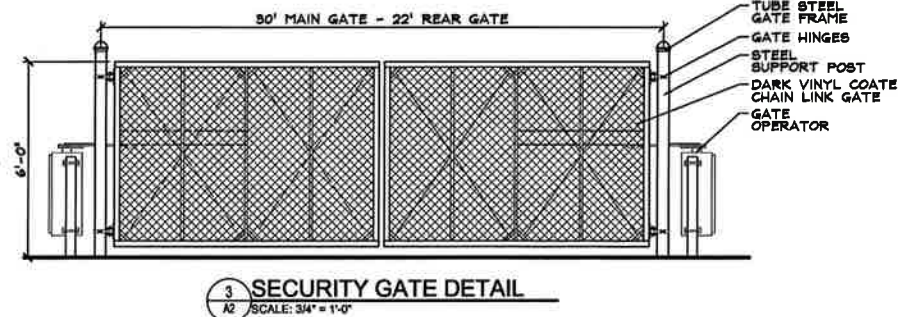
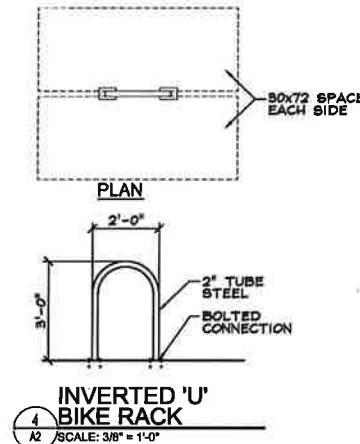
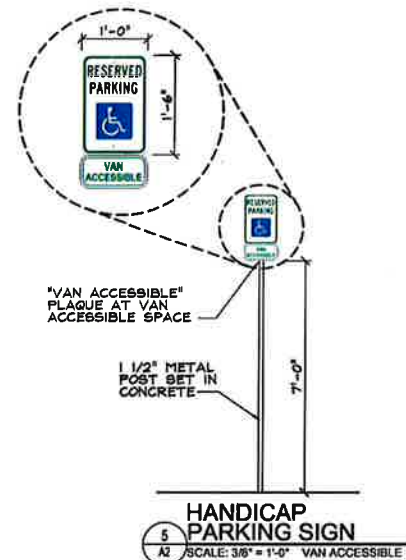
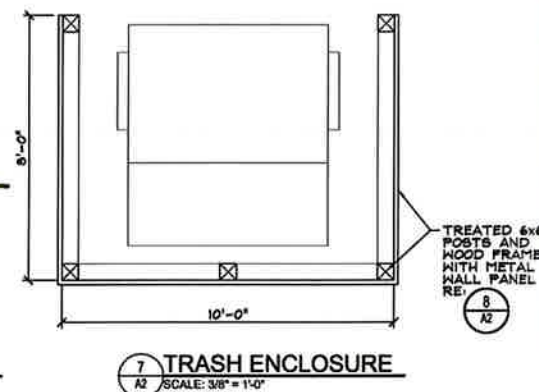
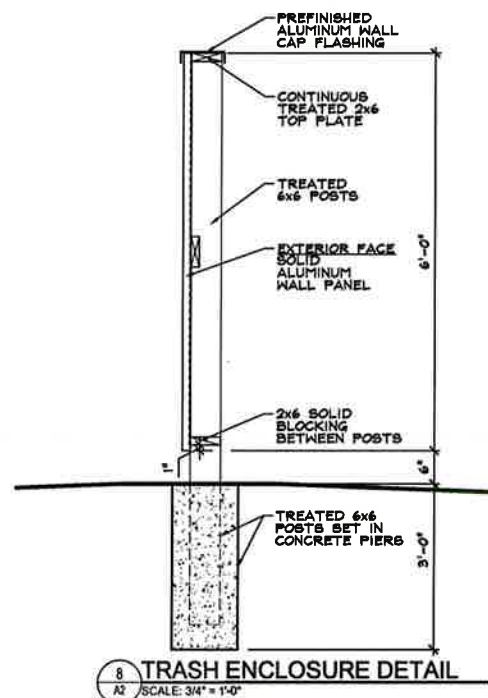




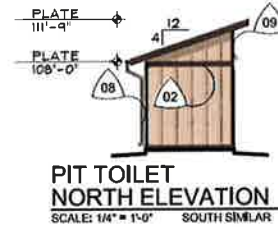
LAND USE TABLE	
TOTAL SITE AREA	1,063,503 GSF
BUILDING AREA AT GRADE	46,070 GSF
PARKING LOTS & DRIVES	142,430 GSF
SITE WALKS & PATHS	10,640 GSF
RANGE & OPEN SPACE	884,463 GSF

PARKING CALCULATIONS	
TOTAL PARKING REQUIRED	
51 EXISTING FIRING LINES	
72 NEW OUTDOOR FIRING LINES	
16 FUTURE INDOOR FIRING LINES	
138 FIRING LINES	
AT 1.6 VEHICLES/ LANE = 208 VEHICLES REQUIRED	
208 SPACES PROVIDED	18 SPACES ADA COMPLIANT
NOTE: ADA PARKING SIGNAGE PROVIDED- RE: DETAIL 6/A2	

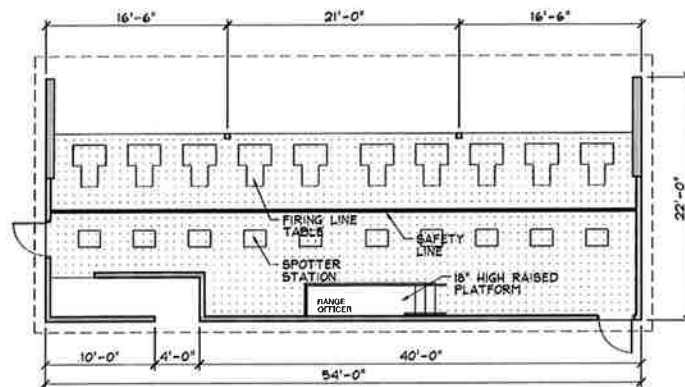
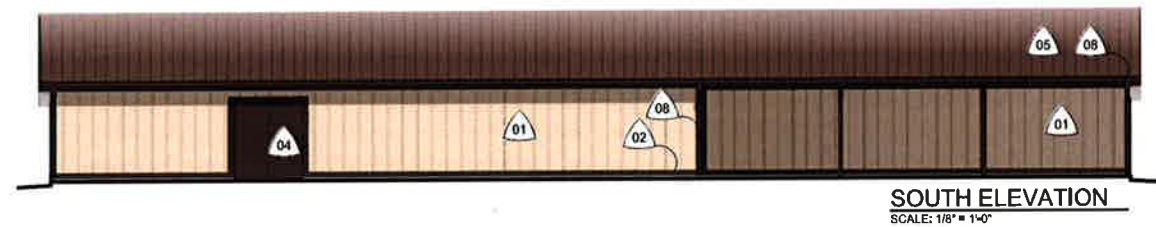
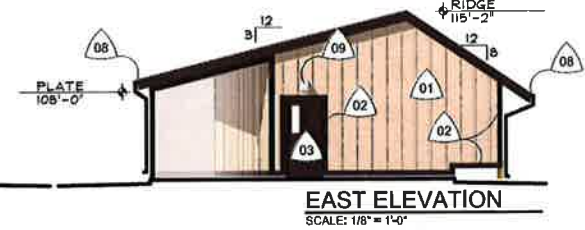
CONCEPTUAL SITE PLAN
SCALE: 1" = 80'
0 30' 60' 120'



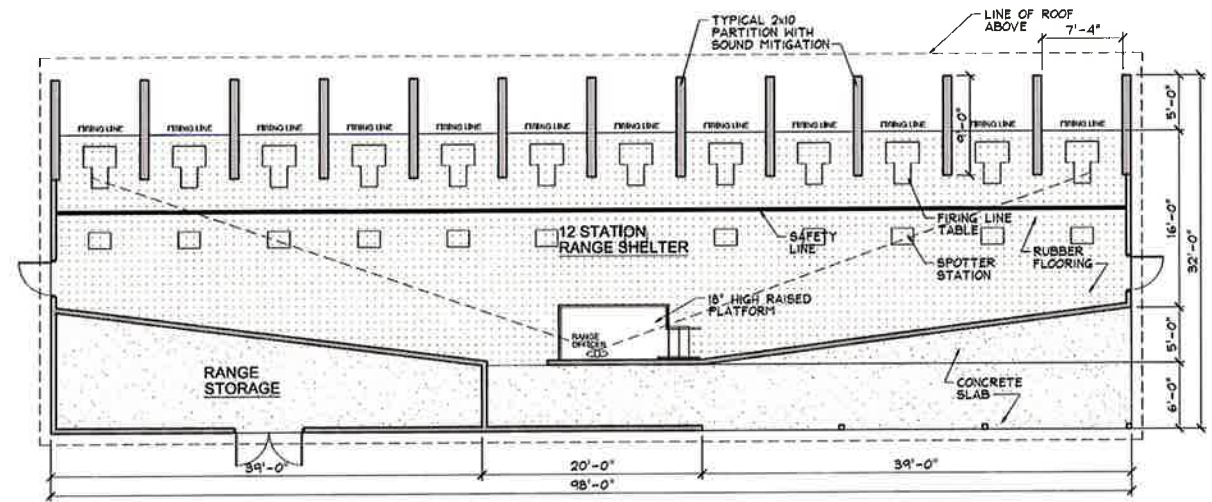
FINISH LEGEND	
01	FIBER-CEMENT BOARD AND BATTEN SIDING
02	CEMENTITIOUS TRIM
03	STEEL DOOR WITH VISION LITE
04	STEEL DOOR
05	STANDING SEAM METAL ROOFING
06	FIRING LINE STATION WITH TABLE AND CHAIR
07	SOUND MITIGATION PARTITION WALL
08	PRE-FINISHED METAL GUTTER AND DOWNSPOUTS
09	WALL MOUNTED, FULL CUT-OFF LED LIGHT FIXTURE



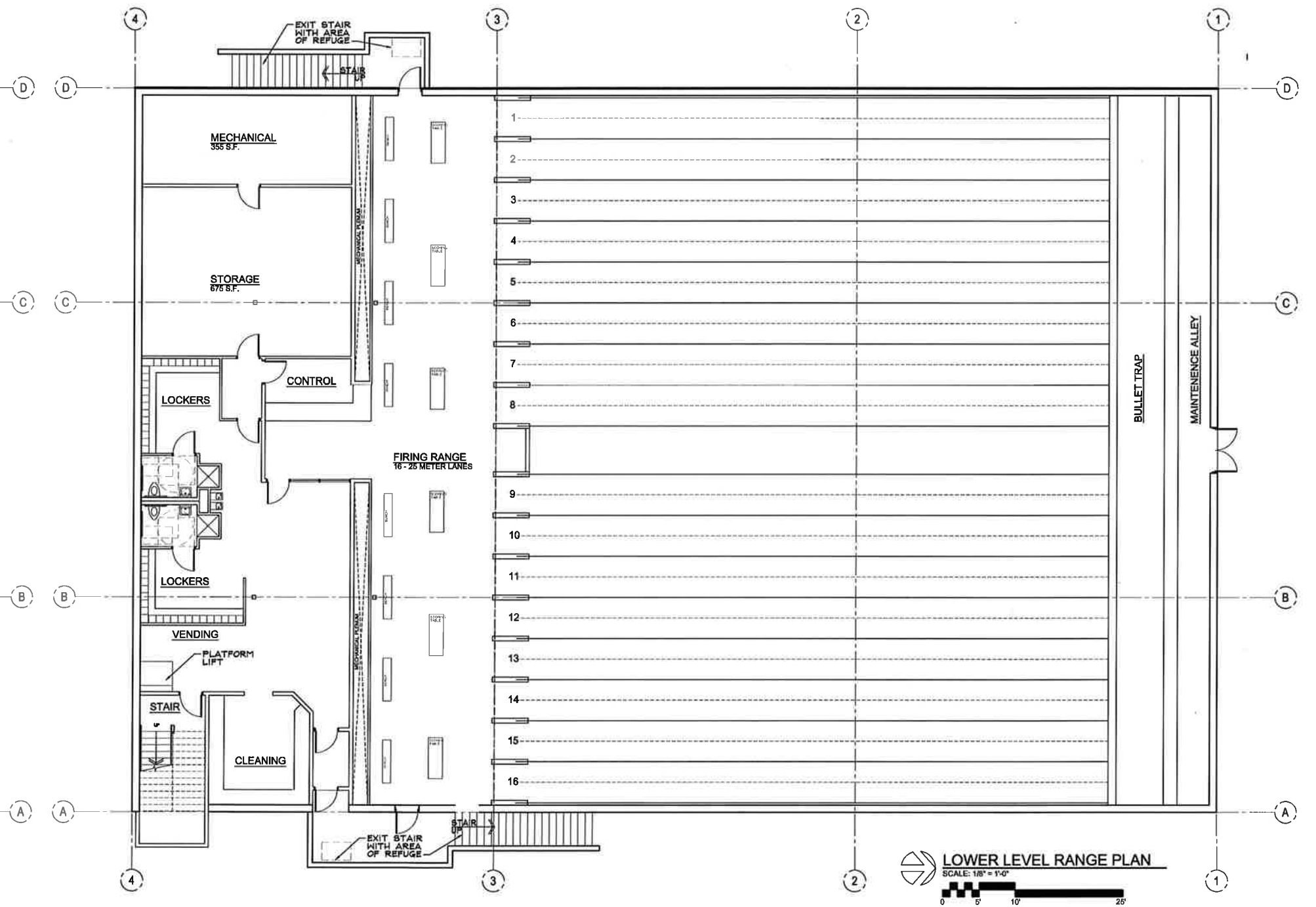
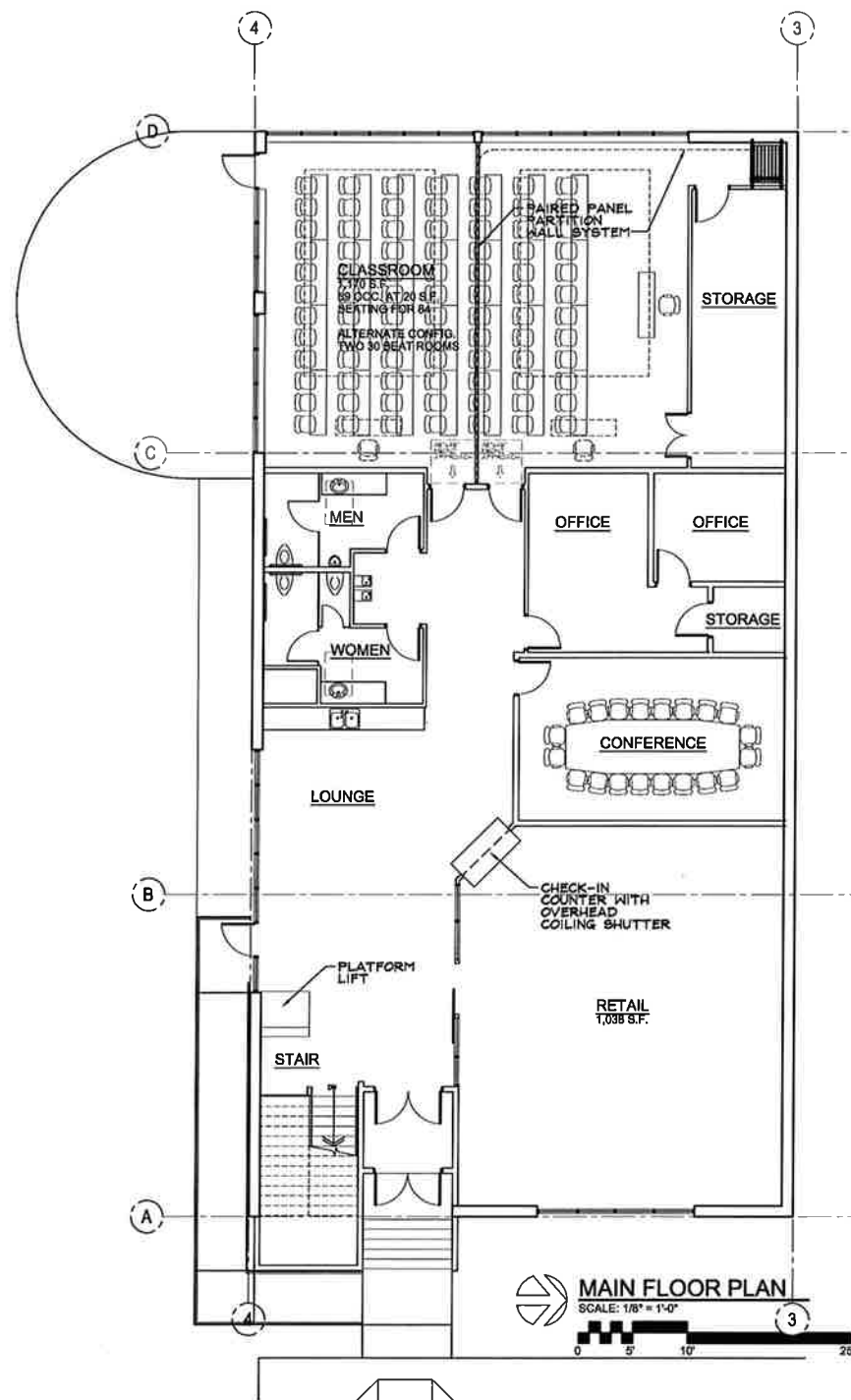
PIT TOILET
EAST ELEVATION
SCALE: 1/4" = 1'-0"



NEW 10 STATION
FIRING LINE SHELTER
AT EXISTING 200 YARD RANGE
SCALE: 1/8" = 1'-0"



TYPICAL 12 STATION
FIRING LINE SHELTER
SCALE: 1/8" = 1'-0"

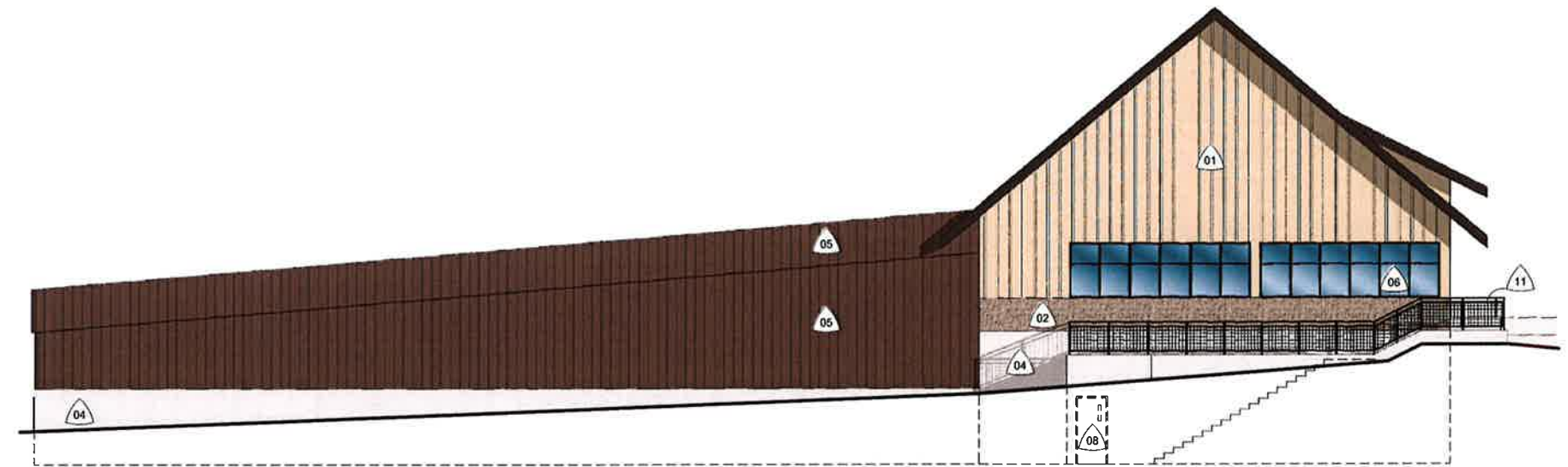




NORTH ELEVATION
SCALE: 1/8" = 1'-0"



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



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



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

FINISH LEGEND	
01	FIBER-CEMENT BOARD AND BATTEN SIDING
02	CONCRETE BLOCK WAINSCOT
03	CORETEN METAL WALL PANELS
04	CONCRETE WALL
05	VERTICAL STANDING SEAM METAL ROOFING
06	INSULATED ALUMINUM STOREFRONT WINDOW AND DOORS
07	INSULATED ALUMINUM STOREFRONT ENTRY DOOR
08	STEEL DOOR WITH VISION LITE
09	STEEL DOOR
10	STANDING SEAM METAL ROOFING
11	METAL GUARDRAIL

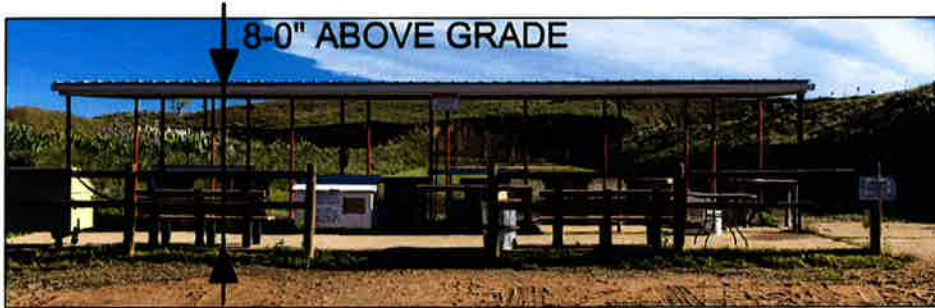


BUILDING A - EXISTING INDOOR RANGE
SCALE: NONE



BUILDING A - EXISTING INDOOR RANGE
SCALE: NONE

EXISTING RANGE FACILITIES



BUILDING B - EXISTING RANGE SHELTER
SCALE: NONE



BUILDING C - EXISTING RANGE SHELTER
SCALE: NONE



TYPICAL EXISTING RANGE SHELTER - END VIEW
SCALE: NONE



BUILDING D - EXISTING RANGE SHELTER
SCALE: NONE



BUILDING E - EXISTING RANGE SHELTER
SCALE: NONE



BUILDING F - EXISTING RANGE STORAGE
SCALE: NONE



BUILDING F - EXISTING RANGE STORAGE
SCALE: NONE



BUILDING G - EXISTING PIT TOILET
SCALE: NONE



BUILDING H - EXISTING PIT TOILET
SCALE: NONE

[illegible]

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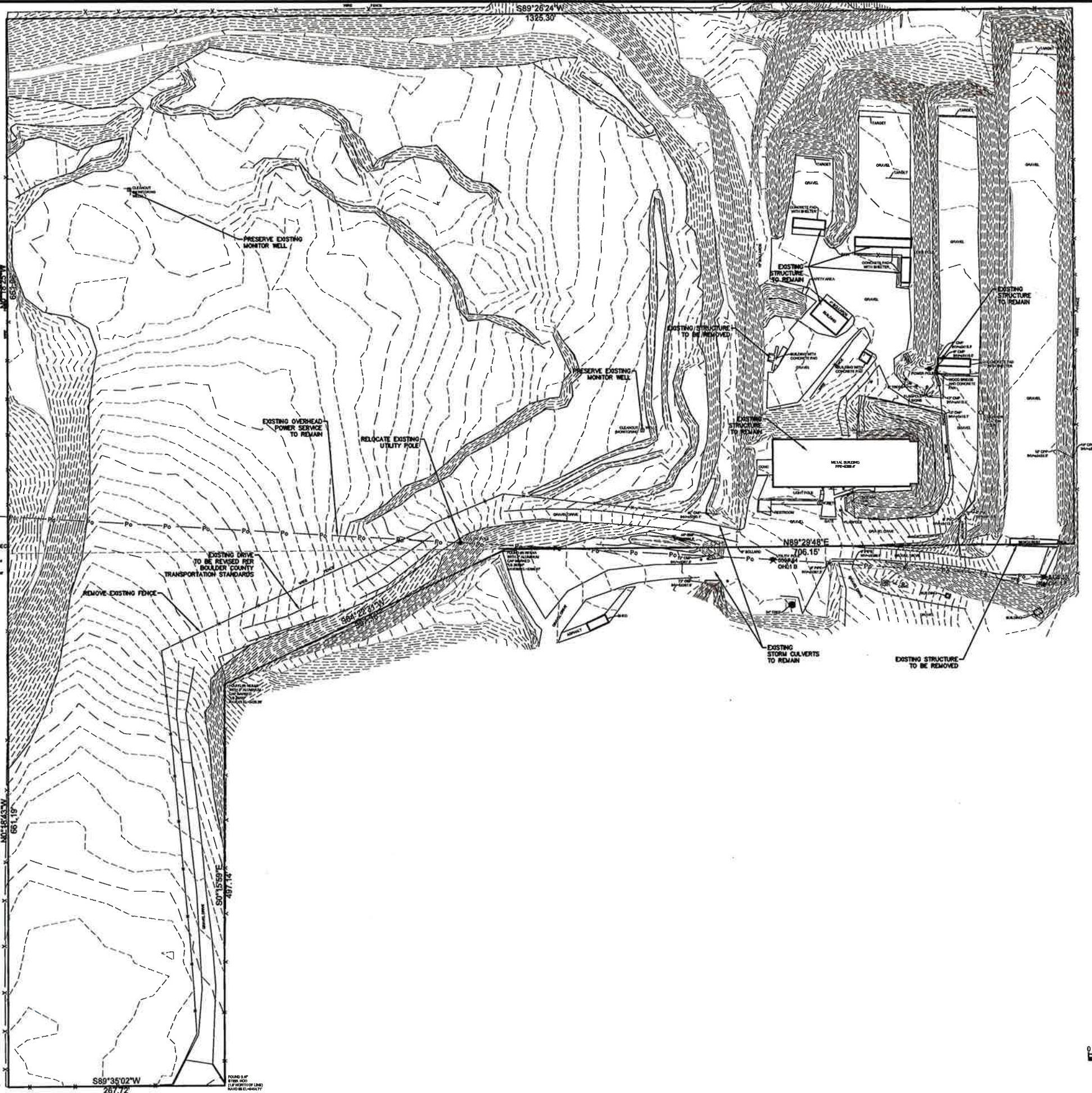
BOULDER RIFLE RANGE				Rocky Ridge Civil Engineering	
UTILITY CONNECTION PLAN				420 21st Ave, Suite 101 Longmont, CO 80501 http://rockyridgecivil.com	
SHEET NO				NO.	
C1.02				DATE	
				DESCRIPTION	
				BY	


NOT TO SCALE

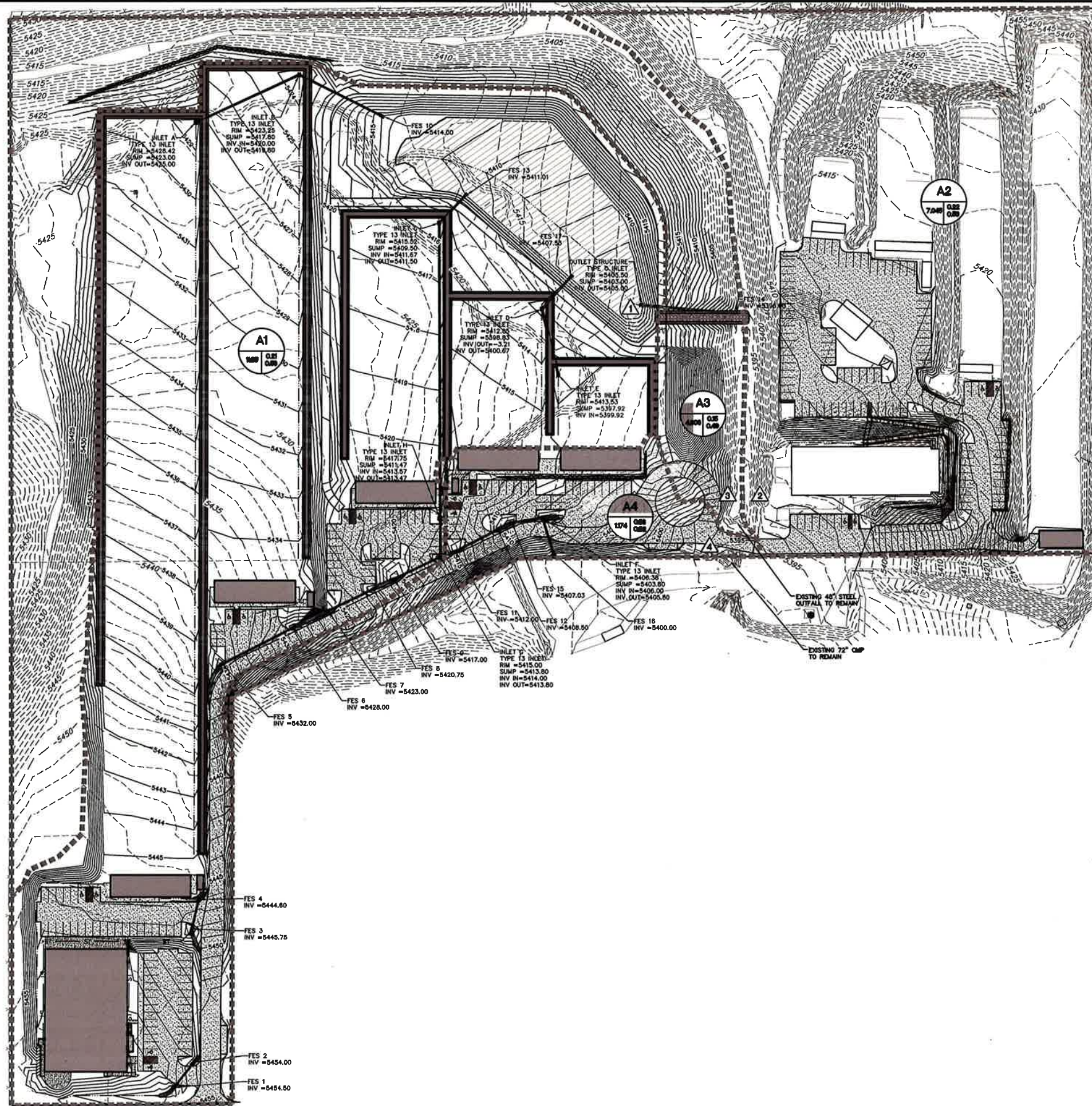
FOUND IN NEAR
W/1/2 ALABAMA
CAP MARKED
N/1/2 SEC. 7
RANGE 61-46-37

UTILITY RDS
C-CENT, SEC
7
FOUND IN NEAR
W/1/2 ALABAMA
CAP MARKED
N/1/2 SEC. 7
RANGE 61-46-37

SE COR, N1/2
N/1/2 ALABAMA
SEC. 7
RANGE 61-46-37



BOULDER RIFLE RANGE		CAD NO 7781BASE		JOB NO 778-1		 Rocky Ridge Civil Engineering 420 21st Ave Suite 101 Longmont, CO 80501 303.761.4620 http://rockyridge44.com																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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POND SUMMARY TABLE

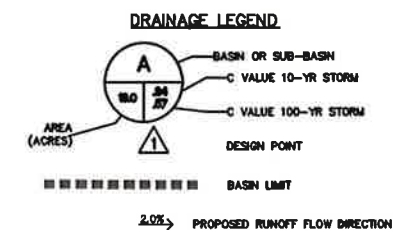
STAGE	W.B.E. (FBI)	VOLUME REQUIRED (FT ³)	VOLUME PROVIDED (FT ³)	ALLOWABLE RELEASE (CFS)	PROPOSED RELEASE (CFS)
WQV	6,407.76	6,342	7,379	NA	NA
10-YEAR	5,410.25	47,202	50,429	0.96	0.94
100-YEAR	6,412.00	107,107	109,899	8.41	8.41

DEVELOPED BASIN FLOWS

BASIN	AREA (Acres)	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)
OVERALL	24.87	10.3	47.6
A1	11.85	4.27	20.3
A2	7.045	3.31	15.2
A3	4.803	1.16	7.32
A4	1.174	1.51	4.76

HISTORIC BASIN FLOWS

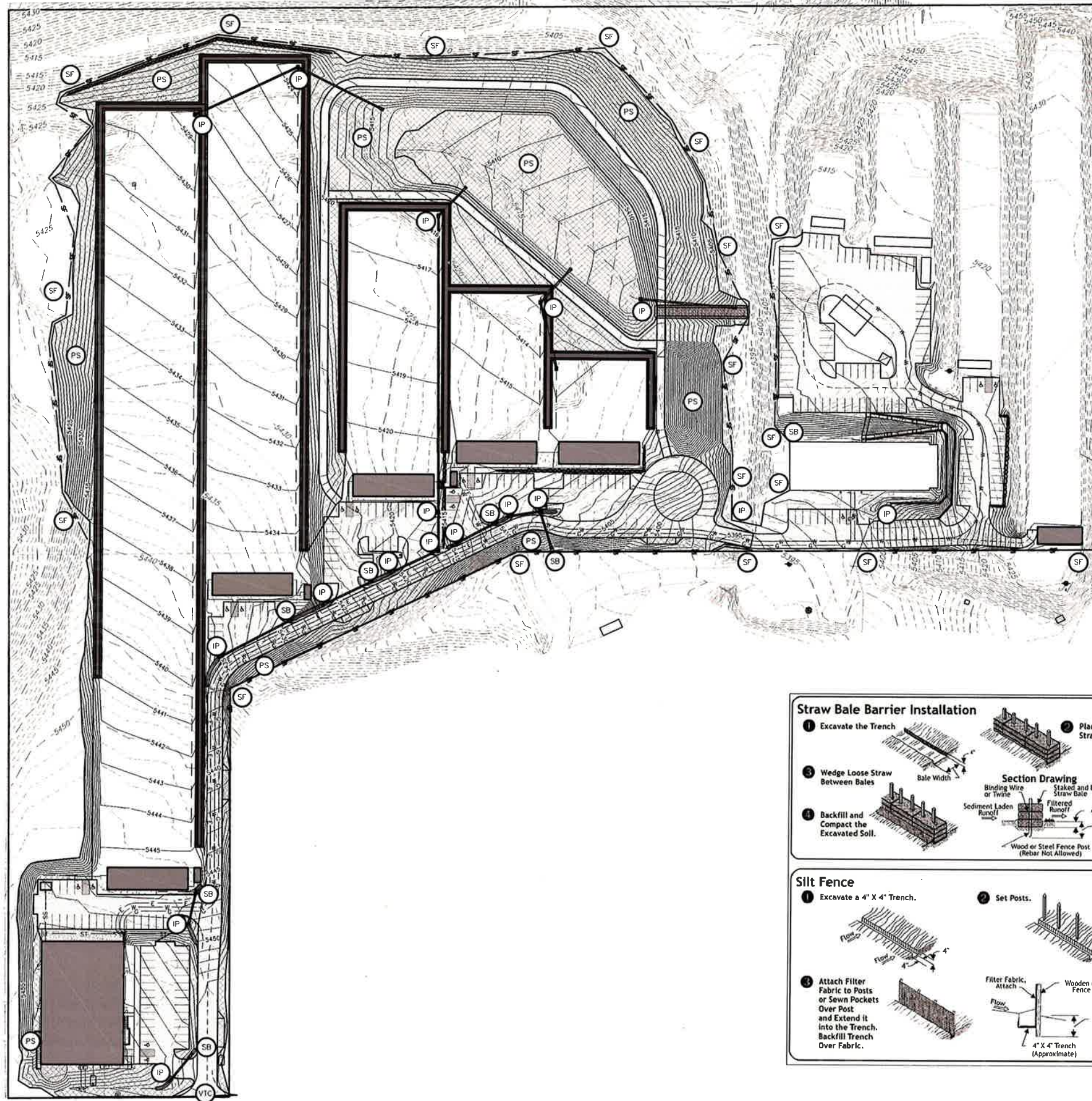
BASIN	AREA (Acres)	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)
OVERALL	24.87	7.44	40.5
H1	17.83	4.52	27.7
H2	7.045	2.92	12.8



Rocky Ridge
Civil Engineering

422 21st Ave. Suite 101
Longmont, CO 80501
303.621.8050
info@rockyridgecivil.com

BOULDER RIFLE RANGE	DATE	05/24/2019	JOB NO	778-1
OVERALL GRADING PLAN	DATE	05/24/2019	CAD NO	778IBASE
SHEET NO	C2.04			



EROSION CONTROL LEGEND

- SF SILT FENCE
- SB STRAW BALES
- VTC VEHICLE TRACKING CONTROL
- IP INLET PROTECTION
- PS PERMANENT SEEDING

BEST MANAGEMENT PRACTICES GENERAL NOTES:

- CONTRACTOR/PERMITEE SHALL PERIODICALLY INSPECT ALL INSTALLED BMPS, PROVIDE MAINTENANCE, AND MAKE REPAIRS AS NECESSARY TO PREVENT THEIR FAILURE.
- SILT FENCE OR AN EQUIVALENT SHALL BE PLACED AS PERIMETER CONTROL ON ALL CONSTRUCTION ACTIVITIES THAT OCCUR ON LAND, UNLESS OTHERWISE SPECIFIED IN THE CONTRACT DOCUMENTS, OR OTHERWISE REQUESTED, REMOVE PERIMETER CONTROLS WITHIN 30 DAYS AFTER THE DATE OF WARRANTY PERFORMANCE OF THE WORK OR IN ACCORDANCE WITH BMPS.
- VEHICLE TRACKING CONTROLS SHALL BE USED AT ALL VEHICLE AND EQUIPMENT ACCESS POINTS TO THE SITE TO PREVENT SEDIMENT EXITING THE PROJECT SITE ONTO PAVED PUBLIC ROADS. ACCESS SHALL BE PROVIDED ONLY AT LOCATIONS APPROVED BY THE ENGINEER. VEHICLE TRACKING CONTROL LOCATIONS SHALL BE RECORDED ON THE SWAMP SITE MAP.
- ALL INLETS AND CULVERTS SHALL BE PROTECTED DURING ONSITE CONSTRUCTION ACTIVITIES. INLET PROTECTION LOCATIONS SHALL BE RECORDED ON THE SWAMP SITE MAP.
- CONCRETE WASTED IN DESIGNATED DEWATERING AREAS SHALL BE COLLECTED, REMOVED FROM THE PROJECT SITE, AND DISPOSED OF PROPERLY. WASTED CONCRETE ALSO INCLUDES EXCESS CONCRETE REMOVED FROM FORMS, SPILLS, SLOP, AND ALL OTHER UNUSED CONCRETE THAT ENDS UP ON THE GROUND.
- THE CONTRACTOR/PERMITEE MUST MAINTAIN A SPILL KIT ON SITE WHEN WORKING AROUND SURFACE WATERS. IF POLLUTANTS ARE SPILLED INTO ANY SURFACE WATERS DURING THE COURSE OF CONSTRUCTION ACTIVITIES, THE CONTRACTOR/PERMITEE MUST NOTIFY THE OWNER'S REPRESENTATIVE OR ENGINEER IMMEDIATELY.
- ALL EXISTING MATURE TREES WITHIN THE DESIGNATED PROJECT AREA ARE TO BE FENCE PROTECTED IN PLACE AT DRIPLINE UNLESS OTHERWISE DIRECTED BY THE ENGINEER. PRIOR TO THE INITIATION OF WORK, THE ENGINEER SHALL MARK ANY TREES AND/OR LARGE SHRUBS TO BE REMOVED AS PART OF CONSTRUCTION ACTIVITIES. AREAS OF TREE REMOVAL SHALL BE DETERMINED AND MARKED IN COLLABORATION BETWEEN THE CONTRACTOR/PERMITEE AND THE ENGINEER.
- ALL EXCAVATION ACTIVITIES OCCURRING WITHIN 10 FEET OF THE DRIPLINE SHALL BE PERFORMED BY HAND AND IF NECESSARY ROOTS SHALL BE CLEANLY CUT NOT TORN OR RIPPED. IF EXPOSED, TREE ROOTS SHALL BE BACKFILLED AND WATERED ON THE SAME DAY OF CUTTING AND APPROVED ROOT STIMULATOR SHALL BE APPLIED. SOILS SHALL NOT BE COMPACTED WITHIN THE DRIPLINE OF MATURE TREES UNLESS OTHERWISE APPROVED BY THE ENGINEER.

PERMANENT SEEDING MIX

Plains Seed Mix				
Below 5,500 Feet Elevation				
Common Name	Species Name	Variety	% of Mix	#PLS/ Acre
Side Oats Grass	Bouteloua curtipendula	Vaughes	15%	2.74
Blue Grama	Bouteloua gracilis	Native, Alma or Hachina	20%	0.84
Bullgrass	Buchloe dactyloides	Native	15%	9.33
Western Wheatgrass	Panicum virgatum	Ames	12.5%	3.96
Western Wheatgrass	Panicum virgatum	Native	12.5%	3.96
Little Bluestem	Schizachyrium scoparium	Climax or Pasture	13%	1.74
Green Needlegrass	Sporobolus vaginatus	Lodron or Native	12%	2.31
Totals:			100%	24.88

Straw Bale Barrier Installation

- Excavate the Trench
 - Place and Stake Straw Bales.
 - Wedge Loose Straw Between Bales
 - Backfill and Compact the Excavated Soil.
- Section Drawing**
Staked and Entrenched Straw Bale
Binding Wire or Twine
Sediment Laden Runoff
Filtered Runoff
4" Minimum
12" Minimum
Wood or Steel Fence Post (Rebar Not Allowed)

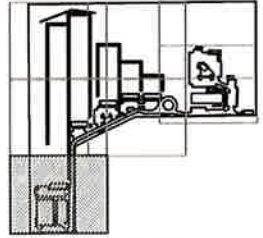
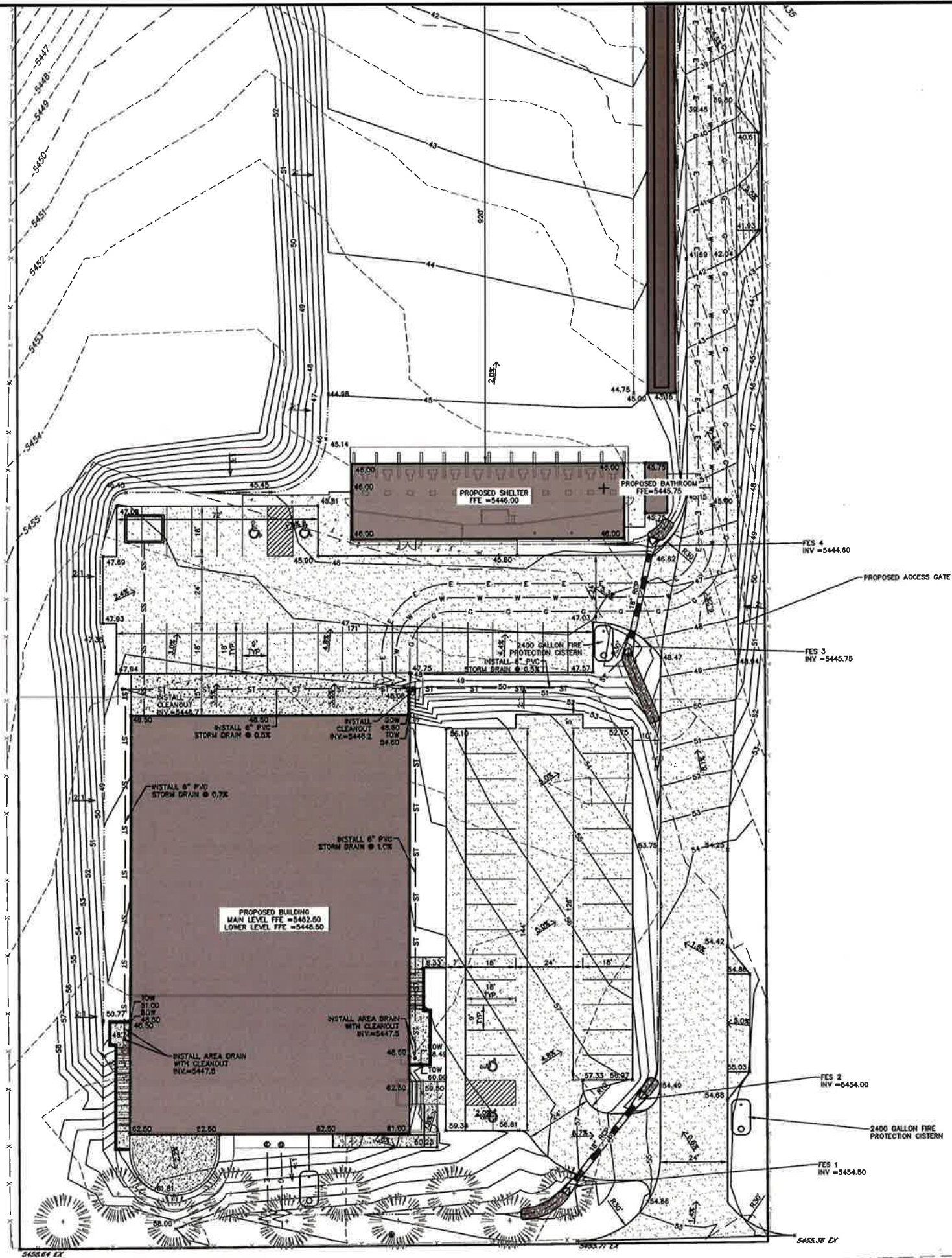
Silt Fence

- Excavate a 4" X 4" Trench.
 - Set Posts.
 - Attach Filter Fabric to Posts or Sewn Pockets Over Post and Extend it into the Trench. Backfill Trench Over Fabric.
- Section Drawing**
Filter Fabric, Attach
Wooden or Steel Fence Posts
Flow
4" X 4" Trench (Approximate)
12" Minimum



Rocky Ridge Civil Engineering	420 21st Ave. Suite 101 Longmont, CO 80501 303.651.6628 http://rockyridgecivil.com	NO.	DATE	DESCRIPTION	BY
BOULDER RIFLE RANGE	778-1	7781BASE	05/24/2019	EROSION CONTROL PLAN	
SHEET NO	C2.05				

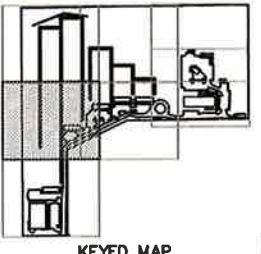
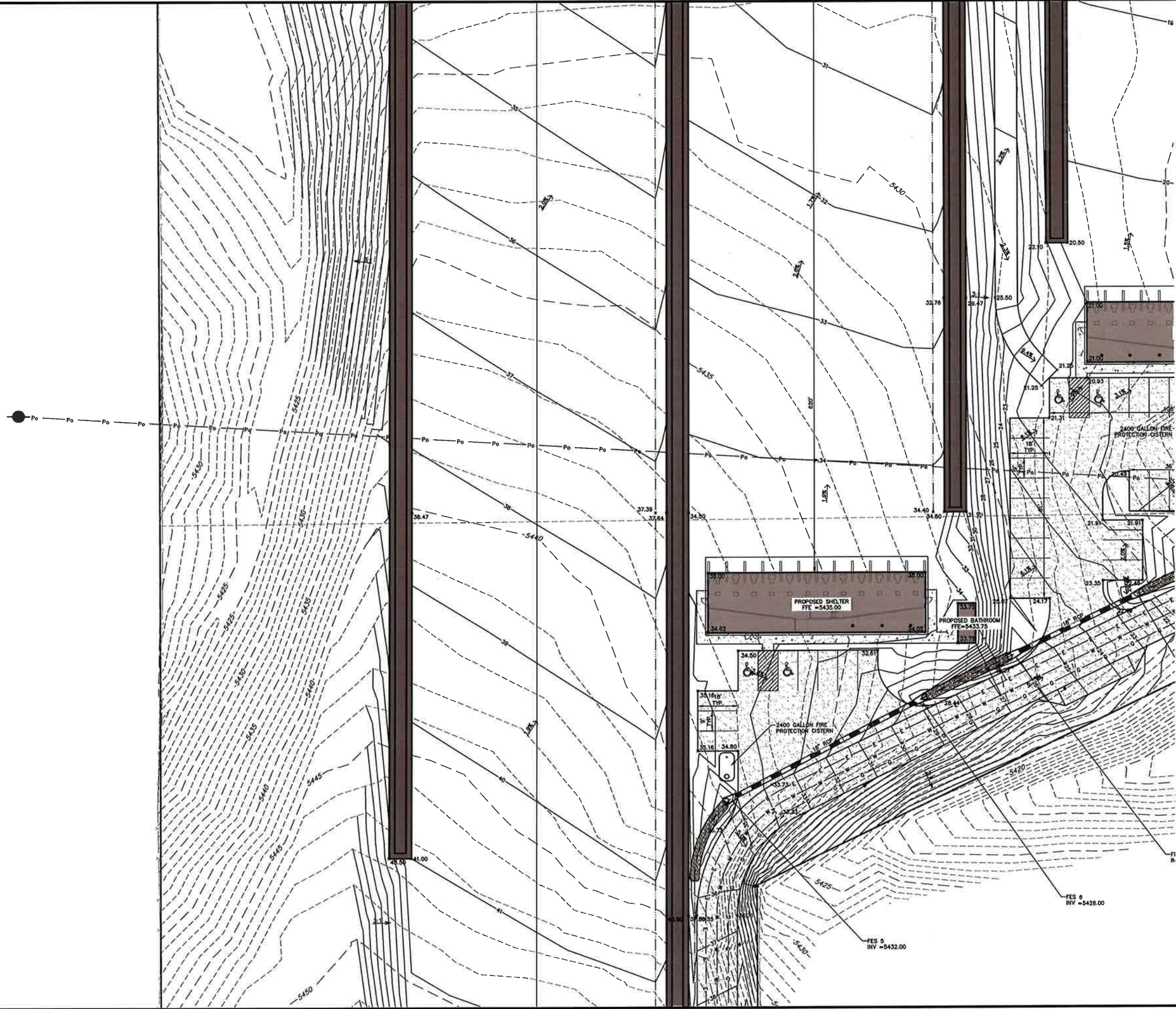
NOT TO SCALE. SEE PLAN. ALL DIMENSIONS ARE IN FEET AND INCHES. ALL ELEVATIONS ARE IN FEET ABOVE SEA LEVEL. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE LATEST EDITIONS OF THE AIAA AND AIAA.




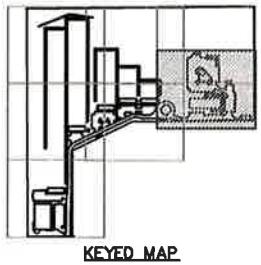
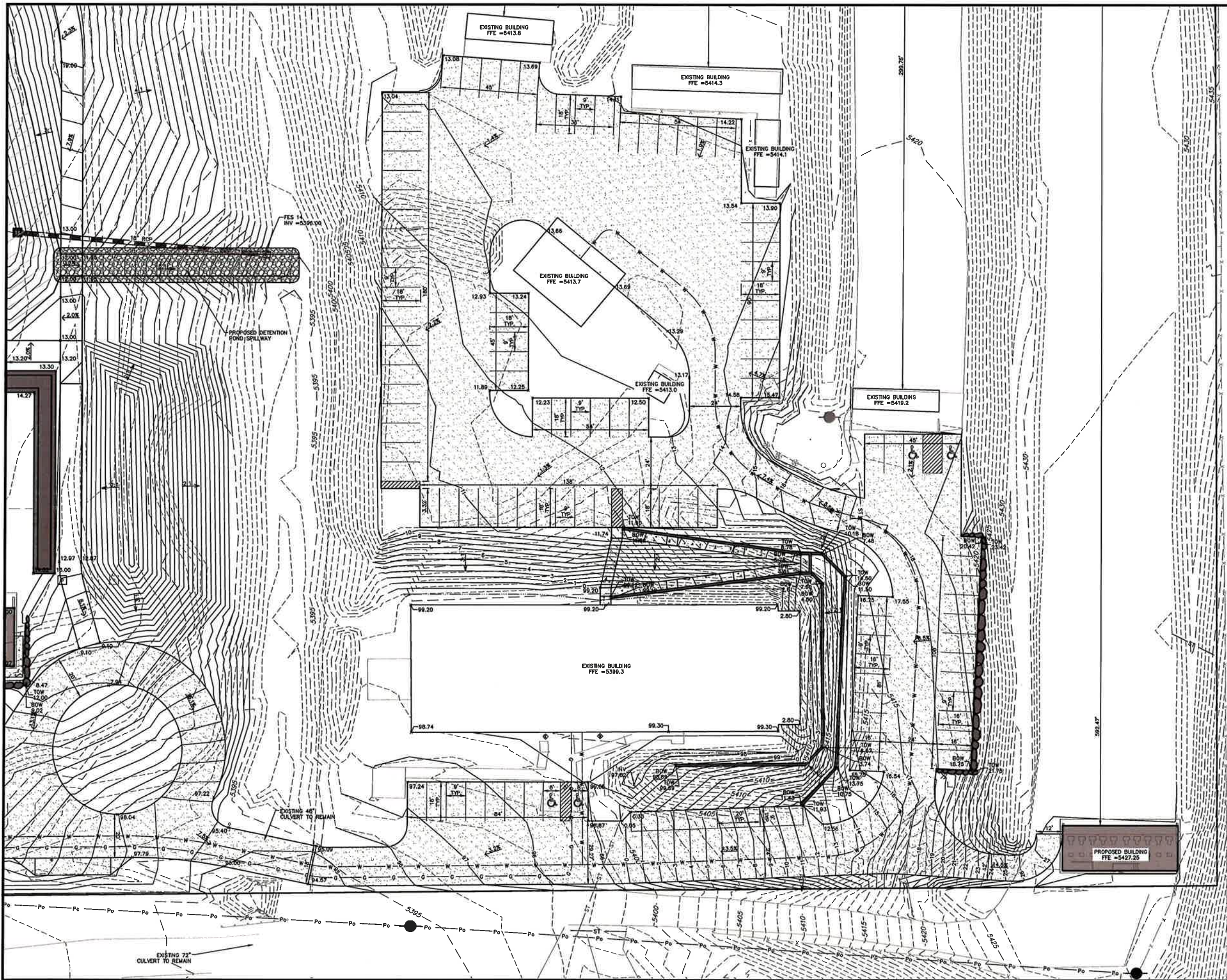
KEYED MAP



SHEET NO		C3.01	
BOULDER RIFLE RANGE		Rocky Ridge Civil Engineering	
DETAILED GRADING PLAN 1		400 21st Ave, Suite 101 Longmont, CO 80501 303.657.6026 http://rockyridgecivil.com	
DATE	05/24/2019	CAD NO	7781BASE
JOB NO	778-1	NO.	DATE
DESCRIPTION		BY	

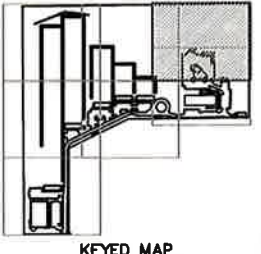
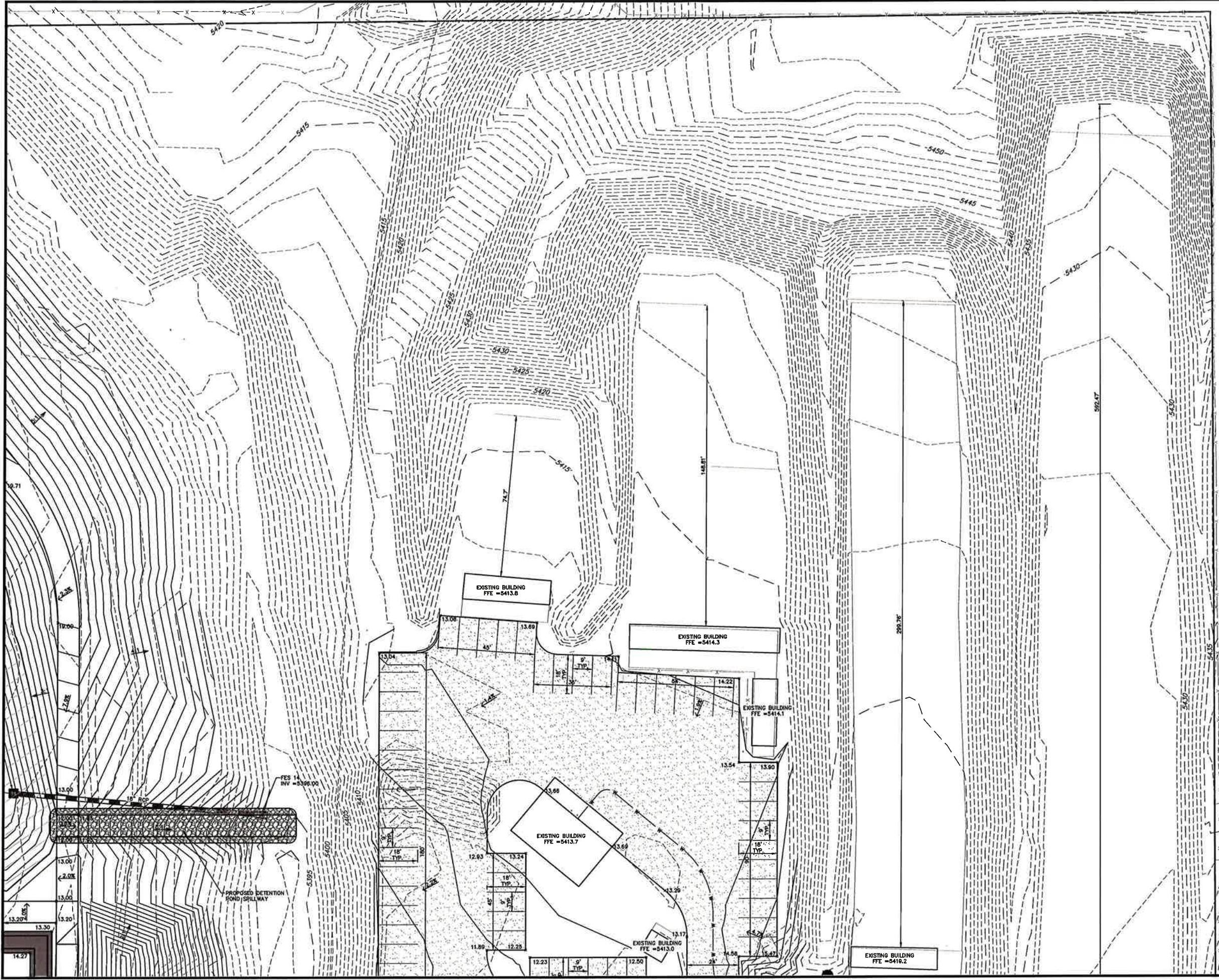


BOULDER RIFLE RANGE		 Rocky Ridge Civil Engineering 400 21st Ave, Suite 101 Longmont, CO 80501 303.651.0035 https://rockyridgecivil.com																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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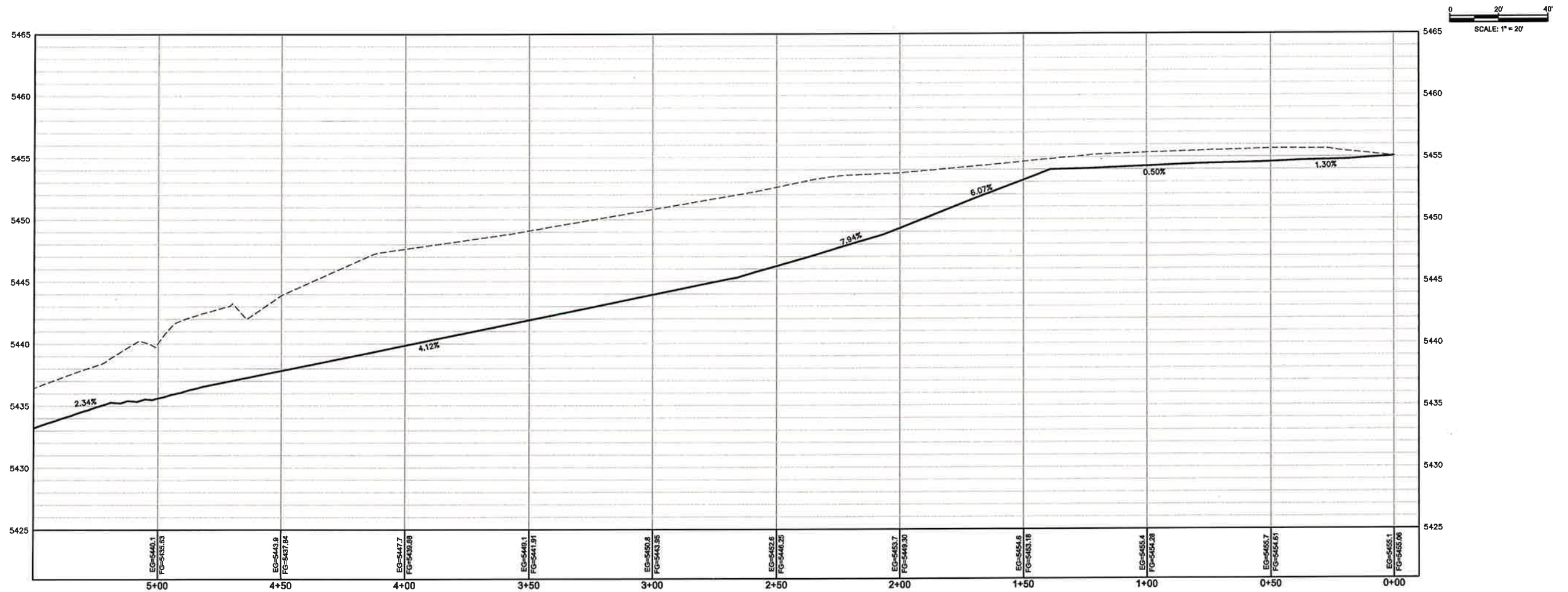
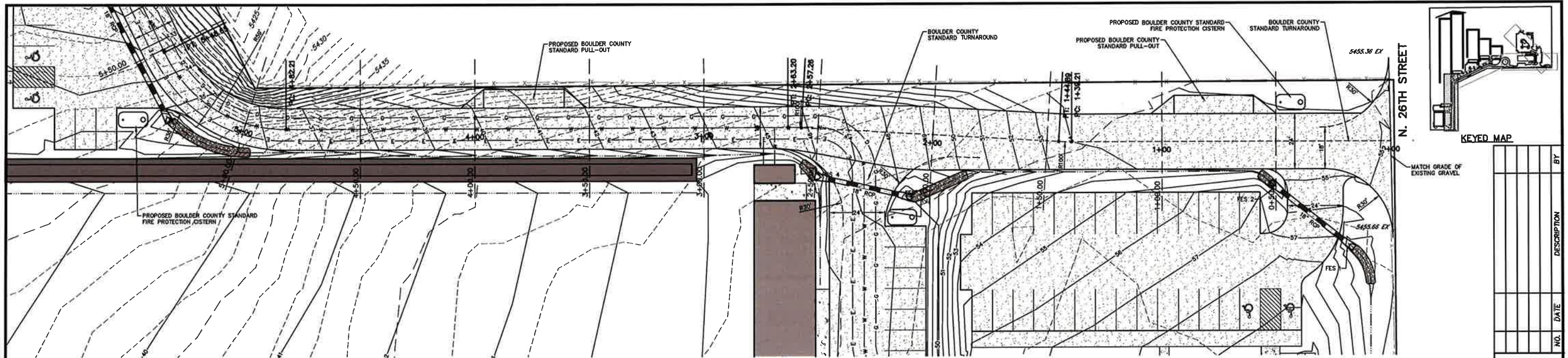


Rocky Ridge Civil Engineering				NO.	DATE	DESCRIPTION	BY
400 21st Ave, Suite 101 Longmont, CO 80501 303.651.0035 http://rockyridgeca.com							
BOULDER RIFLE RANGE							
DETAILED GRADING PLAN 6							
DATE: 05/24/2019							
JOB NO: 778-1							
CAD NO: 778IBASE							
SHEET NO: C3.06							

Rocky Ridge Civil Engineering, Inc. 420 21st Ave. Suite 101
Longmont, CO 80501
503.631.8625
http://rockyridge.net



SHEET NO		BOULDER RIFLE RANGE		Rocky Ridge Civil Engineering																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
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ACCESS ROAD CL PROFILE
SCALE: (H) 1" = 20' (V) 1" = 4'
START STA: -0+10.00, END STA: 5+50.00



BOULDER RIFLE RANGE

ACCESS ROAD
PLAN & PROFILE 1

DATE
05/24/2019

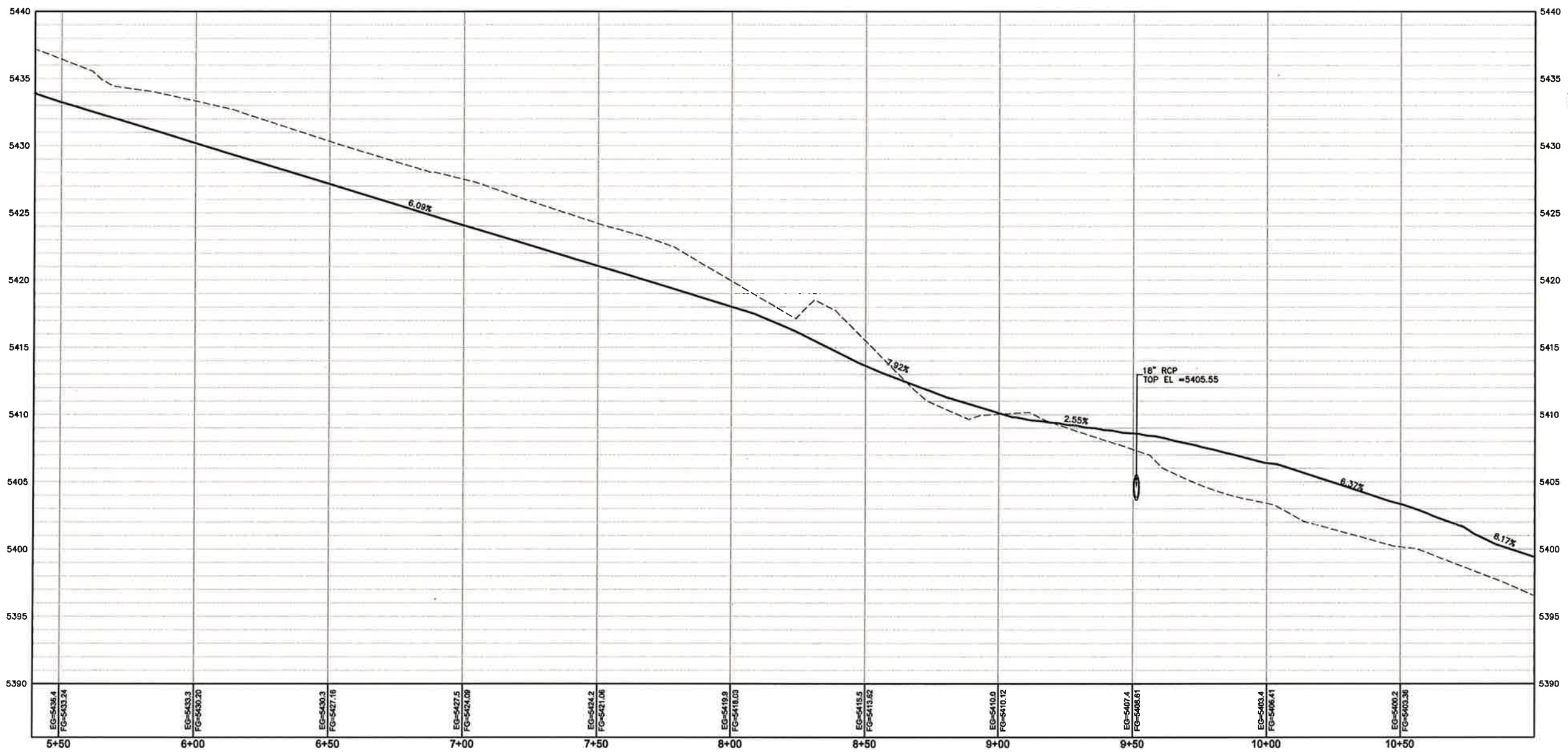
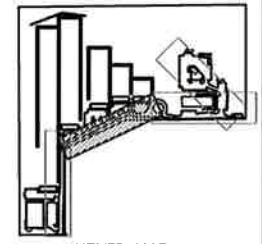
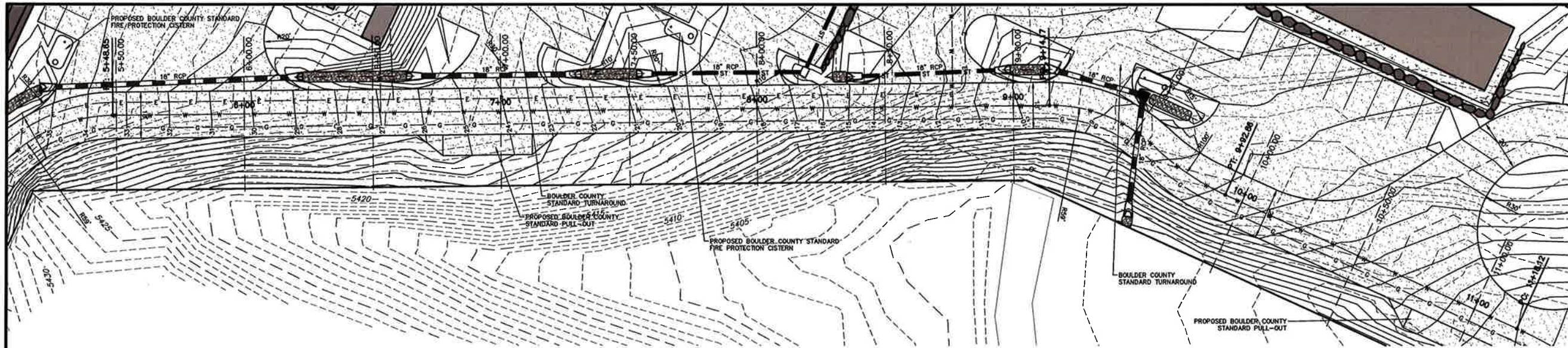
CAD NO
7781P&P

JOB NO
778-1

SHEET NO

C4.01

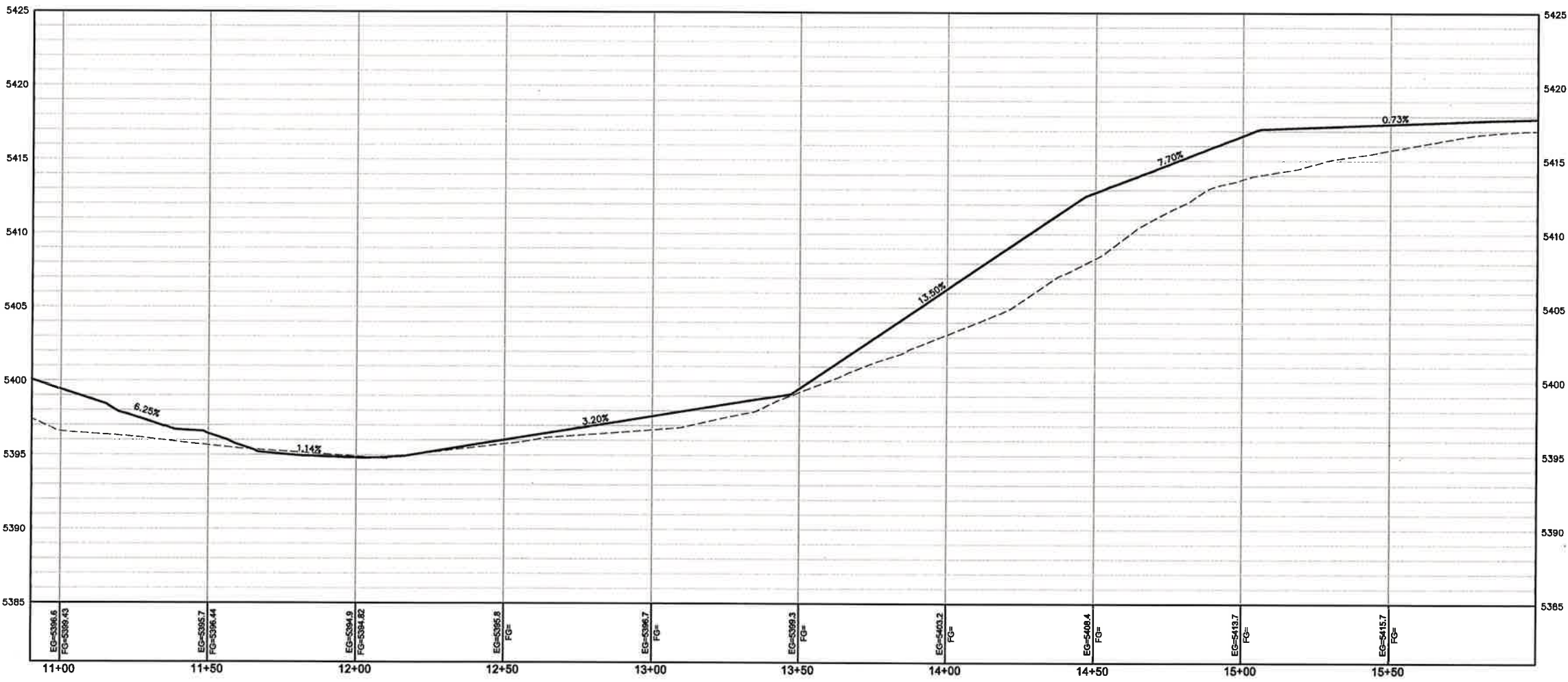
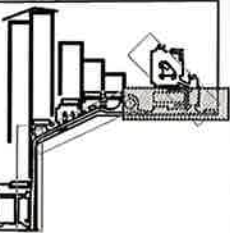
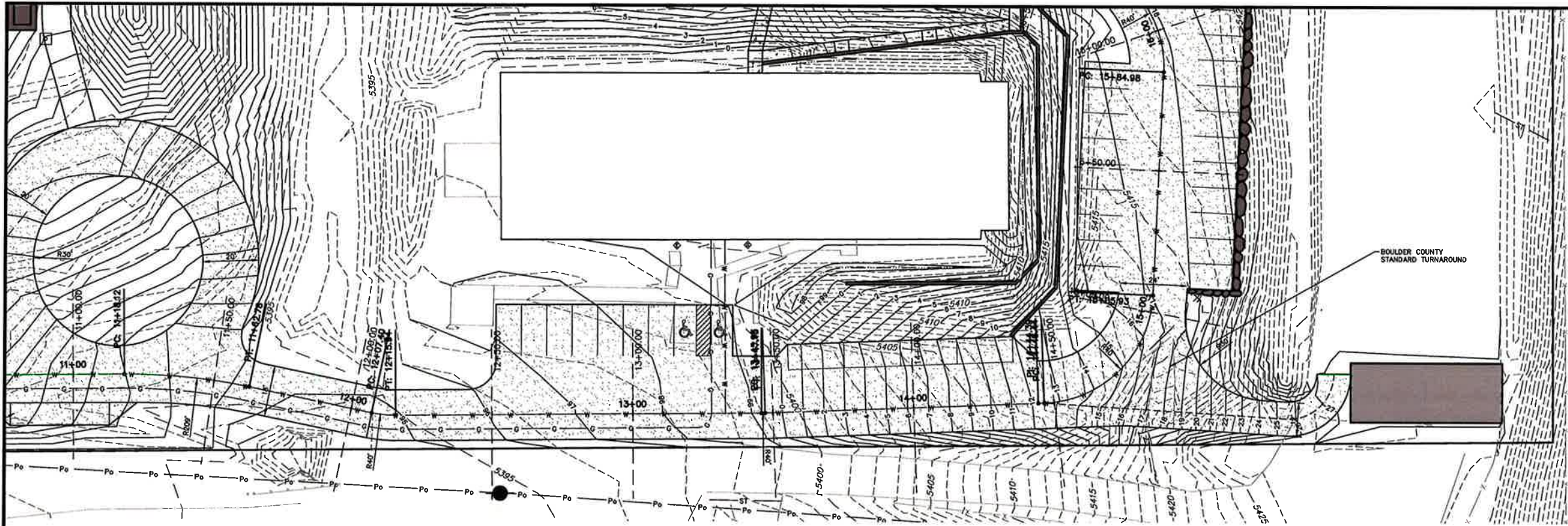
NO.	DATE	DESCRIPTION	BY



ACCESS ROAD CL PROFILE
SCALE: (H) 1" = 20' (V) 1" = 4'
START STA: 5+40.00, END STA: 11+00.00



BOULDER RIFLE RANGE				JOB NO	778-1
ACCESS ROAD		DATE	05/24/2019	CAD NO	7781P&P
PLAN & PROFILE 2					
SHEET NO					
C4.02					



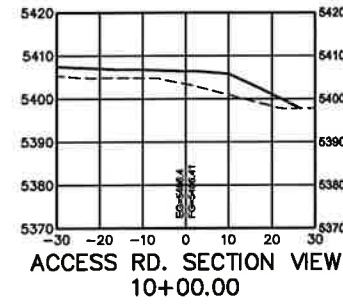
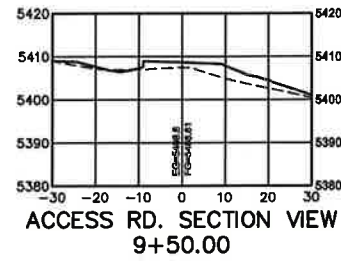
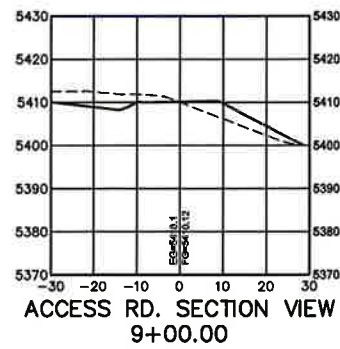
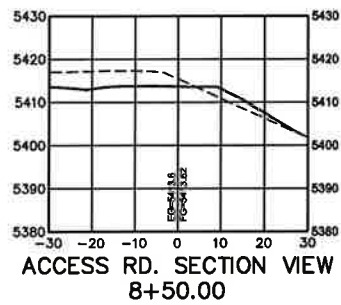
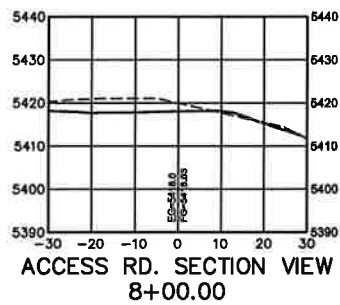
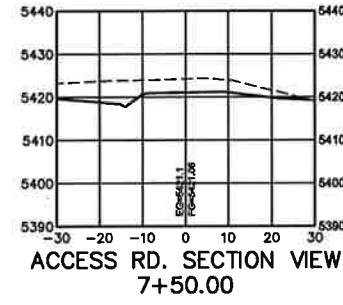
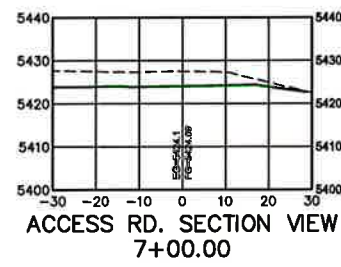
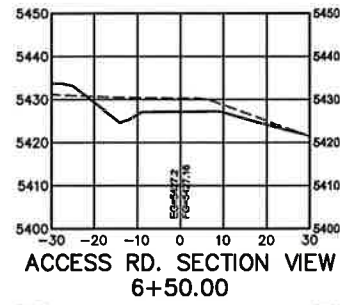
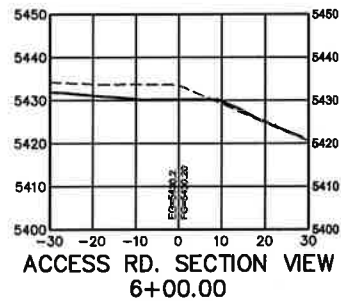
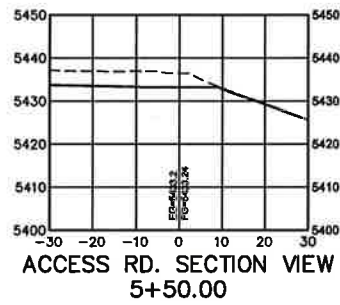
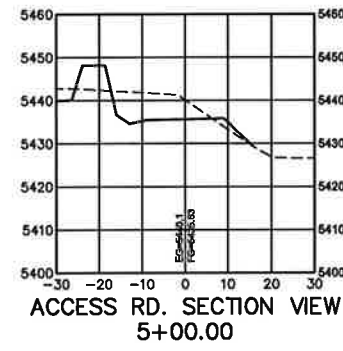
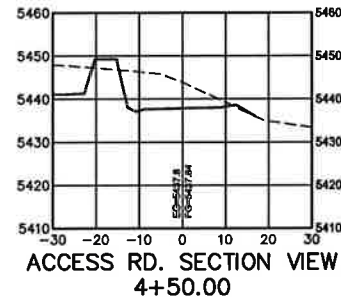
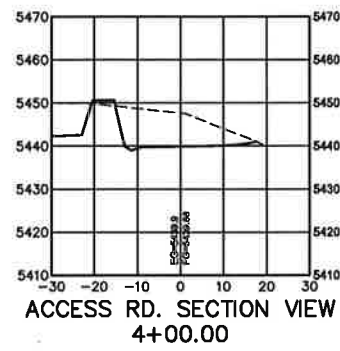
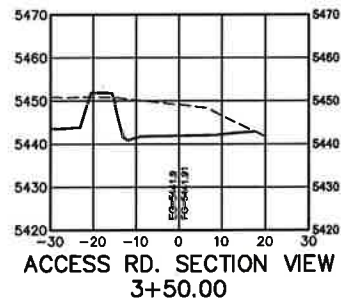
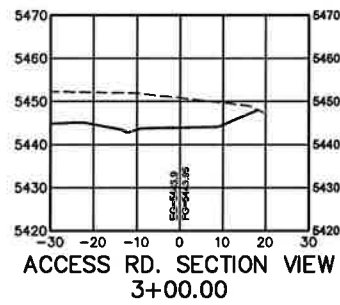
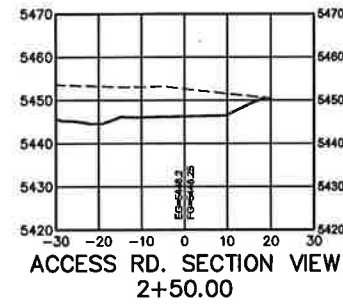
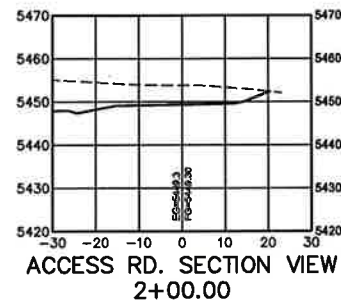
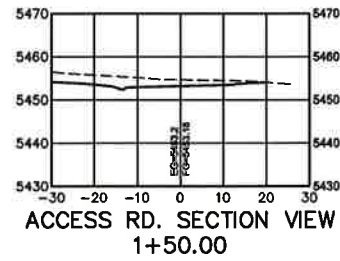
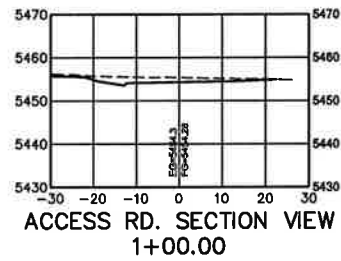
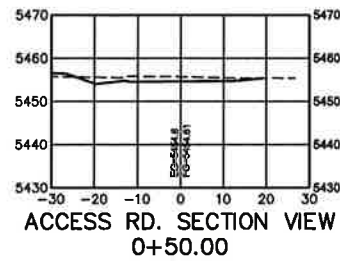
ACCESS ROAD CL PROFILE
SCALE: (H) 1" = 20' (V) 1" = 4'
START STA: 10+90.00, END STA: 16+00.00



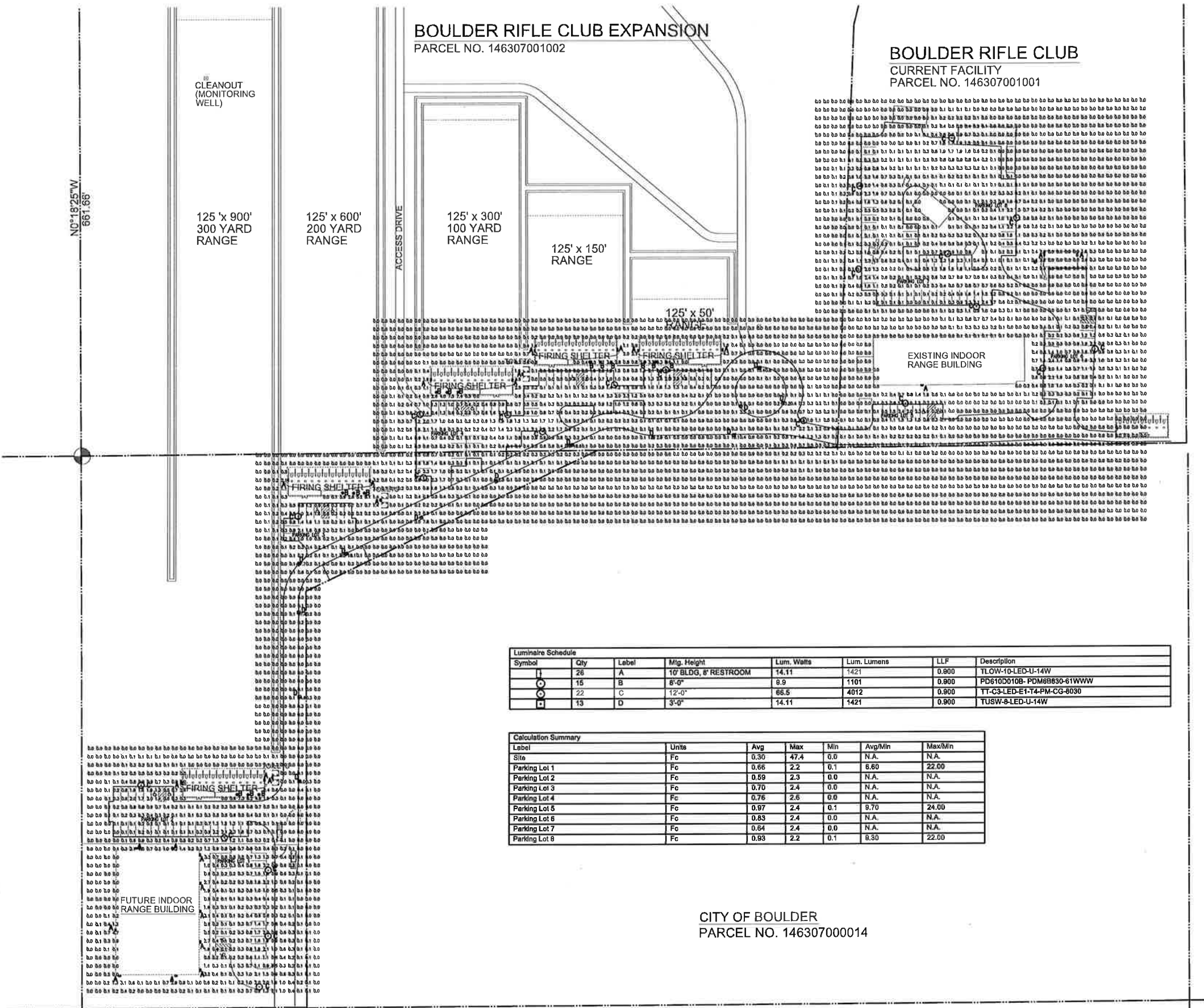
BOULDER RIFLE RANGE			
ACCESS ROAD	DATE	CAD NO	JOB NO
PLAN & PROFILE 3	05/24/2019	7781P&P	778-1

SHEET NO
C4.03

NO.	DATE	DESCRIPTION	BY



Rocky Ridge Civil Engineering		420 21st Ave. Suite 101 Longmont, CO 80501 Phone: 303.778.8888 Web: www.rockyridgecivil.com	
BOULDER RIFLE RANGE		DATE	05/24/2019
ACCESS ROAD CROSS SECTIONS 1		CAD NO	7781PAP
SHEET NO		JOB NO	778-1
C5.01		NO.	DATE
		DESCRIPTION	
		BY	



BOULDER RIFLE CLUB EXPANSION
PARCEL NO. 146307001002

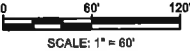
BOULDER RIFLE CLUB
CURRENT FACILITY
PARCEL NO. 146307001001

- NOTES:
1. ALL LIGHTING FIXTURES WILL BE FULL CUTOFF FIXTURES AND MEET THE COUNTY OF BOULDER OUTDOOR LIGHTING STANDARDS SECTION 7-1600.
 2. THE POINT BY POINT ILLUMINANCE PLAN USES A LIGHT LOSS FACTOR (LLF) OF 0.9.
 3. THE PHOTOMETRIC GRID USED IS NO GREATER THAN 10 BY 10 FEET AND PROVIDES LIGHTING LEVELS DIRECTLY UNDER THE FIXTURES.

Luminaire Schedule						
Symbol	Qty	Label	Mtg. Height	Lum. Watts	Lum. Lumens	LLF
⊙	26	A	10' BLDG, 8' RESTROOM	14.11	1421	0.900
⊙	15	B	8'-0"	8.9	1101	0.900
⊙	22	C	12'-0"	66.5	4012	0.900
⊙	13	D	3'-0"	14.11	1421	0.900
Description						
TL0W-10-LED-U-14W						
PD610D010B-PDM6B830-61WWW						
TT-C3-LED-E1-T4-PM-CG-8030						
TUSW-8-LED-U-14W						

Calculation Summary						
Label	Units	Avg	Max	Min	Avg/Min	Max/Min
Site	Fc	0.30	47.4	0.0	N.A.	N.A.
Parking Lot 1	Fc	0.66	2.2	0.1	6.60	22.00
Parking Lot 2	Fc	0.59	2.3	0.0	N.A.	N.A.
Parking Lot 3	Fc	0.70	2.4	0.0	N.A.	N.A.
Parking Lot 4	Fc	0.76	2.6	0.0	N.A.	N.A.
Parking Lot 5	Fc	0.97	2.4	0.1	9.70	24.00
Parking Lot 6	Fc	0.83	2.4	0.0	N.A.	N.A.
Parking Lot 7	Fc	0.64	2.4	0.0	N.A.	N.A.
Parking Lot 8	Fc	0.93	2.2	0.1	9.30	22.00

CITY OF BOULDER
PARCEL NO. 146307000014



Halo Commercial

PD10/PD18/PD680/PD680
PDM1A
6V

COMPLIANCE TABLE

1000 LUMEN

Catalog #	PD10E1D010-PDM1A27				PD10E1D010-PDM1A30				PD10E1D010-PDM1A36				PD10E1D010-PDM1A40			
	Lumen	LPW	ES	T24	Lumen	LPW	ES	T24	Lumen	LPW	ES	T24	Lumen	LPW	ES	T24
B1VC	1032	77			1100	83			1177	88			1187	89		
B1VCF	1005	75			1090	81			1146	86			1156	88		
B1VW	1003	75			1078	80			1144	85			1154	86		
B1VGF	966	72			1039	78			1102	82			1111	83		
B1VH	924	69			993	74			1063	79			1082	79		
B1VHF	921	69			990	74			1061	78			1080	79		
B1VWF	960	72			1032	77			1095	82			1104	82		
B1VGB	897	67			964	72			1025	76			1031	77		
B1VWB	900	73			1053	79			1118	83			1127	84		

Catalog #	PD10E1D010-PDM1A27				PD10E1D010-PDM1A30				PD10E1D010-PDM1A36				PD10E1D010-PDM1A40			
	Lumen	LPW	ES	T24	Lumen	LPW	ES	T24	Lumen	LPW	ES	T24	Lumen	LPW	ES	T24
B1VC	795	59			853	64			917	68			1017	78		
B1VCF	775	58			831	62			894	67			990	74		
B1VW	773	58			829	62			892	67			988	74		
B1VGF	745	56			799	60			859	64			952	71		
B1VH	712	53			763	57			821	61			910	68		
B1VHF	710	53			761	57			819	61			908	68		
B1VWF	740	55			794	59			854	64			940	71		
B1VGB	691	52			741	55			797	59			864	66		
B1VWB	755	56			810	60			871	63			968	72		

1500 LUMEN

Catalog #	PD15E1D010-PDM1A27				PD15E1D010-PDM1A30				PD15E1D010-PDM1A36				PD15E1D010-PDM1A40			
	Lumen	LPW	ES	T24	Lumen	LPW	ES	T24	Lumen	LPW	ES	T24	Lumen	LPW	ES	T24
B1VC	1417	77			1523	82			1616	87			1630	88		
B1VCF	1380	75			1483	80			1574	85			1587	86		
B1VW	1377	74			1480	80			1570	85			1584	86		
B1VGF	1357	72			1458	77			1553	82			1576	82		
B1VH	1269	69			1363	74			1446	78			1458	79		
B1VHF	1265	68			1359	73			1442	78			1455	79		
B1VWF	1318	71			1417	77			1503	81			1516			

Halo Commercial

PD610/PD615/PD630/PD630
PD66A
81V

PHOTOMETRY - 1000 lumen / 80 CRI

PD610E010 - PD66A35-61VC

Spacing Criteria = 0.78
Lumens per Watt = 97.3 lm/W
Test file: P107022

Test Model: PD610E010 - PD66A35-61VC

Configuration: Endhalo

Eyeball at 0-degrees

Scaling factor for the Battery Jack up:

- 1000 Lumens = 0.35
- 1500 Lumens = 0.40
- 2000 Lumens = 0.33
- 3000 Lumens = 0.22

Degrees Vertical	Candela
0°	3923
5	1014
10	1469
20	1057
30	808
40	586
50	38
60	3
70	1
80	0
90	0

"BCP"

Degrees	Avg. 0° Luminaire
0°	4781
5	487
10	231
20	191
30	0

Distance to Illuminated Plane	Initial Beam Footcandle	Beam (ft.)	W	H
0.5	55.1	4	4	
7	34	5.2	5.2	
8	35	8	8	
9	20.0	8.8	8.8	
10	16.7	7.6	7.6	
12	11.8	9	9	

Beam diameter is to 50% of maximum footcandle, rounded to the nearest half foot. Footcandle values are initial, apply appropriate light loss factors where necessary.

Zone	Lumens	% Fixture
0-30	886	75.3
0-40	1113	94.6
0-60	1375	98.8
0-90	1177	100

PHOTOMETRY - 1000 lumen / 80 CRI

PD610E010 - PD66A35-61VC

Spacing Criteria = 0.78
Lumens per Watt = 97.3 lm/W
Test file: P107021

Test Model: PD610E010 - PD66A35-61VC

Configuration: Endhalo

Eyeball at 0-degrees

Scaling factor for the Battery Jack up:

- 1000 Lumens = 0.35
- 1500 Lumens = 0.40
- 2000 Lumens = 0.33
- 3000 Lumens = 0.22

Degrees Vertical	Candela
0°	1295
5	750
10	1148
20	824
30	475
40	320
50	14
60	2
70	1
80	0
90	0

"BCP"

Degrees	Avg. 0° Luminaire
0°	2737
5	291
10	162
20	148
30	0

Distance to Illuminated Plane	Initial Beam Footcandle	Beam (ft.)	W	H
0.5	52	4.6	4.6	
7	32.1	5.8	5.8	
8	24.0	8.8	8.8	
9	18.4	7.4	7.4	
10	15.7	9.2	9.2	
12	10.8	10	10	

Beam diameter is to 50% of maximum footcandle, rounded to the nearest half foot. Footcandle values are initial, apply appropriate light loss factors where necessary.

Zone	Lumens	% Fixture
0-30	881	73.3
0-40	1113	94.6
0-60	910	98.8
0-90	817	100

Eaton

DESCRIPTION

The TopTier™ area and site luminaires are an innovative solution that delivers an unparalleled combination of performance and visual comfort. The patented WaveStream™ optical technology blocks the line of sight from the LED light sources to the observer, while extracting the maximum amount of light on task. This approach results in a high level of uniformity and vertical footcandle that enhances safety in the application environment. The TopTier luminaire is ULUL listed for wet locations, IP66 and 50 vibration rated.

SPECIFICATION FEATURES

Construction
One-piece, low copper die-cast aluminum upper housing with integrated mounting arm provides a clean and symmetrical appearance. Formed aluminum top is sloped to prevent bird nesting. Metal electrical tray allows easy access for field servicing. IP66 rated against the ingress of dust and water.

Optics
Unique optical distributions are accomplished using various combinations of reflective backing plates and WaveStream optical technology. The optical Waveguide is manufactured using precision injection molded acrylic. The optics contain features that form a repeatable and uniform pattern to direct light in a precisely prescribed distribution. For additional glare control and visual comfort with the Wide distribution, specify the SD option which adds a Soli® glass lens that works in combination with the Waveguide.

One and reflective backing plate to reduce high angle lumens. Offered standard in 4000K (±276K) CCT, optional 3000K, 5000K and 6000K. Minimum 70 CRI.

Electrical
LED driver(s) are mounted to metal electrical tray for optimal thermal performance. 120-277V 50/60Hz, 347V 60Hz or 480V 60Hz operation. 480V is compatible for use with 480V Wye systems only. Standard with 0-10V dimming driver(s). See control options page for additional details. Shipped standard with Eaton proprietary circuit module designed to withstand 10kV of transient line surge. Greater than 90% lumen maintenance expected at 60,000 hours based off LM-80 test data and TM-21. Suitable for ambient temperature applications from -40°C (-40°F) to 40°C (104°F). For 50°C (122°F) applications, specify the HA high ambient option.

Mounting
Removal of the access plate on the mounting arm enables wiring of the fixture without having to access the driver compartment. The integrated pole mount arm is bolted directly to the pole with no assembly using an "H" drilling pattern. A knock out on the mounting arm enables round pole mounting.

Finish
Housing finished in super durable TGIC polyester powder coat paint with 2 mil nominal thickness for superior protection against fade and wear. Available colors include white, black, bronze, gray, dark platinum and graphite metallic. RAL and custom color matches available. Consult the McGraw-Edison Architectural Colors brochure for the complete selection.

Warranty
Five-year warranty.

McGraw-Edison

Project	TT-C2-LED-E1-T4-FM-CG-0000	City	C
Client	BOULDER RIFLE CLUB	State	
Contract	TLB	Date	5/16/19



TT TOPTIER SITE LED

Solid White LED AREA/SITE LUMINAIRE

powered by



powered by



powered by



powered by



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powered by



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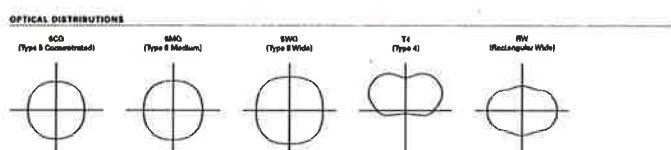
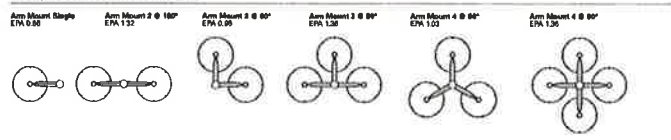


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page 2

INSTALLATION CONFIGURATIONS AND SPACINGS



LUMEN MAINTENANCE

Ambient Temperature	25,000 Hours	50,000 Hours	100,000 Hours	150,000 Hours	200,000 Hours
25°C	> 90%	> 85%	> 80%	> 75%	> 70%
40°C	> 85%	> 80%	> 75%	> 70%	> 65%
60°C	> 80%	> 75%	> 70%	> 65%	> 60%
80°C	> 75%	> 70%	> 65%	> 60%	> 55%
100°C	> 70%	> 65%	> 60%	> 55%	> 50%
125°C	> 65%	> 60%	> 55%	> 50%	> 45%
150°C	> 60%	> 55%	> 50%	> 45%	> 40%
175°C	> 55%	> 50%	> 45%	> 40%	> 35%
200°C	> 50%	> 45%	> 40%	> 35%	> 30%
225°C	> 45%	> 40%	> 35%	> 30%	> 25%
250°C	> 40%	> 35%	> 30%	> 25%	> 20%
275°C	> 35%	> 30%	> 25%	> 20%	> 15%
300°C	> 30%	> 25%	> 20%	> 15%	> 10%
325°C	> 25%	> 20%	> 15%	> 10%	> 5%
350°C	> 20%	> 15%	> 10%	> 5%	> 0%

Notes:
1. Lumen maintenance is based on LM-80 test data and TM-21. For 50°C (122°F) applications, specify the HA high ambient option.
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2. Lumen maintenance is based on LM-80 test data and TM-21. For 50°C (122°F) applications, specify the HA high ambient option.

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page 3

POWER AND LUMENS

Lumen Package ¹	C1		C2		C3		C4		C5		C6		
Power (Wattage)	28		34		43		58		77		108		
Current @ 120V (A)	0.23		0.28		0.36		0.48		0.64		0.90		
Current @ 277V (A)	0.13		0.14		0.19		0.24		0.30		0.41		
3000 CCT	Lumens	3,293		3,957		5,268		6,944		9,267		12,684	
	Lumens per Watt	118		118		127		85		82		84	
	BUG Rating	B1 U0-G1		B2 U0-G1		B3 U0-G1		B2 U0-G1		B2 U0-G1		B3 U0-G1	
	Lumens	3,387		4,076		5,287		6,991		9,243		12,689	
	Lumens per Watt	120		120		119		96		84		86	
	BUG Rating	B3 U0-G1		B2 U0-G1		B3 U0-G2		B3 U0-G3		B3 U0-G3		B3 U0-G3	
	Lumens	3,161		3,784		4,849		5,785		6,881		8,554	
	Lumens per Watt	111		111		110		89		87		79	
	BUG Rating	B2 U0-G1		B3 U0-G2		B3 U0-G2		B3 U0-G3		B3 U0-G3		B3 U0-G3	
	Lumens	3,228		3,508		4,290		4,840		5,882		7,519	
	Lumens per Watt	87		87		87		78		76		70	
	BUG Rating	B3 U0-G1		B2 U0-G2		B3 U0-G2		B3 U0-G2		B3 U0-G3		B3 U0-G3	
4000 CCT	Lumens	3,448		3,699		4,152		—		—		—	
	Lumens per Watt	72		71		82		—		—		—	
	BUG Rating	B1 U0-G2		B1 U0-G3		B2 U0-G3		—		—		—	
	Lumens	3,848		4,870		6,141		7,873		9,423		12,686	
	Lumens per Watt	137		137		136		126		123		111	
	BUG Rating	B2 U0-G1		B2 U0-G1		B3 U0-G1		B2 U0-G1		B3 U0-G1		B3 U0-G2	
	Lumens	3,922		4,160		4,268		2,413		8,804		12,577	
	Lumens per Watt	160		160		139		138		126		114	
	BUG Rating	B2 U0-G1		B2 U0-G3		B3 U0-G2		B3 U0-G2		B3 U0-G3		B3 U0-G3	
	Lumens	3,823		4,287		5,782		6,818		8,872		11,342	
	Lumens per Watt	129		129		128		118		115		106	
	BUG Rating	B2 U0-G2		B3 U0-G3		B3 U0-G3		B3 U0-G3		B3 U0-G3		B4 U0-G3	
5000 CCT	Lumens	3,785		3,888		5,082		8,016		7,769		9,868	
	Lumens per Watt	116		116		113		106		101		87	
	BUG Rating	B2 U0-G2		B2 U0-G2		B3 U0-G2		B3 U0-G2		B3 U0-G2		B3 U0-G3	
	Lumens	3,276		3,819		5,591		—		—		—	
	Lumens per Watt	98		95		83		—		—		—	
	BUG Rating	B3 U0-G2		B1 U0-G3		B3 U0-G3		—		—		—	
	Lumens	3,465		4,424		4,817		2,254		9,234		11,932	
	Lumens per Watt	120		120		124		124		121		110	
	BUG Rating	B1 U0-G1		B2 U0-G1		B3 U0-G1		B2 U0-G1		B3 U0-G1		B3 U0-G2	
	Lumens	3,718		4,508		5,829		5,343		8,513		12,161	
	Lumens per Watt	133		123		122		127		124		113	
	BUG Rating	B2 U0-G1		B2 U0-G2		B3 U0-G2		B3 U0-G2		B3 U0-G3		B3 U0-G3	
9000 CCT	Lumens	4,232		4,168		4,478		8,793		8,788		11,235	
	Lumens per Watt	123		123		122		117		114		104	
	BUG Rating	B2 U0-G3		B3 U0-G3		B3 U0-G3		B3 U0-G3		B3 U0-G3		B3 U0-G3	
	Lumens	3,612		3,682		4,811		5,362		7,775		8,875	
	Lumens per Watt	103		103		103		103		100		91	
	BUG Rating	B2 U0-G2		B2 U0-G3		B3 U0-G3		B3 U0-G3		B3 U0-G3		B3 U0-G3	
	Lumens	3,205		3,558		5,424		—		—		—	
	Lumens per Watt	96		93		82		—		—		—	
	BUG Rating	B1 U0-G3		B1 U0-G3		B3 U0-G3		—		—		—	