BURNCO Colorado LLC
10100 Dallas Street
Henderson, CO
80640

Phone: 970 356 7523
burnco.com

April 16, 2025

Ben Hammar
Environmental Protection Specialist
1313 Sherman St, Room 215
Denver, CO 80203

Subject: Rocky Flats Pit, M1987-113, Amendment-01

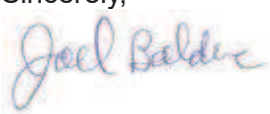
Enclosed please find an application to amend permit M1987-113 for the BURNCO Colorado LLC Rocky Flats Pit located at 20779 W Gate Rd, Golden, CO 80403. This application incorporates the original permit and all technical revisions in their entirety.

Concurrent with this submittal, the Lakewood Brick and Tile Co. is submitting an amendment for their Church Pit permit (M1979-045) that includes many of the changes in this submittal. The two pits are adjacent to each other and will be reclaimed together as a water storage or rangeland and thus many changes are applicable to both permits.

This amendment incorporates four primary changes to the reclamation permit:

1. Redraws the boundary line separating the BURNCO Rocky Flats Pit and Lakewood Brick and Tile Co. Church Pit. The new line of separation accurately reflects the current mining area for each respective company. This change results in a net increase of 24.3 acres in the Rocky Flats Pit permit area from 95.4 acres to 119.8 acres.
2. Adds the entrance area to the Rocky Flat Pit permit that has been an ancillary part of mining operations for a long time but had not been included in the permit area.
3. Changes the final reclamation plan to add an option for Developed Water Storage to the existing plan for non-critical wildlife habitat, rangeland. Reclamation of the site into a reservoir is an appropriate end use as the geology (clay) is favorable and water storage is essential to supplying water to businesses and residents year-round. There are several other reservoirs in the Rocky Flats area currently including the Francis Smart Reservoir one mile south of the pit, Welton Reservoir 3 miles southeast, Standley Lake 5 miles southeast, and the Great Western Reservoir 3 miles northeast. Water storage is very compatible with wildlife and we have shared our planning efforts with David Lucas, the Project Leader of the Rocky Flats Wildlife Refuge.
4. Finalizes the completion of the ditch relocations anticipated in the 1987 application. The McKay and Church ditches previously meandered across the Church and Rocky Flats Pits in a general southwest to northeast direction. The ditches have been relocated and now run along the west boundary of the Church Pit, then turn east along the north edge of the Church Pit, then along the north edge of the Rocky Flats Pit, then return to their historical channels to the northeast of the Rocky Flats Pit.

Sincerely,



Joel Bolduc
BURNCO Colorado, LLC
US Land and Resource Manager

BURNCO Colorado LLC
10100 Dallas Street
Henderson, CO
80640

Phone: 970 356 7523
burnco.com

ROCKY FLATS PIT M1987-113 AMENDMENT-01

CONSTRUCTION MATERIALS 112 RECLAMATION PERMIT APPLICATION

This application incorporates the original permit and all technical revisions in their entirety.

April 16, 2025

Joel Bolduc
BURNCO Colorado, LLC
US Land and Resource Manager
303-913-6583
joel.bolduc@burnco.com

STATE OF COLORADO

DIVISION OF RECLAMATION, MINING AND SAFETY
Department of Natural Resources

1313 Sherman St., Room 215
Denver, Colorado 80203
Phone: (303) 866-3567
FAX: (303) 832-8106

COLORADO DIVISION OF RECLAMATION MINING & SAFETY

CONSTRUCTION MATERIALS
REGULAR (112) OPERATION
RECLAMATION PERMIT APPLICATION FORM

CHECK ONE: ☑ **There is a File Number Already Assigned to this Operation**

Permit # M 1987 113 - ___ (Please reference the file number currently assigned to this operation)

☐ **New** Application (Rule 1.4.5) ☑ **Amendment** Application (Rule 1.10)

☐ **Conversion** Application (Rule 1.11)

Permit # M 1987 113 - ___ (provide for **Amendments** and **Conversions** of existing permits)

The application for a Construction Materials Regular 112 Operation Reclamation Permit contains three major parts: (1) the application form; (2) Exhibits A-S, Addendum 1, any sections of Exhibit 6.5 (Geotechnical Stability Exhibit; and (3) the application fee. When you submit your application, be sure to include one (1) complete signed and notarized **ORIGINAL** and one (1) copy of the completed application form, two (2) copies of Exhibits A-S, Addendum 1, appropriate sections of 6.5 (Geotechnical Stability Exhibit, and a check for the application fee described under Section (4) below. Exhibits should **NOT** be bound or in a 3-ring binder; maps should be folded to 8 1/2" X 11" or 8 1/2" X 14" size. To expedite processing, please provide the information in the format and order described in this form.

GENERAL OPERATION INFORMATION

Type or print clearly, in the space provided, ALL information requested below.

1. **Applicant/operator or company name (name to be used on permit)**: BURNCO COLORADO
   - 1.1 Type of organization (corporation, partnership, etc.): LLC

2. **Operation name (pit, mine or site name)**: ROCKY FLATS PIT

3. **Permitted acreage (new or existing site)**: 95.4 permitted acres
   - 3.1 Change in acreage (+) 24.3 acres
   - 3.2 Total acreage in Permit area 119.8 acres

4. **Fees**:
   - 4.1 New Application $2,696.00 application fee
   - 4.2 New Quarry Application $3,342.00 quarry application
   - 4.4 Amendment Fee $2,229.00 amendment fee
   - 4.5 Conversion to 112 operation (set by statute) $2,696.00 conversion fee

5. **Primary commoditie(s) to be mined**: SDG CLY ___ ___ ___
   - 5.1 Incidental commoditie(s) to be mined: 1. N/A - lbs/Tons/yr 2. / lbs/Tons/yr
     3. / lbs/Tons/yr 4. / lbs/Tons/yr 5. / lbs/Tons/yr
   - 5.2 Anticipated end use of primary commoditie(s) to be mined: CONSTRUCTION MATERIALS
   - 5.3 Anticipated end use of incidental commoditie(s) to be mined: N/A

6. **Name of owner of subsurface rights of affected land**: CHARLES AND PERRY MCKAY
   If 2 or more owners, "refer to Exhibit O".

7. **Name of owner of surface of affected land**: US DEPARTMENT OF ENERGY

8. **Type of mining operation**: ☑ Surface ☐ Underground

9. **Location Information**: The center of the area where the majority of mining will occur:

   COUNTY: Jefferson

   PRINCIPAL MERIDIAN (check one): ☑ 6th (Colorado) ☐ 10th (New Mexico) ☐ Ute

   SECTION (write number): S 9

   TOWNSHIP (write number and check direction): T 2 ☐ North ☑ South

   RANGE (write number and check direction): R 70 ☐ East ☑ West

   QUARTER SECTION (check one): ☐ NE ☐ NW ☑ SE ☐ SW

   QUARTER/QUARTER SECTION (check one): ☐ NE ☐ NW ☐ SE ☑ SW

   GENERAL DESCRIPTION: (the number of miles and direction from the nearest town and the approximate elevation):
   NINE (9) MILES NORTH OF GOLDEN, COLORADO, 6,150 FT

10. **Primary Mine Entrance Location** (report in either Latitude/Longitude **OR** UTM):

    Latitude/Longitude:

    Example: (N) 39° 44′ 12.98″
    (W) 104° 59′ 3.87″

    Latitude (N): deg _____ min _____ sec ____._____ (2 decimal places)

    Longitude (W): deg _____ min _____ sec ____._____ (2 decimal places)

    OR

    Example: (N) 39.73691°
    (W) -104.98449°

    Latitude (N) 39 . 87700 (5 decimal places)

    Longitude(W) 105 . 23340 (5 decimal places)

    OR

    Universal Tranverse Mercator (UTM)

    Example: 201336.3 E NAD27 Zone 13
    4398351.2 N

    UTM Datum (specify NAD27, NAD83 or WGS 84) Nad 83 Zone 13

    Easting _____

    Northing _____

11. **Correspondence Information**:

APPLICANT/OPERATOR (name, address, and phone of name to be used on permit)

Contact's Name: **JOEL BOLDUC** Title: LAND & RESOURCE MGR
Company Name: BURNCO COLORADO LLC
Street/P.O. Box: 10100 DALLAS ST P.O. Box:
City: HENDERSON
State: CO Zip Code: 80640
Telephone Number: (303) - 913-6583
Fax Number: ( ) -

PERMITTING CONTACT (if different from applicant/operator above)

Contact's Name: JOEL BOLDUC Title: LAND & RESOURCE MGR
Company Name: BURNCO COLORADO LLC
Street/P.O. Box: 10100 DALLAS ST P.O. Box:
City: HENDERSON
State: CO Zip Code: 80640
Telephone Number: (303) - 913-6583
Fax Number: ( ) -

INSPECTION CONTACT

Contact's Name: JOEL BOLDUC Title: LAND & RESOURCE MGR
Company Name: BURNCO COLORADO LLC
Street/P.O. Box: 10100 DALLAS ST P.O. Box:
City: HENDERSON
State: CO Zip Code: 80640
Telephone Number: (303) - 913-6583
Fax Number: ( ) -

CC: STATE OR FEDERAL LANDOWNER (if any)

Agency: US DEPARTMENT OF ENERGY (SCOTT SUROVCHAK)
Street: 11025 DOVER ST., SUITE 1000
City: WESTMINSTER
State: CO Zip Code: 80021
Telephone Number: (720) - 377-9682

CC: STATE OR FEDERAL LANDOWNER (if any)

Agency:
Street:
City:
State: Zip Code:
Telephone Number: ( ) -

12. **Primary future (Post-mining) land use (check one)**:

☐ Cropland(CR)	☐ Pastureland(PL)	☐ General Agriculture(GA)
☐ Rangeland(RL)	☐ Forestry(FR)	☐ Wildlife Habitat(WL)
☐ Residential(RS)	☐ Recreation(RC)	☐ Industrial/Commercial(IC)
☑ Developed Water Resources(WR)		☐ Solid Waste Disposal(WD)

13. **Primary present land use (check one)**:

☐ Cropland(CR)	☐ Pastureland(PL)	☐ General Agriculture(GA)
☐ Rangeland(RL)	☐ Forestry(FR)	☐ Wildlife Habitat(WL)
☐ Residential(RS)	☐ Recreation(RC)	☑ Industrial/Commercial(IC)
☐ Developed Water Resources(WR)		

14. **Method of Mining**: Briefly explain mining method (e.g. truck/shovel): EXCAVATOR

15. **On Site Processing**: ☑ Crushing/Screening

13.1 Briefly explain mining method (e.g. truck/shovel): EXCAVATOR

List any designated chemicals or acid-producing materials to be used or stored within permit area: NONE

16. **Description of Amendment or Conversion**:

If you are amending or converting an existing operation, provide a brief narrative describing the proposed change(s).

1) REDRAWS THE BOUNDARY LINE BETWEEN BURNCO ROCKY FLATS PIT (M1987-113) AND LAKEWOOD BRICK CO. CHURCH PIT (M1979-045) TO REFLECT THE CURRENT MINING AREA FOR EACH COMPANY.
2) ADDS THE ENTRANCE AREA TO THE ROCKY FLATS PIT.
3) CHANGES THE RECLAMATION PLAN TO INCLUDE AN OPTION FOR DEVELOPED WATER STORAGE IN ADDITION TO THE EXISTING OPTION FOR RANGELAND.
4) FINALIZES THE DTICH RELOCATIONS ANTICIPATED IN THE 1987 APPLICATION.

Maps and Exhibits:

Two (2) complete, unbound application packages must be submitted. One complete application package consists of a signed application form and the set of maps and exhibits referenced below as Exhibits A-S, Addendum 1, and the Geotechnical Stability Exhibit. Each exhibit within the application must be presented as a separate section. Begin each exhibit on a new page. Pages should be numbered consecutively for ease of reference. If separate documents are used as appendices, please reference these by name in the exhibit.

With each of the two (2) signed application forms, you must submit a corresponding set of the maps and exhibits as described in the following references to Rule 6.4, 6.5, and 1.6.2(1)(b):

EXHIBIT A	Legal Description
EXHIBIT B	Index Map
EXHIBIT C	Pre-Mining and Mining Plan Map(s) of Affected Lands
EXHIBIT D	Mining Plan
EXHIBIT E	Reclamation Plan
EXHIBIT F	Reclamation Plan Map
EXHIBIT G	Water Information
EXHIBIT H	Wildlife Information
EXHIBIT I	Soils Information
EXHIBIT J	Vegetation Information
EXHIBIT K	Climate Information
EXHIBIT L	Reclamation Costs
EXHIBIT M	Other Permits and Licenses
EXHIBIT N	Source of Legal Right-To-Enter
EXHIBIT O	Owners of Record of Affected Land (Surface Area) and Owners of Substance to be Mined
EXHIBIT P	Municipalities Within Two Miles
EXHIBIT Q	Proof of Mailing of Notices to County Commissioners and Conservation District
EXHIBIT R	Proof of Filing with County Clerk or Recorder
EXHIBIT S	Permanent Man-Made Structures
Rule 1.6.2(1)(b)	ADDENDUM 1 - Notice Requirements (sample enclosed)
Rule 6.5	Geotechnical Stability Exhibit (any required sections)

The instructions for preparing Exhibits A-S, Addendum 1, and Geotechnical Stability Exhibit are specified under Rule 6.4 and 6.5 and Rule 1.6.2(1)(b) of the Rules and Regulations. If you have any questions on preparing the Exhibits or content of the information required, or would like to schedule a pre-application meeting you may contact the Office at 303-866-3567.

Responsibilities as a Permittee:

Upon application approval and permit issuance, this application becomes a legally binding document. Therefore, there are a number of important requirements which you, as a permittee, should fully understand. These requirements are listed below. Please read and initial each requirement, in the space provided, to acknowledge that you understand your obligations. If you do not understand these obligations then please contact this Office for a full explanation.

JB
_____ 1. Your obligation to reclaim the site is not limited to the amount of the financial warranty. You assume legal liability for all reasonable expenses which the Board or the Office may incur to reclaim the affected lands associated with your mining operation in the event your permit is revoked and financial warranty is forfeited;

JB 2. The Board may suspend or revoke this permit, or assess a civil penalty, upon a finding that the permittee violated the terms or conditions of this permit, the Act, the Mineral Rules and Regulations, or that information contained in the application or your permit misrepresent important material facts;

JB 3. If your mining and reclamation operations affect areas beyond the boundaries of an approved permit boundary, substantial civil penalties, to you as permittee can result;

JB 4. Any modification to the approved mining and reclamation plan from those described in your approved application requires you to submit a permit modification and obtain approval from the Board or Office;

JB 5. It is your responsibility to notify the Office of any changes in your address or phone number;

JB 6. Upon permit issuance and prior to beginning on-site mining activity, you must post a sign at the entrance of the mine site, which shall be clearly visible from the access road, with the following information (Rule 3.1.12):

a. the name of the operator;

b. a statement that a reclamation permit for the operation has been issued by the Colorado Mined Land Reclamation Board; and,

c. the permit number.

JB 7. The boundaries of the permit boundary area must be marked by monuments or other markers that are clearly visible and adequate to delineate such boundaries prior to site disturbance.

JB 8. It is a provision of this permit that the operations will be conducted in accordance with the terms and conditions listed in your application, as well as with the provisions of the Act and the Construction Material Rules and Regulations in effect at the time the permit is issued.

JB 9. Annually, on the anniversary date of permit issuance, you must submit an annual fee as specified by Statute, and an annual report which includes a map describing the acreage affected and the acreage reclaimed to date (if there are changes from the previous year), any monitoring required by the Reclamation Plan to be submitted annually on the anniversary date of the permit approval. Annual fees are for the previous year a permit is held. For example, a permit with the anniversary date of July 1, 1995, the annual fee is for the period of July 1, 1994 through June 30, 1995. Failure to submit your annual fee and report by the permit anniversary date may result in a civil penalty, revocation of your permit, and forfeiture of your financial warranty. It is your responsibility, as the permittee, to continue to pay your annual fee to the Office until the Board releases you from your total reclamation responsibility.

N/A 10. For joint venture/partnership operators: the signing representative is authorized to sign this document and a power of attorney (provided by the partner(s)) authorizing the signature of the representative is attached to this application.

NOTE TO COMMENTORS/OBJECTORS:

It is likely there will be additions, changes, and deletions to this document prior to final decision by the Office. Therefore, if you have any comments or concerns you must contact the applicant or the Office prior to the decision date so that you will know what changes may have been made to the application document.

The Office is not allowed to consider comments, unless they are written, and received prior to the end of the public comment period. You should contact the applicant for the final date of the public comment period.

If you have questions about the Mined Land Reclamation Board and Office's review and decision or appeals process, you may contact the Office at (303) 866-3567.

Certification:

As an authorized representative of the applicant, I hereby certify that the operation described has met the minimum requirements of the following terms and conditions:

1. To the best of my knowledge, all significant, valuable and permanent man-made structure(s) in existence at the time this application is filed, and located within 200 feet of the proposed affected area have been identified in this application (Section 34-32.5-115(4)(e), C.R.S.).

2. No mining operation will be located on lands where such operations are prohibited by law (Section 34-32.5-115(4)(f), C.R.S.;

3. As the applicant/operator, I do not have any extraction/exploration operations in the State of Colorado currently in violation of the provisions of the Colorado Land Reclamation Act for the Extraction of Construction Materials (Section 34-32.5-120, C.R.S.) as determined through a Board finding.

4. I understand that statements in the application are being made under penalty of perjury and that false statements made herein are punishable as a Class 1 misdemeanor pursuant to Section 18-8-503, C.R.S.

This form has been approved by the Mined Land Reclamation Board pursuant to section 34-32.5-112,C.R.S., of the Colorado Land Reclamation Act for the Extraction of Construction Materials. Any alteration or modification of this form shall result in voiding any permit issued on the altered or modified form and subject the operator to cease and desist orders and civil penalties for operating without a permit pursuant to section 34-32.5-123, C.R.S.

Signed and dated this 16th day of April, 2025.

BURNCO Colorado LLC
Applicant/Operator or Company Name

If Corporation Attest (Seal)

Signed: Joel Balduc

Signed: _____
Corporate Secretary or Equivalent
Town/City/County Clerk

Title: Land and Resource Manager

State of Colorado)
) ss.
County of Adams)

The foregoing instrument was acknowledged before me this 16 day of April, 2025, by Joel Balduc as Land + Resource Manager of Burnco Colorado LLC

Kristina Leigh Kingsley
Notary Public

KRISTINA LEIGH KINGSLEY
Notary Public
State of Colorado
Notary ID # 20234038719
My Commission Expires 10-11-2027

My Commission expires: 10-11-2027

SIGNATURES MUST BE IN BLUE INK

You must post sufficient Notices at the location of the proposed mine site to clearly identify the site as the location of a

TABLE OF CONTENTS

EXHIBIT A - LEGAL DESCRIPTION

A PARCEL OF LAND SITUATED IN THE SOUTH ½ OF SECTION 9, TOWNSHIP 2 SOUTH, RANGE 70 WEST OF THE 6TH .PM., COUNTY OF JEFFERSON, STATE OF COLORADO, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE EAST ¼ CORNER OF SAID SECTION 9, MONUMENTED BY A FOUND 4" BRASS CAP STAMPED WAR DEPARTMENT CORPS OF ENGINEERS POI 2W 1951, AND FROM WHICH THE SOUTHEAST CORNER OF SAID SECTION 9, MONUMENTED BY A FOUND 4" BRASS CAP STAMPED WAR DEPARTMENT CORPS OF ENGINEERS PT I 1951 BEARS S00°04'31"E, A DISTANCE OF 2556.99 FEET FORMING THE BASIS OF BEARINGS ALONG THE EAST LINE OF THE SOUTHEAST ¼ OF SAID SECTION 9 FOR ALL LINES DESCRIBED HEREIN,

THENCE ON SAID EAST LINE, S00°04'31"E, A DISTANCE OF 2156.85 FEET;

THENCE S72°53'45"W, A DISTANCE OF 753.81 FEET TO THE POINT OF INTERSECTION WITH THE NORTH RIGHT-OF-WAY LINE OF ROCKY FLATS ENTRANCE ROAD;

THENCE ON SAID NORTH LINE, AND ON A LINE 200.00 FEET NORTH OF AND PARALLEL TO THE SOUTH LINE OF SAID SOUTHEAST ¼, S88°16'48"W, A DISTANCE OF 1918.66 FEET;

THENCE CONTINUING ON SAID NORTH LINE, AND ON A LINE 200.00 FEET NORTH OF AND PARALLEL TO THE SOUTH LINE OF SAID SOUTHWEST ¼, S88°17'12"W, A DISTANCE OF 1307.80 FEET TO THE INTERSECTION WITH THE WEST LINE OF THE EAST ½ OF THE SOUTHWEST ¼ OF SAID SECTION 9;

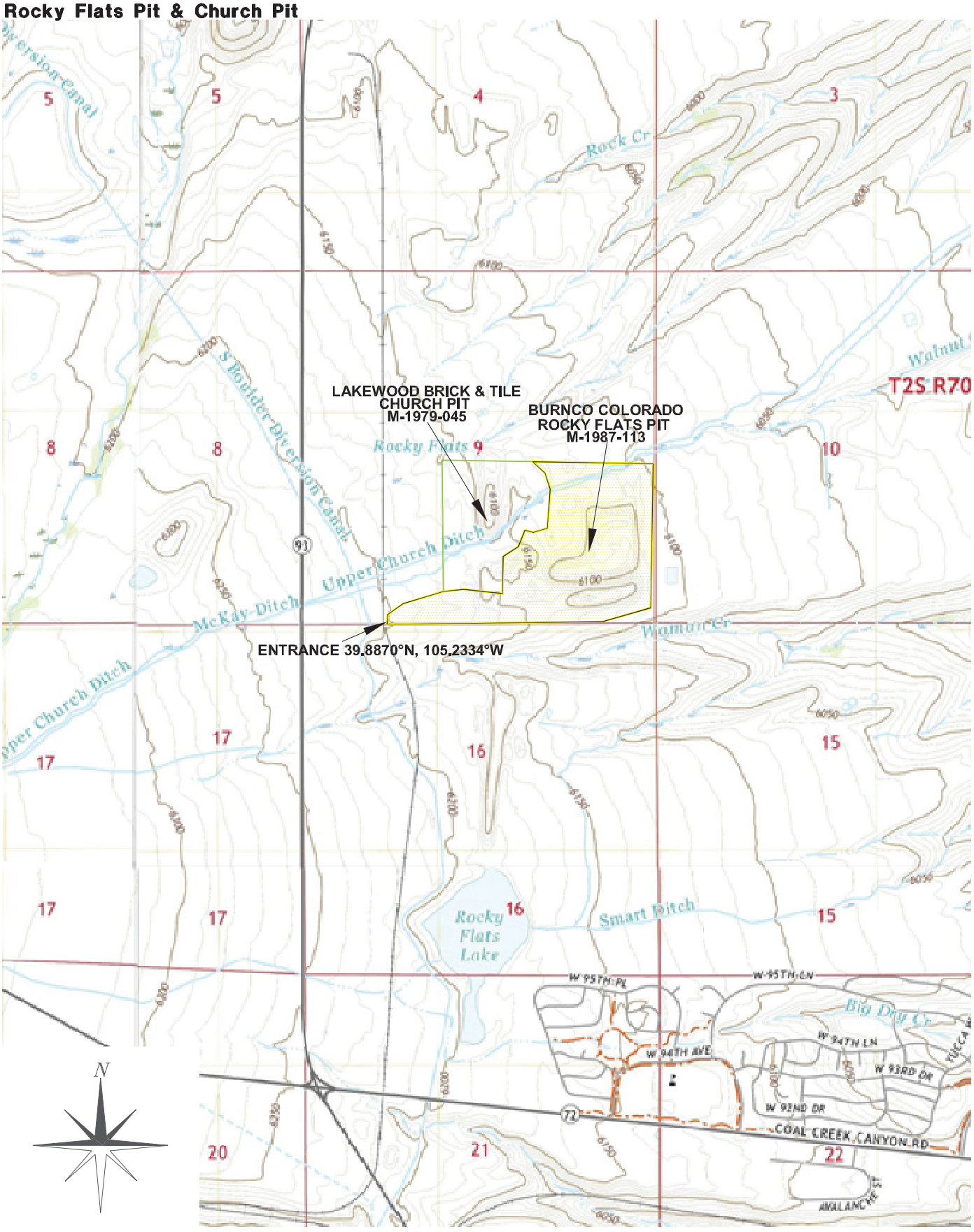
THENCE ON SAID WEST LINE, N00°12'28"W, A DISTANCE OF 140.31 FEET;

THENCE N53°42'15"E, A DISTANCE OF 284.63 FEET;
THENCE N71°52'26"E, A DISTANCE OF 636.05 FEET;
THENCE N83°16'00"E, A DISTANCE OF 305.99 FEET;
THENCE S84°50'53"E, A DISTANCE OF 583.00 FEET;
THENCE N00°00'00"E, A DISTANCE OF 556.84 FEET;
THENCE N56°45'39"E, A DISTANCE OF 271.59 FEET;
THENCE N20°07'17"E, A DISTANCE OF 266.34 FEET;
THENCE S76°49'40"E, A DISTANCE OF 132.18 FEET;
THENCE N72°24'34"E, A DISTANCE OF 218.48 FEET;
THENCE N03°09'10"E, A DISTANCE OF 590.07 FEET;
THENCE N19°43'55"W, A DISTANCE OF 251.96 FEET;
THENCE N48°14'26"W, A DISTANCE OF 249.85 FEET;

THENCE ON THE NORTH LINE OF SOUTH ½ SAID SECTION 9, N89°58'53"E, A DISTANCE OF 1807.99 FEET TO THE POINT OF BEGINNING, CONTAINING 119.78 ACRES, MORE OR LESS.

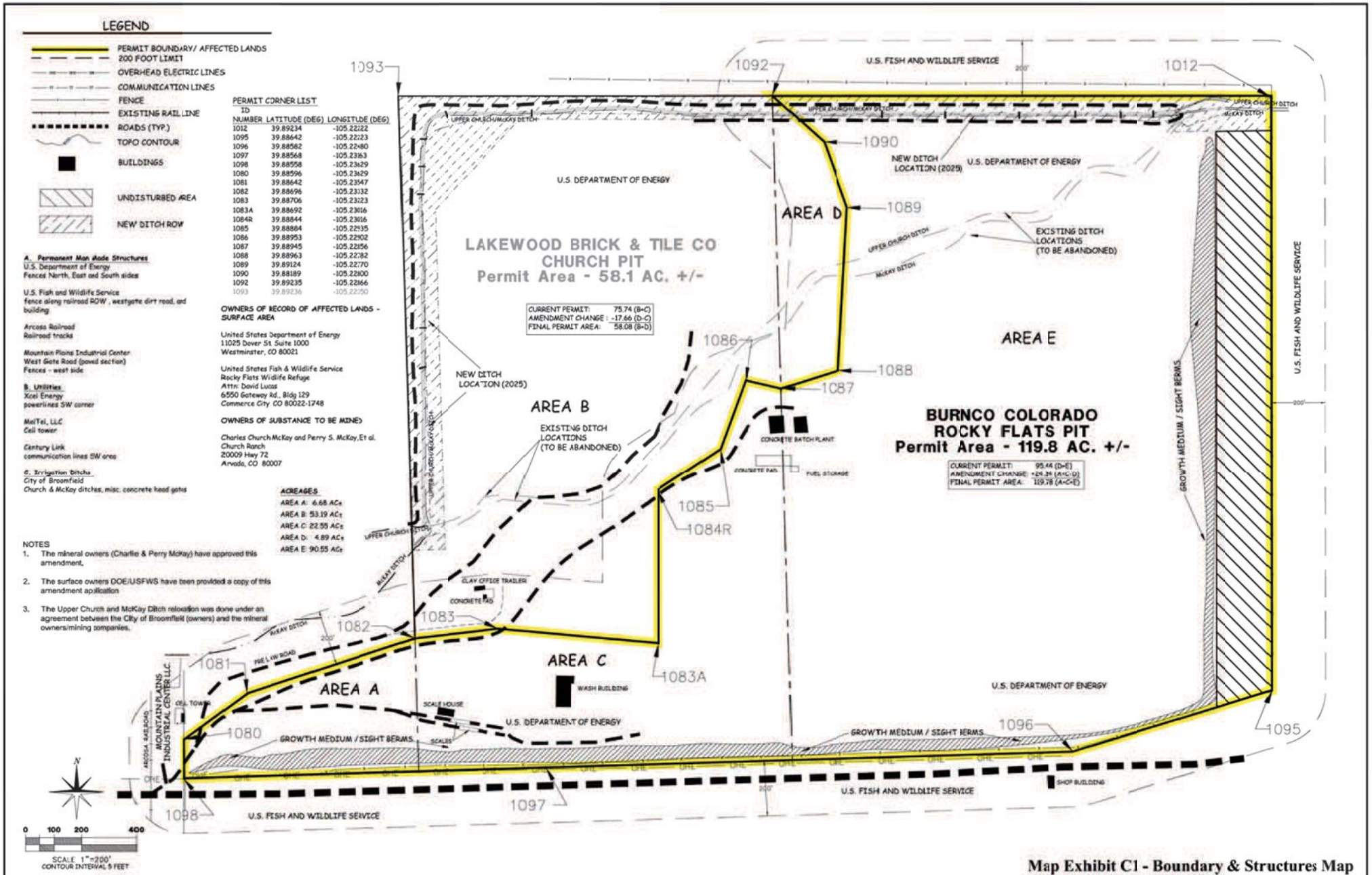
ENTRANCE 39.8857° N, 104.2363° W.

EXHIBIT B - INDEX MAP
BURNCO COLORADO LLC.
Rocky Flats Pit & Church Pit



Date: 04/07/2025
Scale 1 inch= 2000 ft.

PARTS OF SECTION 9, T2S, R70W
JEFFERSON COUNTY, COLORADO

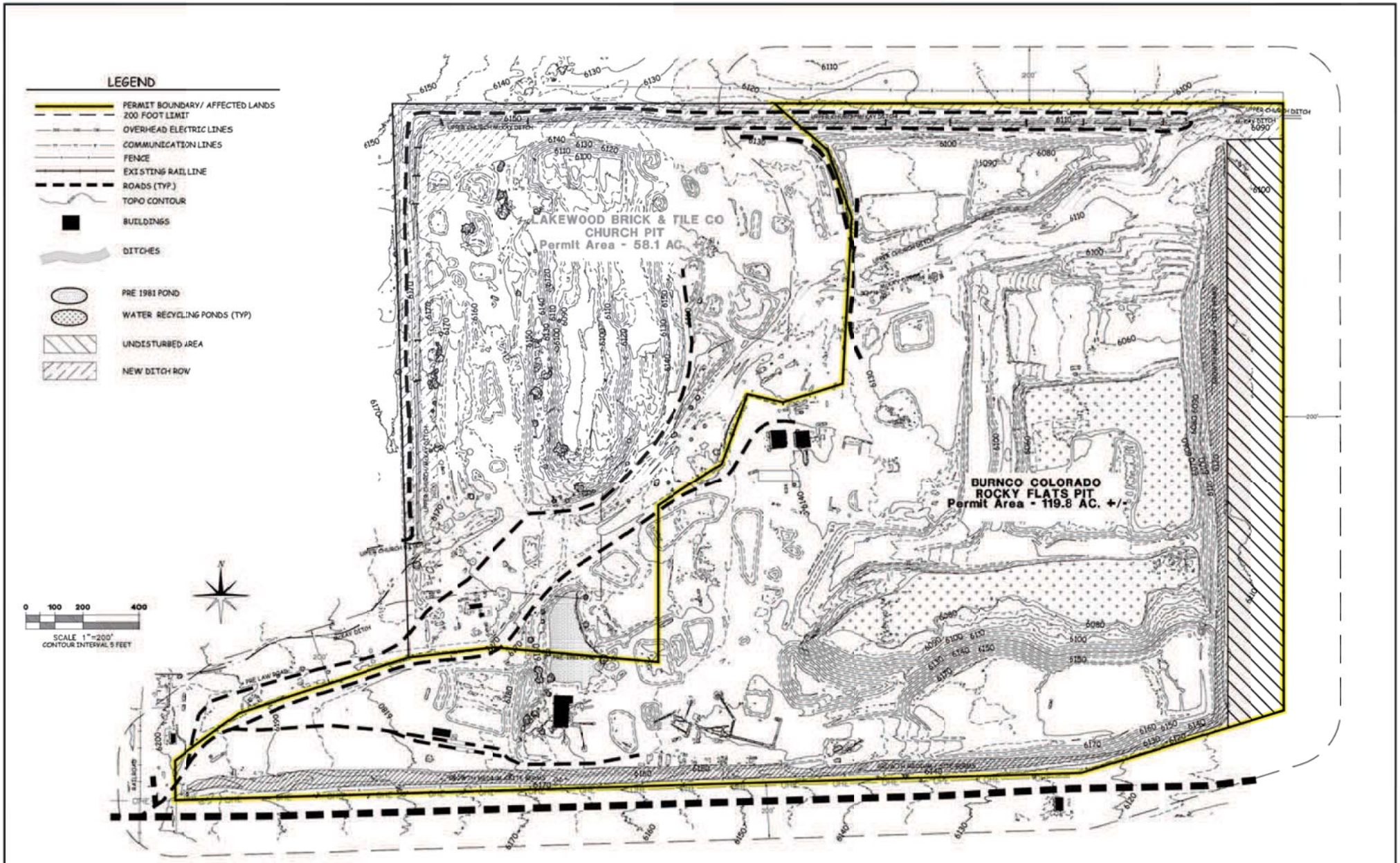


Map Exhibit C1 - Boundary & Structures Map

PREPARED BY: ENVIRONMENT, INC. 7995 VANCE DR., # 201 ARVADA, CO 80003 (303) 423-7291	The NE¼SE¼ and parts of the SE¼SE¼, SW¼SE¼, NW¼SE¼, and SE¼SW¼, Section 9, T-2-S, R-70-W of the 6th P.M., County of Jefferson, State of Colorado	REVISIONS: Original permit NOV 23, 1987; Permit issued JAN 05, 2004; Amendment 01 APR 16, 2025	AMENDMENT FOR ROCKY FLATS PIT PERMIT # M-1987-113	BURNCO COLORADO LLC 10100 DALLAS ST. | Henderson, Colorado 80640 phone: (303) 913-6583	SHEET 1 OF 4

APR 15, 2025 - 13:57:39

FULL SCALE MAP IN MAP POCKET



Map Exhibit C2 - Current Conditions Map

PREPARED BY: ENVIRONMENT, INC.

The NE¼SE¼ and parts of the SE¼SE¼, SW¼SE¼, NW¼SE¼, and SE¼SW¼, Section 9, T-2-S, R-70-W of the 6th P.M., County of Jefferson, State of Colorado

REVISIONS	DATE:
Original permit	NOV 23, 1987
Permit issued	JAN 05, 2004
Amendment 01	APR 15, 2025

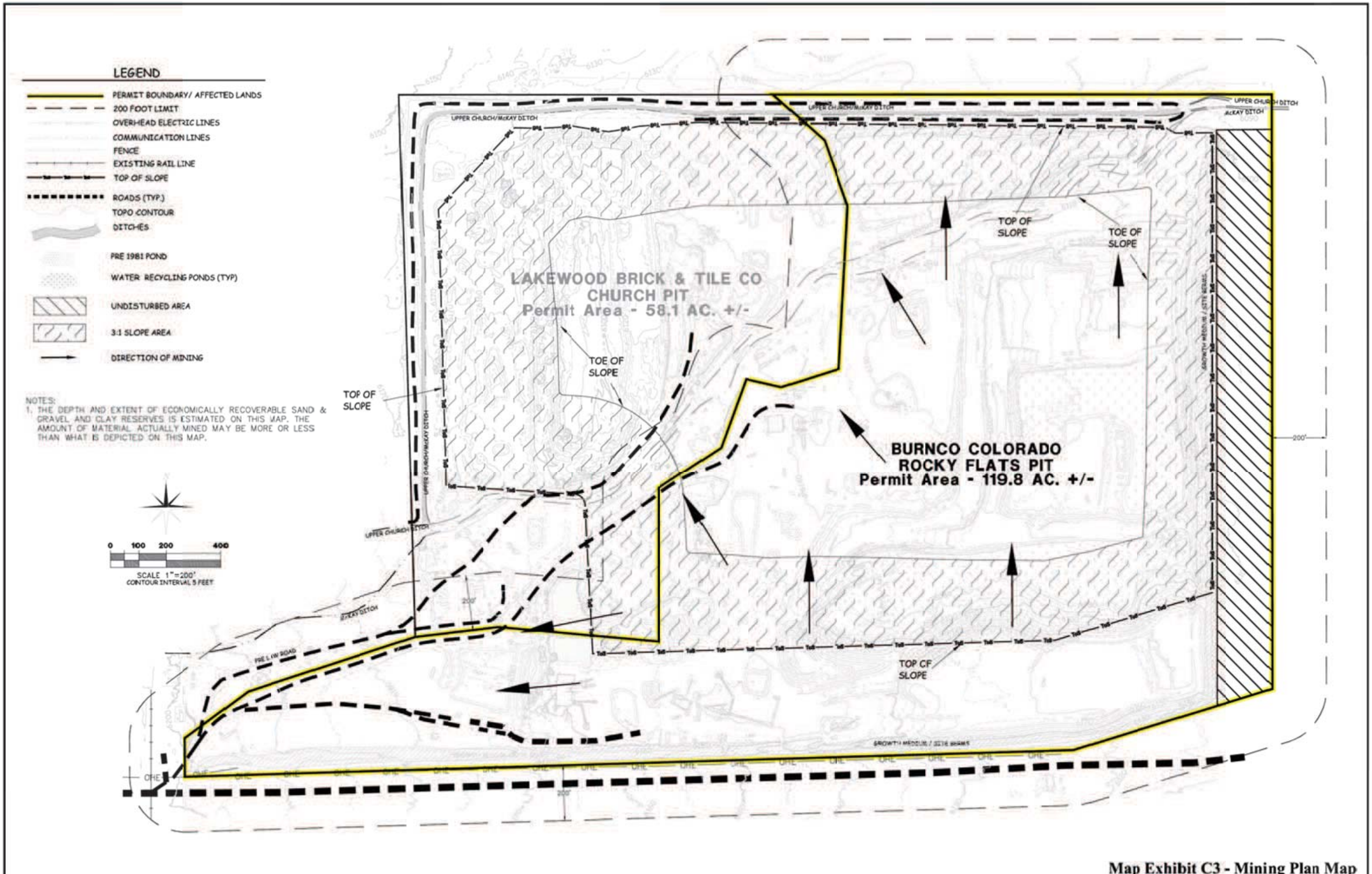
AMENDMENT
FOR
ROCKY FLATS PIT
PERMIT # M-1987-113

BURNCO COLORADO LLC
10100 DALLAS ST. | Henderson, Colorado 80640
phone: (303) 913-6583

SHEET 2 OF 4

APR 15, 2025 – 13:55:17

FULL SCALE MAP IN MAP POCKET



PREPARED BY: ENVIRONMENT, INC.	The NE¼SE¼ and parts of the SE¼SE¼, SW¼SE¼, NW¼SE¼, and SE¼SW¼, Section 9, T-2-S, R-70-W of the 6th P.M., County of Jefferson, State of Colorado	REVISIONS: Original permit / Permit issued / Amendment 01 — DATE: NOV 23, 1987 / JAN 05, 2004 / APR 16, 2025	AMENDMENT FOR ROCKY FLATS PIT PERMIT # M-1987-113	BURNCO COLORADO LLC 10100 DALLAS ST. | Henderson, Colorado 80640 phone: (303) 913-6583	SHEET 3 OF 4

APR 15, 2025 – 13:52:47

FULL SCALE MAP IN MAP POCKET

LOCATION

The BURNCO Rocky Flats Pit (M-1987-113) is located at 20779 West Gate Road, Golden, Colorado, one-quarter mile east of Highway 93 and adjacent to the Rocky Flats National Wildlife Refuge in Jefferson County**.** Access is from the intersection of State Highway 93 and West Gate Road, approximately 10 miles north of Golden, Colorado.

The Rocky Flats Pit and the adjacent Lakewood Brick and Tile Co. Church Pit are located on land owned by the US Department of Energy with mineral rights owned by Church Ranch (Charlie McKay). Upon completion of final reclamation, the permit area will become part of the Rocky Flats National Wildlife Refuge. **Exhibit B - Index Map** shows the general location and land features in the vicinity of the pit.

GEOLOGIC SETTING

The surface gravel being mined is part of the Rocky Flats alluvium deposit (Qrf) that covers large areas surrounding the mine. This alluvium ranges from boulder and cobble gravel size and is predominantly quartzite. The alluvium varies from 15 to 100 plus feet deep on the site and overlays steeply dipping bedrock units at an angular unconformity.

Underlying this gravel is the Laramie formation on the east and the Fox Hill formation on the west. If clay is present, it will be mined from the basal members of the Laramie formation of Upper Cretaceous age. These clay beds dip to the east at approximately 45 degrees and the strike is approximately N01°30' W. The normal dip slope of the clay beds is 1:1. Lakewood Brick & Tile Company is mining clay and sandstone from these beds immediately west of the BURNCO gravel mine.

SOILS AND OVERBURDEN

It should be noted that the USDA Soil Survey description estimates a uniform 18 inches of soil described as a very dark grayish brown cobbly, sandy loam in which the cobbles range from 50 to 75 percent by volume. There are three soil map units on or adjacent to the mining site (see Exhibits I and J). Wherever feasible, this surface layer will be saved and stockpiled for use in reclamation.

CURRENT CONDITIONS

Exhibit C-2 Current Conditions Map shows the outline of the affected land, adjacent landowners, topography and other hydrologic features, and existing facilities. Much of the area is mined or disturbed at this time. There are no permanent buildings, power lines, phone lines, or natural gas, water, or sewer pipelines on the affected land. There is a concrete batch plant located on the west-central area of the Rocky Flats Pit that will continue operation for at least a few more years. The plant will be removed or relocated to the entrance area so that the gravel under the plant can be mined.

MINING PLAN

Mining at the site will continue as presently configured. The current bottom of the pit is at an elevation of 6,060 feet. For at least the next 5 years, mining will be conducted so as to bring the entire pit down to this level before proceeding to a deeper elevation. The last area to be mined will be the aggregate Plant Site on the south side of the permit area. The far southwestern area near the entrance will not be mined. As excavation proceeds, the outside perimeter slopes not adjoining the Church Pit, will be mined near vertical and backfilled to 3:1. Exhibit C-3 - Mining Plan Map shows the progression of mining through the site. The depth and extent of economically recoverable gravel and clay reserves is estimated on the Exhibit C-3 Mining Map. The amount of material actually mined may be more or less than what is depicted on Exhibit C-3 and necessary adjustments to the reclamation plan and map will be completed through Technical Revisions as applicable.

As noted in the geological setting section of this mining plan, gravel deposits overlie the entire Rocky Flats/Church Pit area. At the same time, clay seams that are at the surface of the Church Pit area dip 45 degrees to the east and underlie a considerable but unknown portion of the Rocky Flats Pit. The revised mine permit boundary shown on Exhibit C-1 Boundary Map reflect the boundary between the current Rocky Flats Pit and Church Pit operational areas today.

The pit operates year-round primarily during daylight hours. The mining operations are dependent on demand and may operate intermittently throughout the year with long inactivity punctuating periods of intense activity.

As mining began in un-stripped areas, the soils were removed and stockpiled in setbacks and right-of-way areas for later use as growth medium when resoiling and revegetating the slopes. Growth medium is currently stored on the north, south, and southeast sides of the pit. A portion of the berm may be retained after reclamation is complete.

The gravel at this site is mixed with clay alluvium, and as part of the processing, a large amount of unusable clay fines remains after the gravel is separated out for use. These clay fines are currently being stockpiled along the south side of the mine which will be shaped into a permanent feature at the time of final reclamation. Ongoing operations will provide additional clay fines which will be used to construct the 3H:1V slopes inside the excavation area. Any unused material will be sold, placed inside the excavation, or left in a surface berm.

The excavation for gravel will be set back 30 feet from the Permit/Affected lands line on the east and south sides. On the north side, the excavation will be 30 feet from the south side of the relocated ditch right-of-way. On the west side, where the affected lands adjoin the Church Pit there will not be a setback. As reflected in the Church Pit amendment application being submitted contemporaneously with this application, the floors of the two mines will be blended together and leave one contiguous landscape when reclamation is complete.

Previously, the Church and Rocky Flats Pits had been bisected by the McKay and Upper Church ditches which meandered from southwest to the northeast. An agreement to move these ditches was completed in 2015. Construction of the new combined ditch, drop structures, diversion, splitter, and Parshall flume structures was completed in early 2025 and is expected to be accepted by the City of Broomfield later in 2025. The ditches now run north along the west edge of the Church Pit, then turn east along the north edge of the Church and Rocky Flats Pits, then return to their historical channels to the northeast of the Rocky Flats Pit. All map exhibits show the location of the new ditch easement and reconstructed ditch. Upon Broomfield's acceptance of the completed ditch, the old ditch Right-of-Way will be abandoned as provided for in the ditch relocation agreement. This will allow removal of the gravel and

clay underlying the old ditch locations.

Equipment used for gravel mining include, but is not limited to, front-end loaders, bulldozers, graders, scrapers, haul trucks, water truck, scale and scale house. In addition, crushers, screens, conveyors, stackers, a wash plant, and a portable Concrete Batch Plant are used in the mine.

CLAY MINING

There is evidence that there are clay beds under the gravel along the west side of the Rocky Flats permit area similar to the clay seams being mined in the Church Pit to the west. The clay area is estimated at 20 acres more or less. The presence and extent of the clay seams can be confirmed only when the overlying sand and gravel is removed.

Any area needed by the clay mine will be left un-reclaimed until after the clay is removed. It would be unproductive to reclaim the areas under which the clay lies, so it will be up to the clay operator to reclaim any of the clay areas. With removal of the alluvium, we expect to mine clay beds to a depth of 40 to 50 feet below the reservoir floor left by gravel mining.

Sometimes hard spots of clay or sandstone are encountered within the clay beds that cannot be broken down by ripping. As a result, they must be blasted so that work can continue. This happens only a few times a year.

The clay material will be removed by dozers and track-hoes and loaded onto a truck by a front-end loader. Other equipment used in the clay pit and stockpile areas includes, but is not limited to, a scraper, a Koleman screen, a grizzly, and water pumps.

MINING TIMETABLE

Construction industry demand varies greatly from year-to-year, thus precluding an accurate forecast of demand during the life of the mine. Therefore, the operator has has elected to estimate a mining timetable based on an average year.

Mining area	Years	Total acres
Gravel	8-10	119.8
Clay	15-25	Est. 20

This site will be reclaimed as either:

1) Developed Water Storage; or
2) Rangeland

Either end use will be compatible with the adjacent Rocky Flats National Wildlife Refuge. Reclamation will be carried out to complement refuge purposes, including by improving habitat and public recreation opportunities.

DEVELOPED WATER STORAGE

The excavated area will make an ideal reservoir that is needed in the Denver Metro area. Water storage is essential to supplying water to businesses and residents year-round. There are several other reservoirs in the Rocky Flats area currently including the Francis Smart Reservoir one mile south of the pit, Welton Reservoir 3 miles southeast, Standley Lake 5 miles southeast, and the Great Western Reservoir 3 miles northeast. The material to be used to rebuild the side slopes and pit bottom is available on site and is suitable for constructing a compacted liner because of the high clay content.

Reclamation of the area mined will be carried out as a single Phase once the final depth of the reserves is reached. The final bottom elevation depth of the range land or water storage shown on Exhibit F of 6,030 feet is an estimate and the final bottom elevation depth may be significantly higher or lower than 6,030 feet depending on the depth and extent of economically recoverable gravel and clay material available at the site. Necessary adjustments to the reclamation plan will be completed through Technical Revisions as applicable. Material for slope construction will come from the material being generated daily as a byproduct from the processing plant or from the material stockpiled along the southern side of the permit area. Construction of the compacted liner will begin on the east and north sides of the mine when the bottom is reached.

From the west side of the Church Pit to the east side of the Rocky Flats Pit there is a 90-foot elevation drop. The maximum water storage volume is determined by the

lowest point on the perimeter near the northeast corner. As the reservoir is developed it may be divided into two or more cells to maximize water storage volume. The exact location and configuration of the dividers is unknown at this time, so a Technical Revision will be filed showing the final layout if dividers are to be installed. If the dividers are not constructed, the excess material will be distributed evenly on the floor of the reservoir. The ground level around the perimeter of the reservoir will remain at its pre-mining grade so this will be an inground water storage reservoir and will not involve an impoundment or dam.

Final engineering plans for the compacted clay liner will be prepared when we get closer to construction. The plan is that the slopes along the perimeter areas will be constructed as mining reaches the underlying bedrock. All slopes above and below water level will be constructed and graded to a 3H:1V slope.

RANGELAND

If the site is not reclaimed to Developed Water Storage, the alternative reclamation approach will be to reclaim the site as Rangeland. This is the previously approved end use and remains compatible with the Rocky Flats Wildlife Refuge. In this approach, reclamation contours will remain the same as those shown on the Reclamation Plan Map shown in Exhibit F. Perimeter sloping will be reclaimed at 3H:1V. If reclaimed as Rangeland, growth medium will be spread across the full area and vegetation will be established on the pit floor, slopes, and uplands.

GROWTH MEDIUM

The USDA Soil Survey description for this site estimated a uniform 18 inches of soil described as a very dark grayish brown cobbly, sandy loam in which the cobbles range from 50 to 75 percent by volume. Since opening, it has been challenging to recover and stockpile sufficient quantities of soil material that are likely to support vegetation growth. The soil that has been recovered is currently stored on the north, east and south sides of the pit. This soil will be amended with on-site supplementary materials to create enough growth medium to complete reclamation across the entire

site. As such, these materials will be supplemented with onsite reject and/or imported amendments to provide sufficient growth medium as needed for reclamation. Such blending will be done in consultation with a suitably qualified consultant to ensure that the resulting growth medium will support the growth of vegetation.

Growth medium will be spread on applicable areas to a depth of 4-8 inches, or an average depth of 6 inches once rough grading is completed. If the site is being reclaimed as Developed Water Storage, then growth medium will be spread on those areas shown on the Reclamation Plan Map shown in Exhibit F as above the high-water level. If the site is being reclaimed as Rangeland, then growth medium will be spread on all areas.

Portions of the growth medium berms may be retained after reclamation is complete to screen the area from off-site. Any berms left in place will be graded at a 3H:1V slope and revegetated.

FERTILIZER

Soils will be carefully tested prior to seeding. Samples will be collected from redeposited growth medium and will be submitted to the soil testing laboratory at Colorado State University. We will ask for their recommendations on the fertilizer that will produce the best growth in the shortest time.

SEEDBED PREPARATION

When the growth medium has been placed and the fertilizer spread, the surface where seed is to be drilled will be smoothed of large clods and worked until moderately fine. The surface will be left fairly rough where it is necessary to broadcast the seed so the roughness can reduce the potential for erosion by wind and water.

SEED MIXTURE

The following seed mixture replaces the mix approved in the original permit. The mix has been designed for use on the Rocky Flats National Wildlife Reserve and was provided by Mr. David Lucas of the USFWS for use on the site. Where the topography

allows, a grassland drill will be used to plant the seed mixture. The seed mix will be drilled at a depth of one fourth (0.25) to three fourths (0.75) inches; if it is necessary to broadcast see an area, the seed rates shown will be doubled and the seed will be spread on a rough surface and dragged thoroughly after seeding.

Species	Lbs PLS/Acre
Thickspike Wheatgrass, Critana	0.73
Western Wheatgrass, Arriba	4.17
Slender Wheatgrass, San Luis	2.72
Side-Oats Grama, Vaughn	1.49
Blue Grama, Hachita	0.74
Buffalo Grass, Texoka	4.84
Green Needle Grass, Lodorm	1.21
Rocky Flats NWR Hillside Mix (50 seeds per square foot)	15.90

MULCH

No mulch will be used at this site because wind velocities common to the area would blow any mulch off-site.

IRRIGATION

No irrigation is planned. The grass mixture is designed to survive and grow under existing natural conditions.

WEED CONTROL

Aggressive weed control is currently done each Spring, based on monitoring of the disturbed area and spraying is done as needed. The plan is working as designed as the noxious weeds are under control on the site which is much better than surrounding areas. An updated Weed Control Plan is included in this submittal.

RECLAMATION SCHEDULE

Final grading, fertilizing and seeding will be completed within one year of the

completion of each compacted liner section. When possible, planting and fertilizing will occur in each planting year between the middle of March and the middle of April. If spring planting is not feasible, the operator will plant between mid-September and late October. During the balance of the reclamation phase, reclamation progress will be monitored and remedial work will be performed where necessary.

RECLAMATION PERFORMANCE STANDARDS

The operator plans to operate the site in compliance with the Reclamation Performance Standards of Rule 3.

Grading will be performed to create a final topography appropriate to the planned future land use. When backfilling is necessary, the operator will place overburden and waste materials in the mined area and will ensure that heavy equipment used for this purpose is compacting the earth sufficiently to achieve good stability. All grading will be done in a manner to control erosion and to protect areas outside the affected land from slides or other damage. All grading will be completed as soon as feasible following the mining process. Any refuse will be handled and disposed of in a manner that will control unsightliness and potential safety concerns.

There are no acid-forming or toxic materials involved in this operation. There will be no drill or auger holes left on the land. There are no portals to underground operations on the mine site. The slopes to be revegetated will be capable of being traversed by farm machinery.

This is a dry operation. No ground water is expected to be encountered and stormwater that temporarily ponds will be discharged within 72 hours of the end of a storm event. After reclamation is complete, water will be stored in the reservoir only to the extent the future reservoir developer has water rights sufficient for such storage.

There is no distinct topsoil layer, therefore topsoil and overburden will be removed together and blended into growth medium and stockpiled. If the growth medium is stockpiled for more than six months, a temporary vegetative cover consisting of the approved seed mix will be employed to protect the growth medium from wind and water erosion and keep it free of contaminants so that it is useful for sustaining vegetation

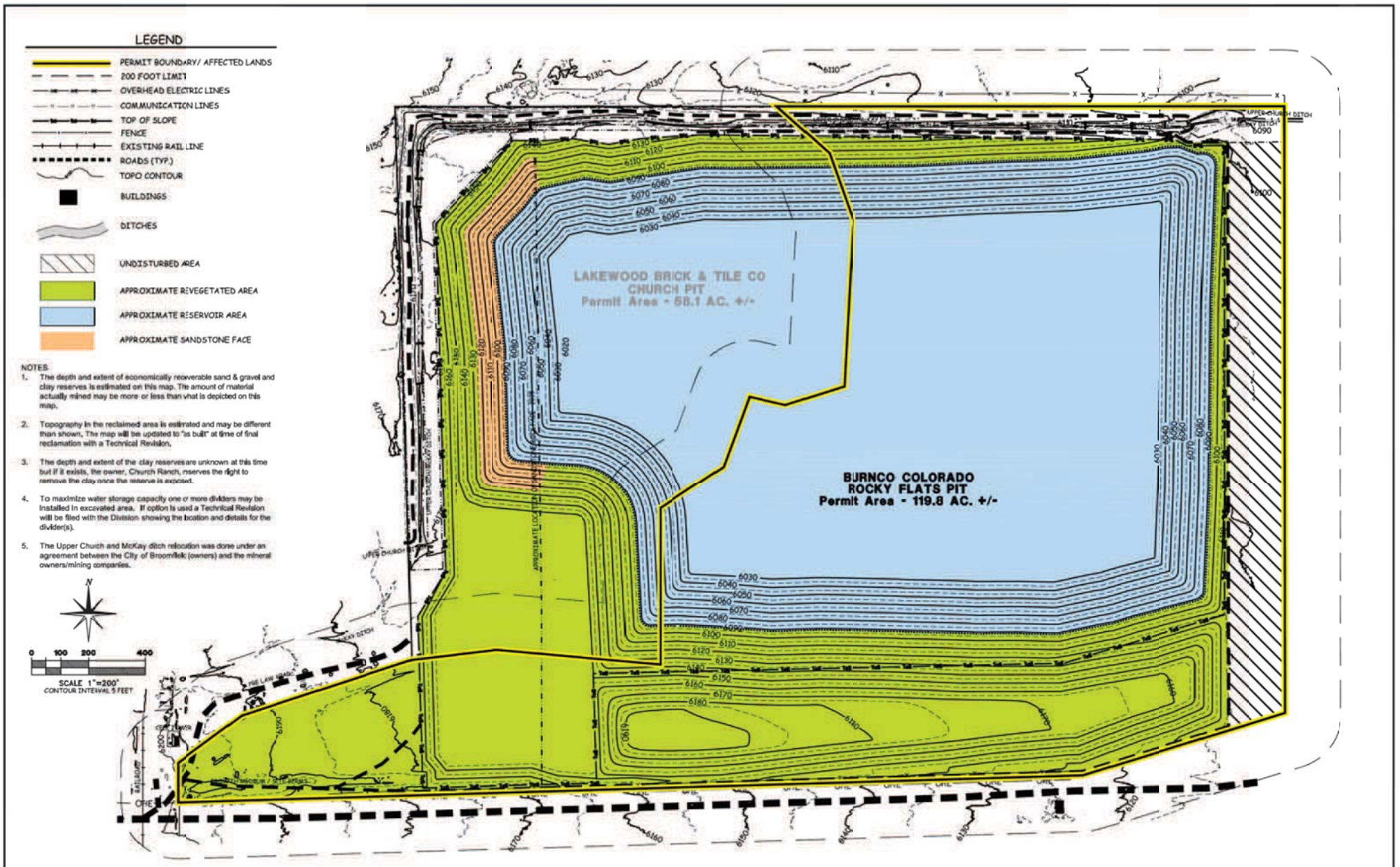
when the site revegetation process begins. The stockpiles will be located in areas where disturbances by active mining operations will be at a minimum. The growth medium will be handled as little as possible until it is replaced in disturbed areas. The operator will take measures necessary to ensure the stability of the replaced growth medium on graded slopes. Growth medium will be spread as evenly as possible. Fertilizers and other soil amendments will be used as required in the reclamation plan.

Revegetation will be carried out in such a way as to establish a diverse, effective and long-lasting vegetative cover that is capable of self-regeneration without continued dependence on irrigation, soil amendments or fertilizers. The plan is designed to create a vegetative cover that is at least equal in extent to the cover of the natural vegetation of the surrounding area.

The land will be restored to slopes commensurate with developed water storage or rangeland. Seed will be drilled wherever possible. Where drilling is not possible, seed will be broadcast. The revegetation plan provides for the greatest probability of success in plant establishment and vegetative development by considering environmental factors such as seasonal patterns of precipitation, temperature and wind. Other factors such as soil texture, fertility, slope stability and slope aspects, have been considered. Weed control is considered in the program and implemented as described in the weed control plan

RECLAMATION TIMETABLE

Reclamation will be done concurrently with mining once mining reaches the bottom mining elevation. Concurrent reclamation will be utilized whenever possible so that areas that are no longer needed, can be reclaimed. Final reclamation will be completed within 5 years after mining ends.



Map Exhibit F - Reclamation Plan Map

ENVIRONMENT, INC.

The NE¼SE¼ and parts of the SE¼SE¼, SW¼SE¼, NW¼SE¼, and SE¼SW¼, Section 9, T-2-S, R-70-W of the 6th P.M., County of Jefferson, State of Colorado

REVISION:	DATE:
Original permit	NOV 25, 1987
Permit issued	JAN 05, 2009
Amendment 01	APR 16, 2025

AMENDMENT
FOR
ROCKY FLATS PIT
PERMIT # M-1987-113

BURNCO COLORADO LLC
10100 DALLAS ST. | Henderson, Colorado 80640
phone: (303) 913-6583

SHEET 4 OF 4

APR 15, 2025 – 13:59:23

FULL SCALE MAP IN MAP POCKET

EXHIBIT G – WATER INFORMATION

This is a dry mine. No ground water is exposed or otherwise impacted, so a Gravel Pit Well Permit and associated water rights are not needed. Water used by the aggregate operation is supplied from an approved off-site well, permit 17190-F and water case W-8239-76 and trucked to the mine site. Water used by the concrete batch plant is supplied by the nearby industrial park. Approximately 15 acre-feet per year is used in aggregate processing and dust control and approximately 15 acre-feet per year is used by the concrete batch plant.

There are no well permits within the permit area. Well permit #242998 was for a well drilled in 2002 one-quarter mile west of the Church Pit permit boundary. The well was drilled 1,400 feet and was a dry hole.

Current natural drainage is toward the Eastern part of the property. Operations will not disturb this drainage pattern except in the immediate area of the mine where all surface runoff water flows into the pit area. There will be no effect on surrounding properties. No water will be used for reclamation.

The operator's intent is to minimize disturbances to the prevailing hydrologic balance of the affected land and to the surrounding area and to the quality and quantity of water in surface and groundwater systems, both during and after mining and during reclamation. The operation will be in compliance with federal and state laws and regulations governing water and water rights.

The final reservoir capacity is unknown at this time and will depend on the mining depth, the amount of backfill, and the final configuration of the reservoir. The mining depth will be determined by the amount of economically recoverable gravel and clay materials. After reclamation is complete, water will be stored in the reservoir only to the extent the future reservoir developer has water rights sufficient for such storage.

EXHIBIT H - WILDLIFE STATEMENT

Wildlife Species list:
Mule deer, elk, cottontail, jackrabbit, skunk, raccoon, small rodents, songbirds, raven, magpie, coyote, raptors (bald eagle, golden eagle, owl, hawk), snakes, lizards, mourning dove.

Endangered/critical species/impacted:
None known. Review of the *Operations Unit 11 Combined Phases RFI/RI Report for Rocky Flats Environmental Technology Site - Final Report June 1995*. Pages 3-25 thru 3-27 indicate there are no endangered or threatened species or their habitat on the Rocky Flats area. OU-11 covered the area west of the plant bounded by West Gate Road on the south and a line along the south side of the main Rock Drainage on the north, west to the western limits of the Plant Buffer area.

Critical habitats/vegetative communities impacted:
The present habitat is a typical high plains pasture/grassland complex that favors small mammals, small birds, and raptors. The ditches and low-lying drainages are used extensively as travel lanes, resting and feeding areas by deer. Even though the land appears rather barren, it is surprisingly productive for wildlife described above.

Assessment of impact:
Mining activity will totally destroy the wildlife habitat until such time as reclamation is complete. Deer/vehicle collisions will result in an unnecessary reduction of the herd unless truck drivers are alert to the possibility.

Mine Reclamation:
The resulting depressed area after mining is completed offers an excellent opportunity to provide vegetation favoring small mammals and songbirds, as well as deer. Native grasses and extensive use of appropriate shrubs that provide both food and cover are recommended to be planted in a suitable layer of growth medium. This vegetative complex will serve to increase prey populations, which in turn will benefit predators, especially the raptors.

The soils information of the area is included below, however, please note, virtually all of the affected area has been mined and disturbed so the soils information is no longer applicable to the affected area, but is representative of the area surrounding the mine.

SOILS:

The data in the following pages of this exhibit describes soils at the mine site. This information came from the "Soil Survey for the Golden area" Published by the Soil Conservation Service in 1983.

Soil Types:

45 – Flatirons very cobbly sandy loam, 0 to 3% slopes
46 – Flatirons very stony sandy loam, 0 to 5% slopes
100 – Nederland very cobbly sandy loam, 15 to 50% slopes

pH – The soils on this site are neutral to slightly alkaline.

Conductivity – Salinity is expressed in terms of (millimhos). Soil salinity is recognized and interpreted in the soil survey process as follows:

CLASS	SALTS (TSS)	EXTRACT MMHOS/CM
Non Saline	0.00-0.15	0 - 4
Slightly Saline	0.15-0.35	4 - 8
Moderately Saline	0.35-0.65	8 - 15
Strongly Saline	above 0.65	above 15

The soils mentioned above are all non saline.

45—Flatirons very cobbly sandy loam, 0 to 3 percent slopes. This is a deep, well drained soil on high terraces and piedmonts. It formed in noncalcareous, stony to gravelly, and loamy material of the Rocky Flats Alluvium. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 47° F, and the average frost-free season is 126 to 142 days. Elevation is 6,000 to 6,600 feet.

Typically, the surface layer is neutral and slightly acid, very dark grayish brown very cobbly sandy loam about 13 inches thick. The subsoil in the upper 8 inches is medium acid, reddish brown very gravelly clay; in the next 26 inches it is slightly acid and neutral, strong brown very gravelly sandy clay; and below that to a depth of 60 inches it is neutral, strong brown very gravelly sandy clay loam.

Included in mapping are small areas of calcareous soils near the edge of terraces, Veldkamp soils in positions similar to those of the Flatirons soil, soils near the mouth of Coal Creek Canyon that have a very stony surface layer, and soils that have a dark surface layer more than 20 inches thick and are on mounds. Also included are small areas of Urban land. The included soils and Urban land make up about 15 percent of the total acreage.

Permeability of this Flatirons soil is slow. The available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is slow, and water erosion and soil blowing are slight hazards. The shrink-swell potential is moderate. Rock fragments make up 35 to 80 percent of the volume.

This soil is used mainly for grazing and as habitat for wildlife and recreation areas. In a few areas it is used for community development.

The native vegetation is mainly big bluestem, little bluestem, needleandthread, and mountain muhly. The average annual production of air-dry vegetation ranges from 1,000 to 2,300 pounds per acre. Proper grazing use and a planned grazing system are needed to maintain the quality and quantity of desirable plants and to prevent erosion. Periodic deferment of grazing during the growing season helps maintain or improve the range condition. This soil is difficult to revegetate; therefore, proper grazing use is needed to prevent depletion. Mechanical treatment is not practical because the surface is stony. Small pastures commonly are severely overgrazed and eroded. Livestock in small pastures should be kept in pens. The rest of the pasture can be used as exercise areas and for very limited grazing.

Grasses, shrubs, trees, and garden plants are difficult to establish and maintain on this soil because of the large stones. Applications of manure and commercial fertilizers that contain nitrogen and phosphorus are needed to maintain fertility. Selecting adapted plants is essential in establishing plantings. Pebbles and cobbles in disturbed areas should be removed from the surface for best results in landscaping, particularly for lawns. Supplemental irrigation is needed at planting time and during dry periods.

The areas of Urban land are covered by streets, parking lots, sidewalks, buildings, and other impervious manmade structures. Because runoff is rapid, storm drains, natural drainageways, and land grading must accommodate heavy flows to prevent flooding downslope in areas that normally would not be subject to flooding.

This Flatirons soil is limited for homesite development by the large stones, the shrink-swell potential, and the slow permeability. Excavating this soil for buildings and roads is difficult because of the large stones, and large equipment may be needed. The effects of shrinking and swelling can be minimized by proper engineering design and by backfilling with material that has a low shrink-swell potential and installing surface and subsurface drains near foundations. Properly installed tile drains below the foundation and minimal surface watering near the foundation help prevent seepage into basements and minimize the effects of shrinking and swelling. Special sewage systems must be installed because of the slow permeability. Erosion and sedimentation can be controlled by maintaining an adequate plant cover.

This soil is in capability subclass VIIs, in the Cobbly Foothill range site, and in plant adaptability group F-5.

46—Flatirons very stony sandy loam, 0 to 5 percent slopes. This is a deep, well drained soil on undulating, dissected fan piedmonts. It formed in noncalcareous, cobbly, stony, gravelly, and loamy material of the Rocky Flats Alluvium. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 47° F, and the average frost-free season is 126 to 142 days. Elevation is 6,000 to 6,600 feet.

Typically, the surface layer is neutral and slightly acid, very dark grayish brown very stony sandy loam about 13 inches thick. The subsoil in the upper 8 inches is medium acid, reddish brown very gravelly clay; in the next 26 inches it is slightly acid and neutral, strong brown very gravelly sandy clay; and below that to a depth of 60 inches it is neutral, strong brown very gravelly sandy clay loam.

Included in mapping are small areas of calcareous soils near the edge of terraces, Veldkamp soils in positions similar to those of the Flatirons soil, and soils that have a very cobbly surface layer and are near the eastern limit of the map unit. Also included are small areas of Urban land. The included soils and Urban land make up about 15 percent of the total acreage.

Permeability of this Flatirons soil is slow. The available water capacity is low. The effective rooting depth is 60 inches or more. Runoff is slow, and water erosion and soil blowing are slight hazards. The shrink-swell potential is moderate. Rock fragments make up 35 to 80 percent of the volume.

In most places this soil is used for grazing and as wildlife habitat and recreation areas. In a few places it is used for community development.

The native vegetation is mainly big bluestem, little bluestem, needleandthread, and mountain muhly. The average annual production of air-dry vegetation ranges from 1,000 to 2,300 pounds per acre. Proper grazing use and a planned grazing system are needed to maintain the quality and quantity of desirable plants and prevent erosion. Periodic deferment of grazing during the growing season helps maintain or improve the range condition. This soil is difficult to revegetate; therefore, proper grazing use is needed to prevent depletion. Mechanical treatment is not practical because the surface is stony. Small pastures commonly are severely overgrazed and eroded. Livestock in small pastures should be kept in pens. The rest of the pasture can be used as exercise areas and for very limited grazing.

Grasses, shrubs, trees, and garden plants are difficult to establish and maintain on this soil because of the large stones. Applications of manure and commercial fertilizers that contain nitrogen and phosphorus are needed to maintain fertility. Selecting adapted plants is essential in establishing plantings. Pebbles and cobbles on the surface should be removed for best results in landscaping, particularly for lawns. Supplemental irrigation is needed at planting time and during dry periods.

The areas of Urban land are covered by streets, parking lots, sidewalks, buildings, and other impervious manmade structures. Because runoff is rapid, storm drains, natural drainageways, and land grading must accommodate heavy flows to prevent flooding downslope in areas that normally would not be subject to flooding.

This Flatirons soil is limited for use as homesites by the large stones, the shrink-swell potential, and the slow permeability. Excavating this soil for buildings and roads is difficult because of the large stones, and large equipment may be needed. The effects of shrinking and swelling can be minimized by proper engineering design and by backfilling with material that has a low shrink-swell potential and installing surface and subsurface drains near foundations. Properly installed tile drains below the foundation and minimal surface watering near the foundation help prevent seepage into basements and minimize the effects of shrinking and swelling. Special sewage systems must be installed because of the slow permeability. Erosion and sedimentation can be controlled by maintaining an adequate plant cover.

This soil is in capability subclass VIIs, in the Cobbly Foothill range site, and in plant adaptability group F-5.

100—Nederland very cobbly sandy loam, 15 to 50 percent slopes. This is a deep, well drained soil on shoulders and back slopes of terrace escarpments. This soil formed in cobbly, gravelly, and loamy alluvium derived from mixed sources. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 47° F, and the average frost-free season is 126 to 142 days. Elevation is 5,600 to 6,500 feet.

Typically, the surface layer is mildly alkaline, dark brown and brown very cobbly sandy loam about 10 inches thick. The subsoil is neutral, dark brown and strong brown very cobbly sandy clay loam about 50 inches thick.

Included in mapping are small areas of Willowman soils on terrace escarpments, Flatirons and Veldkamp soils on terraces, Primen and Leyden soils on hill slopes at the lower edge of the mapped areas, and wet areas below springs. Also included are small areas of Urban land. The included soils and Urban land make up about 15 percent of the total acreage.

Permeability of this Nederland soil is moderate. The available water capacity is moderate. The effective rooting depth is 60 inches or more. Runoff is rapid, and water erosion is a severe hazard. Soil blowing is a slight hazard. The shrink-swell potential is low. Rock fragments make up 35 to 75 percent of the volume.

In most areas this soil is used for grazing, as pasture, and as habitat for wildlife. In a few areas it is used for community development.

The native vegetation is mainly big bluestem, little bluestem, blue grama, mountain muhly, and, on north-facing slopes, mountainmahogany. The average annual production of air-dry vegetation ranges from 1,000 to 2,300 pounds per acre. Proper grazing use and a planned grazing system are needed to maintain the quality and quantity of the desirable plants and to prevent erosion. Proper grazing use is needed to prevent depletion because this soil is difficult to revegetate. Periodic deferment of grazing during the growing season helps maintain or improve the range condition. The steepness of the slopes limits access by livestock and promotes overgrazing of the less sloping areas. The use of machinery is not practical because the surface is stony and the slopes are steep. Small pastures commonly are severely overgrazed and eroded. Livestock in small pastures should be kept in pens. The rest of the pasture can be used as exercise areas and for very limited grazing.

Grasses, shrubs, trees, and garden plants are difficult to establish and maintain because of the slope and large stones. A mulch of plant residue helps reduce runoff, improve tilth, and conserve moisture. Applications of manure and of nitrogen and phosphate fertilizers are needed to maintain fertility. Selecting adapted plants is essential in establishing plantings. Planting on the contour helps conserve moisture and reduce erosion. Pebbles and cobbles on the surface should be removed for best results in landscaping, particularly for lawns. Supplemental irrigation is needed at the time of planting and during dry periods.

The small areas of Urban land are covered by streets, parking lots, sidewalks, buildings, and other impervious manmade structures. Because runoff is rapid, storm drains, natural drainageways, and land grading must accommodate heavy flows to prevent flooding downslope in areas that normally would not be subject to flooding.

The main limitations to use of the soil for homesite development are the slope and large stones. The hazard of erosion increases if the soil is left exposed during site development. Structures to divert runoff from buildings and roads are needed. The steepness of the slope is a limitation for septic tank absorption fields. Absorption lines should be installed on the contour. Effluent from an absorption field can surface downslope and create a health hazard. Cuts and fills should be seeded or mulched. Erosion and sedimentation can be controlled by maintaining an adequate plant cover.

This soil is in capability subclass VIIe, in the Cobbly Foothill range site, and in plant adaptability group F-5.

Custom Soil Resource Report
Soil Map

105° 14' 15" W
105° 13' 14" W
39° 53' 35" N
39° 53' 4" N
479700 479800 479900 480000 480100 480200 480300 480400 480500 480600 480700 480800 480900 481000 481100
4415900 4415800 4415700 4415600 4415500 4415400 4415300 4415200 4415100 4415000

Map Scale: 1:6,650 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 300 600 1200 1800

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

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 1:24,000.

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: Golden Area, Colorado, Parts of Denver, Douglas, Jefferson, and Park Counties
Survey Area Data: Version 19, Aug 29, 2024

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

Date(s) aerial images were photographed: Jul 1, 2020—Jul 2, 2020

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.

EXHIBIT J - VEGETATION

The Vegetation information for the area is included below, however, please note, virtually all of the affected area has been mined and disturbed so the vegetation information is no longer applicable to the affected area, but is representative of the area surrounding the mine. This information was provided by the Jefferson County SCD in 1986 before the area was disturbed.

INVENTORY AND EVALUATION

VEGETATION

The vegetation on this site is typical of a midgrass range-site. The site is a Cobbly foothill range site. The area is within the Southern Rocky Mountain Foothills Resource Area.

Production on the site is approximately 1600 pounds on the areas that have not been disturbed. Ground cover averages 35 per cent. The production from the site is mainly due to the grasses. The carrying capacity, assuming the site will be revegetated to resemble the present community, should be limited to one animal unit/4-5 Acres/month. (An animal unit is the feed required to maintain a 1000 lb. cow for one month.)

Vegetation identified on the site includes:

GRASSES	FORBS	SHRUBS
Big bluestem	Curly cup gumweed	Herbaceous sage
Little bluestem	Hibiscus root	Fringed sage
Junegrass	Wild celery	Prickly pear
Blue grama	Penstomen	Wormwood sage
Squirrel Tail	Hairy gold aster	
Western wheatgrass	Mullen	
Thick spike wheatgrass	Wavy leaf thistle	
Green needlegrass	Bush buckwheat	
Needle and thread	Annual buckwheat	
Mountain muhly	Senecio	
Kentucky bluegrass	Primrose	
Three awn	Drummonds milkvetch	
Sun sedge	Small pod milkvetch	
Japanese Brome		

Revegetation guidelines may be obtained from the Soil Conservation Service.

Information was downloaded from the Climatology Data-base at Colorado State University. The average Daily temperature is 50.70 degrees and the average precipitation amount is 20.3 Inches per year. BOULDER is the closest data collection station to this property (8 miles North of the site). The data in the table is for the years 2012-2023 most recent published. Station data Latitude - 40°00" Longitude - 104°48' Elevation - 4970 Feet

MONTHLY MEAN MAXIMUM TEMPERATURE. (F)

MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	AVE./
AVERAGE	43.2	43.2	51.4	63.6	71.0	83.8	88.3	86.3	81.9	61.2	55.2	43.7	64.4
MAXIMUM	51.9	55.2	65.0	65.2	73.7	86.4	90.8	91.2	84.8	74.5	62.6	53.8	71.3
YEAR	2018	2017	2017	2022	2020	2016	2022	2020	1915	2016	2021	2021	
MINIMUM	40.5	40.5	49.9	57.7	62.9	76.1	84.9	83.2	77.6	60.0	48.2	44.3	60.5
YEAR	2023	2021	2023	2013	2015	2023	2015	2014	2017	2013	2022	2013	
YEARS OF RECORD	11	11	11	11	11	11	11	11	11	11	11	11	11

MONTHLY MEAN MINIMUM TEMPERATURE. (F)

AVERAGE	18.1	18.9	24.0	31.1	38.9	48.2	52.7	51.5	46.0	34.6	36.6	20.1	34.2
MAXIMUM	23.5	29.4	35.5	36.7	45.9	54.5	59.0	58.3	52.5	43.0	33.5	27.0	41.6
YEAR	2020	2017	2017	2016	2018	2016	2022	2022	2013	2016	2017	2021	
MINIMUM	19.7	15.5	23.9	29.8	38.6	49.6	55.7	54.2	48.2	30.9	23.6	17.6	33.9
AR	2013	2021	2023	20.13	2019	2019	2015	2017	2020	2019	2022	2016	
YEARS OF RECORD	11	11	11	11	11	11	11	11	11	11	11	11	11

TOTAL MONTHLY PRECIPITATION. (IN)

AVERAGE	0.80	1.30	1.80	2.40	4.10	1.70	1.80	0.90	2.06	1.30	0.90	0.70	20.30
MAXIMUM	1.70	3.70	3.80	4.50	7.80	5.00	4.60	2.10	18.20	2.70	2.04	1.80	58.30
YEAR	2014	2015	2016	2015	2015	2023	2014	2023	2013	2018	2019	2022	
MINIMUM	0.30	0.70	0.40	0.10	2.00	0.50	0.30	0.10	0.10	0.20	0.10	0.30	5.10
YEAR	2013	2014	2015	2022	2016	2017	2020	2019	2015	2021	2021	2018	
YEARS OF RECORD	11	11	11	11	11	11	11	11	11	11	11	11	11

TOTAL MONTHLY SNOWFALL. (IN)

AVERAGE	10.30	21.50	13.60	15.80	3.80	0.00	0.00	0.00	0.50	5.80	10.80	9.60	99.60
MAXIMUM	27.20	54.60	32.50	47.60	12.30	0.00	0.00	0.00	5.70	26.40	29.50	19.80	255.60
YEAR	2014	2015	2016	2013	2013				2020	2019	2019	2014	
MINIMUM	3.70	9.90	4.30	6.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70	3.40	28.00
YEAR	2003	2005	2004	2006							2021	2019	
YEARS OF RECORD	11	11	11	11	11	11	11	11	11	11	11	11	11

PREPARED FROM DATA PROVIDED BY: COLORADO CLIMATE CENTER, DEPT. OF ATMOSPHERIC SCIENCE, COLORADO STATE FORT. COLLINS, CO 80523, (303)491-8545. DOWN LOADED FROM DATABASE - NOVEMBER 22, 2024

EXHIBIT L - RECLAMATION COSTS

The estimated reclamation cost for the Rocky Flats Pit (M-1987-113) was recalculated in 2024 and is representative of the cost to reclaim the pit into a reservoir or rangeland/depression. We request that the bond amount of $3,255,209 remain the same. The 2024 estimate follows.

COST SUMMARY WORK

Task description: **Cost Estimate**

Site: **Rocky Flats Pit** Permit Action: 2024 Bond Revision Permit/Job#: M1987113

PROJECT IDENTIFICATION

Task #: 001 State: Colorado Abbreviation: None
Date: 9/26/2024 County: Jefferson Filename: M113-001
User: BEH

Agency or organization name: DRMS

TASK LIST (DIRECT COSTS)

Task	Description	Form Used	Fleet Size	Task Hours	Cost
002	Regrade Pit	TRUCK1	1	2,383.48	$2,227,843
003	Topsoil Spreading	TRUCK1	1	130.06	$121,564
004	Reseed	REVEGE	1	95.00	$58,274
005	Mobe	MOBILIZE	1	2.20	$4,526
006	Demolition	DEMOLISH	1	263.00	$113,489
		SUBTOTALS:		**2873.74**	**$2,525,696**

INDIRECT COSTS

OVERHEAD AND PROFIT:

Liability insurance:	2.02	Total =	$51,019
Performance bond:	1.05	Total =	$26,520
Job superintendent:	1,221.75	Total =	$96,848
Profit:	10.00	Total =	$252,570
		TOTAL O & P =	$426,957
		CONTRACT AMOUNT (direct + O & P) =	$2,952,653

LEGAL - ENGINEERING - PROJECT MANAGEMENT:

Financial warranty processing (legal/related costs):	$500	Total =	$500
Engineering work and/or contract/bid preparation:	5.23	Total =	$154,424
Reclamation management and/or administration:	5.00		$147,633
CONTINGENCY:	0.00	Total =	$0
		TOTAL INDIRECT COST =	$729,513
		TOTAL BOND AMOUNT (direct + indirect) =	**$3,255,209**

EXHIBIT M - OTHER PERMITS AND LICENSES

1. Jefferson County Board of Adjustment approval for Case No. M87-1.

2. Colorado Department of Public Health and Environment Air Permit 10JE2435F

3. CDPHE Discharge Certification COG501547.

4. A dredge fill permit (404) is not required because there are no Waters of the United States on the permit area.

5. This is a dry mine. No ground water is exposed or otherwise impacted, so a Well Permit and associated water rights are not needed.

6. Water for the aggregate operation is supplied from an approved off-site source and trucked to the mine site. Water for the concrete batch plant is supplied by the nearby industrial park.

EXHIBIT N - SOURCE OF LEGAL RIGHT TO ENTER

See the attached affidavits from Church Ranch, the minerals owner and the United States of America, the surface owner, giving BURNCO Colorado the right to enter and mine the permit area.

DEMONSTRATION OF LEGAL RIGHT-TO-ENTER

IN ACCORDANCE WITH HARD ROCK AND CONSTRUCTION MATERIALS RULE 6.3.7

The undersigned is Katherine Chester, the Realty Officer (authorized signer) of U.S.A. ("United States of America"). We hereby agree that:

1. U.S.A. is the owner of the lands identified as Parcel ID 20-094-00-001 (Pin 300206197), as depicted on Exhibit A, attached and incorporated herein;

2. Burnco Colorado, LLC has the legal right to enter and mine.

U.S.A

Name: Katherine Chester

Title: Realty Officer

STATE OF COLORADO)

) ss.

COUNTY OF)

The foregoing instrument was acknowledged before me this 2 day of ~~January~~ May KB, 2024, by Katherine Chester, the Realty Officer of U.S.A.

Witness my hand and official seal.

My commission expires: 9/28/26

Notary Public

KERRI M BLAES
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 20024028478
MY COMMISSION EXPIRES SEPTEMBER 28, 2026

DEMONSTRATION OF LEGAL RIGHT-TO-ENTER

IN ACCORDANCE WITH HARD ROCK AND CONSTRUCTION MATERIALS RULE 6.3.7

I, Charles McKay hereby agree that:

1. Charles McKay is the mineral rights owner of the land identified as the Rocky Flats Pit (Permit M-1987-113) within Parcel ID 20-094-00-001 (Pin 300206197), as depicted on Exhibit A, attached and incorporated herein;

2. Burnco Colorado, LLC has the legal right to enter and mine.

Charles McKay

Name: Charles C. McKay

Title: owner

STATE OF COLORADO)

) ss.

COUNTY OF)

The foregoing instrument was acknowledged before me this 25th day of February, 2024, by Charles C McKay.

Witness my hand and official seal.

My commission expires: 10-21-2024

DEBRA EISENHAND
Notary Public
State of Colorado
Notary ID # 2008035906
My Commission Expires 10-21-2024

Notary Public

EXHIBIT A


Highway 93
Highway 93
Rock Creek
Rock Creek
McKay Ditch
McKay Ditch
Rocky Flats Plant Rd
Rocky Flats Plant
Woman Creek
(1 of 2)
Parcel ID (AIN): 20-094-00-001
PIN (Schedule): 300206197
Owner(s)
U.S.A.
Owner Mailing Address
USPO BOX 68102
OMAHA NE 68102
Property Address
VACANT LAND
CO
Block: Lot:
Section: 9, Township: 2, Range: 70
Subdivision Name:
Acres: 302.47
Zoom to

PROJECT: Rocky Flats AEC Site, Colorado

TRACTS NOS.: 35, 36 and 39

WARRANTY DEED

KNOW ALL MEN BY THESE PRESENTS:

That Marcus F. Church and Marcus F. Church as Trustee under Ruth McKay Trust as recorded in Book 1705 at Page 234 in the Office of the County Clerk and Recorder of the County of Jefferson, State of Colorado, of the County of Jefferson, State of Colorado, Grantors, for and in consideration of the sum of [redacted], the receipt of which is hereby acknowledged, do hereby grant, bargain, sell, and convey unto the UNITED STATES OF AMERICA, Grantee, of Washington, D. C., and its assigns, the following real estate situate in the County of Jefferson, State of Colorado, to-wit:

Tract 35

The E½NW¼, E½SW¼ and the SE¼ of Section 9, Township 2 South, Range 70 West of the Sixth Principal Meridian, Jefferson County, Colorado.

Excepting therefrom a tract of land being described as follows: Beginning at a point on the East line of said Section 9, 400.00 feet North of the Southeast corner thereof; thence Southwesterly along the Northerly right-of-way line of roadway to U. S. Atomic Energy Commission's Rocky Flats Plant, 203.16 feet; thence North parallel with said East line, 2,072.10 feet; thence Easterly at right angles to the right to said East line; thence South along said East line to the point of beginning.

The tract of land herein described contains 310.65 acres, more or less.

Subject to existing easements for public roads and highways, public utilities, railroads, and pipelines, water lines, conduits, flumes, ditches and canals; also subject to the rights and interests of third parties, if any, in the coal, oil and gas, in and under said land, except lessees of the Grantors; also subject to the rights and interests of third parties, if any, in the clay and gravel, in and under said land; also subject to reservations, exceptions and any other outstanding rights contained in or referred to in patents issued by the United States.

Tract 36

The SW¼ of Section 14 and the S½ of Section 15, Township 2 South, Range 70 West of the Sixth Principal Meridian, Jefferson County, Colorado.

The tract of land herein described contains 480.00 acres, more or less.

Subject to existing easements for public roads and highways, public utilities, railroads, and pipelines, water lines, conduits, flumes, ditches, and canals; also subject to the rights and interests of third parties, if any, in the coal, oil and gas in and under said land, except lessees of the Grantors; and reservations, exceptions and any other outstanding rights contained in or referred to in patents issued by the United States.

Jefferson County
Recorded Nov. 15, 1974
Bk 2[illegible] Pg 3[illegible]

Tract 39

All of Section 13, except the East 50.00 feet and the following described parcel of land situated in the N½N½:

Beginning at the Northeast corner of said Section 13; thence West along the North line to the Northwest corner of said Section; thence South along the West line, 135.00 feet; thence East parallel with said North line, 2,640.00 feet; thence North, at right angles to the left, 125.00 feet; thence East, parallel with said North line, to the East line of said Section; thence North along said East line to the point of beginning.

Also, a tract of land situated in the S½NE¼ of Section 14, more particularly described as:

Beginning at the Southwest corner of said S½NE¼; thence North 01°49'21" West, 14.00 feet; thence North 89°54'29" East, 27.57 feet; thence North 62°38'17" East, 2,863.83 feet; thence North 89°46'53" East, 27.11 feet to the East line of said S½NE¼; thence South 01°49'21" East to the Southeast corner thereof; thence South 89°16'53" West to the point of beginning.

All the above situated in Township 2 South, Range 70 West of the Sixth Principal Meridian, Jefferson County, Colorado.

The tract of land herein described contains 660.00 acres, more or less.

Subject to existing easements for public roads and highways, public utilities, railroads, and pipelines, water lines, conduits, flumes, ditches and canals; also subject to the rights and interests of third parties, if any, in the coal, oil and gas in and under said land, except lessees of the Grantors; and reservations, exceptions and any other outstanding rights contained in or referred to in patents issued by the United States.

Excepting and reserving to the Grantors all coal, oil, gas, clay, gravel and rock, (rocks to be removed from clay and gravel excavations only) in and under Tract 35 and all appurtenant rights for exploration, development, production and removal of said coal, oil, gas, (clay, gravel, and rock,) but without the right to enter upon or over the surface of said land for the purpose of drilling and extracting therefrom said coal, oil and gas; further excepting and reserving all water rights, if any, in Smart Reservoir, Smart Ditch, Woman Creek, Walnut Creek, Upper Church Ditch, Coal Creek, Last Chance Ditch, McKay Ditch, and South Boulder Division Canal, or in any other reservoir, ditch and creek, together with all appurtenant rights thereto, with right to maintain, replace, and repair said ditches.

Excepting and reserving to the Grantors all coal, oil and gas in and under Tracts 36 and 39 and all appurtenant rights for the exploration, development, production and removal of said coal, oil and gas, but without the right to enter upon or over the surface of said land for the purpose of drilling and extracting therefrom said coal, oil and gas; further excepting and reserving all water rights, if any, in Smart Reservoir, Smart Ditch, Woman Creek, Walnut Creek, Upper Church Ditch, Coal Creek, Last Chance Ditch, McKay Ditch and South Boulder Division Canal, or in any other reservoir, ditch and creek, together with all appurtenant rights thereto, with right to maintain, replace, and repair said ditches.

Excepting and reserving to the Grantors, now in possession of Tracts 35, 36 and 39, in consideration of the protection and maintenance of the land, buildings, and structures, and protection of the property against loss by fire, waste, or other causes to which the Grantors hereby agree, reserve the right to occupy the above described property until 31 December 1974. Such occupancy is subject to revocation by the District Engineer at any time by giving 90 days' notice in writing to the Grantors if possession of the property is required by the United States; and provided further that the Grantors or their tenant will remove no improvements or timber unless otherwise provided herein.

Excepting and reserving to the Grantors the right to remove a corral and interior fence from Tract 39 on or before 31 December 1974. In the event that said improvements are not completely removed on or before said date, the right of removal shall terminate automatically and the United States shall have a good and indefeasible title to said improvements which remain without notice to the Grantors.

Excepting and reserving to the Grantors the right to continue using and maintaining an existing spring and two water pipelines situated in the extreme Southeast corner of Tract 39.

Grantors agree that their reserved rights for, in and under Tract 35 for exploration, development, production and removal of gravel, clay and rock shall be subject and subordinate to the right of the Atomic Energy Commission to evacuate all personnel involved in any operation on said tract for short periods of time, upon notice to the Grantors and all of their lessees, licensees and permittees; and that Grantors agree that the Atomic Energy Commission's right to evacuate will be reflected in all subsequent arrangements with their lessees, licensees and permittees.

To have and to hold the premises above described, together with all the tenements, hereditaments, and appurtenances thereunto belonging unto the said UNITED STATES OF AMERICA and its assigns forever.

The Grantors, for themselves and their heirs, executors, and administrators, do covenant with the UNITED STATES OF AMERICA and its assigns, that they are lawfully seized of said premises; that said premises are free from encumbrances; that they have good right and lawful authority to convey the same; and that they will warrant and defend the title to said premises against the lawful claims of all persons whomsoever.

The Grantors further quitclaim to the UNITED STATES OF AMERICA and its assigns all their right, title and interest in and to any streams, alleys, roads, streets, ways, strips, gores, or railroad rights-of-way abutting or adjoining said land.

The word "Grantors" as used on pages 2 and 3 herein, shall include their respective heirs, personal representatives, successors and assigns.

Dated this 15th day of November, 1974.

Marcus F. Church
MARCUS F. CHURCH

Marcus F. Church, Trustee
MARCUS F. CHURCH
AS TRUSTEE UNDER RUTH MCKAY TRUST

ACKNOWLEDGMENT

STATE OF COLORADO)
) ss.
COUNTY OF JEFFERSON)

The foregoing instrument was acknowledged before me this 15th day of November, 1974, by Marcus F. Church and by Marcus F. Church as Trustee under Ruth McKay Trust.

Witness my hand and official seal.

Mary E Moore
Notary Public

My Commission Expires:

June 25, 1977.

EXHIBIT O - OWNERS OF RECORD

OWNERS OF RECORD OF AFFECTED LANDS - SURFACE AREA

United States Department of Energy
11025 Dover St. Suite 1000
Westminster, CO 80021

United States Fish & Wildlife Service
Rocky Flats Wildlife Refuge
Attn: David Lucas
6550 Gateway Rd., Bldg 129
Commerce City, CO 80022-1748

OWNERS OF SUBSTANCE TO BE MINED

Charles Church McKay and Perry S. McKay, Et al.
Church Ranch
20009 Hwy 72
Arvada, CO 80007

ADJACENT LANDOWNERS

United States Fish & Wildlife Service
Rocky Flats Wildlife Refuge
Attn: David Lucas
6550 Gateway Rd., Bldg 129
Commerce City, CO 80022-1748

United States Department of Energy
11025 Dover St. Suite 1000
Westminster, CO 80021

Mountain Plains Industrial Center
20009 Hwy 72
Arvada, Colorado 80007

Rights of Way and Easements

City of Broomfield
Cathy Harris
3951 W. 144th Ave.
Broomfield, Co 80023

Arcosa Rail
Attn: Kennedy Lord
11728 Highway 93
Boulder, Co 80303

Xcel Energy
1801 California St, Suite 1160
Denver, CO 80202

Century Link
5325 Zuni St., Room 728
Denver, Co 80221

MelTel, LLC
4 Greenwich Office Park, 1st Floor
Greenwich, CT 06831

EXHIBIT P - MUNICIPALITIES WITHIN TWO MILES

The following municipalities are within two miles of the permit area.

City of Arvada
8101 Ralston Road
Arvada, CO 80002

Town of Superior
124 E. Coal Creek Drive
Superior, CO 80027

EXHIBIT Q - PROOF OF MAILING OF NOTICES TO BOARD OF COUNTY COMMISSIONERS

NOTICE OF FILING
FOR COLORADO MINED LAND RECLAMATION PERMIT
FOR **REGULAR (112) CONSTRUCTION MATERIALS EXTRACTION OPERATIONS**
NOTICE TO THE JEFFERSON COUNTY BOARD OF COUNTY COMMISSIONERS

BURNCO Colorado, LLC (the “Applicant/Operator”) has applied for an amendment to their Rocky Flats Pit, a regular (112) reclamation permit (M-1987-113) from the Colorado Mined Land Reclamation Board ("the Board") to conduct an extraction of construction materials operation in Jefferson County. The attached information is being provided to notify you of the location and nature of the proposed operation. The entire application is on file with the Colorado Division of Reclamation, Mining & Safety ("the Division") and the local County Clerk and Recorders office.

The applicant proposes to reclaim the land as Developed Water Storage. Pursuant to C.R.S. 34-32.5-116(4)(m), C.R.S., the Board may confer with the local Board of County Commissioners before approving the post-mining land use. Accordingly, the Board would appreciate your comments on the proposed operation. Please note that, in order to preserve your right to a hearing before the Board on this application, you must submit written comments to the application within twenty (20) days of the date of last publication notice pursuant to Section 34-32.5-112(10), C.R.S.

If you would like to discuss the proposed post-mining land use, or any other issue regarding this application, please contact the Division of Reclamation, Mining & Safety, 1313 Sherman St., Room 215, Denver, CO 80203, (303) 866-3567. You may also contact the applicant directly at the address or phone number below.

BURNCO Colorado, LLC
Attention: Joel Bolduc
10100 Dallas St.
Henderson, CO 80640
303-913-6583

Environment, Inc.

LARRY E. O'BRIAN
FOUNDER

STEVAN L. O'BRIAN
PRESIDENT

7985 VANCE DRIVE, SUITE 205A
ARVADA, COLORADO 80003
303-423-7297
FAX 303-423-7599

April 16, 2025

Jefferson County
Board of County Commissioners
200 South Cascade Avenue, Suite 100
Colorado Springs, CO 80903-2202

Dear Commissioners;

Re: Amended application for a Mined Land Reclamation Permit

We are delivering to you here a Notice of Application amendment and supporting documents for a Mined Land Reclamation Board Regular 112 Permit for the Rocky Flats Pit, M-1987-113 that is operated by BURNCO Colorado, LLC pursuant to rule 2.2.2(1), Colorado Mined Land Reclamation Board - Mineral Rules and Regulations.

Please acknowledge receipt of this notice by signing in the appropriate space provided below or date stamp it and return a signed copy of this cover letter to the person delivering it. We need to submit this copy to the Division of Reclamation, Mining & Safety as proof of our filing with you.

Respectfully Submitted,

Stevan L. O'Brian

enclosure

RECEIVED THIS ____ DAY OF _____, 2025
Jefferson County Board of County Commissioners

By_____

Title _____

EXHIBIT Q - PROOF OF MAILING OF NOTICE TO SOIL CONSERVATION DISTRICT

NOTICE OF FILING
FOR COLORADO MINED LAND RECLAMATION PERMIT
FOR **REGULAR (112) CONSTRUCTION MATERIALS EXTRACTION OPERATIONS**
NOTICE TO THE BOARD OF SUPERVISORS
OF THE LOCAL SOIL CONSERVATION DISTRICT
JEFFERSON COUNTY DISTRICT

BURNCO Colorado, LLC (the "Applicant/Operator") has applied for an amendment to their Rocky Flats Pit regular (112) reclamation permit (M-1987-113) from the Colorado Mined Land Reclamation Board ("the Board") to conduct an extraction of construction materials operation in Jefferson County. The attached information is being provided to notify you of the location and nature of the proposed operation. The entire application is on file with the Colorado Division of Reclamation, Mining & Safety ("the Division") and the local County Clerk and Recorders office.

The applicant proposes to reclaim the land as Developed Water storage. Pursuant to C.R.S. 34-32.5-116(4)(m), C.R.S., the Board may confer with the Board of the local Soil Conservation District before approving the post-mining land use. Accordingly, the Board would appreciate your comments on the proposed operation. Please note that, in order to preserve your right to a hearing before the Board on this application, you must submit written comments to the application within twenty (20) days of the date of last publication notice pursuant to Section 34-32.5-112(10), C.R.S.

If you would like to discuss the proposed post-mining land use, or any other issue regarding this application, please contact Division of Reclamation, Mining & Safety, 1313 Sherman St., Room 215, Denver, CO 80203, (303) 866-3567. You may also contact the applicant directly at the above address or phone number below.

BURNCO Colorado, LLC
Attention: Joel Bolduc
10100 Dallas St.
Henderson, CO 80640
303-913-6583

E-mail to Jefferson County Soil Conservation District

State mining notice packet

1 attachment

From: "Environment, Inc." <environment-inc@startmail.com>

To: JCD General

Cc: Joel.Bolduc@burnco.com

Date: Thursday 17 April 2025 at 13:33:24

Good afternoon,

Here is the Notice Packet for the BURNCO Colorado LLC, Permit # M-1987-113, Rocky Flats Pit amendment I referred to in the previous e-mail. I need a receipt from you to show we delivered it to give to the DRMS. You can either print the cover letter and sign and date or just date stamp it and send me a copy. I think a confirmation e-mail that you got it would also work.

Steve

Steve O'Brian
Environment, Inc.
7985 Vance Dr., #205A
Arvada, CO 80003
(303) 423-7297
environment-inc@startmail.com

EXHIBIT R - PROOF OF FILING WITH COUNTY CLERK AND RECORDER

April 16, 2025

Jefferson County Clerk and Recorder
100 Jefferson County Parkway, Suite 2560
Golden, Colorado 80419

Re: Amendment of Mined Land
Reclamation Permit M-1987-113

Dear Sir or Madam:

We are delivering to you herewith, an amendment to our approved permit application for the Rocky Flats Pit (Permit # M-1987-113) operated by BURNCO Colorado, LLC.

This copy of the amendment application is delivered to you pursuant to 34-32.5-112(9)(a), Colorado Revised Statutes 1995, as amended, which states in part:

> .... the applicant shall place a copy of such application for public inspection at the office of the Board and Office of the County Clerk and Recorder of the County in which the affected land is located.

This book must be kept for public review until the amendment has been approved by the Division. We will contact you once it is and make arrangements to pickup this copy.

Please acknowledge receipt of the copy of the permit amendment by signing in the appropriate space provided below and returning one copy of this letter to the person delivering the book. This will be submitted to the Division of Reclamation, Mining & Safety to prove the amendment book was delivered to your office.

Yours truly,
ENVIRONMENT, INC.

Stevan L. O'Brian

enclosure

RECEIVED THIS ____ DAY OF _____, 2025, one copy of an application amendment packet for above referenced mine.

Jefferson County Clerk and Recorder

By _____

Environment, Inc.

LARRY E. O'BRIAN
FOUNDER

STEVAN L. O'BRIAN
PRESIDENT

7985 VANCE DRIVE, SUITE 205A
ARVADA, COLORADO 80003
303-423-7297
FAX 303-423-7599

April 16, 2025

Jefferson County Clerk and Recorder
100 Jefferson County Parkway, Suite 2560
Golden, Colorado 80419

Re: Amendment of Mined Land
Reclamation Permit M-1987-113

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This book must be kept for public review until the amendment has been approved by the Division. We will contact you once it is and make arrangements to pickup this copy.

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Respectfully Submitted,
ENVIRONMENT, INC.

Stevan L. O'Brian

enclosure

RECEIVED THIS 16 DAY OF April, 2025, one copy of an application amendment packet for above referenced mine.

Jefferson County Clerk and Recorder

By _____

EXHIBIT S - PERMANENT MAN MADE STRUCTURES

Permanent man-made structures within 200 ft of affected areas are shown on all **Exhibit C-1 Boundary and Structures Map** and their owners are listed below. BURNCO Colorado, LLC has entered into an agreement with the structure owner, when possible, or provided an engineering analysis supporting a setback of less than 200 feet. Proof of mailing receipts for the new structures listed below are attached. Structures within 200 feet of the existing permitted areas were addressed in the Slope Stability Analysis (SSA) prepared by Andy Rodriguez of Civil Resources, Inc. and is included in this application. BURNCO commits to implementing all recommendations and requirements found in the SSA report.

OWNER	STRUCTURES	DATE SENT
A. Permanent Man Made Structures		
Department of Energy 11025 Dover St. Suite 1000 Westminster, CO 80021	Fences - east and south sides	4/16/2025
Arcosa Rail Attn: Kennedy Lord 11728 Highway 93 Boulder, Co 80303	Railroad tracks	4/16/2025
U.S. Fish and Wildlife Service Rocky Flats Wildlife Refuge Attn: David Lucas 6550 Gateway Rd., Bldg 129 Commerce City, CO 80022-1748	fence along railroad & north side, West Gate dirt road, and building	4/16/2025
Mountain Plains Industrial Center 20009 Hwy 72 Arvada, Colorado 80007	West Gate Road (paved sections), fence	4/16/2025
B. Utilities		
Xcel Energy 1801 California St, Suite 1160 Denver, CO 80202	powerlines SW corner & across permit areas	4/16/2025
MelTel, LLC 4 Greenwich Office Park, 1st Floor Greenwich, CT 06831	cell tower	4/16/2025
Century Link 5325 Zuni St. Room 728 Denver, Co 80221	communication lines around/across permit area	4/16/2025
C. Irrigation Ditch		
City of Broomfield Cathy Harris 3951 W. 144th Ave. Broomfield, Co 80023	Upper Church & McKay ditches, misc. concrete head gates	4/16/2025

7022 1670 0003 1998 8915

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City, State, ZIP+4®: Greenwich, CT 06831

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Street and Apt. No., or PO Box No.: 20009 HWY 72
City, State, ZIP+4®: Arvada, CO 80007

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

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City, State, ZIP+4®: Denver, CO 80221

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Street and Apt. No., or PO Box No.: 11720 Hwy 93
City, State, ZIP+4®: Boulder, CO 80303

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Postage $ 0.97
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Sent To: Dept of Energy
Street and Apt. No., or PO Box No.: 11025 Dover St Suite 1000
City, State, ZIP+4®: Westminster, CO 80021

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- ☐ Adult Signature Restricted Delivery $ ____

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Sent To: City of Broomfield
Street and Apt. No., or PO Box No.: 3951 W 144th Ave
City, State, ZIP+4®: Broomfield, CO 80023

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PUBLIC NOTICE

PUBLISHED NOTICE OF APPLICATION AMENDMENT FILING FOR A REGULAR (112) CONSTRUCTION MATERIALS RECLAMATION PERMIT

BURNCO Colorado, LLC has filed an application amendment to their Reclamation Permit with the Colorado Mined Land Reclamation Board under the provisions of the Colorado Mined Land Reclamation Act for the extraction of construction materials. The mine is known as the Rocky Flats Pit (permit # M-1987-113) and is located in parts of Sections 9, T2S, R70W 6th Principal Meridian, Jefferson County, Colorado.

The date of commencement for this mine was 2003 and the proposed date of completion December 2045. The proposed future use of the land is as developed water storage or rangeland.

Additional information and the tentative decision date may be obtained from the Division of Reclamation, Mining & Safety, 1313 Sherman St., Suite 215, Denver, CO 80203 (303) 866-3567, or at the Jefferson County Clerk and Recorder's office, 100 Jefferson County PKWY, Suite 2560, Golden, Colorado 80419, or the above named applicant.

Comments must be in writing and must be received by the Division of Minerals and Geology by 4:00 p.m. on ____, 2025.

Please note that comments related to noise, truck traffic, hours of operation, visual impacts, effects on property values and other social or economic concerns are issues not subject to this Office's jurisdiction. These subjects and similar ones, are typically addressed by your local governments, rather that the Division of Reclamation, Mining & Safety or the Mined Land Reclamation Board.

BURNCO Colorado, LLC.
Henderson, Colorado

First Publication:
Second Publication:
Third Publication:
Last Publication:
Published in:

NOTICE

This site is the location of a proposed construction materials operation known as the Rocky Flats Pit, Permit # M-1987-113. BURNCO Colorado LLC, whose address and phone number is 10100 Dallas St., Henderson, CO 80640, (303) 913-6583, has applied for an amendment to a Regular Reclamation Permit with the Colorado Mined Land Reclamation Board. Anyone wishing to comment on the application may view the application at the Jefferson County Clerk and Recorders office, 100 Jefferson County Parkway,, Suite 2560, Golden, CO. 80419, and should send comments prior to the end of the public comment period to the Division of Reclamation, Mining & Safety, 1313 Sherman St, Room 215, Denver, CO 80203.

Certification

I, Stevan L. O'Brian, hereby certify that I posted signs containing the above notice for the proposed permit area known as the Rocky Flats Pit, on April 16, 2025.

Signature

April 16, 2025
Date

Locations:

Area	Latitude	Longitude	date posted
Entrance	39.8857° N	105.2363° W	4/16/2025

Map Pocket

WEED CONTROL PLAN
BURNCO ROCKY FLATS PIT M1987-113
MARCH 26, 2025

This plan is implemented as part of the normal operation of the mine. Diffuse and Spotted Knapweed infestations are of the most concern in the Rocky Flats area. As the U.S. Fish and Wildlife Service has indicated, much money has been spent to control these weeds on the Rocky Flats area. Church Ranch has had an agricultural program in this area since 1869 and Mr. Charles C. McKay has been the manager of the ranch since 1979. During that time period he has observed that the spread of Knapweed, Leafy Spurge, et al, that have come up railroad ROWs and dispersed to adjoining lands. The success of implementation is greatly influenced by how the problem weeds are controlled on surrounding areas.

We use four designations to describe the amount of ground coverage found during annual site inspections. We do comparisons of the various areas to determine the control method that is most effective. The description under each coverage definition explains how we establish that classification for the mine area.

Heavy

This land is typically found on the edges of roads or around the active mining areas. Diffuse Knapweed appears to grow best along the perimeters where the seeds accumulate on newly disturbed area. Little or no vegetation other than Diffuse Knapweed and other weed species grow in these areas.

Moderate

This land usually covers recent growth medium piles that are still being added to or road base material where the piles have not been disturbed for a growing season. Access to these areas may be limited.

Light

This land covers traffic areas where no vegetation exists. It also includes product stockpiles that are disturbed regularly where Diffuse Knapweed has a hard time getting a foot hold.

Scattered

These areas are undisturbed land where the natural vegetation cover is still intact. These areas have few if any Diffuse Knapweed plants interspersed in the grasses.

We do selective spraying of the Knapweed in the heavy and moderate areas starting in the spring of each year (typically in April). This controls the heavier populations of Diffuse Knapweed that spread into the light or scattered areas. The treatment includes using High Noon or Milestone herbicide to water's edge. The chemicals are applied at the manufacturer's suggested rate. Spot spraying is done in the light areas where needed. It is possible that some aerial spraying may be done as part of an overall community control plan, and we may participate if the costs are reasonable.

The sprayed areas are monitored and records are kept to determine the success of the proposed plan. Spraying is on an annual basis unless monitoring indicates that periodic late summer/fall treatment is necessary. We work with the Jeffco Weed Manager to decide if additional spraying is necessary or when it can be suspended because the weed problem is under control.

June 29, 2023

Mr. Chris Oestreich
Operations Manager-Aggregates
BURNCO, LLC
10100 Dallas Street
Henderson, CO 80640

Re: Stability Analyses, Jefferson County Gravel Mine (DRMS Permit No. M-1987-113), Jeferson County, Colorado

Dear Mr. Oestreich:

This stability analyses letter has been prepared in support of the Change of Operator status for the Jefferson County Gravel Mine and to meet the Mined Land Reclamation Board (MLRB) Construction Materials Rule 6, Section 4, Subsection 19, Exhibit S - Permanent Man-Made Structures (6.4.19, Exhibit S). This letter describes the project and slope stability analyses utilized to evaluate the minimum distance between the edge of mining and adjacent structures to avoid damage to the structure.

The site is located east of Highway 93 and west of the Rocky Flats Wildlife Refuge in Jefferson County Colorado. More specifically, the site is located in part of Section 9, Township 2 South, Range 70 West of the 6th Principal Meridian.

REGIONAL GEOLOGY

Regional geologic mapping (Trimble and Machette, 1978) indicates the Jefferson County Mine is located approximately 3 miles east of the eastern flank of the Rocky Mountain Front Range. Younger sedimentary strata dips eastward off the Pre-Cambrian igneous and metamorphic rocks that form the core of the Front Range into the Denver Structural Basin. The Denver Basin is an asymmetrical down-warp of sedimentary strata with a steeply dipping west limb and a gently dipping east limb.

The asymmetrical nature of the dipping sedimentary strata is observed at the mine. Bedrock, progressing from older to younger and west to east, of the Fox Hills Sandstone and the Laramie Formation lie at a shallow depth on the west side of the mine dipping steeply to the east. This land form is locally known as a "hogback". Borings at the site indicate the steeply dipping bedrock folds at depth forming a gently, eastward dipping bedrock surface. This bedrock surface is typically at depths of approximately 70 to 105 feet below the pre-mined elevation. Closer to the "hogback", the bedrock lies at shallower depths. The bedrock is overlain by the Rocky Flats Alluvium. The Rocky Flats Alluvium is described as consisting of boulders, cobbles, and gravel with a clayey sand matrix that was deposited during glacial melting periods.

Aggregate deposits within the Rocky Flats Alluvium are mined by BURNCO east of the "hogback".

Exploratory Drilling

Five exploratory borings were drilled at the mine at the approximate locations shown on Figure 1. The borings were drilled with a truck-mounted CME-75 drill rig using the Tubex drill system in which a downhole percussion hammer is followed by advancing 4-inch casing. Cuttings were lifted to the surface with air. The borings ranged in depth from approximately 24.5 to 105.5 feet below existing ground. All of the borings extended through our interpretation of the aggregate deposit. Four of the borings extended to the underlying claystone bedrock of the Laramie Formation. Subsurface samples were obtained at various intervals during drilling by driving a standard split spoon sampler utilizing a 140-pound weight free falling 30-inches (Standard Penetration Test, (SPT)).

8308 Colorado Blvd • Ste 200 • Firestone, Colorado 80504 • Phone: 303.833.1416

The borings were logged by a representative of Civil Resources. During drilling the cuttings were observed to get an indication of the rock and matrix percentages. In addition, the subsurface samples were logged in the field. Logs and notes regarding the drilling operations are included on Figure 2.

Subsurface Conditions

Based on the borings drilled, there appear to be three geologic units at the site. These units are herein referred to as 1) the Aggregate Unit, 2) a Finer Grained Alluvial Unit that locally underlies the Aggregate Unit and overlies the bedrock, and 3) Bedrock Unit. These units are described as follows:

1) **Aggregate Unit**--This unit lies at the surface east of the "hogback" and is described as dense to very dense; boulders, cobbles, and gravel in a clayey sand matrix. This unit is typically moist becoming wet below the groundwater table. When washed and processed, the aggregate is grey. The clayey sand matrix is typically red. Local clayey sand lenses are present within this unit. The estimated rock to matrix ratio ranges from 20 percent rock/80 percent matrix to 100 percent rock/0 percent matrix. The average estimated rock to matrix ratio is 71 percent rock and 29 percent matrix. This unit ranged from approximately 21 to 101 feet in thickness. The thickness will tend to be less near the "hogback". We interpret this unit as the mineable unit.

2) **Finer Grained Alluvial Unit**—This unit locally underlies the Aggregate Unit and was encountered in boring TH-1 at the base of the mine and in TH-3 in the north part of the mine. This unit is described as a dense to very dense; clayey to very clayey sand with occasional cobbles and gravel. This unit is very moist. The thickness of this unit ranged from greater than 15 feet to approximately 28 feet where encountered. Due to the relatively low occurrence of gravel and cobbles, we consider this to be an unmineable unit.

3) **Bedrock Unit**--This unit is claystone of the Laramie Formation. This unit underlies the Aggregate Unit and the local Finer Grained Alluvial Unit. In borings TH-2, TH-4, and TH-5; the claystone lies directly below the Aggregate Unit. The claystone is typically hard, moderately to highly plastic, moist, and grey.

In borings TH-3, TH-4, and TH-5: groundwater was present at depths ranging from approximately 57 to 65 feet below the premining surface. In boring TH-1, drilled near the current mine bottom, groundwater was encountered at a depth of approximately 39 feet. The shallowest boring (TH-2, near the "hogback") did not encounter groundwater at the time of drilling.

Laboratory Data

Civil Resources tested the clayey sand material that remains after processing the aggregate. Two samples were analyzed for gradation, Atterberg Limits, Standard Proctor moisture/density relationships, and remolded permeabilities. The laboratory results are attached. The results indicate that the soil classifies as a clayey sand with a remolded permeability on the order 10 E-7 centimeters per second.

In addition, laboratory testing (gradation and Atterberg Limits) was performed on two soil samples obtained from shallow test pits excavated in the area of the relocated ditch. These lab tests are also attached.

STRUCTURES WITH 200 FEET OF DISTURBED AREAS

The known, permanent, man-made structures within 200 feet of the proposed mine limits that are not owned by the miner are listed below.

1. Westgate Road located approximately 55-feet south of the mine at its nearest point.

2. A small building located on the south side of Westgate Road approximately 80-feet from the mine.
3. A railway line located approximately 185 feet from the mine at its closest point near the southeast corner of the mine.
4. An overhead utility approximately 200 feet east of the mine.
5. The relocated McKay Ditch located 95-feet north of the mine.

These structures are closest to the planned mine limits and will be stable per the stability analyses described herein. All other known structures are at greater distances and, therefore, will also be stable.

STABILITY ANALYSES

Division of Reclamation and Mining Safety (DRMS) drafted a policy regarding stability analyses of neighboring structures. The policy summarizes adequate factors of safety (FOS) for non-critical and critical structures. Most of the structures at the Jefferson County Mine are considered critical structures. The FOS are for both static and seismic (ground accelerations from an earthquake) stability analyses are listed in the DRMS policy. Soil laboratory testing has been performed at the site. For critical structures, FOS of 1.5 and 1.2 are considered sufficient for static and seismic conditions respectively.

The stability of structures within 200 feet of the proposed mining limits was evaluated at the most critical representative sections under anticipated loading conditions as discussed below. The GALENA computer program was used for the analysis. The method for selecting the critical failure surface for each analyzed loading condition was the following. The Simplified Bishop's Method of Analysis was used to find the critical failure surface by randomly searching 2,001 trial failure circles over a broad range of the slope surface and at the structure in question to evaluate the lowest FOS. Both static stability under anticipated mining conditions and seismic stability under peak ground acceleration (PGA) loads were performed. Seismic loading was obtained from the U.S.G.S. Unified Hazard Tool attached to this report. Review of the Hazard Tool indicated a maximum horizontal acceleration of 0.132g with a return period of 2,475 years for the site.

The two most critical cross sections were selected and analyzed as described below.

- Section 1 Westgate Road Section: This section is on the southeast corner of the mine where Westgate Road is at its closest (~55 feet) to the mine limit and the mine is at its deepest point on the south side. This section was analyzed with sixty-six (66)-feet of the Aggregate Unit overlying twenty-eight (28) feet of the Finer-Grained Alluvial Unit on top of claystone bedrock. The top two (2) feet of the claystone was modeled with residual strength values reflecting the weathered nature to the contact with the overlying alluvium. Unweathered bedrock was modeled beneath the residual layer.

- Section 2 Ditch Section: This section is on the northeast corner of the mine where the relocated McKay Ditch is approximately 95 feet to the mine limit and the mine is at its deepest point. This section was analyzed with one hundred (100)-feet of the Aggregate Unit on top of claystone bedrock (borings indicated there was no Finer-Grained Alluvium in this part of the mine). The top two (2) feet of the claystone was modeled with residual strength values reflecting the weathered nature to the contact with the overlying alluvium. Unweathered bedrock was modeled beneath the residual layer.

Both sections were modeled for static and seismic conditions. As discussed below, all FOS required by the DRMS were met.

MATERIAL PROPERTIES

The material index and engineering strengths utilized in this slope stability report are discussed below.

Aggregate Unit

The strength properties for the in-situ Aggregate Unit were based geotechnical laboratory testing, standard penetration tests (SPT), our experience at similar sites and engineering judgment; the following parameters have been used to model the Aggregate Unit.

Unit Weight (pcf)	*Cohesion C' psf*	*Friction Angle Φ' °*
130	175	35

Finer Grained Alluvium

The strength properties for the in-situ Finer Grained Alluvial Unit were based geotechnical laboratory testing, standard penetration tests (SPT), our experience at similar sites and engineering judgment; the following parameters have been used to model the Aggregate Unit.

Unit Weight (pcf)	*Cohesion C' psf*	*Friction Angle Φ' °*
125	200	30

Bedrock

Bedrock at the base of the mine is claystone. For the claystone bedrock, two potential strength conditions were considered. These strength conditions are referred to as: 1) peak strength, and 2) residual strength.

Peak strength is the maximum shear strength the claystone bedrock exhibits. The shear strength is made up of both cohesion (diagenetic bonding) and internal friction. Under short-term conditions for unsheared claystone, peak strength governs behavior. If a sheared surface or sheared zone is present within claystone because of faulting, slippage between beds due to folding, past shrink-swell behavior, stress relief, weathering, or from a landslide, the cohesion along the sheared surface is reduced to zero, and the angle of internal friction is decreased, due to alignment of clay minerals parallel to the shear plane. Under these conditions a claystone exhibits its lowest strength known as residual strength. Residual strength bedrock occurs in discrete zones, parallel with the sheared surface or zone, whereas fully softened strength occurs over a broader area (not used in this modeling). Based on data from site investigations, the residual strength claystone was modeled in a 2-foot thick, weathered layer overlying the peak strength bedrock as follows:

Unit Weight (pcf)	*Cohesion C' psf*	*Friction Angle Φ' °*
Peak = 124 Residual = 110	Peak = 100 Residual = 0	Peak = 26 Residual = 14

STABILITY ANALYSES RESULTS

The stability analyses assumed the mining will be per the mine plan. The plan includes dry mining in the mine cell as the water level in the cell is controlled by dewatering. Exterior mine slopes in the slurry wall lined cells will not exceed 1h:1v.

Setbacks listed in Table 1 (below) indicate the setback from the structure to the mining limits.

The factor of safety shown below is the minimum factor of safety of the conditions listed above.

TABLE 1 - SLOPE STABILITY RESULTS AND SETBACKS

Section	Location	Critical Structure	Structure Setback From Mine Limit (ft)	Static Factor of Safety at Structure	Seismic Factor of Safety at Structure (0.132g horizontal)	DRMS Draft FOS Requirement Static/Seismic
1	Southeast Corner	Westgate Road	55	1.5	1.2	1.5/1.2
2	Northeast Corner	Relocated McKay Ditch	95	1.6	1.2	1.5/1.2

CONCLUSIONS

The Westgate Road and the relocated McKay Ditch are the nearest structures to the mine and are stable based on the Factors of Safety listed in the table above. All other structures in the area are located at or at greater than those described above. Factors of Safety on other neighboring structures will be greater than those summarized in the Table above.

LIMITATIONS

Our review is based on regional geologic mapping, present mining plans, laboratory and borehole data. Stability analyses were performed using typical strength parameters for the various strata in the critical sections. Should the mining plans change or subsurface conditions vary from those portrayed in this letter, we should be contacted in order to re-evaluate the potential affects on permanent man-made structures. Stability analyses were run at the structure in question and were not on failure surfaces closer to the mine limit.

Please call with any questions or comments.

Sincerely,

Civil Resources, LLC

Gary Linden, P.G.
Senior Engineering Geologist

Attachments:

Figures 1 and 2

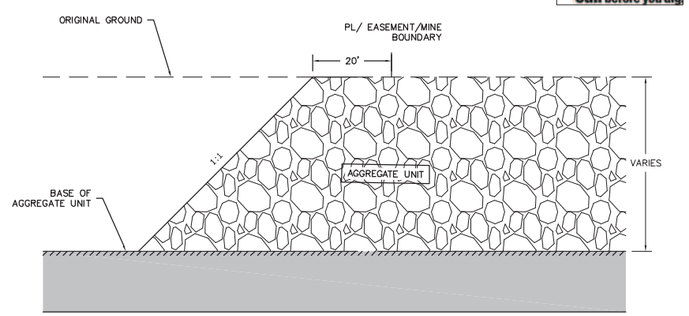
Attachment A Geotechnical Laboratory Data

Attachment B Galena Stability Model Outputs and U.S.G.S. Uniform Hazard Tool

REFERENCES

Trimble, D.E. and Machette, M.N., 1979, “Geologic Map of the Greater Denver Area, Front Range Urban Corridor”, U.S.G.S. Map I-856-H.

Figures



TYPICAL MINE EXCAVATION SECTION
NTS

LEGEND:

- TH- GROUND ELEV: BOA ELEV: — APPROXIMATE BOREHOLE LOCATION DRILLED BY CIVIL RESOURCES, LLC IN DECEMBER 2017 SHOWING APPROXIMATE GROUND ELEVATION AND APPROXIMATE BASE OF AGGREGATE
- 6080 — APPROXIMATE BASE OF AGGREGATE CONTOUR
- MINING BUILDINGS AND EQUIPMENT
- APPROXIMATE MINING AND PROPERTY BOUNDARIES
- PROPOSED RELOCATED DITCH

NOTES:

1. EXISTING GROUND TOPOGRAPHICAL DATA SOURCED FROM AUTODESK INFRAWORKS. JANUARY 2016.
2. MINING BOUNDARY IS SET 20' OFFSET FROM MINE PERMIT BOUNDARY AND 40' OFFSET FROM RELOCATED DITCH CENTERLINE.

NORTH

0 100 200
(IN FEET)

811 Know what's below. Call before you dig.

CIVIL RESOURCES, LLC
323 5th STREET
P.O. Box 680
FREDERICK, CO 80530
303.833.1416
WWW.CIVILRESOURCES.COM

BESTWAY CONCRETE
301 CENTENNIAL DR.
MILLIKEN, CO
970.587.7277
CONTACT: MARK JOHNSON

CHURCH-MCKAY GRAVEL MINE
JEFFERSON COUNTY, CO

REVISIONS

NO.	DESCRIPTION	DATE

DESIGNED BY: GKL	DATE: 1/12/2018
DRAWN BY: BLG	SCALE: AS NOTED
CHECKED BY: ARR	AS NOTED
JOB NO.: 213.001.30	
DWG NAME: CHURCH-MCKAY.DWG	

SITE PLAN AND APPROXIMATE BASE OF AGGREGATE

SHEET: 1

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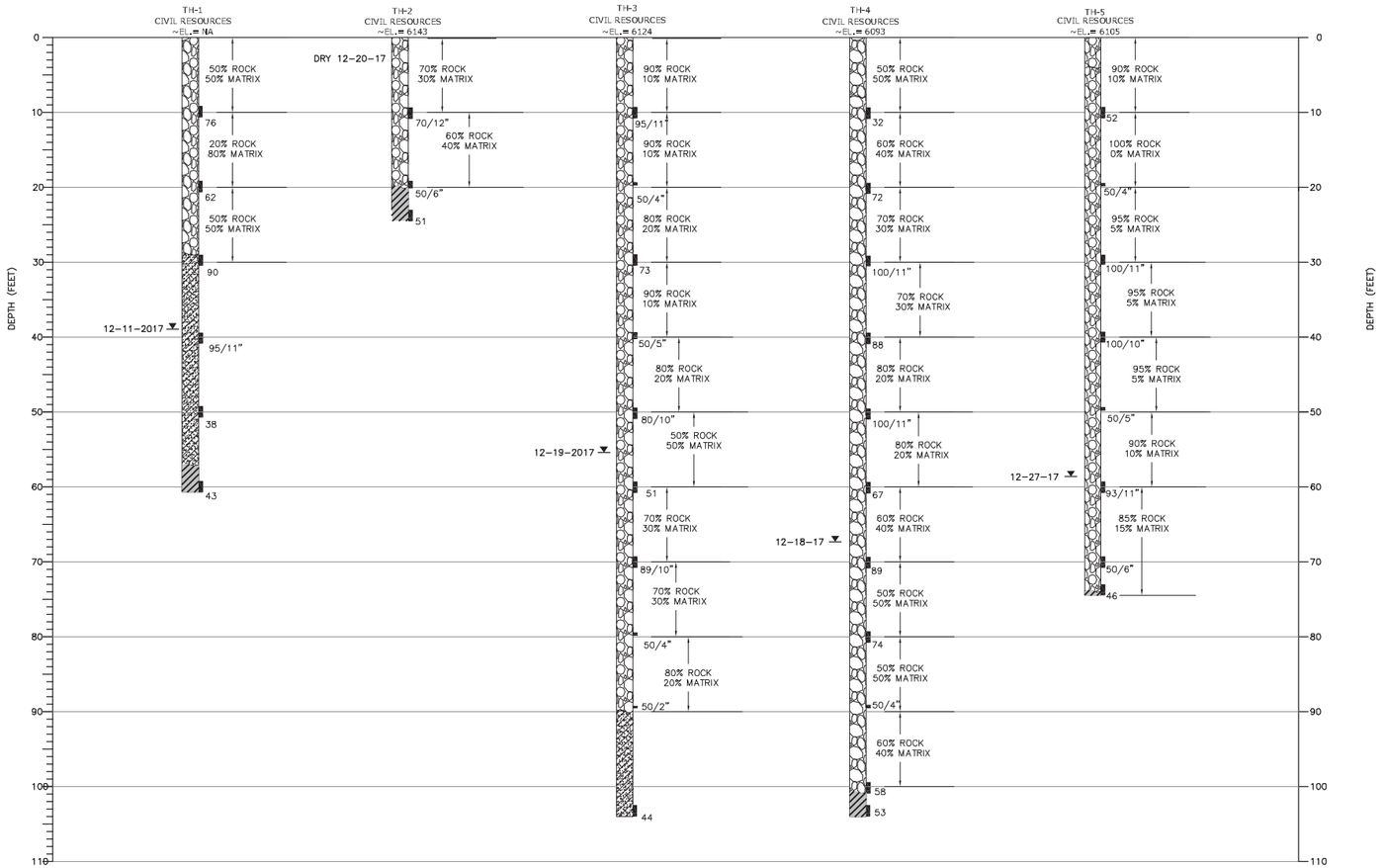
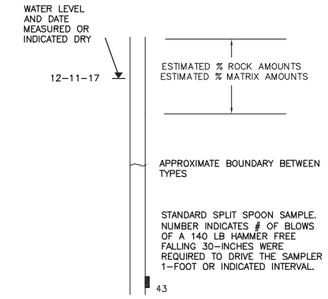




NOTES:

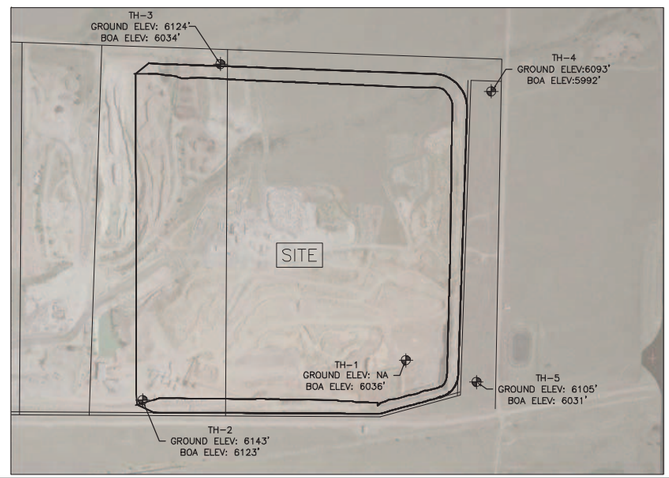
1. EXPLORATORY BORINGS WERE DRILLED BETWEEN DECEMBER 11, 2017 AND DECEMBER 27, 2017 USING A DOWNHOLE PERCUSSION HAMMER WITH 4 INCH ADVANCING CASING KNOWN AS THE TUBEX SYSTEM POWERED BY A TRUCK MOUNTED CME-75 DRILL RIG.
2. LINES BETWEEN MATERIALS REPRESENT APPROXIMATE BOUNDARIES BETWEEN TYPES. TRANSITIONS MAY BE GRADUAL.
3. GROUNDWATER LEVELS WILL FLUCTUATE.
4. BORING ELEVATIONS ARE ESTIMATED FROM TOPOGRAPHICAL MAPPING AND SHALL BE CONSIDERED APPROXIMATE.
5. % ROCK AND % MATRIX VALUES ARE APPROXIMATE AND AREA BASED ON WIDELY SPACED SAMPLES CUTTING RETURNS AND DRILL BEHAVIOR. ACTUAL VALUES WILL DIFFER AND CLAYEY SAND LENSES WILL BE PRESENT.

BORE LOG LEGEND:

AGGREGATE UNIT: BOULDERS, COBBLES, AND GRAVEL WITHIN A CLAYEY SAND MATRIX. DENSE TO VERY DENSE. AGGREGATES ARE TYPICALLY GRAY TO DARK GRAY, MATRIX IS TYPICALLY RED, MOIST BECOMING WET BELOW THE WATER TABLE. LOCAL LAYEY SAND LENSES (GW, GC, GM, GC-GM, SC, SM, SC-SM)

FINER ALLUVIAL UNIT: SAND, DENSE TO VERY DENSE. CLAYEY TO VERY CLAYEY WITH OCCASIONAL COBBLES AND GRAVEL, VERY MOIST, BUFF, GRAY. (SW, SC, GC)

BEDROCK UNIT: CLAYSTONE, HARD, MODERATE TO HIGH PLASTICITY, MOIST, GRAY



NORTH

CIVIL RESOURCES, LLC
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FREDERICK, CO 80530
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WWW.CIVILRESOURCES.COM

BESTWAY CONCRETE
301 CENTENNIAL DR.
MILLIKEN, CO 80543
970.587.7277
CONTACT: MARK JOHNSON

CHURCH-MCKAY MINE
JEFFERSON COUNTY, CO

REVISIONS

NO.	DESCRIPTION	DATE

DESIGNED BY: XXX
DRAWN BY: BLG
CHECKED BY: XXX
DATE: 1/12/2018
SCALE: AS NOTED
AS NOTED
JOB NO.: 213.001.30
DWG NAME: CHURCH-MCKAY.DWG

EXPLATORY BORING LOGS

SHEET: 2

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Attachment A
Geotechnical Laboratory Data

COMPACTION TEST REPORT

Curve No.: Soil813

Project No.: 17-1137 **Date:** 7-27-2017

Project: Jeffco Gravel Mine

Client: Civil Resources

Location: Jeffco Gravel Mine A

Sample Number: Soil813

Remarks:

MATERIAL DESCRIPTION

Description: Clayey Sand with gravel

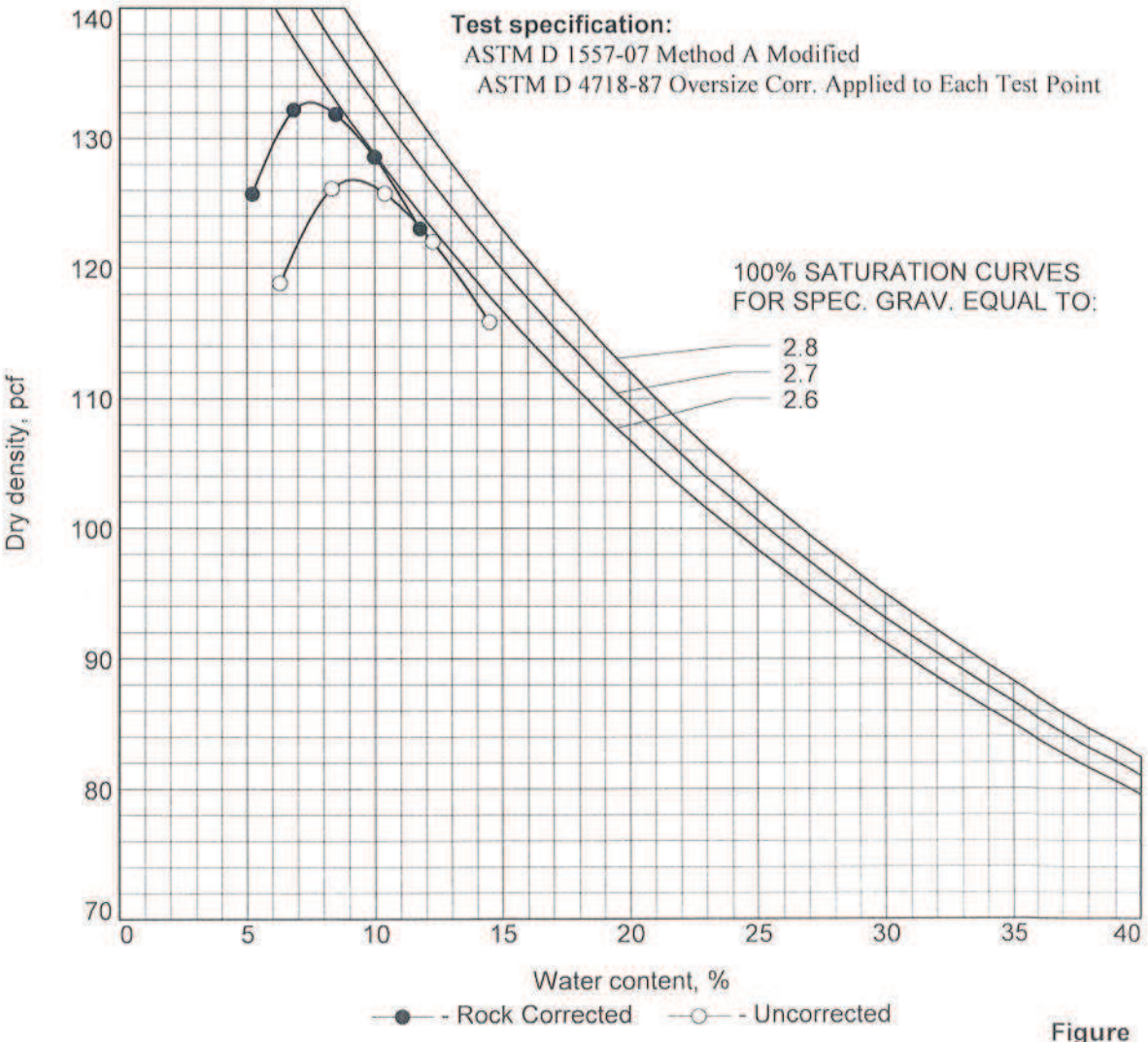
Classifications - **USCS:** (SC)g **AASHTO:** A-2-6(0)

Nat. Moist. = **Sp.G. =**

Liquid Limit = 37 **Plasticity Index =** 15

% < No.200 = 20.3 %

ROCK CORRECTED TEST RESULTS	UNCORRECTED
Maximum dry density = 132.8 pcf	126.8 pcf
Optimum moisture = 7.5 %	9.2 %



Figure

GROUND ENGINEERING CONSULTANTS, INC.

GROUND ENGINEERING

GRADATION PROPERTIES

Project: **Civil Resources Lupton Meadow**
Job Number: **17-1137** Date: 8/23/2017

Reported to: **Civil Resources, LLC**
323 5th Street
PO Box 680
Frederick, CO 80530
Attn: Mr. Andy Rodriguez

Sample Information

Sample Number: Soil813
Sample Location: Jeffco Gravel Mine A
Aggregate Identification: Sands and gravels
Date Sampled: Delivered by Client on 7-27-2017
Sampled By: Civil Resources Representative

Gradation Analysis

Sieve Size *(opening)*	Passing *(%)*
2"	100
1 1/2"	100
1"	100
3/4"	99
1/2"	94
3/8"	88
#4	80
#10	59
#16	51
#20	46
#40	34
#50	30
#100	25
#200	20.3

Liquid Limit: 37
Plasticity Index: 15

Classification: USCS: (SC)g AASHTO: A-2-6

GROUND
ENGINEERING

Project:	Civil Resources | Jeffco Gravel Mine	August 23, 2017
Job Number:	17-1137	
Reported To:	Civil Resources	

Sample Information

Lab ID:	813 | Jeffco Gravel Mine B	Type of Permeant:	Tap Water
		Confining Pressure:	40.0 (psi)
Sample Description:	California Liner (Remolded)	Date Test Started:	August 3, 2017
Date Sampled:	July 27, 2017	Date Test Completed:	August 21, 2017
Total Back Pressure:	30 (psi)	Effective Consolidation Stress:	10.0 (psi)
a_{in}	0.76712 cm^2	a_{out}	0.031416 cm^2

MEASUREMENT OF HYDRAULIC CONDUCTIVITY USING A FLEXIBLE WALL PERMEAMETER
ASTM D 5084-00 - METHOD C FALLING HEAD RISING TAILWATER

Sample Information:

	Pre-Test	Post-Test
Sample Mass (g)	198	208.9
Sample Diameter (in)	1.940	1.930
Sample Length (in)	1.942	2.000
Area (in^2)	2.956	2.926
Specific Gravity (assumed)	2.66	2.66
Volume of Solids (ft^3)	0.00241	0.00242
Volume of Water (ft^3)	0.00059	0.00096
Volume of Air (ft^3)	0.00032	0.00001
Total Volume (ft^3)	0.00332	0.00339
Void Ratio	0.38	0.40
Porosity (%)	27	29
Degree of Saturation (%)	65	99
Pressure Difference (psi)	0.0	0.0
Wet Mass of Sample + Dish (g)	556.30	435.70
Dry Mass of Sample + Dish (g)	526.40	408.50
Mass of Dish (g)	199.70	226.70
Moisture Content (%)	9.2	15.0
Wet Density (pcf)	131.4	136.0
Dry Density (pcf)	120.4	118.3

Permeability Test Trials

Time (min)	Cap Elev. (cm)	Pedestal Elev. (cm)	Elev. Head (cm)	Total Head (cm)	Temp	Permeability (cm/sec)
0	0.30	22.90	23	23	20	
90	1.20	22.00	21	21	Correction Factor	6.6E-07
0	1.50	21.70	20	20	1.000	
90	2.40	20.80	18	18		7.4E-07
0	1.10	23.10	22	22		
240	3.20	20.80	18	18		6.6E-07
0	3.80	20.40	17	17		
180	5.40	18.70	13	13		8.8E-07

Average	7.32E-07
Temp Correction	7.32E-07

COMPACTION TEST REPORT

Curve No.: Soil814

Project No.: 17-1137 **Date:** 7-27-2017

Project: Jeffco Gravel Mine

Client: Civil Resources

Location: Jeffco Gravel Mine B

Sample Number: Soil814

Remarks:

MATERIAL DESCRIPTION

Description: Clayey Sand with gravel

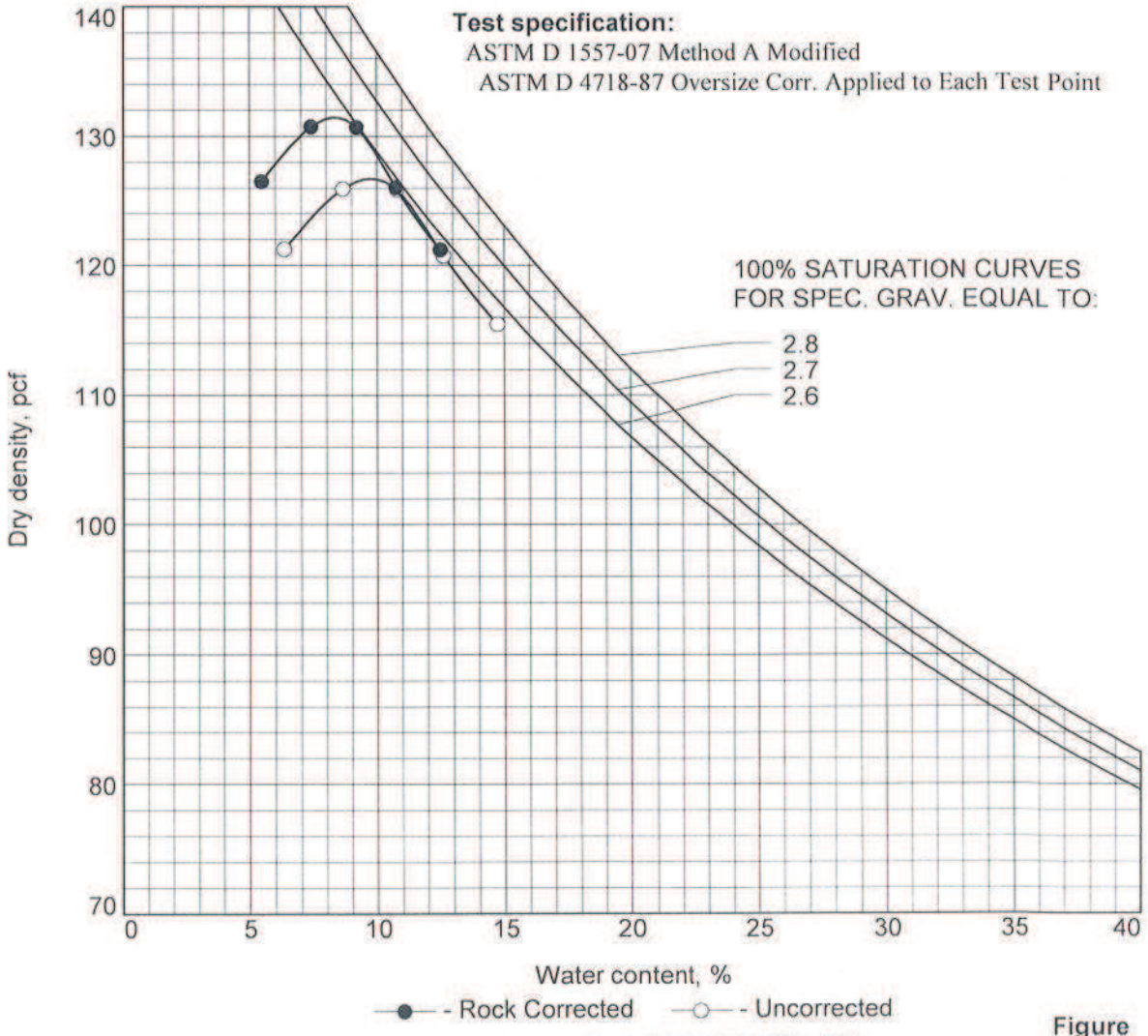
Classifications - **USCS:** (SC)g **AASHTO:** A-2-6(0)

Nat. Moist. = **Sp.G. =**

Liquid Limit = 33 **Plasticity Index =** 14

% < No.200 = 18.6 %

ROCK CORRECTED TEST RESULTS	UNCORRECTED
Maximum dry density = 131.5 pcf	126.7 pcf
Optimum moisture = 8.3 %	9.8 %



Figure

GROUND ENGINEERING CONSULTANTS, INC.

GROUND ENGINEERING

GRADATION PROPERTIES

Project: **Civil Resources Jeffco Gravel Mine**
Job Number: **17-1137** Date: 8/16/2017

Reported to: Civil **Resources, LLC**
323 5th Street
PO Box 680
Frederick, CO 80530
Attn: Mr. Andy Rodriguez

Sample Information

Sample Number: Soil814
Sample Location: Jeffco Gravel Mine B
Aggregate Identification: Sands and gravels
Date Sampled: Delivered by Client on 7-27-2017
Sampled By: Civil Resources Representative

Gradation Analysis

Sieve Size *(opening)*	Passing *(%)*
2"	100
1 1/2"	100
1"	99
3/4"	99
1/2"	96
3/8"	91
#4	84
#10	54
#16	46
#20	42
#40	31
#50	27
#100	22
#200	18.6

Liquid Limit:	33
Plasticity Index:	14

Classification: USCS: (SC)g AASHTO: A-2-6

GROUND ENGINEERING

Project:	Civil Resources | Jeffco Gravel Mine	August 16, 2017
Job Number:	17-1137	
Reported To:	Civil Resources	

Sample Information

Lab ID:	814 | Jeffco Gravel Mine B	Type of Permeant:	Tap Water
		Confining Pressure:	40.0 (psi)
Sample Description:	California Liner (Remolded)	Date Test Started:	August 8, 2017
Date Sampled:	July 27, 2017	Date Test Completed:	August 14, 2017
Total Back Pressure:	30 (psi)	Effective Consolidation Stress:	10.0 (psi)
a_{in}	0.76712 cm^2	a_{out}	0.031416 cm^2

MEASUREMENT OF HYDRAULIC CONDUCTIVITY USING A FLEXIBLE WALL PERMEAMETER
ASTM D 5084-00 - METHOD C FALLING HEAD RISING TAILWATER

Sample Information:

	Pre-Test	Post-Test
Sample Mass (g)	198.7	209.9
Sample Diameter (in)	1.940	1.961
Sample Length (in)	1.960	1.990
Area (in^2)	2.956	3.020
Specific Gravity (assumed)	2.66	2.66
Volume of Solids (ft^3)	0.00246	0.00238
Volume of Water (ft^3)	0.00049	0.00108
Volume of Air (ft^3)	0.00040	0.00001
Total Volume (ft^3)	0.00335	0.00348
Void Ratio	0.36	0.46
Porosity (%)	27	31
Degree of Saturation (%)	55	99
Pressure Difference (psi)	0.0	0.0
Wet Mass of Sample + Dish (g)	765.40	421.70
Dry Mass of Sample + Dish (g)	725.30	391.00
Mass of Dish (g)	195.70	211.80
Moisture Content (%)	7.6	17.1
Wet Density (pcf)	130.7	133.0
Dry Density (pcf)	121.5	113.6

Permeability Test Trials

Time (min)	Cap Elev. (cm)	Pedestal Elev. (cm)	Elev. Head (cm)	Total Head (cm)	Temp	Permeability (cm/sec)
0	0.40	23.00	23	23	20	
240	2.50	21.00	19	19	Correction Factor	5.7E-07
0	2.90	20.60	18	18	1.000	
180	4.30	19.20	15	15		6.6E-07
0	0.50	22.80	22	22		
180	2.90	20.60	18	18		8.8E-07
0	3.50	20.00	17	17		
180	5.50	17.80	12	12		1.1E-06

Average	8.06E-07
Temp Correction	8.06E-07

WESTEST
SPECIALISTS TO THE PAVING INDUSTRY

845 Navajo Street
Denver, CO 80204
303.975.9959, Fax: 303.975.9969

LABORATORY TEST REPORT

PROJECT: Miscellaneous
WesTest PROJECT NO.: 298311
CLIENT: Bestway Concrete
Mr. Myron Moorhead
301 Centennial Drive
Milliken, CO 80543

REPORT DATE: January 17, 2011
DATE SAMPLED:
DATE RECEIVED: January 12, 2011
DATE TESTED: January 14, 2011
SAMPLED BY: Client
SOURCE: Jeffco East
SAMPLE DESCRIPTION: Red slightly clayey, sandy Gravel
SAMPLE NO.: 1

GRADATION ANALYSIS - AASHTO T 11 & T 27, ASTM C 117 & C 136

SIEVE SIZE	PERCENT PASSING	
	SAMPLE	SPECIFICATION
4 - 1/2"	100	
4"	88	
3 - 1/2"	88	
3"	88	
2 - 1/2"	82	
2"	69	
1 - 1/2"	61	
1"	51	
3/4"	44	
1/2"	38	
3/8"	35	
#4	29	
#8	25	
#16	22	
#30	19	
#50	16	
#100	13	
#200	10.3	

PLASTICITY INDEX - AASHTO T 89 & T 90, ASTM D 4318

		SPECIFICATION
LIQUID LIMIT (%)	41	
PLASTIC LIMIT (%)	21	
PLASTICITY INDEX	20	

REVIEWED BY:

WESTEST
SPECIALISTS TO THE PAVING INDUSTRY

845 Navajo Street
Denver, CO 80204
303.975.9959, Fax: 303.975.9969

LABORATORY TEST REPORT

PROJECT: Miscellaneous
WesTest PROJECT NO.: 298311
CLIENT: Bestway Concrete
Mr. Myron Moorhead
301 Centennial Drive
Milliken, CO 80543

REPORT DATE: January 17, 2011
DATE SAMPLED:
DATE RECEIVED: January 12, 2011
DATE TESTED: January 14, 2011
SAMPLED BY: Client
SOURCE: Jeffco West
SAMPLE DESCRIPTION: Red slightly clayey, sandy Gravel
SAMPLE NO.: 2

GRADATION ANALYSIS - AASHTO T 11 & T 27, ASTM C 117 & C 136

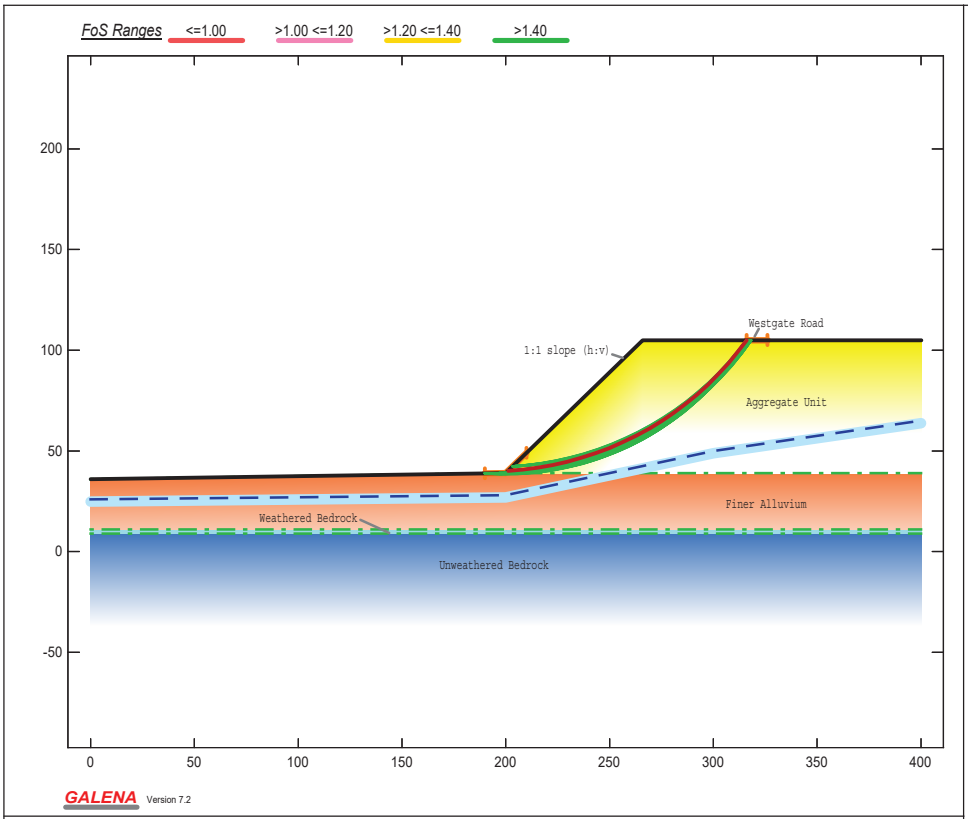
SIEVE SIZE	PERCENT PASSING	
	SAMPLE	SPECIFICATION
3 - 1/2"	100	
3"	95	
2 - 1/2"	90	
2"	82	
1 - 1/2"	70	
1"	57	
3/4"	49	
1/2"	42	
3/8"	37	
#4	30	
#8	25	
#16	22	
#30	18	
#50	15	
#100	13	
#200	10.0	

PLASTICITY INDEX - AASHTO T 89 & T 90, ASTM D 4318

		SPECIFICATION
LIQUID LIMIT (%)	38	
PLASTIC LIMIT (%)	18	
PLASTICITY INDEX	20	

REVIEWED BY:

Attachment B
Galena Model Outputs



Material Keys

1: Aggregate Unit

2: Finer Alluvial Unit

3: weathered bedrock

4: UnweatheredBedrock

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 1.51

Project BURNCO, LLC, Church/McKay
Westgate Road, Static

File: J:\Bestway-213\church-mckay\geotech\Stability\Westgate Static.gmf

Edited: 28 Jun 2023 *Processed:*28 Jun 2023

Civil Resources

GALENA 7.2 Analysis Results Version: 7.2.1.05 Licensee: Civil Resources

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Project: BURNCO, LLC, Church/McKay
File: J:\Bestway-213\church-mckay\geotech\Stability\Westgate Static.gmf
Processed: 28 Jun 2023 09:27:00

DATA: Analysis 1 - Westgate Road, Static

Material Properties (4 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Aggregate Unit
Cohesion Phi UnitWeight Ru
175.00 35.0 130.00 Auto
Material: 2 (Mohr-Coulomb Isotropic) - Finer Alluvial Unit
Cohesion Phi UnitWeight Ru
200.00 30.0 125.00 Auto
Material: 3 (Mohr-Coulomb Isotropic) - weathered bedrock
Cohesion Phi UnitWeight Ru
0.00 14.0 110.00 Auto
Material: 4 (Mohr-Coulomb Isotropic) - UnweatheredBedrock
Cohesion Phi UnitWeight Ru
100.00 26.0 124.00 Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 62.400

Material Profiles (4 profiles)

Profile: 1 (2 points) Material beneath: 1 - Aggregate Unit
0.00 140.00 400.00 140.00
Profile: 2 (2 points) Material beneath: 2 - Finer Alluvial Unit
0.00 39.00 400.00 39.00
Profile: 3 (2 points) Material beneath: 3 - weathered bedrock
0.00 11.00 400.00 11.00
Profile: 4 (2 points) Material beneath: 4 - UnweatheredBedrock
0.00 9.00 400.00 9.00

Slope Surface (4 points)

0.00 36.00 200.00 39.00 266.00 105.00 400.00 105.00

Phreatic Surface (4 points)

0.00 26.00 200.00 28.00 300.00 50.00 400.00 65.00

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R
Intersects: XL: 200.00 YL: 39.00 XR: 321.00 YR: 105.00
Centre: XC: 201.60 YC: 179.99 Radius: R: 141.00

Variable Restraints

```
Parameter descriptor:              XL         XR         R
Range of variation:             20.00      10.00      20.00
Trial positions within range:      10         10         20

-  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --  --
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RESULTS: Analysis  1 - Westgate Road, Static

Bishop Simplified Method of Analysis - Circular Failure Surface
---------------------------------------------------------------
Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety:   1.611

Analysis Summary
================
There were:  1812 successful analyses from a total of 2001 trial failure surfaces
             189 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety:  1.51
==========================================

Results Summary - Lowest 99 Factor of Safety circles
----------------------------------------------------
Circle    X-Left      Y-Left     X-Right     Y-Right     X-Centre    Y-Centre
Radius      FoS
   1       201.11       40.11      316.00      105.00      191.76      190.82
151.00     1.515   <-- Critical Surface
   2       201.11       40.11      316.00      105.00      192.34      189.80
149.95     1.517
   3       201.11       40.11      316.00      105.00      192.91      188.78
148.89     1.519
   4       201.11       40.11      316.00      105.00      193.49      187.76
147.84     1.522
   5       201.11       40.11      316.00      105.00      194.07      186.73
146.79     1.524
   6       201.11       40.11      316.00      105.00      194.65      185.70
145.74     1.526
   7       201.11       40.11      316.00      105.00      195.23      184.68
144.68     1.529
   8       192.22       38.88      316.00      105.00      194.49      183.55
144.68     1.530
   9       190.00       38.85      316.00      105.00      193.88      184.54
145.74     1.530
  10       201.11       40.11      316.00      105.00      195.81      183.64
143.63     1.532
  11       201.11       40.11      317.11      105.00      192.92      190.89
151.00     1.532
  12       192.22       38.88      316.00      105.00      195.06      182.49
143.63     1.532
  13       190.00       38.85      316.00      105.00      194.44      183.47
144.68     1.532
  14       201.11       40.11      316.00      105.00      196.40      182.61
142.58     1.534
  15       201.11       40.11      317.11      105.00      193.49      189.86
149.95     1.534
  16       190.00       38.85      316.00      105.00      195.00      182.39
143.63     1.535
  17       192.22       38.88      316.00      105.00      195.63      181.42
142.58     1.535
  18       194.44       38.92      316.00      105.00      196.25      180.43
141.53     1.535
```

19	203.33	42.33	316.00	105.00	193.29	193.00	151.00	1.536
20	201.11	40.11	317.11	105.00	194.06	188.84	148.89	1.537
21	190.00	38.85	316.00	105.00	195.57	181.32	142.58	1.537
22	201.11	40.11	316.00	105.00	196.98	181.58	141.53	1.537
23	192.22	38.88	316.00	105.00	196.20	180.35	141.53	1.537
24	194.44	38.92	316.00	105.00	196.83	179.37	140.47	1.537
25	203.33	42.33	316.00	105.00	193.86	191.98	149.95	1.538
26	190.00	38.85	316.00	105.00	196.13	180.24	141.53	1.539
27	201.11	40.11	317.11	105.00	194.64	187.81	147.84	1.539
28	192.22	38.88	316.00	105.00	196.77	179.28	140.47	1.540
29	201.11	40.11	316.00	105.00	197.57	180.54	140.47	1.540
30	194.44	38.92	316.00	105.00	197.41	178.31	139.42	1.540
31	203.33	42.33	316.00	105.00	194.43	190.96	148.89	1.540
32	190.00	38.85	316.00	105.00	196.70	179.16	140.47	1.541
33	201.11	40.11	317.11	105.00	195.21	186.78	146.79	1.542
34	192.22	38.88	317.11	105.00	194.47	185.66	146.79	1.542
35	190.00	38.85	317.11	105.00	193.86	186.64	147.84	1.542
36	192.22	38.88	316.00	105.00	197.35	178.21	139.42	1.542
37	203.33	42.33	316.00	105.00	194.99	189.94	147.84	1.543
38	201.11	40.11	316.00	105.00	198.15	179.50	139.42	1.543
39	194.44	38.92	316.00	105.00	197.99	177.24	138.37	1.543
40	190.00	38.85	316.00	105.00	197.27	178.08	139.42	1.544
41	196.67	38.95	316.00	105.00	198.62	176.25	137.32	1.544
42	201.11	40.11	317.11	105.00	195.79	185.75	145.74	1.544
43	192.22	38.88	317.11	105.00	195.03	184.59	145.74	1.544
44	190.00	38.85	317.11	105.00	194.41	185.57	146.79	1.544
45	192.22	38.88	316.00	105.00	197.92	177.13	138.37	1.545
46	203.33	42.33	316.00	105.00	195.56	188.92	146.79	1.545
47	201.11	40.11	316.00	105.00	198.74	178.46	138.37	1.546
48	194.44	38.92	316.00	105.00	198.57	176.17	137.32	1.546
49	190.00	38.85	316.00	105.00	197.84	177.00	138.37	1.546

50	190.00	38.85	317.11	105.00	194.97	184.50	145.74	1.547
51	192.22	38.88	317.11	105.00	195.59	183.53	144.68	1.547
52	201.11	40.11	317.11	105.00	196.37	184.72	144.68	1.547
53	196.67	38.95	316.00	105.00	199.20	175.19	136.26	1.547
54	192.22	38.88	316.00	105.00	198.50	176.06	137.32	1.547
55	203.33	42.33	316.00	105.00	196.13	187.89	145.74	1.547
56	190.00	38.85	316.00	105.00	198.41	175.91	137.32	1.548
57	194.44	38.92	316.00	105.00	199.15	175.10	136.26	1.549
58	190.00	38.85	317.11	105.00	195.53	183.43	144.68	1.549
59	201.11	40.11	316.00	105.00	199.33	177.42	137.32	1.549
60	192.22	38.88	317.11	105.00	196.16	182.46	143.63	1.549
61	194.44	38.92	317.11	105.00	196.78	181.48	142.58	1.549
62	201.11	40.11	317.11	105.00	196.95	183.68	143.63	1.549
63	201.11	40.11	318.22	105.00	194.07	190.95	151.00	1.550
64	192.22	38.88	316.00	105.00	199.08	174.97	136.26	1.550
65	203.33	42.33	316.00	105.00	196.70	186.87	144.68	1.550
66	196.67	38.95	316.00	105.00	199.79	174.12	135.21	1.550
67	190.00	38.85	316.00	105.00	198.98	174.82	136.26	1.551
68	190.00	38.85	317.11	105.00	196.09	182.35	143.63	1.551
69	194.44	38.92	316.00	105.00	199.73	174.02	135.21	1.552
70	192.22	38.88	317.11	105.00	196.72	181.39	142.58	1.552
71	201.11	40.11	318.22	105.00	194.64	189.92	149.95	1.552
72	192.22	38.88	316.00	105.00	199.66	173.89	135.21	1.552
73	194.44	38.92	317.11	105.00	197.35	180.41	141.53	1.552
74	201.11	40.11	316.00	105.00	199.92	176.37	136.26	1.552
75	203.33	42.33	316.00	105.00	197.28	185.84	143.63	1.552
76	201.11	40.11	317.11	105.00	197.53	182.65	142.58	1.552
77	190.00	38.85	316.00	105.00	199.56	173.72	135.21	1.553
78	196.67	38.95	316.00	105.00	200.39	173.06	134.16	1.553
79	190.00	38.85	317.11	105.00	196.65	181.27	142.58	1.553
80	203.33	42.33	317.11	105.00	194.46	193.07	151.00	1.554

81	192.22	38.88	318.22	105.00	194.45	187.76
148.89	1.554					
82	192.22	38.88	317.11	105.00	197.29	180.32
141.53	1.554					
83	201.11	40.11	318.22	105.00	195.21	188.89
148.89	1.554					
84	190.00	38.85	318.22	105.00	193.84	188.75
149.95	1.554					
85	194.44	38.92	316.00	105.00	200.32	172.95
134.16	1.554					
86	192.22	38.88	316.00	105.00	200.24	172.80
134.16	1.555					
87	203.33	42.33	316.00	105.00	197.85	184.81
142.58	1.555					
88	194.44	38.92	317.11	105.00	197.92	179.35
140.47	1.555					
89	190.00	38.85	316.00	105.00	200.13	172.62
134.16	1.555					
90	198.89	38.98	316.00	105.00	201.03	172.07
133.11	1.555					
91	201.11	40.11	317.11	105.00	198.11	181.61
141.53	1.555					
92	190.00	38.85	317.11	105.00	197.21	180.19
141.53	1.555					
93	201.11	40.11	316.00	105.00	200.51	175.32
135.21	1.555					
94	196.67	38.95	317.11	105.00	198.55	178.36
139.42	1.556					
95	203.33	42.33	317.11	105.00	195.02	192.05
149.95	1.556					
96	196.67	38.95	316.00	105.00	200.98	171.99
133.11	1.556					
97	192.22	38.88	318.22	105.00	195.00	186.70
147.84	1.556					
98	190.00	38.85	318.22	105.00	194.39	187.68
148.89	1.557					
99	192.22	38.88	317.11	105.00	197.86	179.24
140.47	1.557					

Critical Failure Surface (circle 1)

Intersects: XL: 201.11 YL: 40.11 XR: 316.00 YR: 105.00

Centre: XC: 191.76 YC: 190.82 Radius: R: 151.00

Generated failure surface: (20 points)

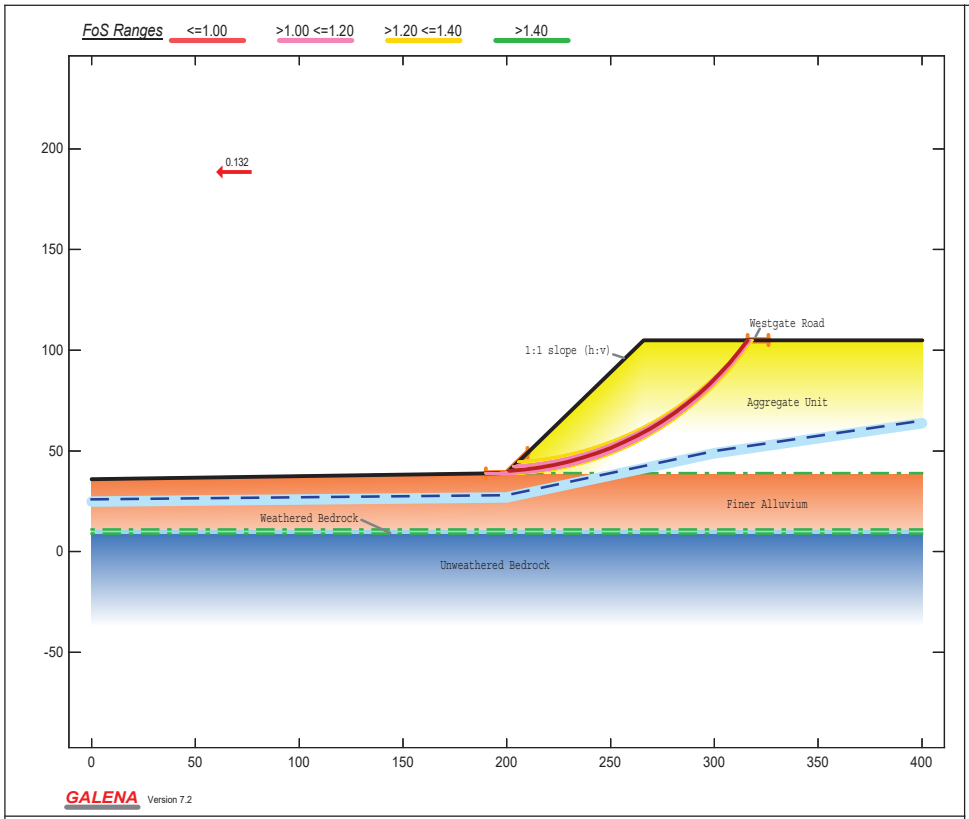
201.11	40.11	208.27	40.73	215.39	41.68
222.46	42.98	229.46	44.60		
236.38	46.56	243.19	48.85	249.89	51.46
256.45	54.38	262.87	57.61		
269.13	61.15	275.21	64.97	281.10	69.09
286.79	73.48	292.27	78.13		
297.51	83.04	302.52	88.19	307.28	93.58
311.78	99.19	316.00	105.00		

Slice Geometry and Properties - Critical Failure Surface (circle 1, 38 slices)

Slice	X-S	Base						PoreWater	Normal	Test
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force	Stress	Factor
1	201.11	5.86	4.9	3.58	3.59	1	175.00	35.0	761.43	0.00	195.01	0.97

2	204.69	17.57	4.9	3.58	3.59	1	175.00	35.0
2284.29	0.00	604.13	0.97					
3	208.27	28.80	7.6	3.56	3.59	1	175.00	35.0
3743.56	0.00	975.21	0.95					
4	211.83	39.78	7.6	3.56	3.59	1	175.00	35.0
5171.08	0.00	1352.65	0.95					
5	215.39	50.03	10.4	3.53	3.59	1	175.00	35.0
6504.07	0.00	1677.19	0.94					
6	218.93	60.24	10.4	3.53	3.59	1	175.00	35.0
7830.97	0.00	2023.33	0.94					
7	222.46	69.40	13.1	3.50	3.59	1	175.00	35.0
9021.76	0.00	2303.30	0.93					
8	225.96	78.80	13.1	3.50	3.59	1	175.00	35.0
10243.62	0.00	2618.53	0.93					
9	229.46	86.76	15.8	3.46	3.59	1	175.00	35.0
11278.79	0.00	2855.73	0.92					
10	232.92	95.32	15.8	3.46	3.59	1	175.00	35.0
12392.12	0.00	3140.48	0.92					
11	236.38	102.01	18.5	3.41	3.59	1	175.00	35.0
13260.73	0.00	3336.47	0.91					
12	239.78	109.72	18.5	3.41	3.59	1	175.00	35.0
14263.07	0.00	3591.20	0.91					
13	243.19	115.05	21.3	3.35	3.59	1	175.00	35.0
14956.67	0.00	3747.45	0.91					
14	246.54	121.90	21.3	3.35	3.59	1	175.00	35.0
15846.62	0.00	3972.68	0.91					
15	249.89	125.84	24.0	3.28	3.59	1	175.00	35.0
16359.73	0.00	4090.55	0.91					
16	253.17	131.82	24.0	3.28	3.59	1	175.00	35.0
17136.59	0.00	4286.85	0.91					
17	256.45	134.36	26.7	3.21	3.59	1	175.00	35.0
17466.30	0.00	4367.63	0.91					
18	259.66	139.47	26.7	3.21	3.59	1	175.00	35.0
18130.88	0.00	4535.62	0.91					
19	262.87	140.71	29.5	3.13	3.60	1	175.00	35.0
18292.82	0.00	4580.64	0.91					
20	266.00	139.84	29.5	3.13	3.59	1	175.00	35.0
18178.91	0.00	4559.88	0.91					
21	269.13	130.45	32.2	3.04	3.59	1	175.00	35.0
16958.23	0.00	4263.42	0.92					
22	272.17	124.63	32.2	3.04	3.59	1	175.00	35.0
16201.60	0.00	4070.68	0.92					
23	275.21	114.91	34.9	2.95	3.59	1	175.00	35.0
14937.66	0.00	3772.04	0.92					
24	278.15	108.85	34.9	2.95	3.59	1	175.00	35.0
14149.97	0.00	3569.92	0.92					
25	281.10	99.06	37.6	2.85	3.59	1	175.00	35.0
12877.99	0.00	3270.86	0.93					
26	283.95	92.82	37.6	2.85	3.59	1	175.00	35.0
12066.34	0.00	3060.57	0.93					
27	286.79	83.12	40.4	2.74	3.59	1	175.00	35.0
10805.41	0.00	2762.95	0.94					
28	289.53	76.75	40.4	2.74	3.59	1	175.00	35.0
9977.05	0.00	2545.76	0.94					
29	292.27	67.28	43.1	2.62	3.59	1	175.00	35.0
8746.65	0.00	2251.63	0.96					
30	294.89	60.84	43.1	2.62	3.59	1	175.00	35.0
7909.40	0.00	2028.85	0.96					
31	297.51	51.76	45.8	2.50	3.59	1	175.00	35.0
6729.43	0.00	1740.49	0.97					
32	300.02	45.31	45.8	2.50	3.59	1	175.00	35.0
5890.49	0.00	1513.48	0.97					

```
 33      302.52     36.77    48.5      2.38      3.59      1      175.00    35.0
4780.64        0.00       1233.44    0.99
 34      304.90     30.37    48.5      2.38      3.59      1      175.00    35.0
3947.87        0.00       1003.62    0.99
 35      307.28     22.52    51.3      2.25      3.59      1      175.00    35.0
2927.67        0.00        734.77    1.01
 36      309.53     16.22    51.3      2.25      3.59      1      175.00    35.0
2108.51        0.00        503.61    1.01
 37      311.78      9.21    54.0      2.11      3.59      1      175.00    35.0
1197.14        0.00        249.24    1.04
 38      313.89      3.07    54.0      2.11      3.59      1      175.00    35.0
399.05         0.00         18.29    1.04
                --------                    -------                          -------
---
     X-S Area:    2967.19    Path Length:    136.54              X-S Weight:
385735.19
```



Material Keys

1: Aggregate Unit

2: Finer Alluvial Unit

3: weathered bedrock

4: UnweatheredBedrock

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 1.18

Project BURNCO, LLC, Church/McKay
Westgate Road, Seismic

File: J:\Bestway-213\church-mckay\geotech\Stability\Westgate Seismic2.gmf

Edited: 28 Jun 2023 *Processed:*28 Jun 2023

Civil Resources

GALENA 7.2 Analysis Results Version: 7.2.1.05 Licensee: Civil Resources

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Project: BURNCO, LLC, Church/McKay
File: J:\Bestway-213\church-mckay\geotech\Stability\Westgate Seismic2.gmf
Processed: 28 Jun 2023 09:54:29

DATA: Analysis 1 - Westgate Road, Seismic

Material Properties (4 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Aggregate Unit
Cohesion Phi UnitWeight Ru
175.00 35.0 130.00 Auto
Material: 2 (Mohr-Coulomb Isotropic) - Finer Alluvial Unit
Cohesion Phi UnitWeight Ru
200.00 30.0 125.00 Auto
Material: 3 (Mohr-Coulomb Isotropic) - weathered bedrock
Cohesion Phi UnitWeight Ru
0.00 14.0 110.00 Auto
Material: 4 (Mohr-Coulomb Isotropic) - UnweatheredBedrock
Cohesion Phi UnitWeight Ru
100.00 26.0 124.00 Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 62.400

Material Profiles (4 profiles)

Profile: 1 (2 points) Material beneath: 1 - Aggregate Unit
0.00 140.00 400.00 140.00
Profile: 2 (2 points) Material beneath: 2 - Finer Alluvial Unit
0.00 39.00 400.00 39.00
Profile: 3 (2 points) Material beneath: 3 - weathered bedrock
0.00 11.00 400.00 11.00
Profile: 4 (2 points) Material beneath: 4 - UnweatheredBedrock
0.00 9.00 400.00 9.00

Slope Surface (4 points)

0.00 36.00 200.00 39.00 266.00 105.00 400.00 105.00

Phreatic Surface (4 points)

0.00 26.00 200.00 28.00 300.00 50.00 400.00 65.00

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R
Intersects: XL: 200.00 YL: 39.00 XR: 321.00 YR: 105.00
Centre: XC: 201.60 YC: 179.99 Radius: R: 141.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.132

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	20.00	10.00	20.00
Trial positions within range:	10	10	20

- -

RESULTS: Analysis 1 - Westgate Road, Seismic

Bishop Simplified Method of Analysis - Circular Failure Surface
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Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 1.249

Analysis Summary
==========
There were: 1812 successful analyses from a total of 2001 trial failure surfaces
             189 analyses terminated due to unacceptable geometry

Critical (minimum) Factor of Safety: 1.18
==========
Negative normal stresses exist on the base of one or more slices; examine slice data and consult the GALENA Help utility

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	201.11	40.11	316.00	105.00	191.76	190.82	151.00	1.177	<-- Critical Surface
2	201.11	40.11	316.00	105.00	192.34	189.80	149.95	1.179	
3	201.11	40.11	316.00	105.00	192.91	188.78	148.89	1.181	
4	201.11	40.11	316.00	105.00	193.49	187.76	147.84	1.183	
5	201.11	40.11	316.00	105.00	194.07	186.73	146.79	1.185	
6	201.11	40.11	316.00	105.00	194.65	185.70	145.74	1.187	
7	201.11	40.11	317.11	105.00	192.92	190.89	151.00	1.189	
8	201.11	40.11	316.00	105.00	195.23	184.68	144.68	1.189	
9	203.33	42.33	316.00	105.00	193.29	193.00	151.00	1.190	
10	201.11	40.11	317.11	105.00	193.49	189.86	149.95	1.191	
11	201.11	40.11	316.00	105.00	195.81	183.64	143.63	1.192	
12	203.33	42.33	316.00	105.00	193.86	191.98	149.95	1.192	
13	192.22	38.88	316.00	105.00	194.49	183.55	144.68	1.193	
14	190.00	38.85	316.00	105.00	193.88	184.54	145.74	1.193	
15	201.11	40.11	317.11	105.00	194.06	188.84	148.89	1.193	

16	203.33	42.33	316.00	105.00	194.43	190.96	148.89	1.194
17	201.11	40.11	316.00	105.00	196.40	182.61	142.58	1.194
18	192.22	38.88	316.00	105.00	195.06	182.49	143.63	1.195
19	201.11	40.11	317.11	105.00	194.64	187.81	147.84	1.195
20	190.00	38.85	316.00	105.00	194.44	183.47	144.68	1.195
21	203.33	42.33	316.00	105.00	194.99	189.94	147.84	1.196
22	201.11	40.11	316.00	105.00	196.98	181.58	141.53	1.197
23	190.00	38.85	316.00	105.00	195.00	182.39	143.63	1.197
24	192.22	38.88	316.00	105.00	195.63	181.42	142.58	1.197
25	194.44	38.92	316.00	105.00	196.25	180.43	141.53	1.197
26	201.11	40.11	317.11	105.00	195.21	186.78	146.79	1.197
27	203.33	42.33	316.00	105.00	195.56	188.92	146.79	1.198
28	201.11	40.11	316.00	105.00	197.57	180.54	140.47	1.199
29	190.00	38.85	316.00	105.00	195.57	181.32	142.58	1.199
30	201.11	40.11	317.11	105.00	195.79	185.75	145.74	1.199
31	192.22	38.88	316.00	105.00	196.20	180.35	141.53	1.199
32	194.44	38.92	316.00	105.00	196.83	179.37	140.47	1.200
33	203.33	42.33	316.00	105.00	196.13	187.89	145.74	1.200
34	192.22	38.88	317.11	105.00	194.47	185.66	146.79	1.200
35	190.00	38.85	317.11	105.00	193.86	186.64	147.84	1.200
36	201.11	40.11	318.22	105.00	194.07	190.95	151.00	1.201
37	190.00	38.85	316.00	105.00	196.13	180.24	141.53	1.201
38	201.11	40.11	316.00	105.00	198.15	179.50	139.42	1.202
39	201.11	40.11	317.11	105.00	196.37	184.72	144.68	1.202
40	192.22	38.88	316.00	105.00	196.77	179.28	140.47	1.202
41	203.33	42.33	316.00	105.00	196.70	186.87	144.68	1.202
42	203.33	42.33	317.11	105.00	194.46	193.07	151.00	1.202
43	192.22	38.88	317.11	105.00	195.03	184.59	145.74	1.202
44	194.44	38.92	316.00	105.00	197.41	178.31	139.42	1.202
45	190.00	38.85	317.11	105.00	194.41	185.57	146.79	1.202
46	201.11	40.11	318.22	105.00	194.64	189.92	149.95	1.203

47	190.00	38.85	316.00	105.00	196.70	179.16	140.47	1.203
48	203.33	42.33	317.11	105.00	195.02	192.05	149.95	1.204
49	192.22	38.88	316.00	105.00	197.35	178.21	139.42	1.204
50	201.11	40.11	317.11	105.00	196.95	183.68	143.63	1.204
51	203.33	42.33	316.00	105.00	197.28	185.84	143.63	1.204
52	201.11	40.11	316.00	105.00	198.74	178.46	138.37	1.204
53	190.00	38.85	317.11	105.00	194.97	184.50	145.74	1.204
54	192.22	38.88	317.11	105.00	195.59	183.53	144.68	1.204
55	205.56	44.56	316.00	105.00	194.88	195.18	151.00	1.205
56	194.44	38.92	316.00	105.00	197.99	177.24	138.37	1.205
57	201.11	40.11	318.22	105.00	195.21	188.89	148.89	1.205
58	196.67	38.95	316.00	105.00	198.62	176.25	137.32	1.205
59	190.00	38.85	316.00	105.00	197.27	178.08	139.42	1.205
60	203.33	42.33	317.11	105.00	195.58	191.03	148.89	1.206
61	205.56	44.56	316.00	105.00	195.44	194.16	149.95	1.206
62	203.33	42.33	316.00	105.00	197.85	184.81	142.58	1.206
63	190.00	38.85	317.11	105.00	195.53	183.43	144.68	1.206
64	192.22	38.88	316.00	105.00	197.92	177.13	138.37	1.206
65	201.11	40.11	317.11	105.00	197.53	182.65	142.58	1.207
66	192.22	38.88	317.11	105.00	196.16	182.46	143.63	1.207
67	194.44	38.92	317.11	105.00	196.78	181.48	142.58	1.207
68	201.11	40.11	316.00	105.00	199.33	177.42	137.32	1.207
69	201.11	40.11	318.22	105.00	195.78	187.86	147.84	1.207
70	194.44	38.92	316.00	105.00	198.57	176.17	137.32	1.207
71	192.22	38.88	318.22	105.00	194.45	187.76	148.89	1.207
72	190.00	38.85	316.00	105.00	197.84	177.00	138.37	1.208
73	190.00	38.85	318.22	105.00	193.84	188.75	149.95	1.208
74	203.33	42.33	317.11	105.00	196.15	190.00	147.84	1.208
75	205.56	44.56	316.00	105.00	196.00	193.14	148.89	1.208
76	196.67	38.95	316.00	105.00	199.20	175.19	136.26	1.208
77	190.00	38.85	317.11	105.00	196.09	182.35	143.63	1.208

78	192.22	38.88	316.00	105.00	198.50	176.06	137.32	1.209
79	203.33	42.33	316.00	105.00	198.42	183.77	141.53	1.209
80	192.22	38.88	317.11	105.00	196.72	181.39	142.58	1.209
81	201.11	40.11	317.11	105.00	198.11	181.61	141.53	1.209
82	194.44	38.92	317.11	105.00	197.35	180.41	141.53	1.209
83	201.11	40.11	318.22	105.00	196.35	186.82	146.79	1.209
84	192.22	38.88	318.22	105.00	195.00	186.70	147.84	1.210
85	190.00	38.85	318.22	105.00	194.39	187.68	148.89	1.210
86	190.00	38.85	316.00	105.00	198.41	175.91	137.32	1.210
87	194.44	38.92	316.00	105.00	199.15	175.10	136.26	1.210
88	201.11	40.11	316.00	105.00	199.92	176.37	136.26	1.210
89	205.56	44.56	316.00	105.00	196.56	192.12	147.84	1.210
90	203.33	42.33	317.11	105.00	196.71	188.97	146.79	1.210
91	190.00	38.85	317.11	105.00	196.65	181.27	142.58	1.210
92	192.22	38.88	316.00	105.00	199.08	174.97	136.26	1.211
93	196.67	38.95	316.00	105.00	199.79	174.12	135.21	1.211
94	203.33	42.33	316.00	105.00	199.00	182.74	140.47	1.211
95	192.22	38.88	317.11	105.00	197.29	180.32	141.53	1.211
96	190.00	38.85	318.22	105.00	194.95	186.61	147.84	1.212
97	201.11	40.11	317.11	105.00	198.69	180.56	140.47	1.212
98	201.11	40.11	318.22	105.00	196.93	185.79	145.74	1.212
99	192.22	38.88	318.22	105.00	195.56	185.63	146.79	1.212

Critical Failure Surface (circle 1)

Intersects: XL: 201.11 YL: 40.11 XR: 316.00 YR: 105.00

Centre: XC: 191.76 YC: 190.82 Radius: R: 151.00

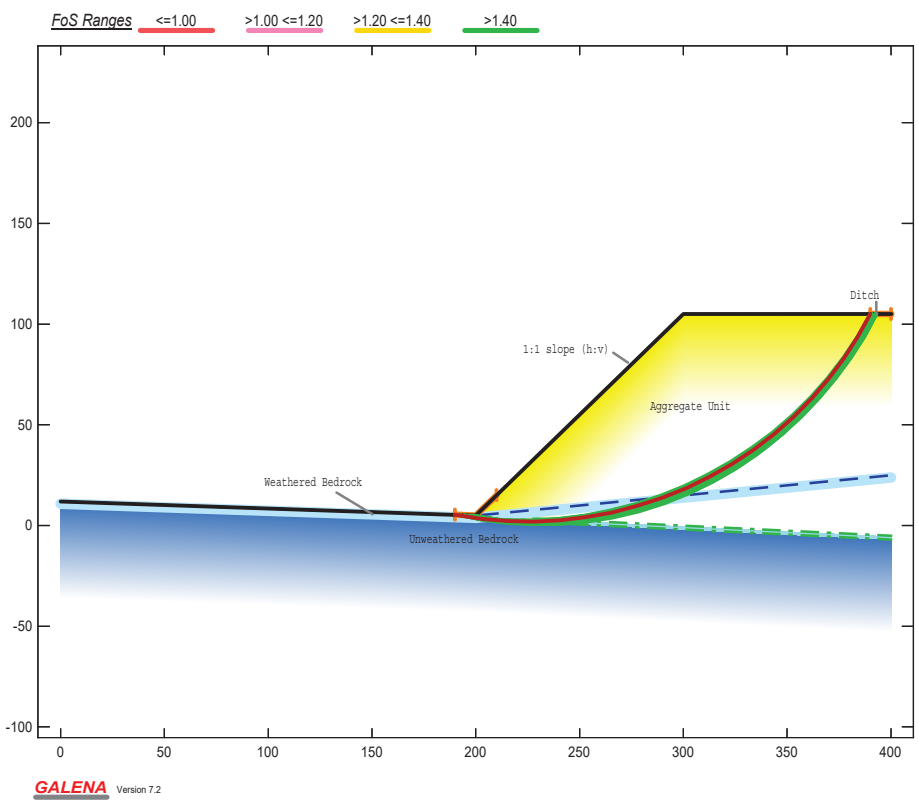
Generated failure surface: (20 points)

201.11	40.11	208.27	40.73	215.39	41.68	222.46	42.98	229.46	44.60
236.38	46.56	243.19	48.85	249.89	51.46	256.45	54.38	262.87	57.61
269.13	61.15	275.21	64.97	281.10	69.09	286.79	73.48	292.27	78.13
297.51	83.04	302.52	88.19	307.28	93.58	311.78	99.19	316.00	105.00

Slice Geometry and Properties - Critical Failure Surface (circle 1, 38 slices)

Slice	X-S	---------- Base ----------						
PoreWater	Normal	Test						
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi
Weight	Force		Stress	Factor				
1	201.11	5.86	4.9	3.58	3.59	1	175.00	35.0
761.43	0.00		190.17	0.95				
2	204.69	17.57	4.9	3.58	3.59	1	175.00	35.0
2284.29	0.00		594.85	0.95				
3	208.27	28.80	7.6	3.56	3.59	1	175.00	35.0
3743.56	0.00		955.00	0.93				
4	211.83	39.78	7.6	3.56	3.59	1	175.00	35.0
5171.08	0.00		1326.22	0.93				
5	215.39	50.03	10.4	3.53	3.59	1	175.00	35.0
6504.07	0.00		1634.97	0.92				
6	218.93	60.24	10.4	3.53	3.59	1	175.00	35.0
7830.97	0.00		1973.52	0.92				
7	222.46	69.40	13.1	3.50	3.59	1	175.00	35.0
9021.76	0.00		2234.03	0.90				
8	225.96	78.80	13.1	3.50	3.59	1	175.00	35.0
10243.62	0.00		2540.70	0.90				
9	229.46	86.76	15.8	3.46	3.59	1	175.00	35.0
11278.79	0.00		2755.73	0.89				
10	232.92	95.32	15.8	3.46	3.59	1	175.00	35.0
12392.12	0.00		3031.31	0.89				
11	236.38	102.01	18.5	3.41	3.59	1	175.00	35.0
13260.73	0.00		3203.27	0.88				
12	239.78	109.72	18.5	3.41	3.59	1	175.00	35.0
14263.07	0.00		3448.54	0.88				
13	243.19	115.05	21.3	3.35	3.59	1	175.00	35.0
14956.67	0.00		3579.65	0.87				
14	246.54	121.90	21.3	3.35	3.59	1	175.00	35.0
15846.62	0.00		3795.42	0.87				
15	249.89	125.84	24.0	3.28	3.59	1	175.00	35.0
16359.73	0.00		3887.67	0.87				
16	253.17	131.82	24.0	3.28	3.59	1	175.00	35.0
17136.59	0.00		4074.79	0.87				
17	256.45	134.36	26.7	3.21	3.59	1	175.00	35.0
17466.30	0.00		4130.06	0.86				
18	259.66	139.47	26.7	3.21	3.59	1	175.00	35.0
18130.88	0.00		4289.40	0.86				
19	262.87	140.71	29.5	3.13	3.60	1	175.00	35.0
18292.82	0.00		4309.50	0.86				
20	266.00	139.84	29.5	3.13	3.59	1	175.00	35.0
18178.91	0.00		4289.91	0.86				
21	269.13	130.45	32.2	3.04	3.59	1	175.00	35.0
16958.23	0.00		3989.02	0.86				
22	272.17	124.63	32.2	3.04	3.59	1	175.00	35.0
16201.60	0.00		3808.00	0.86				
23	275.21	114.91	34.9	2.95	3.59	1	175.00	35.0
14937.66	0.00		3508.70	0.86				
24	278.15	108.85	34.9	2.95	3.59	1	175.00	35.0
14149.97	0.00		3319.81	0.86				
25	281.10	99.06	37.6	2.85	3.59	1	175.00	35.0
12877.99	0.00		3023.74	0.87				
26	283.95	92.82	37.6	2.85	3.59	1	175.00	35.0
12066.34	0.00		2828.21	0.87				
27	286.79	83.12	40.4	2.74	3.59	1	175.00	35.0
10805.41	0.00		2537.12	0.87				
28	289.53	76.75	40.4	2.74	3.59	1	175.00	35.0
9977.05	0.00		2336.21	0.87				
29	292.27	67.28	43.1	2.62	3.59	1	175.00	35.0
8746.65	0.00		2052.01	0.88				

```
 30      294.89     60.84    43.1     2.62     3.59     1     175.00    35.0
7909.40        0.00      1847.01    0.88
 31      297.51     51.76    45.8     2.50     3.59     1     175.00    35.0
6729.43        0.00      1571.82    0.89
 32      300.02     45.31    45.8     2.50     3.59     1     175.00    35.0
5890.49        0.00      1364.05    0.89
 33      302.52     36.77    48.5     2.38     3.59     1     175.00    35.0
4780.64        0.00      1100.21    0.90
 34      304.90     30.37    48.5     2.38     3.59     1     175.00    35.0
3947.87        0.00       891.03    0.90
 35      307.28     22.52    51.3     2.25     3.59     1     175.00    35.0
2927.67        0.00       641.18    0.92
 36      309.53     16.22    51.3     2.25     3.59     1     175.00    35.0
2108.51        0.00       431.99    0.92
 37      311.78      9.21    54.0     2.11     3.59     1     175.00    35.0
1197.14        0.00       199.09    0.94
 38      313.89      3.07    54.0     2.11     3.59     1     175.00    35.0
399.05         0.00       -8.66    0.94
                --------                  -------                          -------
---
     X-S Area:    2967.19    Path Length:    136.54              X-S Weight:
385735.19
```



Material Keys

1: Aggregate Unit

3: weathered bedrock

4: UnweatheredBedrock

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 1.56

Project BURNCO, LLC, Church/McKay
Ditch, Static

File: J:\Bestway-213\church-mckay\geotech\Stability\Ditch Static.gmf

Edited: 28 Jun 2023 *Processed:*28 Jun 2023

Civil Resources

GALENA 7.2 Analysis Results Version: 7.2.1.05 Licensee: Civil Resources

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Project: BURNCO, LLC, Church/McKay
File: J:\Bestway-213\church-mckay\geotech\Stability\Ditch Static.gmf
Processed: 28 Jun 2023 10:30:29

DATA: Analysis 1 - Ditch, Static

Material Properties (4 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Aggregate Unit
Cohesion Phi UnitWeight Ru
175.00 35.0 130.00 Auto
Material: 2 (Mohr-Coulomb Isotropic) - Finer Alluvial Unit
Cohesion Phi UnitWeight Ru
200.00 30.0 125.00 Auto
Material: 3 (Mohr-Coulomb Isotropic) - weathered bedrock
Cohesion Phi UnitWeight Ru
0.00 14.0 110.00 Auto
Material: 4 (Mohr-Coulomb Isotropic) - UnweatheredBedrock
Cohesion Phi UnitWeight Ru
100.00 26.0 124.00 Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 62.400

Material Profiles (3 profiles)

Profile: 1 (2 points) Material beneath: 1 - Aggregate Unit
0.00 140.00 400.00 140.00
Profile: 2 (3 points) Material beneath: 3 - weathered bedrock
0.00 12.00 200.00 5.00 400.00 -5.00
Profile: 3 (3 points) Material beneath: 4 - UnweatheredBedrock
0.00 10.00 200.00 3.00 400.00 -7.00

Slope Surface (4 points)

0.00 12.00 200.00 5.00 300.00 105.00 400.00 105.00

Phreatic Surface (4 points)

0.00 12.00 200.00 5.00 300.00 15.00 400.00 25.00

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R
Intersects: XL: 200.00 YL: 5.00 XR: 395.00 YR: 105.00
Centre: XC: 231.19 YC: 184.31 Radius: R: 182.00

Variable Restraints

Parameter descriptor: XL XR R
Range of variation: 20.00 10.00 20.00

Trial positions within range: 10 10 20

- -

RESULTS: Analysis 1 - Ditch, Static

Bishop Simplified Method of Analysis - Circular Failure Surface
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Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 1.634

Analysis Summary
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There were: 2001 successful analyses from a total of 2001 trial failure surfaces

Critical (minimum) Factor of Safety: 1.56
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Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	190.00	5.35	390.00	105.00	225.04	185.55	183.58	1.555	<-- Critical Surface
2	192.22	5.27	390.00	105.00	226.98	182.31	180.42	1.558	
3	190.00	5.35	390.00	105.00	224.45	186.74	184.63	1.559	
4	190.00	5.35	390.00	105.00	225.63	184.36	182.53	1.560	
5	194.44	5.19	390.00	105.00	228.95	179.07	177.26	1.561	
6	192.22	5.27	390.00	105.00	226.38	183.50	181.47	1.561	
7	192.22	5.27	390.00	105.00	227.58	181.12	179.37	1.562	
8	190.00	5.35	390.00	105.00	223.86	187.92	185.68	1.563	
9	196.67	5.12	390.00	105.00	230.95	175.81	174.11	1.564	
10	194.44	5.19	390.00	105.00	228.34	180.26	178.32	1.564	
11	192.22	5.27	390.00	105.00	225.79	184.69	182.53	1.565	
12	190.00	5.35	391.11	105.00	225.46	186.54	184.63	1.565	
13	190.00	5.35	391.11	105.00	224.88	187.73	185.68	1.565	
14	194.44	5.19	390.00	105.00	229.56	177.87	176.21	1.565	
15	192.22	5.27	391.11	105.00	227.40	183.30	181.47	1.566	
16	194.44	5.19	391.11	105.00	229.36	180.06	178.32	1.567	
17	192.22	5.27	391.11	105.00	226.80	184.49	182.53	1.567	
18	190.00	5.35	390.00	105.00	226.23	183.17	181.47	1.568	
19	190.00	5.35	390.00	105.00	223.27	189.10	186.74	1.568	

20	196.67	5.12	390.00	105.00	230.33	177.01	175.16	1.568
21	194.44	5.19	390.00	105.00	227.74	181.45	179.37	1.568
22	196.67	5.12	390.00	105.00	231.57	174.61	173.05	1.568
23	196.67	5.12	391.11	105.00	231.35	176.81	175.16	1.570
24	194.44	5.19	391.11	105.00	228.76	181.25	179.37	1.570
25	190.00	5.35	391.11	105.00	226.05	185.35	183.58	1.570
26	190.00	5.35	392.22	105.00	225.30	188.72	186.74	1.571
27	192.22	5.27	390.00	105.00	228.19	179.92	178.32	1.571
28	192.22	5.27	390.00	105.00	225.19	185.87	183.58	1.571
29	190.00	5.35	391.11	105.00	224.29	188.91	186.74	1.571
30	196.67	5.12	390.00	105.00	229.71	178.20	176.21	1.572
31	198.89	5.04	390.00	105.00	232.34	173.75	172.00	1.572
32	192.22	5.27	391.11	105.00	228.00	182.11	180.42	1.573
33	190.00	5.35	391.11	105.00	223.71	190.09	187.79	1.573
34	192.22	5.27	392.22	105.00	227.23	185.48	183.58	1.573
35	192.22	5.27	391.11	105.00	226.21	185.68	183.58	1.573
36	190.00	5.35	390.00	105.00	222.69	190.27	187.79	1.573
37	190.00	5.35	390.00	105.00	226.82	181.97	180.42	1.574
38	196.67	5.12	391.11	105.00	230.73	178.00	176.21	1.574
39	198.89	5.04	391.11	105.00	233.36	173.55	172.00	1.574
40	190.00	5.35	392.22	105.00	224.72	189.90	187.79	1.574
41	190.00	5.35	392.22	105.00	225.89	187.53	185.68	1.574
42	194.44	5.19	390.00	105.00	230.18	176.67	175.16	1.575
43	194.44	5.19	390.00	105.00	227.13	182.63	180.42	1.575
44	194.44	5.19	391.11	105.00	229.97	178.86	177.26	1.575
45	190.00	5.35	390.00	105.00	227.42	180.77	179.37	1.575
46	190.00	5.35	390.00	105.00	228.02	179.56	178.32	1.576
47	190.00	5.35	390.00	105.00	228.63	178.35	177.26	1.576
48	190.00	5.35	390.00	105.00	229.23	177.14	176.21	1.576
49	192.22	5.27	392.22	105.00	227.82	184.29	182.53	1.576
50	198.89	5.04	390.00	105.00	231.71	174.95	173.05	1.576

51	192.22	5.27	391.11	105.00	225.62	186.86	184.63	1.576
52	194.44	5.19	391.11	105.00	228.15	182.44	180.42	1.576
53	190.00	5.35	390.00	105.00	229.84	175.92	175.16	1.576
54	194.44	5.19	392.22	105.00	229.17	182.24	180.42	1.576
55	192.22	5.27	392.22	105.00	226.64	186.67	184.63	1.577
56	190.00	5.35	390.00	105.00	230.45	174.69	174.11	1.577
57	192.22	5.27	390.00	105.00	224.60	187.04	184.63	1.577
58	190.00	5.35	392.22	105.00	224.14	191.08	188.84	1.578
59	194.44	5.19	392.22	105.00	229.77	181.05	179.37	1.578
60	198.89	5.04	391.11	105.00	232.74	174.75	173.05	1.578
61	192.22	5.27	390.00	105.00	228.79	178.72	177.26	1.578
62	190.00	5.35	390.00	105.00	222.10	191.44	188.84	1.578
63	190.00	5.35	391.11	105.00	223.12	191.26	188.84	1.579
64	190.00	5.35	390.00	105.00	231.06	173.46	173.05	1.579
65	196.67	5.12	390.00	105.00	229.10	179.39	177.26	1.579
66	190.00	5.35	393.33	105.00	225.73	189.71	187.79	1.579
67	196.67	5.12	391.11	105.00	231.97	175.61	174.11	1.579
68	190.00	5.35	390.00	105.00	231.68	172.22	172.00	1.579
69	192.22	5.27	393.33	105.00	227.65	186.47	184.63	1.579
70	196.67	5.12	391.11	105.00	230.12	179.19	177.26	1.579
71	190.00	5.35	391.11	105.00	226.64	184.16	182.53	1.579
72	194.44	5.19	391.11	105.00	227.55	183.62	181.47	1.580
73	196.67	5.12	390.00	105.00	232.19	173.41	172.00	1.580
74	196.67	5.12	392.22	105.00	231.14	179.00	177.26	1.580
75	196.67	5.12	392.22	105.00	231.75	177.80	176.21	1.580
76	190.00	5.35	393.33	105.00	225.15	190.89	188.84	1.580
77	192.22	5.27	390.00	105.00	229.40	177.52	176.21	1.580
78	192.22	5.27	392.22	105.00	226.05	187.85	185.68	1.581
79	194.44	5.19	390.00	105.00	226.53	183.81	181.47	1.581
80	190.00	5.35	392.22	105.00	226.47	186.34	184.63	1.581
81	192.22	5.27	390.00	105.00	230.01	176.30	175.16	1.581

82	192.22	5.27	390.00	105.00	230.63	175.09	174.11	1.582
83	192.22	5.27	390.00	105.00	224.01	188.22	185.68	1.582
84	192.22	5.27	390.00	105.00	231.24	173.87	173.05	1.582
85	192.22	5.27	391.11	105.00	225.03	188.04	185.68	1.582
86	194.44	5.19	393.33	105.00	229.59	183.23	181.47	1.582
87	190.00	5.35	391.11	105.00	227.24	182.96	181.47	1.583
88	192.22	5.27	391.11	105.00	228.60	180.91	179.37	1.583
89	190.00	5.35	390.00	105.00	221.52	192.61	189.89	1.583
90	190.00	5.35	391.11	105.00	227.83	181.76	180.42	1.583
91	190.00	5.35	391.11	105.00	229.03	179.34	178.32	1.583
92	192.22	5.27	393.33	105.00	227.06	187.66	185.68	1.583
93	190.00	5.35	391.11	105.00	228.43	180.55	179.37	1.583
94	190.00	5.35	391.11	105.00	229.63	178.13	177.26	1.583
95	198.89	5.04	390.00	105.00	231.09	176.14	174.11	1.583
96	194.44	5.19	390.00	105.00	230.79	175.46	174.11	1.583
97	198.89	5.04	391.11	105.00	232.12	175.94	174.11	1.583
98	192.22	5.27	392.22	105.00	228.41	183.10	181.47	1.583
99	196.67	5.12	391.11	105.00	229.51	180.38	178.32	1.584

Critical Failure Surface (circle 1)

Intersects: XL: 190.00 YL: 5.35 XR: 390.00 YR: 105.00

Centre: XC: 225.04 YC: 185.55 Radius: R: 183.58

Generated failure surface: (20 points)

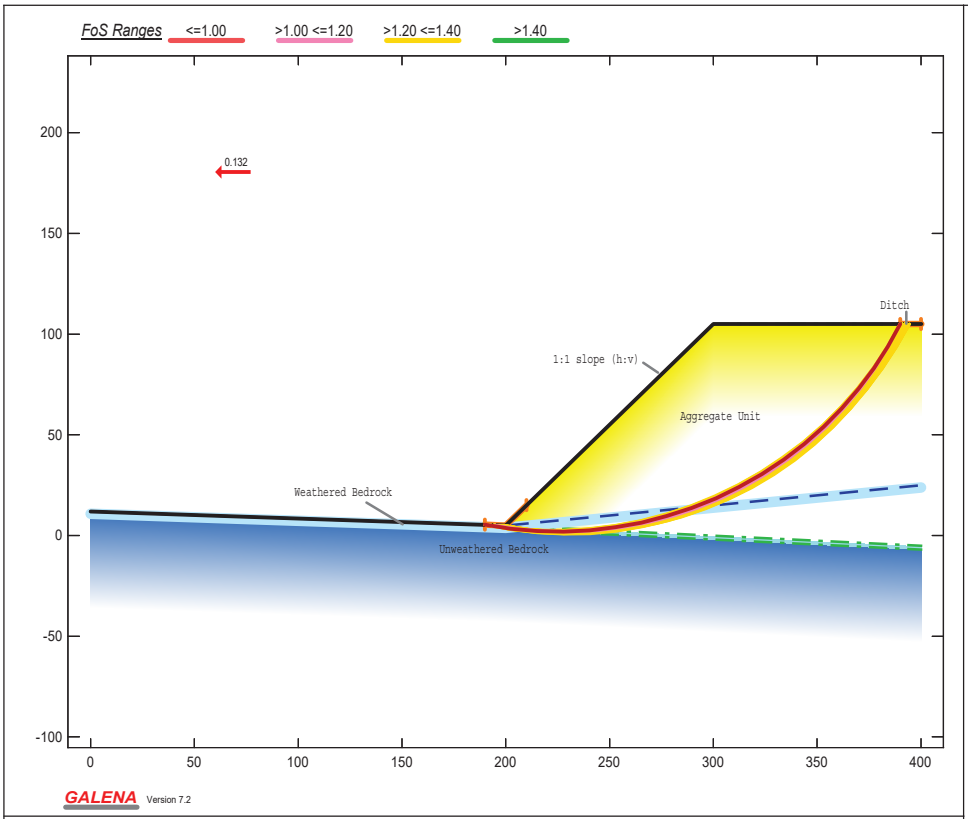
190.00	5.35	202.48	3.37	215.08	2.25	227.71	1.99	240.34	2.61
252.89	4.10	265.31	6.45	277.54	9.64	289.53	13.67	301.20	18.52
312.52	24.16	323.42	30.56	333.85	37.70	343.77	45.54	353.12	54.04
361.87	63.17	369.97	72.87	377.38	83.11	384.07	93.84	390.00	105.00

Slice Geometry and Properties - Critical Failure Surface (circle 1, 41 slices)

Slice	X-S	Base						PoreWater	Normal	Test
	X-Left	Area	Angle	Width	Length	Matl	Cohesion	Phi	Weight	Force	Stress	Factor
1	190.00	1.55	-9.0	5.00	5.06	3	0.00	14.0	170.39	97.87	34.46	1.04
2	195.00	4.65	-9.0	5.00	5.06	3	0.00	14.0	511.18	293.62	103.39	1.04

3	200.00	6.66	-9.0	2.48	2.52	3	0.00	14.0
796.90	245.01	326.60	1.04					
4	202.48	47.44	-5.1	6.29	6.31	3	0.00	14.0
5962.21	975.90	959.42	1.02					
5	208.77	90.52	-5.1	6.29	6.31	3	0.00	14.0
11531.71	1444.21	1856.67	1.02					
6	215.06	133.10	-1.1	6.33	6.33	3	0.00	14.0
17062.43	1831.56	2705.24	1.00					
7	221.39	173.91	-1.1	6.33	6.33	3	0.00	14.0
22391.22	2130.86	3550.18	1.00					
8	227.71	212.88	2.8	6.31	6.32	3	0.00	14.0
27509.60	2341.79	4326.52	0.99					
9	234.03	250.78	2.8	6.31	6.32	3	0.00	14.0
32515.33	2468.64	5113.41	0.99					
10	240.34	95.71	6.8	2.19	2.21	3	0.00	14.0
12434.46	880.93	5577.91	0.99					
11	242.53	243.22	6.8	5.18	5.22	1	175.00	35.0
31618.47	2061.50	5800.76	0.96					
12	247.71	266.89	6.8	5.18	5.22	1	175.00	35.0
34695.05	2030.40	6364.19	0.96					
13	252.89	349.73	10.7	6.21	6.32	1	175.00	35.0
45464.52	2331.83	6755.78	0.94					
14	259.10	381.01	10.7	6.21	6.32	1	175.00	35.0
49531.58	2113.94	7356.55	0.94					
15	265.31	404.36	14.6	6.12	6.32	1	175.00	35.0
52567.34	1810.41	7695.04	0.92					
16	271.43	431.99	14.6	6.12	6.32	1	175.00	35.0
56158.16	1421.28	8213.94	0.92					
17	277.54	448.63	18.6	5.99	6.32	1	175.00	35.0
58322.14	947.45	8441.68	0.92					
18	283.54	472.45	18.6	5.99	6.32	1	175.00	35.0
61418.16	388.92	8878.88	0.92					
19	289.53	71.59	22.5	0.88	0.96	1	175.00	35.0
9306.37	8.29	8846.12	0.91					
20	290.41	396.93	22.5	4.80	5.19	1	175.00	35.0
51601.18	0.00	9026.67	0.91					
21	295.20	410.38	22.5	4.80	5.19	1	175.00	35.0
53349.76	0.00	9333.95	0.91					
22	300.00	104.23	22.5	1.20	1.30	1	175.00	35.0
13550.22	0.00	9460.27	0.91					
23	301.20	481.26	26.5	5.66	6.32	1	175.00	35.0
62563.97	0.00	8986.88	0.91					
24	306.86	465.32	26.5	5.66	6.32	1	175.00	35.0
60490.99	0.00	8687.59	0.91					
25	312.52	431.86	30.4	5.45	6.32	1	175.00	35.0
56141.44	0.00	8094.34	0.92					
26	317.97	414.41	30.4	5.45	6.32	1	175.00	35.0
53873.05	0.00	7765.22	0.92					
27	323.42	379.01	34.4	5.22	6.32	1	175.00	35.0
49271.45	0.00	7161.97	0.93					
28	328.63	360.40	34.4	5.22	6.32	1	175.00	35.0
46851.55	0.00	6807.29	0.93					
29	333.85	324.01	38.3	4.96	6.32	1	175.00	35.0
42121.19	0.00	6199.24	0.94					
30	338.81	304.57	38.3	4.96	6.32	1	175.00	35.0
39594.71	0.00	5823.47	0.94					
31	343.77	268.18	42.3	4.68	6.32	1	175.00	35.0
34863.21	0.00	5216.58	0.96					
32	348.44	248.29	42.3	4.68	6.32	1	175.00	35.0
32278.11	0.00	4824.42	0.96					
33	353.12	212.90	46.2	4.37	6.32	1	175.00	35.0
27676.83	0.00	4225.69	0.98					

```
 34      357.49    192.94    46.2     4.37     6.32     1     175.00    35.0
25082.50        0.00      3822.10    0.98
 35      361.87    159.57    50.2     4.05     6.32     1     175.00    35.0
20744.04        0.00      3239.70    1.01
 36      365.92    139.92    50.2     4.05     6.32     1     175.00    35.0
18189.21        0.00      2829.93    1.01
 37      369.97    109.57    54.1     3.71     6.32     1     175.00    35.0
14243.48        0.00      2273.66    1.05
 38      373.67     90.59    54.1     3.71     6.32     1     175.00    35.0
11776.93        0.00      1863.33    1.05
 39      377.38     64.23    58.1     3.34     6.32     1     175.00    35.0
8350.10       0.00      1345.05    1.10
 40      380.72     46.30    58.1     3.34     6.32     1     175.00    35.0
6018.41       0.00       940.18    1.10
 41      384.07     33.12    62.0     5.93    12.64     1     175.00    35.0
4305.41       0.00       278.22    1.15
                 --------                  -------                          -------
---
     X-S Area:    9725.04    Path Length:    240.18              X-S Weight:
1262905.00
```



Project BURNCO, LLC, Church/McKay
Ditch, Seismic

File: J:\Bestway-213\church-mckay\geotech\Stability\Ditch Seismic.gmf

Material Keys

1: Aggregate Unit

3: weathered bedrock

4: UnweatheredBedrock

Analysis 1

Multiple Stability Analysis

Method: Bishop Simplified

Surface: Circular

Results

Critical Factor of Safety: 1.19

Edited: 28 Jun 2023 *Processed:*28 Jun 2023

Civil Resources

GALENA 7.2 Analysis Results Version: 7.2.1.05 Licensee: Civil Resources

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Project: BURNCO, LLC, Church/McKay
File: J:\Bestway-213\church-mckay\geotech\Stability\Ditch Seismic.gmf
Processed: 28 Jun 2023 10:31:18

DATA: Analysis 1 - Ditch, Seismic

Material Properties (4 materials)

Material: 1 (Mohr-Coulomb Isotropic) - Aggregate Unit
Cohesion Phi UnitWeight Ru
175.00 35.0 130.00 Auto
Material: 2 (Mohr-Coulomb Isotropic) - Finer Alluvial Unit
Cohesion Phi UnitWeight Ru
200.00 30.0 125.00 Auto
Material: 3 (Mohr-Coulomb Isotropic) - weathered bedrock
Cohesion Phi UnitWeight Ru
0.00 14.0 110.00 Auto
Material: 4 (Mohr-Coulomb Isotropic) - UnweatheredBedrock
Cohesion Phi UnitWeight Ru
100.00 26.0 124.00 Auto

Water Properties

Unit weight of water: 62.400 Unit weight of water/medium above ground: 62.400

Material Profiles (3 profiles)

Profile: 1 (2 points) Material beneath: 1 - Aggregate Unit
0.00 140.00 400.00 140.00
Profile: 2 (3 points) Material beneath: 3 - weathered bedrock
0.00 12.00 200.00 5.00 400.00 -5.00
Profile: 3 (3 points) Material beneath: 4 - UnweatheredBedrock
0.00 10.00 200.00 3.00 400.00 -7.00

Slope Surface (4 points)

0.00 12.00 200.00 5.00 300.00 105.00 400.00 105.00

Phreatic Surface (4 points)

0.00 12.00 200.00 5.00 300.00 15.00 400.00 25.00

Failure Surface

Initial circular surface for critical search defined by: XL,XR,R
Intersects: XL: 200.00 YL: 5.00 XR: 395.00 YR: 105.00
Centre: XC: 231.19 YC: 184.31 Radius: R: 182.00

Earthquake Force

Pseudo-static earthquake (seismic) coefficient: 0.132

Variable Restraints

Parameter descriptor:	XL	XR	R
Range of variation:	20.00	10.00	20.00
Trial positions within range:	10	10	20

- -

RESULTS: Analysis 1 - Ditch, Seismic

Bishop Simplified Method of Analysis - Circular Failure Surface
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Critical Failure Surface Search using Multiple Circle Generation Techniques

Initial failure surface approximation - Factor of Safety: 1.250

Analysis Summary
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There were: 2001 successful analyses from a total of 2001 trial failure surfaces

Critical (minimum) Factor of Safety: 1.19
==

Results Summary - Lowest 99 Factor of Safety circles

Circle	X-Left	Y-Left	X-Right	Y-Right	X-Centre	Y-Centre	Radius	FoS	
1	190.00	5.35	390.00	105.00	225.04	185.55	183.58	1.195	<-- Critical Surface
2	192.22	5.27	390.00	105.00	226.98	182.31	180.42	1.197	
3	190.00	5.35	390.00	105.00	224.45	186.74	184.63	1.198	
4	194.44	5.19	390.00	105.00	228.95	179.07	177.26	1.199	
5	190.00	5.35	390.00	105.00	225.63	184.36	182.53	1.200	
6	192.22	5.27	390.00	105.00	226.38	183.50	181.47	1.200	
7	190.00	5.35	391.11	105.00	224.88	187.73	185.68	1.201	
8	190.00	5.35	390.00	105.00	223.86	187.92	185.68	1.201	
9	190.00	5.35	391.11	105.00	225.46	186.54	184.63	1.201	
10	192.22	5.27	390.00	105.00	227.58	181.12	179.37	1.201	
11	192.22	5.27	391.11	105.00	227.40	183.30	181.47	1.202	
12	196.67	5.12	390.00	105.00	230.95	175.81	174.11	1.202	
13	194.44	5.19	390.00	105.00	228.34	180.26	178.32	1.202	
14	194.44	5.19	391.11	105.00	229.36	180.06	178.32	1.202	
15	192.22	5.27	390.00	105.00	225.79	184.69	182.53	1.202	
16	194.44	5.19	390.00	105.00	229.56	177.87	176.21	1.203	
17	192.22	5.27	391.11	105.00	226.80	184.49	182.53	1.203	

18	190.00	5.35	392.22	105.00	225.30	188.72	186.74	1.204
19	196.67	5.12	391.11	105.00	231.35	176.81	175.16	1.205
20	196.67	5.12	390.00	105.00	230.33	177.01	175.16	1.205
21	194.44	5.19	390.00	105.00	227.74	181.45	179.37	1.205
22	194.44	5.19	391.11	105.00	228.76	181.25	179.37	1.205
23	190.00	5.35	390.00	105.00	223.27	189.10	186.74	1.205
24	196.67	5.12	390.00	105.00	231.57	174.61	173.05	1.205
25	192.22	5.27	392.22	105.00	227.23	185.48	183.58	1.206
26	190.00	5.35	390.00	105.00	226.23	183.17	181.47	1.206
27	190.00	5.35	391.11	105.00	226.05	185.35	183.58	1.206
28	190.00	5.35	391.11	105.00	224.29	188.91	186.74	1.206
29	190.00	5.35	392.22	105.00	224.72	189.90	187.79	1.207
30	190.00	5.35	392.22	105.00	225.89	187.53	185.68	1.207
31	190.00	5.35	391.11	105.00	223.71	190.09	187.79	1.207
32	198.89	5.04	391.11	105.00	233.36	173.55	172.00	1.208
33	198.89	5.04	390.00	105.00	232.34	173.75	172.00	1.208
34	192.22	5.27	391.11	105.00	228.00	182.11	180.42	1.208
35	192.22	5.27	391.11	105.00	226.21	185.68	183.58	1.208
36	196.67	5.12	390.00	105.00	229.71	178.20	176.21	1.208
37	196.67	5.12	391.11	105.00	230.73	178.00	176.21	1.208
38	192.22	5.27	390.00	105.00	225.19	185.87	183.58	1.208
39	192.22	5.27	392.22	105.00	227.82	184.29	182.53	1.208
40	194.44	5.19	392.22	105.00	229.17	182.24	180.42	1.208
41	192.22	5.27	390.00	105.00	228.19	179.92	178.32	1.208
42	192.22	5.27	392.22	105.00	226.64	186.67	184.63	1.209
43	190.00	5.35	393.33	105.00	225.73	189.71	187.79	1.209
44	192.22	5.27	393.33	105.00	227.65	186.47	184.63	1.209
45	190.00	5.35	392.22	105.00	224.14	191.08	188.84	1.209
46	194.44	5.19	392.22	105.00	229.77	181.05	179.37	1.209
47	194.44	5.19	391.11	105.00	228.15	182.44	180.42	1.210
48	194.44	5.19	391.11	105.00	229.97	178.86	177.26	1.210

49	190.00	5.35	393.33	105.00	225.15	190.89	
188.84	1.210						
50	192.22	5.27	391.11	105.00	225.62	186.86	
184.63	1.210						
51	190.00	5.35	390.00	105.00	222.69	190.27	
187.79	1.210						
52	194.44	5.19	390.00	105.00	227.13	182.63	
180.42	1.211						
53	198.89	5.04	391.11	105.00	232.74	174.75	
173.05	1.211						
54	198.89	5.04	390.00	105.00	231.71	174.95	
173.05	1.211						
55	196.67	5.12	392.22	105.00	231.14	179.00	
177.26	1.211						
56	194.44	5.19	393.33	105.00	229.59	183.23	
181.47	1.211						
57	196.67	5.12	392.22	105.00	231.75	177.80	
176.21	1.211						
58	190.00	5.35	390.00	105.00	226.82	181.97	
180.42	1.211						
59	194.44	5.19	390.00	105.00	230.18	176.67	
175.16	1.211						
60	192.22	5.27	392.22	105.00	226.05	187.85	
185.68	1.212						
61	192.22	5.27	393.33	105.00	227.06	187.66	
185.68	1.212						
62	196.67	5.12	391.11	105.00	230.12	179.19	
177.26	1.212						
63	190.00	5.35	391.11	105.00	223.12	191.26	
188.84	1.212						
64	196.67	5.12	391.11	105.00	231.97	175.61	
174.11	1.212						
65	194.44	5.19	391.11	105.00	227.55	183.62	
181.47	1.213						
66	192.22	5.27	390.00	105.00	224.60	187.04	
184.63	1.213						
67	190.00	5.35	394.44	105.00	225.59	191.88	
189.89	1.213						
68	190.00	5.35	390.00	105.00	227.42	180.77	
179.37	1.213						
69	190.00	5.35	392.22	105.00	226.47	186.34	
184.63	1.213						
70	190.00	5.35	390.00	105.00	228.02	179.56	
178.32	1.213						
71	190.00	5.35	390.00	105.00	228.63	178.35	
177.26	1.213						
72	198.89	5.04	392.22	105.00	233.76	174.54	
173.05	1.214						
73	198.89	5.04	392.22	105.00	233.14	175.74	
174.11	1.214						
74	190.00	5.35	393.33	105.00	226.32	188.52	
186.74	1.214						
75	196.67	5.12	393.33	105.00	231.55	179.99	
178.32	1.214						
76	196.67	5.12	390.00	105.00	229.10	179.39	
177.26	1.214						
77	190.00	5.35	390.00	105.00	229.23	177.14	
176.21	1.214						
78	190.00	5.35	391.11	105.00	226.64	184.16	
182.53	1.214						
79	190.00	5.35	390.00	105.00	222.10	191.44	
188.84	1.214						

```
  80       194.44        5.19      393.33      105.00      228.99      184.42
182.53     1.214
  81       190.00        5.35      390.00      105.00      229.84      175.92
175.16     1.214
  82       190.00        5.35      392.22      105.00      223.56      192.26
189.89     1.214
  83       194.44        5.19      392.22      105.00      227.97      184.61
182.53     1.214
  84       192.22        5.27      393.33      105.00      228.24      185.28
183.58     1.215
  85       190.00        5.35      393.33      105.00      224.58      192.07
189.89     1.215
  86       192.22        5.27      392.22      105.00      228.41      183.10
181.47     1.215
  87       192.22        5.27      394.44      105.00      227.49      188.65
186.74     1.215
  88       192.22        5.27      390.00      105.00      228.79      178.72
177.26     1.215
  89       198.89        5.04      391.11      105.00      232.12      175.94
174.11     1.215
  90       192.22        5.27      391.11      105.00      225.03      188.04
185.68     1.215
  91       194.44        5.19      392.22      105.00      228.57      183.43
181.47     1.215
  92       190.00        5.35      394.44      105.00      226.17      190.70
188.84     1.215
  93       196.67        5.12      390.00      105.00      232.19      173.41
172.00     1.215
  94       190.00        5.35      390.00      105.00      230.45      174.69
174.11     1.215
  95       192.22        5.27      394.44      105.00      228.08      187.46
185.68     1.216
  96       190.00        5.35      394.44      105.00      225.01      193.06
190.95     1.216
  97       196.67        5.12      391.11      105.00      229.51      180.38
178.32     1.216
  98       194.44        5.19      390.00      105.00      226.53      183.81
181.47     1.216
  99       192.22        5.27      393.33      105.00      226.48      188.84
186.74     1.216

Critical Failure Surface (circle 1)
-----------------------
Intersects:  XL:     190.00      YL:       5.35      XR:     390.00      YR:
105.00
    Centre:  XC:     225.04      YC:     185.55                  Radius:  R:
183.58
Generated failure surface: (20 points)
    190.00      5.35          202.48      3.37          215.08      2.25
227.71      1.99          240.34      2.61
    252.89      4.10          265.31      6.45          277.54      9.64
289.53     13.67          301.20     18.52
    312.52     24.16          323.42     30.56          333.85     37.70
343.77     45.54          353.12     54.04
    361.87     63.17          369.97     72.87          377.38     83.11
384.07     93.84          390.00    105.00

Slice Geometry and Properties - Critical Failure Surface (circle 1,  41 slices)
-----------------------------------------------------
Slice                X-S     ------------------- Base ---------------------
PoreWater      Normal    Test
        X-Left      Area    Angle    Width    Length  Matl   Cohesion    Phi
Weight      Force        Stress   Factor
```

1	190.00	1.55	-9.0	5.00	5.06	3	0.00	14.0
170.39	97.87	34.58	1.05					
2	195.00	4.65	-9.0	5.00	5.06	3	0.00	14.0
511.18	293.62	103.75	1.05					
3	200.00	6.66	-9.0	2.48	2.52	3	0.00	14.0
796.90	245.01	328.42	1.05					
4	202.48	47.44	-5.1	6.29	6.31	3	0.00	14.0
5962.21	975.90	962.95	1.02					
5	208.77	90.52	-5.1	6.29	6.31	3	0.00	14.0
11531.71	1444.21	1863.81	1.02					
6	215.06	133.10	-1.1	6.33	6.33	3	0.00	14.0
17062.43	1831.56	2707.58	1.00					
7	221.39	173.91	-1.1	6.33	6.33	3	0.00	14.0
22391.22	2130.86	3553.28	1.00					
8	227.71	212.88	2.8	6.31	6.32	3	0.00	14.0
27509.60	2341.79	4317.23	0.99					
9	234.03	250.78	2.8	6.31	6.32	3	0.00	14.0
32515.33	2468.64	5102.33	0.99					
10	240.34	95.71	6.8	2.19	2.21	3	0.00	14.0
12434.46	880.93	5548.98	0.98					
11	242.53	243.22	6.8	5.18	5.22	1	175.00	35.0
31618.47	2061.50	5715.72	0.94					
12	247.71	266.89	6.8	5.18	5.22	1	175.00	35.0
34695.05	2030.40	6270.59	0.94					
13	252.89	349.73	10.7	6.21	6.32	1	175.00	35.0
45464.52	2331.83	6602.49	0.92					
14	259.10	381.01	10.7	6.21	6.32	1	175.00	35.0
49531.58	2113.94	7188.59	0.92					
15	265.31	404.36	14.6	6.12	6.32	1	175.00	35.0
52567.34	1810.41	7459.38	0.90					
16	271.43	431.99	14.6	6.12	6.32	1	175.00	35.0
56158.16	1421.28	7960.42	0.90					
17	277.54	448.63	18.6	5.99	6.32	1	175.00	35.0
58322.14	947.45	8115.80	0.88					
18	283.54	472.45	18.6	5.99	6.32	1	175.00	35.0
61418.16	388.92	8532.95	0.88					
19	289.53	71.59	22.5	0.88	0.96	1	175.00	35.0
9306.37	8.29	8434.25	0.87					
20	290.41	396.93	22.5	4.80	5.19	1	175.00	35.0
51601.18	0.00	8606.23	0.87					
21	295.20	410.38	22.5	4.80	5.19	1	175.00	35.0
53349.76	0.00	8899.58	0.87					
22	300.00	104.23	22.5	1.20	1.30	1	175.00	35.0
13550.22	0.00	9020.18	0.87					
23	301.20	481.26	26.5	5.66	6.32	1	175.00	35.0
62563.97	0.00	8503.24	0.86					
24	306.86	465.32	26.5	5.66	6.32	1	175.00	35.0
60490.99	0.00	8219.63	0.86					
25	312.52	431.86	30.4	5.45	6.32	1	175.00	35.0
56141.44	0.00	7599.27	0.86					
26	317.97	414.41	30.4	5.45	6.32	1	175.00	35.0
53873.05	0.00	7289.68	0.86					
27	323.42	379.01	34.4	5.22	6.32	1	175.00	35.0
49271.45	0.00	6670.55	0.86					
28	328.63	360.40	34.4	5.22	6.32	1	175.00	35.0
46851.55	0.00	6339.38	0.86					
29	333.85	324.01	38.3	4.96	6.32	1	175.00	35.0
42121.19	0.00	5726.25	0.87					
30	338.81	304.57	38.3	4.96	6.32	1	175.00	35.0
39594.71	0.00	5378.04	0.87					
31	343.77	268.18	42.3	4.68	6.32	1	175.00	35.0
34863.21	0.00	4776.43	0.88					

32	348.44	248.29	42.3	4.68	6.32	1	175.00	35.0
32278.11	0.00	4415.85	0.88					
33	353.12	212.90	46.2	4.37	6.32	1	175.00	35.0
27676.83	0.00	3832.25	0.90					
34	357.49	192.94	46.2	4.37	6.32	1	175.00	35.0
25082.50	0.00	3464.14	0.90					
35	361.87	159.57	50.2	4.05	6.32	1	175.00	35.0
20744.04	0.00	2906.13	0.92					
36	365.92	139.92	50.2	4.05	6.32	1	175.00	35.0
18189.21	0.00	2535.53	0.92					
37	369.97	109.57	54.1	3.71	6.32	1	175.00	35.0
14243.48	0.00	2012.06	0.94					
38	373.67	90.59	54.1	3.71	6.32	1	175.00	35.0
11776.93	0.00	1644.26	0.94					
39	377.38	64.23	58.1	3.34	6.32	1	175.00	35.0
8350.10	0.00	1166.03	0.97					
40	380.72	46.30	58.1	3.34	6.32	1	175.00	35.0
6018.41	0.00	806.60	0.97					
41	384.07	33.12	62.0	5.93	12.64	1	175.00	35.0
4305.41	0.00	214.07	1.01					

X-S Area: 9725.04 Path Length: 240.18 X-S Weight: 1262905.00

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Please also see the new USGS Earthquake Hazard Toolbox for access to the most recent NSHMs for the conterminous U.S. and Hawaii.

Input

Edition

Conterminous U.S. 2014 (v4.0.x)

Spectral Period

Peak Ground Acceleration

Latitude

Decimal degrees

Time Horizon

Return period in years

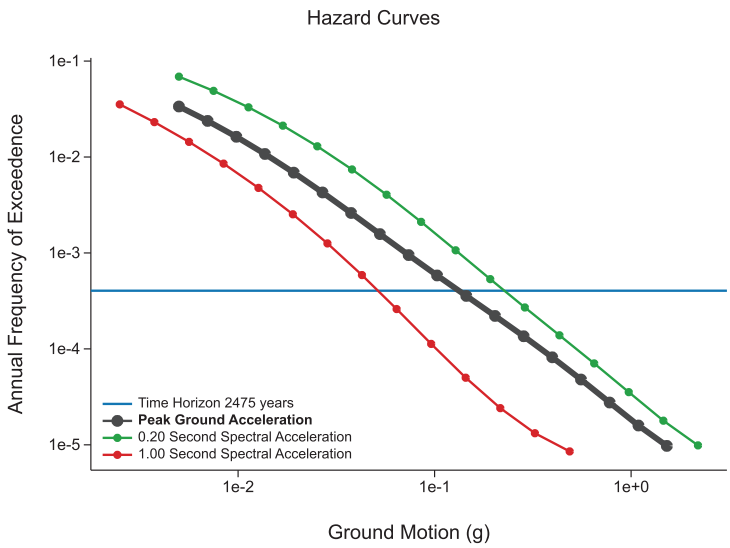
Longitude

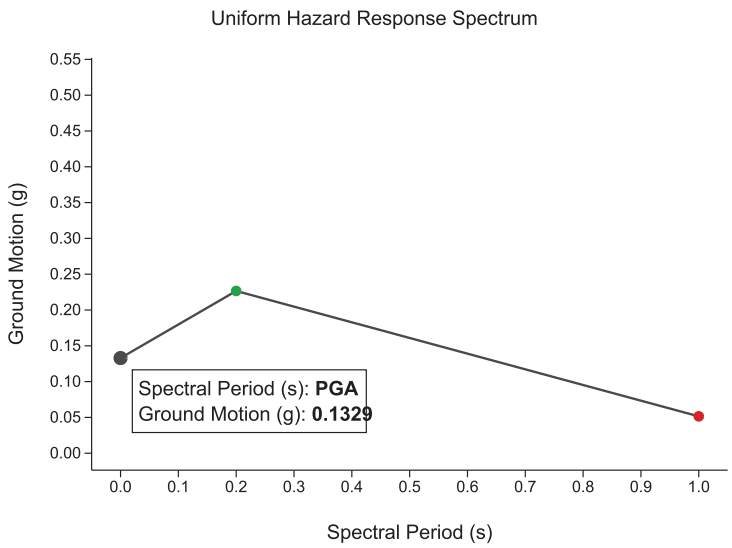
Decimal degrees, negative values for western longitudes

Site Class

760 m/s (B/C boundary)

Hazard Curve





View Raw Data