Asphalt Paving Co.
The Sign of Quality

14802 W. 44th Avenue
Golden, Colorado 80403
Office: 303-279-6611
Fax: 303-279-6216
www.asphaltpavingco.com

November 13, 2014

RECEIVED
NOV 13 2014
DIVISION OF RECLAMATION
MINING AND SAFETY

Tony Waldron
Division of Reclamation, Mining and Safety
Department of Natural Resources
1313 Sherman St. Room 215
Denver, CO 80203

Hand Delivered on November 13, 2014
Re: Ralston Quarry Amendment Application (112)
to update permit to match final land use as approved by Jefferson County via ODP in 2012

Dear Tony:

I am hand delivering the referenced Amendment, original Amendment Application together with one copy of the Amendment and a check in the amount of $2,229.00 as the amendment fee. Both Greg Lewicki and Associates, our consultant, and Asphalt Paving Co. believe that this Amendment meets the DRMS' requirements, is complete and thus ready for confirmation of the same by a determination of adequacy by your office.

Please let me know when you consider our Amendment to be filed such that the ninety (90) period for review begins and so that we can move this Amendment forward via the next steps. As you are aware, this submittal is an Amendment to update the reclamation permit to match the final land use which has already been approved by Jefferson County via ODP in 2012.

I look forward to working with you on this and can be reached on my cell at: 303-619-0784.

Sincerely,

M.L. Richardson
Asphalt Paving Co.

Enclosure
C: Greg Lewicki, w/o encl.

APC
14802 W 44th Avenue
Golden, CO 80403
Heavy Hwy Const.-Commercial Paving-Rock Products

M.L. Richardson
Director of Strategy and Sustainable Development
mlrichardson@apc.us.com
Direct: 303-996-7222
Cell: 303-619-0784
Fax: 303-279-6216

MHC

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

RECEIVED
NOV 13 2014
DIVISION OF RECLAMATION
MINING AND SAFETY

COLORADO DIVISION OF RECLAMATION MINING & SAFETY

Am03

CONSTRUCTION MATERIALS
REGULAR (112) OPERATION
RECLAMATION PERMIT APPLICATION FORM

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

Permit # M 19 74 086 (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 19 74 086 (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)**: Asphalt Paving Co.
   - 1.1 Type of organization (corporation, partnership, etc.): S Corporation
2. **Operation name (pit, mine or site name)**: Ralston Quarry
3. **Permitted acreage (new or existing site)**: 271.61 permitted acres
   - 3.1 Change in acreage (+): 0 acres
   - 3.2 Total acreage in Permit area: 271.61 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**: rock
   - 5.1 Incidental commoditie(s) to be mined: 1. - 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:
   - 5.3 Anticipated end use of incidental commoditie(s) to be mined:

√ AF & Report
√ No Violations

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

7. **Name of owner of surface of affected land**: refer to Exhibit O

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 4

   TOWNSHIP (write number and check direction): T 3 ☐ 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):
   The Ralston Quarry is 0.5 miles west of Arvada, CO at 6300' average elevation.

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 39 min 48 sec 44.54 (2 decimal places)

    Longitude (W): deg 105 min 13 sec 53.79 (2 decimal places)

    OR

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

    Latitude (N) _____._____ (5 decimal places)

    Longitude(W) _____._____ (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: M.L Richardson. Title: _____

Company Name: Asphalt Paving Co.

Street/P.O. Box: 14802 W 44th Avenue P.O. Box: _____

City: Golden

State: CO Zip Code: 80403

Telephone Number: (303) - 996-7222

Fax Number: (_____) - _____

PERMITTING CONTACT (if different from applicant/operator above)

Contact's Name: _____ Title: _____

Company Name: _____

Street/P.O. Box: _____ P.O. Box: _____

City: _____

State: _____ Zip Code: _____

Telephone Number: (_____) - _____

Fax Number: (_____) - _____

INSPECTION CONTACT

Contact's Name: M.L Richardson. Title: _____

Company Name: Asphalt Paving Co.

Street/P.O. Box: 14802 W 44th Avenue P.O. Box: _____

City: Golden

State: CO Zip Code: 80403

Telephone Number: (303) - 996-7222

Fax Number: (_____) - _____

CC: STATE OR FEDERAL LANDOWNER (if any)

Agency: _____

Street: _____

City: _____

State: _____ Zip Code: _____

Telephone Number: (_____) - _____

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) - Mining
☐ Developed Water Resources(WR)		

14. **Method of Mining**: Briefly explain mining method (e.g. truck/shovel): Drilling and blasting of in place rock followed by excavation by front shovel and/or loader transport by truck.

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

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

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).

Modification of the reclamation plan to match the post mine land use of water storage approved by the Jefferson County Commissioners by ODP (Official Development Plan) on June 26, 2012 and recorded on October 8, 2012 at Reception Number 2012107332 in Jefferson County.

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.

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;

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;

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;

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;

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

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.

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.

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.

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. <u>For joint venture/partnership operators</u>: 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 3rd day of November, 2014.

Asphalt Paving Co.
Applicant/Operator or Company Name

If Corporation Attest (Seal)

Signed: Jeffrey W. Keller

Title: President

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

State of Colorado)
) ss.
County of Jefferson)

The foregoing instrument was acknowledged before me this 3rd day of November, 2014, by Jeffrey W. Keller as President of Asphalt Paving Co

ELIZABETH WHITESEL-DUTTON
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID # 20014022842
MY COMMISSION EXPIRES JULY 24, 2017

Notary Public

My Commission expires: 7/24/2017

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

proposed mining operation. The following is a sample of the Notice required for Rule 1.6.2(1)(b) that you may wish to use.

NOTICE

This site is the location of a proposed construction materials operation. (Name of the Applicant/Operator) _____, whose address and phone number is (Address and Phone Number of the Applicant/Operator) _____, has applied for a Reclamation Permit with the Colorado Mined Land Reclamation Board. Anyone wishing to comment on the application may view the application at the (County Name) _____County Clerk and Recorder's Office, (Clerk and Recorder's Office Address) _____, and should send comments prior to the end of the public comment period to the Division of Reclamation, Mining, and Safety, 1313 Sherman St, Room 215, Denver, Colorado 80203.

Certification:

I, _____, hereby certify that I posted a sign containing the above notice for the proposed permit area known as the (Name of Operation) _____, on (Date Posted) _____,

.

_____ _____

SIGNATURE DATE

NOTICE

This site is the location of an existing construction materials operation, the Ralston Quarry. Asphalt Paving Co., whose address and phone number is 14802 W 44th Avenue, Golden CO 80403 and phone number is (303) 996-7222, has applied for a Reclamation Permit Amendment with the Colorado Mined Land Reclamation Board. Anyone wishing to comment on the application may view the application at the Jefferson County Clerk and Recorder's Office, 100 Jefferson County Pkwy, Suite 2560, Admin and Courts Facility, Golden, CO 80419, and should send comments prior to the end of the public comment period to the Division of Reclamation, Mining, and Safety, 1313 Sherman St, Room 215, Denver, Colorado 80203.

Certification:

I, Mark Martin, hereby certify that I posted a sign containing the above notice for the existing permit area known as the Ralston Quarry , on:

11/11/14
Date Posted

The signs were posted at the start of the access road on Highway 93.

SIGNATURE

11/11/14
DATE

Asphalt Paving Co.

Ralston Quarry

112c AMENDMENT APPLICATION TO THE COLORADO DIVISION OF RECLAMATION, MINING, AND SAFETY

November 2014

PREPARED BY:

Greg Lewicki And Associates

11541 Warrington Court
Parker, CO USA 80138

Phone (303) 346-5196 Fax: (303)-346-6934
E-Mail:info@lewicki.biz

RALSTON QUARRY PERMIT

REGULAR 112c OPERATION

TABLE OF CONTENTS

APPENDIX 1 – SOILS REPORT

APPENDIX 2 – BRIERLEY REPORT

APPENDIX 3 – RECENT BLASTING REPORT

APPENDIX 4 – MAPS

INTRODUCTION

Mining has been conducted on this site since before 1976, with operations being continuous since then. Asphalt Paving Co. ("APC") is amending the 112c reclamation permit for its Ralston Quarry (M-1974-086) to incorporate a revised post mine land use and reclamation plan. The existing permit area of approximately 271.61 acres is located in Jefferson County. The operation is accessed via a private access road that connects to State Highway 93, to the east of the operation. It is approximately 3.5 miles north of Golden, CO, in Jefferson County. The site, in relation to the City of Golden, is shown on Map B-1.

The mining operation is in a basalt formation overlaying uplifted Pierre shale. Topographically, the permit area encompasses a singular ridge of the basalt separating a pair of reservoirs. The disturbed area for the Ralston Quarry is 210 acres, and includes all of the mining area, berms, and roads. The permit boundary is shown on Map C-1 and is 271.61 acres.

The permittee and operator for this site is Asphalt Paving Co. Asphalt Paving Co. leases the entire property from Keller Family Limited Partnership, LLLP. Property lines obtained from the property owner are shown on Map C-1.

An amendment approved in 1994 expanded the operation slightly, and this amendment is to change the post mine land use for the bulk of the site, and correct a small error in the permit boundary. The site will be reclaimed to a land use of a water reservoir and rangeland. The topography of the reclaimed land is shown on Map F-1. All maps are found in Appendix 4.

LEGAL DESCRIPTION EXHIBIT A

The site is approximately 3.5 miles north of Golden, CO. A legal description is shown on Map C-1. A general location map is enclosed as Map B-1 in Exhibit B. The total permit area is 271.61 acres. The main entrance to the Mining Area is located at coordinates 39.8123° N, 105.2344° W on CO 93.

1. Legal Description

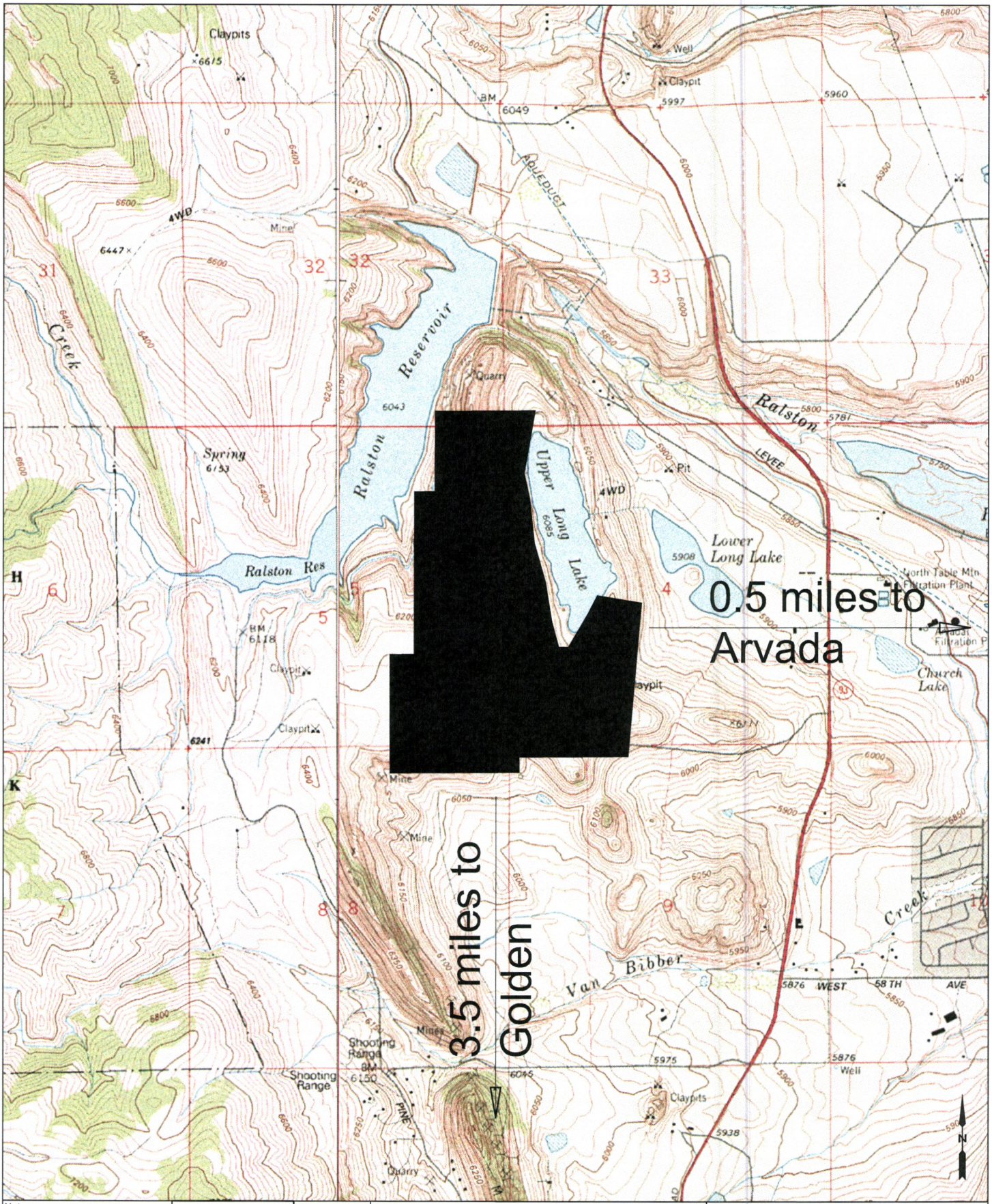
A tract of land located Sections 4,5, and 8, Township 3 South, Range 70 West of the 6th Principal Meridian, Jefferson County, State of Colorado and being more particularly described as follows:

Beginning at the SW corner of Section 4, Township 3 South, Range 70 West of the 6th Principal Meridian, with the south boundary of Section as a basis of bearing at N89°57'27"E a distance of 5306.2440';
thence S 00°06'27" E a distance of 249.94';
thence S 89°39'16" W a distance of 1720.08';
thence N 00°01'49" W a distance of 1550.70';
thence N 89°26'46" E a distance of 181.79';
thence N 72°24'45" E a distance of 151.57';
thence N 01°03'11" W a distance of 532.69';
thence N 89°58'11" E a distance of 83.10';
thence N 00°01'49" W a distance of 733.68';
thence N 00°06'58" E a distance of 1223.44';
thence N 89°20'26" E a distance of 331.01';
thence N 00°22'07" W a distance of 126.30';
thence N 00°09'07" E a distance of 1321.71';
thence N 89°43'41" E a distance of 990.71';
thence N 89°53'59" E a distance of 217.85';
thence S 09°50'30" W a distance of 844.31';
thence S 11°39'30" E a distance of 478.38';
thence S 06°14'30" E a distance of 717.02';

thence S 15°56'30" E a distance of 674.02';
thence S 08°48'10" E a distance of 633.30';
thence S 15°44'36" E a distance of 610.08';
thence N 89°51'12" E a distance of 419.65';
thence N 30°35'05" E a distance of 779.09';
thence N 27°29'45" E a distance of 170.32';
thence S 80°42'40" E a distance of 403.61';
thence S 04°56'33" W a distance of 2165.16';
thence S 89°39'16" W a distance of 822.05';
thence S 89°39'16" W a distance of 985.84';which is the point of beginning,
having an area of 271.61 acres

Therefore, the entire amendment area is 271.61 acres.

.



Notes:	Designed:	DATE: 5/20/14	Exhibit B Index Map
	Drawn:		
	Checked:	SCALE: 1" = 2000'	
	Approved:		

X:\Asphalt Paving Company\Ralston Quarry\AutoCAD\Ralston Quarry 02SEPT14.dwg

Greg Lewicki And Associates
11541 Warrington Court
Parker, CO USA 80138
Phone (303)-346-5196
E-Mail - info@lewicki.biz

PRE-MINING AND MINING

PLAN MAPS OF AFFECTED LANDS — EXHIBIT C

Map C-1 shows the estimated pre mine conditions of the site.

Map C-2 shows the conditions of the site as of 2010.

Map C-3 shows the maximum mining extents of the quarry.

Map C-4 shows the cross sections of the current conditions and the mined out conditions.

All maps are found in Appendix 4.

MINING PLAN EXHIBIT D

1. General Mining Plan

The original application, and this amendment, proposes surface mining basalt for the production of construction materials. This amendment proposes to change the post mine land use of the site to a water storage reservoir. The total permit area will remain 271.61 acres. The total expected mine life is 50+ years, with roughly 20 years of that remaining. The purpose of the mining activity is to provide crushed rock, road base, asphalt, and related products for construction along the Front Range.

The basalt dike that is being mined at the Ralston Quarry extends down at least 500 feet from the original peak of the ridge (6500' elevation). Mining will continue to a final floor elevation of 6000'. The basalt likely continues deeper. The deposit is constrained by the shale contact along the ridge line on the west side, and then extends out past the property line to the east. Mining will be constrained by the shale contact and the property lines.

The amended permit boundary will encompass 271.61 acres containing all of the Asphalt Paving Co. operations. The permit area is marked on site. Map C-3 shows the configuration of the fully mined out quarry along with stormwater drainage patterns and the location of processing equipment and stockpiles. The basalt is blasted in place into a series of slopes and benches on the western side of the mining area. One continuous slope of 65° will be excavated on the east side. Material is hauled from mining faces to the processing area via haul truck. Finished product that is made in the processing area in the southwest of the permit area is sold and transferred off site. Ralston Quarry produces crushed rock, road base, and asphalt.

Access to the mining area will be from the existing road connecting to Highway 93.

Traditional topsoil is not present on the site. The upper 2-10 feet of material on undisturbed areas contains a mixture of fine material and varying sizes of loose basalt. This material is stripped and screened by Asphalt Paving Co. (APC) to sell the basalt, and the remaining fine material will be used as topsoil and fill. This process will generate approximately 50,000 CY of fill material a year. This fill material is stored in stockpiles along the quarry edge and future mining areas in the southeast corner of the permit.

The operation will mine throughout the year, with most sales taking place during the construction season in the summer. Stockpiles of raw and finished material will be located in the southwest corner of the operation near the processing facilities. The mining areas and stockpiles are shown on Map C-3. Mine life is based on production rates that are derived from expected annual sales. Market conditions may vary, and will therefore affect the production rates and mine life.

Table D-1 Approximate Mine Life

	Time (years)
Previously Mined	38
Remaining Mine Life	20-25
Total	50+

Note: These values are based on comparing the estimated pre mine topography (Map C-1), the 2010 survey of the site (Map C-2), and quarry extents shown on Map C-3.

The material volumes described in Table D-1 are calculated from limited drilling on site. The quarry is roughly 140 acres in size. Processing and stockpiling will take place in a 67 acre area occupying the southwest corner of the permit area.

The topsoil on site will be stripped from undisturbed areas prior to their mining, screened to remove large rock pieces, and then used in reclamation activities. This is further discussed in Exhibit E.

Basalt will be carried to the processing area via haul truck. Highway trucks will haul sellable material to market from the processing site. Truck traffic will be along Highway 93.

2. Mining Timetable

The following table **(Table D-2)** is a best estimate of the sequence of operations for the life of the mine and is based on mining 350,000 to 600,000 tons per year from the quarry.

Table D-2 Ralston Quarry Mining Timetable

Stage of Operation	Length of time to complete (years)
Mining of north platform area above water tunnel	3
Mining of reservoir area below water tunnel	15-20
Reclamation of processing and stockpiling area	1.00
Total	19-24

Evident from the table above, the mining of the Ralston Quarry can be roughly divided into two stages. The first is the mining of the north platform area above the Denver Water tunnel. This area will not be part of the larger reservoir area, and therefore will be backfilled, topsoiled, and revegetated. The second stage is the mining of the remaining internal area of the quarry. This will be the location of the water reservoir, and therefore will not be backfilled.

3. Mine Facilities and Operation

The crushing and screening will take place within the processing area in the southwest corner of the site. Fuel will be brought on site by fuel truck, and on site storage will be maintained at a fuel farm. This fuel farm will be constructed to have secondary containment of 110% capacity of all tanks stored within. The fuel tanks for all fixed plants will be stored at this fuel farm. Other individual pieces of equipment that are of a more mobile type will carry their own fuel tanks, and will have secondary capacity of 110% as well. An SPCC Plan will be placed in the mine office and the employees will be trained to take the appropriate steps for inspections and spill response. Portable plants and equipment are covered under their own portable plant SPCC Plans. If any fuel spill is encountered, the material will be removed from the site. The Division will be notified in the case of any spill. Upon final reclamation, all equipment will be removed from the site.

The asphalt plant consists of burner fuel tanks, asphalt cement tanks, mixer drum, storage silos, loading hopper and a control room. Asphalt processing operations will only be conducted in the warmer months as the placement of asphalt is weather and temperature dependent.

Control rooms for the plants, truck scale, and office trailer will be the only other structures on site. Portable toilets and potable water will be brought on site for employee use, and serviced by a contractor.

Maintenance vehicles will visit the site regularly to provide oil, grease, and perform other minor maintenance on vehicles and equipment. Any major equipment repair work will be performed off site.

The following list is the best estimate of the required equipment to be used onsite throughout the mine life:

3.1 Equipment

- Front end loaders
- Track Drill
- Skid Steer Loaders
- Motor Grater
- Front Shovel
- Bulldozers
- Off-highway haul trucks
- Highway haul trucks
- Water trucks
- Water Wagon

Employees will park in the processing and stockpile area.

Blasting is conducted on a regular basis as part of mining activities. The Geotechnical Stability Exhibit contains further information regarding off site stability in regards to blasting.

No refuse, acid or toxic producing materials are expected to be encountered in this operation. If these materials are encountered, overburden and topsoil will be placed over the area and mining will move to a different area.

Fencing internal to the property will be removed as needed to facilitate on site activities. Upon completion of the reservoir, a combination wildlife fence and security fence will be installed

around the reservoir. Due to the steep slopes and long drop from the crest of said slopes in some places, wildlife and people will need to be kept out of the reservoir area for their own safety.

The operator commits to clearly marking the permit boundary on site.

The currently existing access road will be maintained throughout the life of the mine, and will remain following reclamation to facilitate access of the reservoir.

3.2 Blasting

The basalt is blasted in place using a blasthole drill which sits on a bench created by previous blasting. The drill creates a series of holes which are then loaded with ammonium nitrate and fuel oil. Blasting caps and delays are employed to minimize the amount of explosives used. The holes are generally 5.25 inches in diameter and 38 feet deep.

Seismic measurements are recorded for every shot to ensure that no damage will occur to surrounding properties and structures. The mine has not had any complaints of blasting damage.

3.3 Denver Water Tunnel

As shown on Maps C-1, C-2, C-3 and F, a water tunnel of approximately six feet diameter was constructed many years ago by the Denver Water Board. This tunnel carries water from a ditch west of the permit area underneath the permit area to Upper Long Lake Reservoir located east of the permit area. This tunnel has operated for many years.

The mining plan will avoid this tunnel by maintaining a minimum 40 feet height of existing rock (basalt) between the bottom of the pit and the top of the water tunnel. This higher elevation will be maintained until the northern end of the pit is reached, as shown on Map C-3. This area from the tunnel to the north edge of the pit will not be part of the planned water reservoir.

4. Topsoil and Overburden Handling

In the undisturbed areas, the top 2-10 feet of the mining area is covered with a fine material mixed with sizeable basalt rocks. This material is screened for large rocks during excavation. The rocks are used in the construction materials operation, and the reject fines are stockpiled for future backfill, topsoiling, or fill sales. This fine material will be used as a topsoil in the final

reclamation of the site. Details of this topsoil re-distribution are discussed in Exhibit E: Reclamation Plan.

5. Water Handling

All water issues such as availability of water for this operation, consumption rates, dust control, etc. are presented in Exhibit G - Water Information. In general, the Ralston Quarry will divert outside runoff around the site, and contain runoff on disturbed areas until it evaporates. There will be no discharge of water from the site. Map C-3 shows runoff control structures and general site drainage.

6. Schedule of Operations

Mining operations will only occur as dictated by market demand. Mining, crushing and screening may take place in any part of the year. Product will be sold throughout the year, although far less material is expected to be sold in winter months. Generally, only minor truck activity or repairs may occur at night.

7. Jefferson County Impacts and Environmental Impacts

Mining is estimated to be 350,000 to 600,000 tons annually. Crushed rock and asphalt will be the products that are sold from the Ralston Quarry. This is a continuation of activities at this site going back several decades.

a) Truck traffic: Highway trucks will use the access to Highway 93 via the current private access. No additional access development will be needed as part of this amendment.

b) Noise: The operations at the Ralston Quarry will be a continuation of the mining and processing that have taken place at the site for several decades. State noise restrictions will continue to be followed.

c) Dust: Pit activities will be watered and all operations on the site are regulated by the Air Pollution Control Division of the CDPHE.

d) Visual impact: There will be no additional significant visual impacts generated by this amendment.

e) The product from this mine will positively impact the local community by supplying construction materials for the foreseeable growth of this part of Jefferson County.

f) Stormwater control structures will be maintained to protect the area surface water regime.

g) The operator will work closely with the County, Natural Resource Conservation Service (NRCS), and the DRMS to ensure that the reclamation plan is the most appropriate for achieving the post-mining land use.

7. Recycled Concrete and Asphalt

The pit may accept concrete and asphalt materials that have been removed from project locations in order that they can be recycled through the plants on site.

8. Import Fill

Fill material may be accepted into the mine site. None of this material can be accepted by the Operator unless the attached form is filled out by the entity bringing the material to the site. The form provides an assurance that all material brought to the site is inert and has no toxic or acid forming material above acceptable limits.

Affidavit for Import of Materials into Ralston Quarry

Date or Time Period of Import:

Description of Import Material:

Entity Providing Material to Pit (not the trucking Company):

I hereby certify that the material described above and brought to the Ralston Quarry site is inert, which means it is free from any chemicals, toxic substances, acid forming material, or any other material which would violate the material waste disposal laws of the State of Colorado.

_____ _____

Signature Written Name of Signer

_____ _____

Signer's Position in Company Company

Date: _____

RECLAMATION PLAN EXHIBIT E

1. General Reclamation Plan

The total area of the permit is 271.61 acres. The permit has both a disturbed area (209.00 acres) and an undisturbed area (62.61 acres). Much of the undisturbed areas are perimeter areas of the pit, particularly the west side of the ridge. The reclaimed land use is shown in Table E-1.

Table E-1 Ralston Quarry Reclamation Land Use

Land Use	Area (acres)
Water Resevoir	127.76
Rangeland	77.91
Access Roads (left in place)	3.33
Undisturbed Areas	62.61
Total	**271.61**

Note: Areas listed above can be seen on Map F.

Reclamation will be conducted in concurrence with the two mining stages. Once the north platform above the Denver Water tunnel is mined out, backfilling will commence in that area. Following this, there will not be a need for reclamation work until the final mining slopes are complete around the quarry. Since there is no backfill within the reservoir area, the only reclamation activity that will need to be conducted in this area as time goes on is the construction of the vegetation islands shown on Map C-4. Map F shows the post mine land use along with the reclaimed slopes for the entire site.

2. Topsoil Replacement

Since there is not quality topsoil material on site, the fines generated both during processing and during the stripping of the top layer of material from undisturbed areas will be used as topsoil. This screened material will be used for topsoiling disturbed areas and building the vegetation islands along the western slope of the reservoir (see Map C-4). All areas other than the quarry slopes and benches will be covered in the screened material to a 12-inch depth. The benches will have topsoil on the vegetation islands that will be created as shown on Map C-4.

3. Haul Roads and Access

Portions of the existing roads in the permit area will be removed and others altered. See Map F for details. Access through the site will remain after mining using the access road installed as shown on Map C-2

4. Reclamation Timetable

The timetable for reclamation is shown below in **Table E-2.** Exhibit L: Reclamation Costs describes the maximum bond scenario.

Table E-2 Reclamation Timetable

Comments	Length of time to complete (years)
Mining out of north platform above water tunnel	3
Begin mining the remainder of the reservoir area. Backfill, grade, and revegetate the north plarform area. Build vegetation islands on the reservoir benches as mining progresses in a portion of the resevoir.	15-20
Topsoil and revegetate non-resevoir areas as needed.	1.00
Total	19-24

This mine life will vary according to market demands for material.

5. Revegetation Plan

The final reclaimed use for the Ralston Quarry is a water reservoir and surrounding rangeland.

If any fill stockpile remains more than one growing season, it will be seeded with a fast growing vegetative cover to prevent erosion. Approximately 12 inches of the screened material will be placed on the appropriate areas during final reclamation.

When mining operations are completed in areas outside of the water reservoir that require topsoiling and seeding, these activities will take place promptly. The seed mix listed below will

be applied to these areas as well as the vegetation islands along the reservoir benches. The seed mix listed below is the same as the one found in the original permit:

Rangeland Seed Mix

Intermediate Wheatgrass	8 lbs (PLS) per acre
Western Wheatgrass	8 lbs (PLS) per acre
Little Bluestem	3 lbs (PLS) per acre
Russian Wildrye	4 lbs (PLS) per acre
Sideoats Grama	3 lbs (PLS) per acre

6. Post-Reclamation Site Drainage

The final configuration of the Ralston Quarry will create four drainage basins:

1. The north platform, which will drain offsite once reclaimed
2. The processing area, which will drain offsite once reclaimed
3. Undisturbed areas around the site, which will continue their pre mine drainage patterns
4. The reservoir, which will contain all runoff that drains into it.

Exhibit G: Water Information has a detailed discussion of site drainage during and after mining.

7. Revegetation Success Criteria

Revegetation will be deemed adequate when erosion is controlled, and the vegetation cover is similar to the existing cover, and is considered satisfactory according to Division standards.

8. Monitoring Reclamation Success

Monitoring the reclamation on an ongoing basis will ensure its success. The operator plans to use the local NRCS office to determine the capacity of the reclaimed land to control erosion. If

minor changes or modifications are needed to the seeding and reclamation plan, revision plans will be submitted to the Division. It is hoped that the Division will provide assistance in evaluating the success of the ongoing reclamation process. Information on all areas disturbed and reclaimed, as well as any other important items regarding the reclamation will be submitted in the annual reports to the Division and Jefferson County.

9. Weed Control

Measures will be employed for the control of any noxious weed species. The objective of this weed management plan is to control undesirable plants on the Ralston Quarry property. Plants identified through the Colorado Noxious Weed Act (C.R.S. 35-5.5) and the Jefferson County Noxious Weed List are undesirable and designated for management within the county. These plants identified as noxious weeds will be managed by control measures. A Weed Control Plan will be utilized as follows:

1) Each spring, a weed survey will be taken of the permit area.

2) If any patches or plants have been identified, they will be sprayed by backpack sprayer or 4-wheeler using chemicals approved for use by the weed control staff of Jefferson County.

3) After reclamation, weed surveys and spraying will continue until the perennial cover and production of the site have met DRMS requirements and bond release has been obtained.

The Division and Jefferson County weed control staff will be consulted regarding any weed infestation areas and any control measures prior to their initiation. The plan does not contemplate total weed removal on the property. Past experience has shown that some initial weed cover in the first year following the retopsoiling is beneficial to the reclamation effort in rangeland site. Weeds tend to provide shade for new grasses, are a means of holding snow on the seedbed longer and protecting it from wind and water erosion until the planted species have taken hold.

During all phases of the mining operation the permit area will be monitored closely every year, through which the operator may determine if any additional weeds have grown. If any new

species of weeds are found, Jefferson County Weed Control Program and the Division will be consulted in order to formulate the best plan for the new infestation.

RECLAMATION PLAN MAP EXHIBIT F

Map F- shows the final contours of the reclaimed area as well as the final land uses.

WATER INFORMATION EXHIBIT G

1. Surface Water General Discussion

Surface water features at the Ralston Quarry consist of ephemeral ditches on the east side of the property, the Denver Water ditch that passes through the water tunnel to Upper Long Lake Reservoir, and a pair of sediment ponds southeast of the processing area. Mining will only affect the ephemeral ditches on the east side of the site, which will be removed. The remaining features will be either completely unaffected (Denver Water ditch and water tunnel) or reclaimed after mining is complete (sediment ponds). The post mine condition will see a net reduction in the runoff leaving the site. Map C-3 shows the drainage basins, drainage patterns, and surface water control structures for the site. Map F shows the post mine drainage patterns.

2. Hydrology and Sediment Control for Mining

The only water that will be found within the disturbed area is stormwater runoff and water transported to the mining area and used in processing and for dust control.

2.1 Uphill Runoff

Due to the topography of the site, most uphill areas are on the ridge upon which mining is taking place. The outside slopes of this ridge are not being disturbed by operations, and therefore will be allowed to discharge offsite. There are no outside areas that drain onto the operation area.

2.2 Disturbed Area Runoff

Disturbed area on site consists of three drainage basins:

1. North platform above water tunnel: drains to quarry during mining
2. Quarry south of water tunnel: drains into itself (pit bottom)
3. Processing area in the southwest corner of the site: drains to the sediment ponds to its southeast.

Only the processing area will require a special control structure, as the quarry will serve as a sufficient sediment trap for all runoff entering it. The processing area drains to a collection ditch along the south side of the area, which then drains into a sump north of the access road, that then drains into a larger sediment pond south of the road. This sediment pond does not discharge.

3. Groundwater

As described in the Brierley hydrologic analysis attached in Appendix 2, artesian conditions were observed in a lower area of the quarry floor during a site visit. From the report:

> *Water level readings on borings and monitoring wells after drilling was complete shows artesian conditions in two locations in the form of water exiting the top of casing or monitoring well...*
>
> *Observations from the Brierley staff taking the water measurements noted that there was a pool of water in the quarry where runoff collected which was located at a higher elevation than the two locations where artesian conditions were observed. Brierley believes that this pool is the source of the artesian conditions observed.*

The low permeability of both the basalt and the shale that surrounds it makes the source of the artesian conditions likely to be an internal water source (i.e. the uphill runoff pool). The artesian conditions are the only ground water encountered in the Ralston Quarry.

Based on the analysis conducted by Brierley showing very low permeability, and the localized artesian conditions, the Ralston Quarry is considered a closed hydrologic system. It is anticipated that some water (~80 gallons a day) would be lost into the cracks of the basalt once the reservoir is filled to its anticipated final level, but this small amount will be dwarfed by the likely surface evaporation.

The Brierley information found in Appendix 2 contains more detail on the hydrologic conditions in the Ralston Quarry. It is from a proprietary report produced for Asphalt Paving Co. as part of the reservoir analysis.

4. Irrigation Water

The land within and surrounding the permit area is not irrigated.

5. Water Consumption for the Operation

The only water consumption for an operation like the Ralston Quarry is that needed for dust control and asphalt production. Dust control is needed both for disturbed surface areas as well as

during crushing of mined basalt. Table G-2 shows the total consumptive uses anticipated for this site.

5.1 Dust Control – Disturbed Areas

Water used for dust suppression is usually 100 percent depletive with no measurable return flows to the river system. Dust from the haul roads will be controlled by paving for all areas outside the mining pit boundary. Water will be used on all in pit roads. Water will only be applied when needed at this elevation, since the cold conditions on site for much of the year result in little evaporation and/or dust. The main access road is paved to reduce the water requirements. It is assumed that watering of roads will require approximately 5000 gallons water six times a day for 150 days per year. Other days will have natural moisture on the roads or the site will be inactive since the annual production is not very high. This is equivalent to approximately 13.8 acre feet per year.

5.2 Dust Control - Crushing and Screening Plant Operations

The crushing and screening plant uses roughly 9.2 acre feet per year.

5.3 Asphalt plant operation

The asphalt plant requires approximately 4.0 acre feet per year.

5.4 Potable water for drinking

Potable drinking water will be purchased commercially and will not be considered in the consumptive use calculations.

Table G-2 Summary of Consumptive Uses

Consumptive use	**Approximate Acre-feet/yr Use**	**Comments**
Dust Control on Roads/Pit	13.8	
Crushing and Screen Plant	9.2	
Asphalt Plant	4.0	
Total	27	This water will be pumped from Upper Long Lake Reservoir

5.5 Water Purchases Needed for the Operation

Asphalt Paving Co. continues to utilize water provided via a purchase agreement for water that has existed since the early 1980s.

WILDLIFE INFORMATION EXHIBIT H

1. Description of Significant Wildlife Resources on the Affected Lands

Deer and coyotes are present in the area.

2. Significant Non-Game Resources on the Affected Lands

Small rodents and various bird species are found within the permit area. No raptor nests have been identified within the affected lands.

3. Seasonal Use of Affected Lands

There is some winter use by deer.

4. Presence and Estimated Population of Threatened or Endangered species in the area.

There are no known occurrences of critical habitat of any state or federally listed threatened or endangered species at this site.

5. Fish Resources

None.

6. General Effects of the Operation on the Existing Wildlife of the Area

Considering the extensive period of time that the Ralston Quarry has been in operation, local wildlife are likely used to the presence of the operation. With a post mine land use of a water reservoir, wildlife fencing will be necessary to keep deer and other animals from falling down the quarry slopes.

Due to the possibility for animal/vehicle collisions, hauling activities could pose a threat to wildlife. To minimize impacts, haul trucks will keep to posted speeds and drivers need to remain aware of the potential for collisions.

SOILS INFORMATION EXHIBIT I

1. General Information

The soil survey performed by the NRCS covers the permit area. The soil mapping is shown on Map C-1. A custom soil report for this site is contained in Appendix 1.

The topsoil available onsite is a mixture of soil and rock, and thus is not conducive to vegetation growth. Therefore, when topsoil is stripped at the Ralston Quarry, it is screened to remove the rock, and the remaining fine material is used for topsoiling.

VEGETATION INFORMATION EXHIBIT J

1. Existing Plant Communities

The pre mine plant communities at the Ralston Quarry were a mixture of grasses and forbs along the main ridge, with shrubs and trees dominating the rockier areas, and pastureland grasses in the flat areas away from the ridges. Photos on the following pages show the vegetation communities present at the Ralston Quarry.

Picture 1 – East slope of ridge below current mining area. Grass and forb community.

Picture 2 – Close up of grasses and forbs on the east side of the ridge.

Picture 3 – West side of ridge, near the top. Grass and forb community.

CLIMATE INFORMATION EXHIBIT K

1. General Information

The following climate data is from the Ralston Reservoir, CO located slightly west of the Ralston Quarry. The station is at an elevation of 5910', while the quarry is entirely above 6000'.

2. Period of Record Monthly Climate Summary

RALSTON RESERVOIR, COLORADO (056816)

Period of Record : 5/ 1/1978 to 3/31/2013

Jan	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	45.2	44.9	53.3	59.5	68.9	80.0	87.7	83.9	75.5	62.6	52.5	43.5	63.1
Average Min. Temperature (F)	23.1	22.1	29.2	34.9	44.4	53.7	61.1	58.4	50.3	39.0	29.5	22.2	39.0
Average Total Precipitation (in.)	0.61	0.75	1.76	2.44	2.89	1.90	1.65	2.02	1.33	1.27	1.04	0.82	18.49
Average Total SnowFall (in.)	8.5	8.9	12.8	9.6	1.6	0.0	0.0	0.0	0.7	3.7	10.6	11.6	68.0
Average Snow Depth (in.)	1	1	1	1	0	0	0	0	0	0	1	2	1

RECLAMATION COSTS — EXHIBIT L

The maximum bond reclamation scenario will occur when the north platform above the Denver Water water tunnel is mined out. This area will require the largest amount of backfill. At this point in time, Asphalt Paving Co. will have the 1.2 million cubic yards of material available to backfill the north platform and construct the vegetation islands along the quarry slopes. Topsoiling will involve the placement of screened topsoil on disturbed areas. Revegetation of disturbed areas using the approved seed mixes will be completed once all backfilling, grading, and topsoiling is done. Broadcast seeding or hydroseeding will be used, and mulch applied as well.

Backfill		
Maximum bond volume of backfill needed	1,000,000	CY
Topsoil		
North platform (12 inches over 10.5 acres)	16,940	CY
Processing area (12 inches over 67.4 acres)	108,755	CY
Vegetation islands	10,000	CY
Material available on site	1,200,000	CY

The permanent facilities on site that need to be removed are the scale house, asphalt plant, and asphalt parking lot. All other equipment on site is portable.

The backfill requirements for the bond calculation were determined using CAD software, the volume report is attached.

Volume Report Wed Jul 16 15:25:42 2014

Project: Ralston Quarry

Grid corner locations: 3071644.84,1725018.65 to 3073584.84,1726478.65

Grid resolution X: 194, Y: 146 Grid cell size X: 10.00, Y: 10.00

Area in Cut : 0.06 Acres

Area in Fill: 10.48 Acres

Total inclusion area: 10.54 Acres

Cut to Fill ratio: 0.00

Average Cut Depth: 5.87 Average Fill Depth: 59.59

Max Cut Depth: 99.54 Max Fill Depth: 162.38

Cut (C.Y.) / Area (acres): 58.08

Fill (C.Y.) / Area (acres): 95556.24

Cut volume: 612.16 C.Y.

Fill volume: 1,007,178.28 C.Y.

Table L-1 Reclamation Task and Cost Estimate

Activity Description	Time (Months)	Quantity		Unit Cost ($)	Cost ($)
Remove all diesel tanks, plants, and other facilities	1				$ 5,000
Backfill and grade north platform area.		1,000,000	CY	$ 2.00	$ 2,000,000
Topsoil appropriate areas to a depth of 12 inches.	0.5	135,695	CY	$ 2.00	$ 271,390
Broadcast seed all topsoiled areas including vegetation islands.	0.5	80	acres	$ 700.00	$ 56,000
Mulch seeded areas excluding vegetation islands.	0.5	78	acres	$ 500.00	$ 38,955
Totals	**2.5**				**$ 2,371,345**
DRMS Costs (28% x direct costs)					**$ 663,976**
Total Bond Amount					**$ 2,869,327**

OTHER PERMITS AND LICENSES REQUIRED EXHIBIT M

The following permits are needed for the site:

1. Jefferson County Special Use Permit (in place)
2. CDPHE stormwater permit (in place)
3. APEN – A fugitive air emissions permit is needed from the Colorado Department of Public Health and Environment (in place)
4. A Spill Prevention Control and Countermeasure (SPCC) Plan (in place)

SOURCE OF LEGAL RIGHT TO ENTER

EXHIBIT N

See attached Affidavit .

AFFIDAVIT

I, M.L. Richardson, do hereby state and aver under oath as follows:

1. That I am the Successor Trustee of Keller Family Limited Partnership, LLLP, a Colorado limited liability limited partnership currently in good standing, hereinafter referred to as "Keller Family".

2. That I have knowledge of the operations and real estate of Keller Family.

3. That Keller Family is the current successor to all right, title and interest in real property previously owned by Asphalt Paving Co., a Colorado corporation currently in good standing.

4. That Asphalt Paving Co. holds the reclamation permit for its mining operations at the Ralston Quarry located in Jefferson County, Colorado. The permit number is M1974086 and became effective on or about May 17, 1976, with subsequent amendment on or about July 24, 1980.

5. That Keller Family and Asphalt Paving Co., own all surface and subsurface rights in fee to the Ralston Quarry.

6. That Asphalt Paving Co. has been operating and has the full right and power to continue operating the Ralston Quarry.

FURTHER AFFIANT SAYETH NAUGHT

Signed and sworn to this 18th day of September, 2014.

M.L. Richardson, Successor Trustee to the Keller Family Limited Parnership, LLLP, a Colorado limited liability limited partnership

STATE OF COLORADO)
) ss.
COUNTY OF JEFFERSON)

SUBSCRIBED TO AND AFFIRMED TO before me in the County of Jefferson, State of Colorado, by M.L. Richardson, Successor Trustee to the Keller Family Limited Partnership, LLLP, this 18th day of September, 2014.

Notary's Official Signature

NOTARY SEAL

ELIZABETH WHITESEL-DUTTON
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID # 20014022842
MY COMMISSION EXPIRES JULY 24, 2017

7/24/2014
Commission Expiration

OWNERS OF AFFECTED LAND

OWNERS OF MINED SUBSTANCE EXHIBIT O

The mined substance is rock. No other lands will be affected by the operation. The surface and mineral owners of the property are:

Surface Owners

Keller Family Limited Partnerships, LLLP
14802 W 44th Ave
Golden, CO 80403

Mineral Owners

Anadarko E&P Onshore, LLC
1201 Lake Robbins Drive
The Woodlands, TX 77380

Ivanhoe Investment Co.
4996 N. Pheasant Drive
Ozark, MO 65721-6270
Registered Agent:
Joyce H Nakamura
Hail & Evans, LLC
1001 17th Street, Suite 300
Denver, CO 80202

MUNICIPALITIES WITHIN TWO MILES EXHIBIT P

The closest municipality is Arvada, CO just across the state highway east of the site.

PROOF OF MAILING NOTICES TO COUNTY COMMISSIONERS & SOIL CONSERVATION DISTRICT EXHIBIT Q

Notifications and accompanying permit forms have been sent to the Jefferson Conservation District and the Jefferson County Commissioners.

Please see attached return receipts.

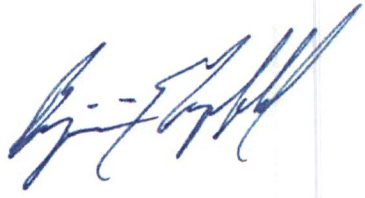
November 7, 2014

Jefferson Conservation District
Denver Federal Center
Bldg 56, Room 2604
PO Box 25426
Denver, CO 80225-0426

To Whom It May Concern:

Enclosed is a notice for an amendment application to the Colorado Division of Reclamation, Mining, and Safety for the existing 112 quarry permit for the pit known as the Ralston Quarry, located less than a half mile west of Arvada off Highway 93. The applicant is Asphalt Paving Co. and the permit number is M-1974-086. The Colorado Division of Reclamation, Mining, and Safety needs evidence that you received this notice and that the application has been filed with your office. Therefore, please sign and date the box below, and fax it to 303 346-6934. Thank you.

Sincerely,



Ben Langenfeld
(720) 842-5321
Greg Lewicki and Associates
On behalf of: Asphalt Paving Co.

The application was received on the following date: _____

by:_____

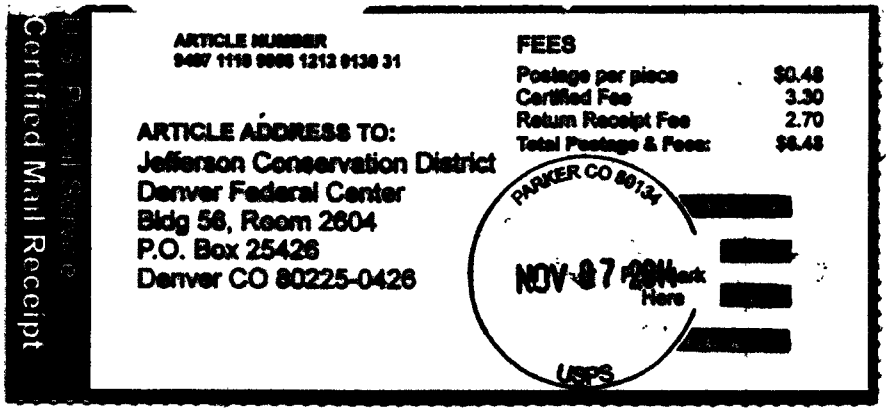
NOTICE OF FILING APPLICATION
FOR COLORADO MINING LAND RECLAMATION PERMIT
FOR **REGULAR (112) CONSTRUCTION MATERIALS OPERATION**

NOTICE TO THE JEFFERSON CONSERVATION DISTRICT

Asphalt Paving Co. has applied for an amendment to an existing Regular (112) Reclamation permit, named the Ralston Quarry, from the Colorado Mined Land reclamation Board (the "Board") to conduct extraction of construction materials in Jefferson County. The attached information is being provided to notify you of the location and nature of the existing operation. This amendment updates the reclamation permit to match land use approved in the Official Development Plan (ODP) recorded at reception number F0049387. The entire application is on file with the Division of Reclamation, Mining, and Safety (the "Division") and the local county clerk and recorder.

The applicant/operator proposes to reclaim the affected land to water storage and rangeland. Pursuant to Section 34-32.5-116(4)(m),.C.R.S., the Board may confer with the local Board of County Commissioners before approving of 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 on the application within ten (10) days after the last publication of this 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, and Safety, 1313 Sherman Street, Room 215, Denver, Colorado 80203, (303) 866-3567.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ARTICLE NUMBER
9407 1110 9898 1212 9130 31
FEES
Postage per piece $0.48
Certified Fee 3.30
Return Receipt Fee 2.70
Total Postage & Fees: $6.48
ARTICLE ADDRESS TO:
Jefferson Conservation District
Denver Federal Center
Bldg 56, Room 2604
P.O. Box 25426
Denver CO 80225-0426
PARKER CO 80134
NOV 07
Here
USPS

Asphalt Paving Co.

14802 W. 44th Avenue
Golden, Colorado 80403
Office: 303-279-6611
Fax: 303-279-6216
www.asphaltpavingco.com

The Sign of Quality

November 12, 2014

Jefferson County Commissioners
100 Jefferson County Pkwy.
Suite 2560
Admin and Courts Facility
Golden, CO 80419

Dear County Commissioners:

Enclosed is a notice for an amendment application to the Colorado Division of Reclamation, Mining, and Safety for the existing 112 quarry permit for the pit known as the Ralston Quarry, located less than a half mile west of Arvada off Highway 93. The applicant is Asphalt Paving Co. and the permit number is M-1974-086. The Colorado Division of Reclamation, Mining, and Safety needs evidence that you received this notice and that the application has been filed with your office. Therefore, please sign and date the box below. Thank you.

Sincerely,

M.L. Richardson
Director of Strategy and Sustainable Development
Asphalt Paving Co.

Enclosure

The application was received on the following date: 11.12.14

by:

Donald Rosier
Jefferson County Commissioner

NOTICE OF FILING APPLICATION
FOR COLORADO MINING LAND RECLAMATION PERMIT
FOR **REGULAR (112) CONSTRUCTION MATERIALS OPERATION**

NOTICE TO THE JEFFERSON COUNTY BOARD OF COUNTY COMMISSIONERS

Jefferson County

Asphalt Paving Co. has applied for an amendment to an existing Regular (112) Reclamation permit, named the Ralston Quarry, from the Colorado Mined Land reclamation Board (the "Board") to conduct extraction of construction materials in Jefferson County. The attached information is being provided to notify you of the location and nature of the existing operation. This amendment updates the reclamation permit to match land use approved in the Official Development Plan (ODP) recorded at reception number F0049387. The entire application is on file with the Division of Reclamation, Mining, and Safety (the "Division") and the local county clerk and recorder.

The applicant/operator proposes to reclaim the affected land to water storage and rangeland. Pursuant to Section 34-32.5-116(4)(m),.C.R.S., the Board may confer with the local Board of County Commissioners before approving of 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 on the application within ten (10) days after the last publication of this 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, and Safety, 1313 Sherman Street, Room 215, Denver, Colorado 80203, (303) 866-3567.

PROOF OF FILING WITH COUNTY CLERK — EXHIBIT R

Please see attached return receipt.

Asphalt Paving Co.

The Sign of Quality

14802 W. 44th Avenue
Golden, Colorado 80403
Office: 303-279-6611
Fax: 303-279-6216
www.asphaltpavingco.com

November 12, 2014

Clerk and Recorder
100 Jefferson County Pkwy.
Suite 2560
Admin and Courts Facility
Golden, CO 80419

Dear Clerk and Recorder:

Enclosed is a notice for an amendment application to the Colorado Division of Reclamation, Mining, and Safety for the existing 112 quarry permit for the pit known as the Ralston Quarry, located less than a half mile west of Arvada off Highway 93. The applicant is Asphalt Paving Co. and the permit number is M-1974-086. The Colorado Division of Reclamation, Mining, and Safety needs evidence that you received this notice and that the application has been filed with your office. Therefore, please sign and date the box below. Thank you.

Sincerely,

M.L. Richardson
Director of Strategy and Sustainable Development
Asphalt Paving Co.

Enclosure

The application was received on the following date: 11/12/14

by: Lori Webb

NOTICE OF FILING APPLICATION
FOR COLORADO MINING LAND RECLAMATION PERMIT
FOR **REGULAR (112) CONSTRUCTION MATERIALS OPERATION**

NOTICE TO THE JEFFERSON COUNTY CLERK AND RECORDER

Jefferson County

Asphalt Paving Co. has applied for an amendment to an existing Regular (112) Reclamation permit, named the Ralston Quarry, from the Colorado Mined Land reclamation Board (the "Board") to conduct extraction of construction materials in Jefferson County. The attached information is being provided to notify you of the location and nature of the existing operation. This amendment updates the reclamation permit to match land use approved in the Official Development Plan (ODP) recorded at reception number F0049387. The entire application is on file with the Division of Reclamation, Mining, and Safety (the "Division") and the local county clerk and recorder.

The applicant/operator proposes to reclaim the affected land to water storage and rangeland. Pursuant to Section 34-32.5-116(4)(m),.C.R.S., the Board may confer with the local Board of County Commissioners before approving of 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 on the application within ten (10) days after the last publication of this 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, and Safety, 1313 Sherman Street, Room 215, Denver, Colorado 80203, (303) 866-3567.

PERMANENT MAN-MADE STRUCTURES EXHIBIT S

The man-made structures within 200 feet of the permit boundary are as listed below:

1. Fences along the property lines
2. Existing access road from Highway 93.
3. Denver Water water tunnel passing through the northern part of the quarry.

Damage waivers are attached to this section. In addition, a Geotechnical Stability Exhibit is part of this application.

STRUCTURE AGREEMENT

Project Name:	**Ralston Quarry 112c Amendment Application** **(File # M-1974-086)**
Project Location:	Sections 4, 5 and 8, Twp. 3 South, Range 70 West of the 6th Principal Meridian, Jefferson County, CO
Applicant:	**Asphalt Paving Co.** 14802 W. 44th Avenue, Golden, CO 80403
Structures Owner:	**City and County of Denver, acting by and through its Board of Water Commissioners** 1600 W 12th Avenue, Denver, CO 80204-3412

Structures:

1. Fencing along the shared property line west, east and north of portions of the property.
2. A water tunnel passing through the property roughly 900 feet south of the north property line.
3. A ditch which enters the water tunnel from the west and exits the water tunnel on the east.

The Applicant is applying for an Amendment to its reclamation permit from the Colorado Division of Reclamation, Mining and Safety to update the permit to match the final end use of water storage (approved by Jefferson County Commissioners via ODP 6/26/12 and recorded on 10/8/12 at Reception # 2012107332 in Jefferson County). This update relates to property generally located in Sections 4, 5 and 8, Township 3 South, Range 70 West of the 6th Principal Meridian in Jefferson County, CO, consisting of approximately 271.61 acres. Portions of this property are located within 200 feet of structures owned by Denver Water or, with regard to the fence potentially co-owned by Denver Water and Applicant.

Should any damage occur to the structures noted above resulting from the continued operations, Asphalt Paving Co. will compensate for any such damage at its expense. The signatures of the Asphalt Paving Co. officer and the Structure Owner below confirm such Agreement and repair/compensation obligation between the parties.

City and County of Denver, acting by and through its Board of Water Commissioners, Structures Owner

Acknowledged by: _____
Robert J. Mahoney, Director of Engineering

Reviewed by: _____
Legal Division

STATE OF COLORADO)
) ss
COUNTY OF DENVER)

The foregoing instrument was acknowledged before me this 31 day of October, 2014 by Robert J. Mahoney.

Witness my hand and official seal.

My commission expires: April 18, 2017

MOLLY MARTINEZ JACKSON
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID # 20134024017
MY COMMISSION EXPIRES APRIL 18, 2017

_____
Notary Public

Asphalt Paving Co., Applicant

By: _____ Title: President
Jeffrey W. Keller

STATE OF COLORADO)
) ss
COUNTY OF DENVER)

The foregoing instrument was acknowledged before me this 31st day of October, 2014 by Jeffrey W Keller.

Witness my hand and official seal.

My commission expires: 7/24/2017

ELIZABETH WHITESEL-DUTTON
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID # 20014022842
MY COMMISSION EXPIRES JULY 24, 2017

_____
Notary Public

Adjacent Property Owners

All adjacent property owners are shown on Map C-1 in Appendix 4.

RULE 1.6.2(1)(B) **EXHIBIT T**

Prior to the submittal of the application, a sign was erected at the entrance to the site which contained all the required information regarding Rule 1.6.2(1)(b).

Please see enclosed sign certification.

NOTICE

This site is the location of an existing construction materials operation, the Ralston Quarry. Asphalt Paving Co., whose address and phone number is 14802 W 44th Avenue, Golden CO 80403 and phone number is (303) 996-7222, has applied for a Reclamation Permit Amendment with the Colorado Mined Land Reclamation Board. Anyone wishing to comment on the application may view the application at the Jefferson County Clerk and Recorder's Office, 100 Jefferson County Pkwy, Suite 2560, Admin and Courts Facility, Golden, CO 80419, and should send comments prior to the end of the public comment period to the Division of Reclamation, Mining, and Safety, 1313 Sherman St, Room 215, Denver, Colorado 80203.

Certification:

I, Mark Martin, hereby certify that I posted a sign containing the above notice for the existing permit area known as the Ralston Quarry , on:

11/11/14
Date Posted

The signs were posted at the start of the access road on Highway 93.

SIGNATURE

11/11/14
DATE

GEOTECHNICAL STABILITY EXHIBIT

There are no buildings or any structures outside the permit area which could be affected by the excavation. A minimum 30 foot buffer will be maintained from the permit boundary line to all new excavations. There will be no excavation within 30 feet of the property line.

1. Slope Stability

The Ralston Quarry is entirely contained within a basalt extrusion adjacent to Pierre shale that has been uplifted. Basalt, like what is found in this quarry, is highly competent material that facilitates mining to very steep slopes. The south, north, and east slopes of the quarry are entirely contained within the basalt, and are therefore limited in their slopes by the basalt's geotechnical properties and local jointing. On the west slope, the basalt-shale contact creates potential failure planes, and therefore dictates the limits of excavation and permanent slopes.

Brierley and Associates of Golden, CO performed a site specific analysis of the slope stability at Ralston Quarry. Their report is attached as Appendix 2. According to their analysis of possible wedge failures in the quarry, the following worst case scenarios were determined that will be used to limit the final excavation highwalls of the quarry:

1. West slope (east dipping)
    a. Overall all slope limit = 73°. Measured from the top bench crest to the bottom bench toe.
    b. Individual bench limit = 90°. Measured from a single bench crest to that bench's toe.
    c. Minimum bench width = 14'
    d. Maximum bench height = 80'
2. East slope (west dipping)
    a. Overall slope limit = 90°. Measured as a single slope from the top of the excavation to the bottom.
    b. Maximum bench height = 200'
3. North slope (south dipping)

a. Overall slope limit = 79°. Measured as a single slope from the top of the excavation to the bottom.
b. Maximum bench height = 400'

4. South slope (north dipping)
    a. This slope will be limited to the same as the north slope.

The south slope will be limited to the same geometry as the north and east slope based on the similarity in the material and local conditions.

Each of the slopes above has maximum and minimum listed conditions for their final slopes configuration. Asphalt Paving Co. will adjust bench heights and widths within these limits to create slopes that are aesthetically pleasing in reclamation. Also, internal slopes maintained during mining will vary as necessary to facilitate mining, and to maintain safety standards. The slopes shown on Maps C-3 and F are plan views of the maximums and minimums determined by Brierley, and are used to illustrate the maximum possible build out of the quarry. The final slopes will be much more varied.

2. Blasting

Seismic measurements are taken each year, and a report of these measurements is provided to Asphalt Paving Co. A copy of the most recent report can be found in Appendix 3.

APPENDIX 1 – SOILS REPORT

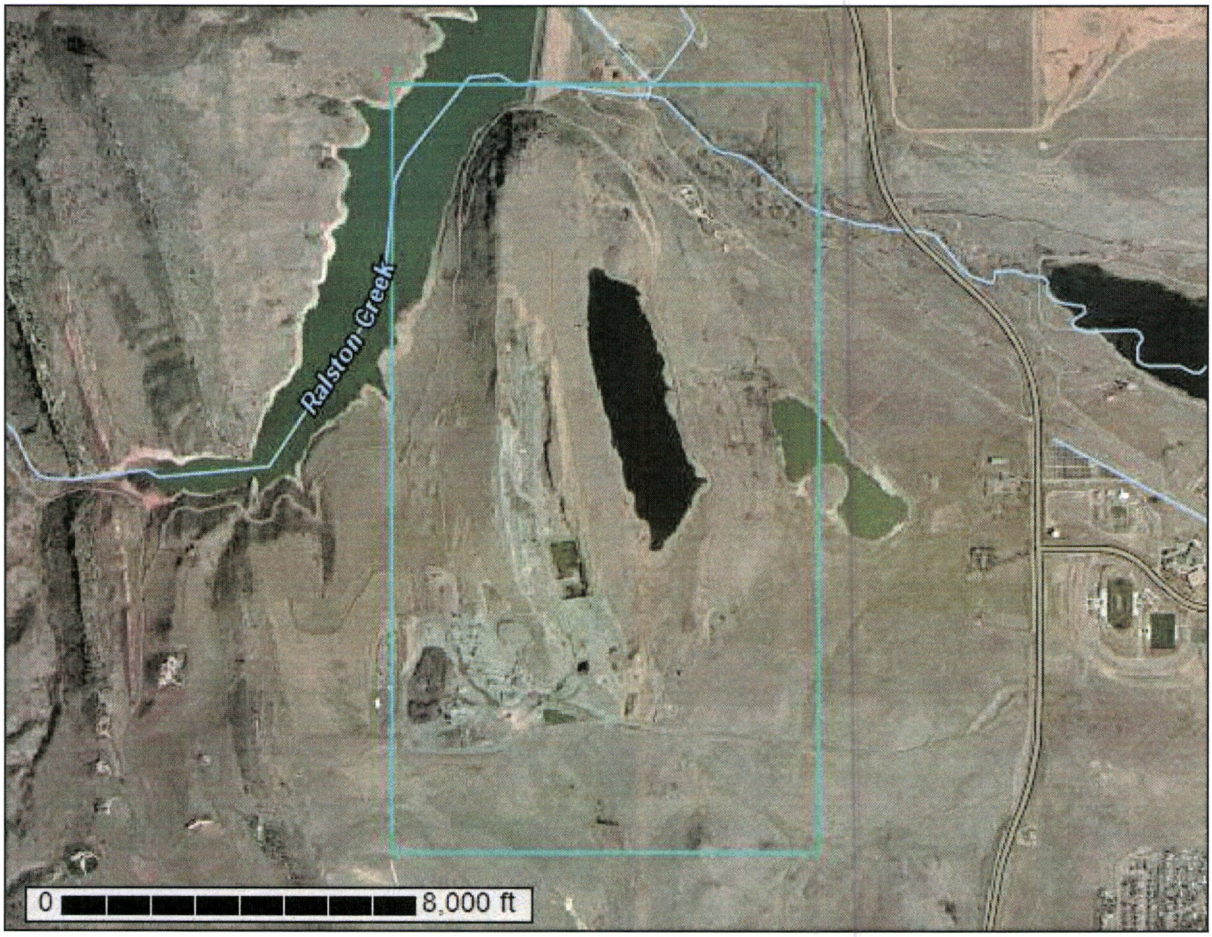
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Golden Area, Colorado, Parts of Denver, Douglas, Jefferson, and Park Counties



July 11, 2014

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means

for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

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.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
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 8, Dec 23, 2013

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

Date(s) aerial images were photographed: Apr 29, 2011—Apr 13, 2012

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

Map Unit Legend

Golden Area, Colorado, Parts of Denver, Douglas, Jefferson, and Park Counties (CO641)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
1	Alda loam, 0 to 2 percent slopes	25.0	2.8%
5	Argiustolls-Rock outcrop complex, 15 to 60 percent slopes	12.2	1.4%
7	Ascalon sandy loam, 5 to 9 percent slopes	2.7	0.3%
10	Baller variant-Lavina-Rock outcrop complex, 5 to 15 percent slopes	22.8	2.5%
11	Baller variant-Lavina-Rock outcrop complex, 15 to 30 percent slopes	215.0	24.0%
18	Critchell gravelly sandy loam, 3 to 9 percent slopes	61.2	6.8%
28	Denver cobbly clay loam, 5 to 9 percent slopes	16.6	1.9%
29	Denver-Kutch clay loams, 5 to 9 percent slopes	20.6	2.3%
30	Denver-Kutch clay loams, 9 to 15 percent slopes	49.0	5.5%
45	Flatirons very cobbly sandy loam, 0 to 3 percent slopes	72.2	8.1%
60	Haverson loam, 0 to 3 percent slopes	2.1	0.2%
61	Haverson loam, 3 to 9 percent slopes	4.0	0.4%
63	Heldt clay, 9 to 15 percent slopes	41.1	4.6%
69	Laporte variant complex, 15 to 60 percent slopes	2.8	0.3%
74	Lebsack clay loam, saline, 0 to 2 percent slopes	2.6	0.3%
80	Leyden-Primen-Standley cobbly clay loams, 15 to 50 percent slopes	36.3	4.1%
98	Midway clay loam, 9 to 30 percent slopes	53.0	5.9%
111	Pits, gravel	0.2	0.0%
138	Rock outcrop, igneous and metamorphic	11.9	1.3%
139	Rock outcrop, sedimentary	3.9	0.4%
148	Standley-Leyden-Primen very stony clay loams, 15 to 30 percent slopes	58.7	6.6%

Golden Area, Colorado, Parts of Denver, Douglas, Jefferson, and Park Counties (CO641)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
149	Standley-Nunn gravelly clay loams, 0 to 5 percent slopes	6.1	0.7%
164	Ulm-Urban land complex, 9 to 18 percent slopes	3.1	0.4%
168	Valmont clay loam, 0 to 3 percent slopes	12.3	1.4%
169	Veldkamp-Nederland very cobbly sandy loams, 0 to 3 percent slopes	5.5	0.6%
174	Willowman-Leyden cobbly loams, 9 to 30 percent slopes	39.3	4.4%
177	Dam	1.4	0.2%
178	Water	113.9	12.7%
Totals for Area of Interest		**895.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Golden Area, Colorado, Parts of Denver, Douglas, Jefferson, and Park Counties

1—Alda loam, 0 to 2 percent slopes

Map Unit Setting

Elevation: 5,200 to 6,500 feet
Mean annual precipitation: 13 to 17 inches
Frost-free period: 126 to 142 days

Map Unit Composition

Alda and similar soils: 85 percent
Minor components: 10 percent

Description of Alda

Setting

Landform: Terraces, flood plains, valley floors
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous, stratified alluvium

Typical profile

H1 - 0 to 28 inches: loam
H2 - 28 to 97 inches: stratified loamy sand to loam
H3 - 97 to 152 inches: very gravelly loamy sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: Low (about 5.6 inches)

Interpretive groups

Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: C
Other vegetative classification: WET MEADOW (48AY315CO)

Minor Components

Fluventic haplaquolls

Percent of map unit: 10 percent
Landform: Flood plains

5—Argiustolls-Rock outcrop complex, 15 to 60 percent slopes

Map Unit Setting

Elevation: 5,600 to 6,500 feet
Mean annual precipitation: 15 to 17 inches
Frost-free period: 126 to 142 days

Map Unit Composition

Argiustolls: 65 percent
Rock outcrop: 20 percent

Description of Argiustolls

Setting

Landform: Hills, escarpments
Landform position (two-dimensional): Footslope, backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, concave
Across-slope shape: Linear
Parent material: Colluvium derived from sedimentary rock

Typical profile

H1 - 0 to 25 inches: stony sandy loam
H2 - 25 to 89 inches: very gravelly sandy clay loam, very gravelly sandy loam
H2 - 25 to 89 inches: unweathered bedrock
H3 - 89 to 99 inches:

Properties and qualities

Slope: 15 to 60 percent
Depth to restrictive feature: 10 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Available water storage in profile: Low (about 5.4 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: Rocky Foothill (R048AY206CO)

Description of Rock Outcrop

Typical profile

H1 - 0 to 152 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 60 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Available water storage in profile: Very low (about 0.0 inches)

Interpretive groups
Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydrologic Soil Group: D

7—Ascalon sandy loam, 5 to 9 percent slopes

Map Unit Setting
Elevation: 5,200 to 6,500 feet
Mean annual precipitation: 13 to 17 inches
Frost-free period: 126 to 142 days

Map Unit Composition
Ascalon and similar soils: 100 percent

Description of Ascalon

Setting
Landform: Hills, alluvial fans
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian deposits

Typical profile
H1 - 0 to 18 inches: sandy loam
H2 - 18 to 46 inches: sandy loam, sandy clay loam
H2 - 18 to 46 inches: sandy loam, loam, sandy clay loam
H3 - 46 to 58 inches: sandy loam, loamy sand, fine sandy loam
H3 - 46 to 58 inches:
H3 - 46 to 58 inches:
H4 - 58 to 152 inches:
H4 - 58 to 152 inches:
H4 - 58 to 152 inches:

Properties and qualities
Slope: 5 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent

Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very high (about 17.2 inches)

Interpretive groups
Farmland classification: Not prime farmland
Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Loamy Foothill (R048AY202CO)

10—Baller variant-Lavina-Rock outcrop complex, 5 to 15 percent slopes

Map Unit Setting
Elevation: 5,600 to 6,500 feet
Mean annual precipitation: 15 to 17 inches
Frost-free period: 126 to 142 days

Map Unit Composition
Baller variant and similar soils: 45 percent
Lavina and similar soils: 25 percent
Rock outcrop: 20 percent

Description of Baller Variant

Setting
Landform: Hills
Landform position (two-dimensional): Footslope, backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum

Typical profile
H1 - 0 to 8 inches: gravelly sandy loam
H2 - 8 to 25 inches: very gravelly sandy loam
H3 - 25 to 43 inches: weathered bedrock
H4 - 43 to 53 inches: unweathered bedrock

Properties and qualities
Slope: 5 to 15 percent
Depth to restrictive feature: 8 to 20 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 0.7 inches)

Interpretive groups
Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: D
Ecological site: Shallow Foothill (R048AY204CO)

Description of Lavina

Setting

Landform: Hills
Landform position (two-dimensional): Shoulder, summit, footslope, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum

Typical profile

H1 - 0 to 13 inches: loam
H2 - 13 to 30 inches: clay loam, clay
H2 - 13 to 30 inches: unweathered bedrock
H3 - 30 to 41 inches:

Properties and qualities

Slope: 5 to 15 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.9 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: Shallow Foothill (R048AY204CO)

Description of Rock Outcrop

Typical profile

H1 - 0 to 152 inches: unweathered bedrock

Properties and qualities

Slope: 5 to 15 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Capacity of the most limiting layer to transmit water (Ksat): Very low to low (0.00 to 0.01 in/hr)
Available water storage in profile: Very low (about 0.0 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydrologic Soil Group: D

11—Baller variant-Lavina-Rock outcrop complex, 15 to 30 percent slopes

Map Unit Setting

Elevation: 5,600 to 6,500 feet
Mean annual precipitation: 15 to 17 inches
Frost-free period: 126 to 142 days

Map Unit Composition

Baller variant and similar soils: 45 percent
Lavina and similar soils: 25 percent
Rock outcrop: 20 percent

Description of Baller Variant

Setting

Landform: Hills
Landform position (two-dimensional): Footslope, backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum

Typical profile

H1 - 0 to 8 inches: gravelly sandy loam
H2 - 8 to 25 inches: very gravelly sandy loam
H3 - 25 to 43 inches: weathered bedrock
H4 - 43 to 53 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: 8 to 20 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 0.7 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: Shallow Foothill (R048AY204CO)

Description of Lavina

Setting

Landform: Hills
Landform position (two-dimensional): Footslope, backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum

Typical profile

H1 - 0 to 13 inches: loam
H2 - 13 to 30 inches: clay loam, clay
H2 - 13 to 30 inches: unweathered bedrock
H3 - 30 to 41 inches:

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.9 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: Shallow Foothill (R048AY204CO)

Description of Rock Outcrop

Typical profile

H1 - 0 to 152 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Capacity of the most limiting layer to transmit water (Ksat): Very low to low (0.00 to 0.01 in/hr)
Available water storage in profile: Very low (about 0.0 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydrologic Soil Group: D

18—Critchell gravelly sandy loam, 3 to 9 percent slopes

Map Unit Setting

Elevation: 5,200 to 6,500 feet
Mean annual precipitation: 13 to 17 inches
Frost-free period: 126 to 142 days

Map Unit Composition

Critchell and similar soils: 100 percent

Description of Critchell

Setting

Landform: Fans, terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sedimentary rock

Typical profile

H1 - 0 to 15 inches: gravelly sandy loam
H2 - 15 to 64 inches: gravelly clay loam, gravelly sandy clay loam
H2 - 15 to 64 inches: gravelly loam, gravelly sandy clay loam, gravelly sandy loam
H3 - 64 to 89 inches: gravelly coarse sandy loam, gravelly sandy loam
H3 - 64 to 89 inches:
H3 - 64 to 89 inches:
H4 - 89 to 152 inches:
H4 - 89 to 152 inches:

Properties and qualities

Slope: 3 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very high (about 13.0 inches)

Interpretive groups

Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Gravelly Foothill (R048AY214CO)

28—Denver cobbly clay loam, 5 to 9 percent slopes

Map Unit Setting

Elevation: 5,600 to 6,500 feet
Mean annual precipitation: 13 to 17 inches
Frost-free period: 126 to 142 days

Map Unit Composition

Denver and similar soils: 100 percent

Description of Denver

Setting

Landform: Alluvial fans, terraces, hills
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

H1 - 0 to 8 inches: cobbly clay loam
H2 - 8 to 74 inches: clay loam, clay
H2 - 8 to 74 inches: gravelly clay loam, gravelly clay, gravelly sandy clay
H3 - 74 to 152 inches:
H3 - 74 to 152 inches:
H3 - 74 to 152 inches:

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Very high (about 22.2 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: Clayey Foothill (R049BY208CO)
Other vegetative classification: CLAYEY FOOTHILL (048AY208CO)

29—Denver-Kutch clay loams, 5 to 9 percent slopes

Map Unit Setting

Elevation: 5,200 to 6,500 feet
Mean annual precipitation: 13 to 17 inches
Frost-free period: 126 to 142 days

Map Unit Composition

Denver and similar soils: 50 percent
Kutch and similar soils: 35 percent

Description of Denver

Setting

Landform: Hills
Landform position (two-dimensional): Footslope, backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

H1 - 0 to 15 inches: clay loam
H2 - 15 to 74 inches: clay, silty clay
H2 - 15 to 74 inches: clay, clay loam, silty clay
H3 - 74 to 152 inches:
H3 - 74 to 152 inches:
H3 - 74 to 152 inches:

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very high (about 25.1 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: Clayey Foothill (R049BY208CO)
Other vegetative classification: CLAYEY FOOTHILL (048AY208CO)

Description of Kutch

Setting

Landform: Hills
Landform position (two-dimensional): Footslope, backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Colluvium and/or residuum

Typical profile

H1 - 0 to 8 inches: clay loam
H2 - 8 to 48 inches: clay, clay loam
H2 - 8 to 48 inches: clay loam
H3 - 48 to 66 inches: weathered bedrock
H4 - 66 to 76 inches:

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Gypsum, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: Moderate (about 7.0 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: Clayey Foothill (R049BY208CO)
Other vegetative classification: CLAYEY FOOTHILL (048AY208CO)

30—Denver-Kutch clay loams, 9 to 15 percent slopes

Map Unit Setting

Elevation: 5,200 to 6,500 feet
Mean annual precipitation: 13 to 17 inches
Frost-free period: 126 to 142 days

Map Unit Composition

Denver and similar soils: 45 percent
Kutch and similar soils: 40 percent

Description of Denver

Setting

Landform: Hills
Landform position (two-dimensional): Footslope, backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

H1 - 0 to 15 inches: clay loam
H2 - 15 to 74 inches: clay, silty clay
H2 - 15 to 74 inches: clay, clay loam, silty clay
H3 - 74 to 152 inches:
H3 - 74 to 152 inches:
H3 - 74 to 152 inches:

Properties and qualities

Slope: 9 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very high (about 25.1 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: Clayey Foothill (R049BY208CO)
Other vegetative classification: CLAYEY FOOTHILL (048AY208CO)

Description of Kutch

Setting

Landform: Hills
Landform position (two-dimensional): Footslope, backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Colluvium and/or residuum

Typical profile

H1 - 0 to 8 inches: clay loam
H2 - 8 to 48 inches: clay, clay loam
H2 - 8 to 48 inches: clay loam
H3 - 48 to 66 inches: weathered bedrock
H4 - 66 to 76 inches:

Properties and qualities

Slope: 9 to 15 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Gypsum, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: Moderate (about 7.0 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: Clayey Foothill (R049BY208CO)
Other vegetative classification: CLAYEY FOOTHILL (048AY208CO)

45—Flatirons very cobbly sandy loam, 0 to 3 percent slopes

Map Unit Setting

Elevation: 6,000 to 6,600 feet
Mean annual precipitation: 15 to 17 inches
Frost-free period: 126 to 142 days

Map Unit Composition

Flatirons and similar soils: 100 percent

Description of Flatirons

Setting

Landform: Terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

H1 - 0 to 33 inches: very cobbly sandy loam
H2 - 33 to 119 inches: very gravelly clay loam, very gravelly sandy clay, very gravelly clay
H2 - 33 to 119 inches: very gravelly sandy clay loam
H2 - 33 to 119 inches:
H3 - 119 to 152 inches:

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.9 inches)

Interpretive groups
Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: Cobbly Foothills (R048AY346CO)

60—Haverson loam, 0 to 3 percent slopes

Map Unit Setting
Elevation: 5,200 to 6,500 feet
Mean annual precipitation: 13 to 17 inches
Frost-free period: 126 to 142 days

Map Unit Composition
Haverson and similar soils: 100 percent

Description of Haverson

Setting
Landform: Stream terraces, flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile
H1 - 0 to 15 inches: loam
H2 - 15 to 117 inches: stratified gravelly sandy loam to clay loam
H3 - 117 to 152 inches: very gravelly loamy sand

Properties and qualities
Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Gypsum, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (2.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 2.0

Available water storage in profile: Moderate (about 7.1 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: B
Ecological site: Overflow (R049XY036CO)

61—Haverson loam, 3 to 9 percent slopes

Map Unit Setting

Elevation: 5,200 to 6,500 feet
Mean annual precipitation: 13 to 17 inches
Frost-free period: 126 to 142 days

Map Unit Composition

Haverson and similar soils: 100 percent

Description of Haverson

Setting

Landform: Flood plains, stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

H1 - 0 to 15 inches: loam
H2 - 15 to 117 inches: stratified gravelly sandy loam to clay loam
H3 - 117 to 152 inches: very gravelly loamy sand

Properties and qualities

Slope: 3 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Gypsum, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (2.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 2.0
Available water storage in profile: Moderate (about 7.1 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Overflow (R049XY036CO)

63—Heldt clay, 9 to 15 percent slopes

Map Unit Setting

Elevation: 5,200 to 6,500 feet
Mean annual precipitation: 13 to 17 inches
Frost-free period: 126 to 142 days

Map Unit Composition

Heldt and similar soils: 100 percent

Description of Heldt

Setting

Landform: Hills, alluvial fans
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey, calcareous alluvium

Typical profile

H1 - 0 to 15 inches: clay
H2 - 15 to 107 inches: clay
H3 - 107 to 152 inches: clay, clay loam
H3 - 107 to 152 inches:

Properties and qualities

Slope: 9 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Gypsum, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 10.0
Available water storage in profile: Very high (about 12.7 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: Clayey Foothill (R049BY208CO)
Other vegetative classification: CLAYEY FOOTHILL (048AY208CO)

69—Laporte variant complex, 15 to 60 percent slopes

Map Unit Setting

Elevation: 5,600 to 6,500 feet
Mean annual precipitation: 15 to 17 inches
Frost-free period: 126 to 142 days

Map Unit Composition

Laporte variant and similar soils: 100 percent

Description of Laporte Variant

Setting

Landform: Alluvial fans, hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from limestone and shale

Typical profile

H1 - 0 to 25 inches: channery loam
H2 - 25 to 46 inches: channery loam
H3 - 46 to 56 inches: weathered bedrock

Properties and qualities

Slope: 15 to 60 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 60 percent
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very low (about 2.2 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: Shallow Foothill (R048AY204CO)

74—Lebsack clay loam, saline, 0 to 2 percent slopes

Map Unit Setting

Elevation: 5,200 to 6,500 feet
Mean annual precipitation: 13 to 17 inches
Frost-free period: 126 to 142 days

Map Unit Composition

Lebsack, saline and similar soils: 100 percent

Description of Lebsack, Saline

Setting

Landform: Terraces, flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous, saline, clayey alluvium

Typical profile

H1 - 0 to 13 inches: clay loam
H2 - 13 to 58 inches: silty clay, clay
H2 - 13 to 58 inches: clay, clay loam
H3 - 58 to 152 inches:
H3 - 58 to 152 inches:

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 60 to 72 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Gypsum, maximum in profile: 5 percent
Salinity, maximum in profile: Very slightly saline to moderately saline (4.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 5.0
Available water storage in profile: Very high (about 16.3 inches)

Interpretive groups

Farmland classification: Prime farmland if irrigated and reclaimed of excess salts and sodium
Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Ecological site: Salt Meadow (R048AY265CO)

80—Leyden-Primen-Standley cobbly clay loams, 15 to 50 percent slopes

Map Unit Setting

Elevation: 5,200 to 6,500 feet
Mean annual precipitation: 13 to 17 inches
Frost-free period: 126 to 142 days

Map Unit Composition

Leyden and similar soils: 35 percent
Primen and similar soils: 30 percent
Standley and similar soils: 20 percent

Description of Leyden

Setting

Landform: Hills
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum

Typical profile

H1 - 0 to 8 inches: cobbly clay loam
H2 - 8 to 89 inches: gravelly clay loam, gravelly clay
H2 - 8 to 89 inches: weathered bedrock
H3 - 89 to 99 inches:

Properties and qualities

Slope: 15 to 50 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.8 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: Clayey Foothill (R049BY208CO)
Other vegetative classification: CLAYEY FOOTHILL (048AY208CO)

Description of Primen

Setting

Landform: Hills
Landform position (two-dimensional): Backslope, shoulder, summit

Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum

Typical profile

H1 - 0 to 23 inches: cobbly clay loam
H2 - 23 to 36 inches: cobbly clay loam, cobbly clay
H2 - 23 to 36 inches: gravelly clay loam, gravelly clay
H3 - 36 to 46 inches: weathered bedrock
H3 - 36 to 46 inches:
H4 - 46 to 56 inches:

Properties and qualities

Slope: 15 to 50 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 3.7 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: Clayey Foothill (R049BY208CO)
Other vegetative classification: CLAYEY FOOTHILL (048AY208CO)

Description of Standley

Setting

Landform: Hills
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and/or colluvium

Typical profile

H1 - 0 to 23 inches: cobbly clay loam
H2 - 23 to 56 inches: gravelly clay, gravelly clay loam
H2 - 23 to 56 inches: gravelly clay loam, gravelly loam
H3 - 56 to 152 inches:
H3 - 56 to 152 inches:

Properties and qualities

Slope: 15 to 50 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: Very high (about 17.3 inches)

Interpretive groups
Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: Clayey Foothill (R049BY208CO)
Other vegetative classification: CLAYEY FOOTHILL (048AY208CO)

98—Midway clay loam, 9 to 30 percent slopes

Map Unit Setting
Elevation: 5,200 to 6,500 feet
Mean annual precipitation: 13 to 17 inches
Frost-free period: 126 to 142 days

Map Unit Composition
Midway and similar soils: 100 percent

Description of Midway

Setting
Landform: Hills
Landform position (two-dimensional): Footslope, backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey, calcareous residuum

Typical profile
H1 - 0 to 8 inches: clay loam
H2 - 8 to 36 inches: clay, clay loam
H2 - 8 to 36 inches: weathered bedrock
H3 - 36 to 46 inches:

Properties and qualities
Slope: 9 to 30 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Calcium carbonate, maximum in profile: 10 percent
Gypsum, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 2.0
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups
Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: Shaly Foothill (R049BY212CO)

111—Pits, gravel

Map Unit Setting
Mean annual air temperature: 41 to 47 degrees F

Map Unit Composition
Pits: 90 percent

Description of Pits

Typical profile
H1 - 0 to 15 inches: extremely gravelly sand
H2 - 15 to 152 inches: extremely gravelly sand, extremely gravelly coarse sand, very gravelly coarse sand
H2 - 15 to 152 inches:
H2 - 15 to 152 inches:

Interpretive groups
Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydrologic Soil Group: A

138—Rock outcrop, igneous and metamorphic

Map Unit Composition
Rock outcrop, igneous: 100 percent

Description of Rock Outcrop, Igneous

Setting
Landform: Mountains
Landform position (two-dimensional): Backslope, shoulder, summit
Down-slope shape: Convex
Across-slope shape: Convex

Parent material: Igneous and metamorphic rock

Typical profile

H1 - 0 to 152 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 99 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Capacity of the most limiting layer to transmit water (Ksat): Very low to low (0.00 to 0.01 in/hr)
Available water storage in profile: Very low (about 0.0 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydrologic Soil Group: D

139—Rock outcrop, sedimentary

Map Unit Composition

Rock outcrop, sedimentary: 100 percent

Description of Rock Outcrop, Sedimentary

Setting

Landform: Hogbacks, terraces, mountains
Landform position (two-dimensional): Backslope, shoulder
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Sandstone and shale and/or conglomerate and/or mudstone

Typical profile

H1 - 0 to 152 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 99 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Available water storage in profile: Very low (about 0.0 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydrologic Soil Group: D

148—Standley-Leyden-Primen very stony clay loams, 15 to 30 percent slopes

Map Unit Setting

Elevation: 5,600 to 6,500 feet
Mean annual precipitation: 15 to 17 inches
Frost-free period: 126 to 142 days

Map Unit Composition

Standley and similar soils: 35 percent
Leyden and similar soils: 30 percent
Primen and similar soils: 20 percent

Description of Standley

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

H1 - 0 to 23 inches: very stony clay loam
H2 - 23 to 56 inches: gravelly clay, gravelly clay loam
H2 - 23 to 56 inches: gravelly clay loam, gravelly loam
H3 - 56 to 152 inches:
H3 - 56 to 152 inches:

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: Very high (about 14.1 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: Rocky Foothill (R048AY206CO)

Description of Leyden

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum

Typical profile

H1 - 0 to 20 inches: very stony clay loam
H2 - 20 to 89 inches: gravelly clay loam, gravelly clay
H2 - 20 to 89 inches: weathered bedrock
H3 - 89 to 99 inches:

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.9 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: Rocky Foothill (R048AY206CO)

Description of Primen

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum

Typical profile

H1 - 0 to 23 inches: very stony clay loam
H2 - 23 to 36 inches: cobbly clay loam, cobbly clay
H2 - 23 to 36 inches: gravelly clay loam, gravelly clay
H3 - 36 to 46 inches: weathered bedrock
H3 - 36 to 46 inches:
H4 - 46 to 56 inches:

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Natural drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 3.3 inches)

Interpretive groups
Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: Rocky Foothill (R048AY206CO)

149—Standley-Nunn gravelly clay loams, 0 to 5 percent slopes

Map Unit Setting
Elevation: 5,200 to 6,500 feet
Mean annual precipitation: 13 to 17 inches
Frost-free period: 126 to 142 days

Map Unit Composition
Standley and similar soils: 45 percent
Nunn and similar soils: 40 percent

Description of Standley

Setting
Landform: Hills, terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile
H1 - 0 to 23 inches: gravelly clay loam
H2 - 23 to 56 inches: gravelly clay, gravelly clay loam
H2 - 23 to 56 inches: gravelly clay loam, gravelly loam
H3 - 56 to 152 inches:
H3 - 56 to 152 inches:

Properties and qualities
Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Available water storage in profile: Very high (about 14.6 inches)

Interpretive groups

Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: Clayey Foothill (R049BY208CO)
Other vegetative classification: CLAYEY FOOTHILL (048AY208CO)

Description of Nunn

Setting

Landform: Terraces, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

H1 - 0 to 13 inches: gravelly clay loam
H2 - 13 to 69 inches: clay, clay loam
H2 - 13 to 69 inches: clay loam, loam
H3 - 69 to 152 inches:
H3 - 69 to 152 inches:

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Very high (about 19.2 inches)

Interpretive groups

Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: C
Ecological site: Clayey Foothill (R049BY208CO)
Other vegetative classification: CLAYEY FOOTHILL (048AY208CO)

164—Ulm-Urban land complex, 9 to 18 percent slopes

Map Unit Setting

Elevation: 5,200 to 6,500 feet
Mean annual precipitation: 13 to 17 inches
Frost-free period: 126 to 142 days

Map Unit Composition

Ulm and similar soils: 65 percent
Urban land: 20 percent

Description of Ulm

Setting

Landform: Hills
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey, calcareous mudstone and/or clayey alluvium derived from calcareous shale

Typical profile

H1 - 0 to 15 inches: clay loam
H2 - 15 to 53 inches: clay
H3 - 53 to 127 inches: clay, clay loam
H3 - 53 to 127 inches: clay loam
H4 - 127 to 152 inches:

Properties and qualities

Slope: 9 to 18 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very high (about 15.7 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: Clayey Foothill (R049BY208CO)
Other vegetative classification: CLAYEY FOOTHILL (048AY208CO)

Description of Urban Land

Typical profile
H1 - 0 to 15 inches: variable

Interpretive groups
Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s

168—Valmont clay loam, 0 to 3 percent slopes

Map Unit Setting
Elevation: 5,200 to 6,500 feet
Mean annual precipitation: 13 to 17 inches
Frost-free period: 126 to 142 days

Map Unit Composition
Valmont and similar soils: 100 percent

Description of Valmont

Setting
Landform: Terraces, alluvial fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous, clayey alluvium

Typical profile
H1 - 0 to 10 inches: clay loam
H2 - 10 to 79 inches: clay loam, clay
H2 - 10 to 79 inches: very gravelly loam, very gravelly sandy loam
H3 - 79 to 152 inches:
H3 - 79 to 152 inches:

Properties and qualities
Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very high (about 13.5 inches)

Interpretive groups
Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 2e

Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: C
Ecological site: Clayey Foothill (R049BY208CO)
Other vegetative classification: CLAYEY FOOTHILL (048AY208CO)

169—Veldkamp-Nederland very cobbly sandy loams, 0 to 3 percent slopes

Map Unit Setting

Elevation: 5,600 to 6,500 feet
Mean annual precipitation: 15 to 17 inches
Frost-free period: 126 to 142 days

Map Unit Composition

Veldkamp and similar soils: 65 percent
Nederland and similar soils: 20 percent

Description of Veldkamp

Setting

Landform: Terraces, fan terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

H1 - 0 to 8 inches: very cobbly sandy loam
H2 - 8 to 53 inches: very cobbly clay loam, very cobbly clay, very cobbly sandy clay
H2 - 8 to 53 inches: very cobbly sandy clay loam, very cobbly sandy loam
H2 - 8 to 53 inches:
H3 - 53 to 152 inches:
H3 - 53 to 152 inches:

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 9.1 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Ecological site: Cobbly Foothills (R048AY346CO)

Description of Nederland

Setting

Landform: Fan terraces, terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

H1 - 0 to 25 inches: very cobbly sandy loam
H2 - 25 to 152 inches: very cobbly sandy clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.6 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: Cobbly Foothills (R048AY346CO)

174—Willowman-Leyden cobbly loams, 9 to 30 percent slopes

Map Unit Setting

Elevation: 5,600 to 6,500 feet
Mean annual precipitation: 15 to 17 inches
Frost-free period: 126 to 142 days

Map Unit Composition

Willowman and similar soils: 60 percent
Leyden and similar soils: 25 percent

Description of Willowman

Setting

Landform: Hills, terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

H1 - 0 to 15 inches: cobbly loam
H2 - 15 to 25 inches: very gravelly sandy clay loam, very gravelly loam, very gravelly clay loam
H2 - 15 to 25 inches: very gravelly sandy loam, very gravelly loam
H2 - 15 to 25 inches:
H3 - 25 to 152 inches:
H3 - 25 to 152 inches:

Properties and qualities

Slope: 9 to 30 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 30 percent
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.8 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Cobbly Foothills (R048AY346CO)

Description of Leyden

Setting

Landform: Terraces, hills
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum

Typical profile

H1 - 0 to 8 inches: cobbly loam
H2 - 8 to 89 inches: gravelly clay loam, gravelly clay
H2 - 8 to 89 inches: weathered bedrock
H3 - 89 to 99 inches:

Properties and qualities

Slope: 9 to 30 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.7 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: Cobbly Foothills (R048AY346CO)

177—Dam

Map Unit Composition

Dam: 100 percent

178—Water

Map Unit Composition

Water: 100 percent

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APPENDIX 2 – BRIERLEY REPORT

Ralston Quarry, November 2014

BRIERLEY ASSOCIATES
Creating Space Underground

July 22, 2014
File No.: 514104-000

Asphalt Paving Co.
14802 W 44th Ave
Golden, CO 80403

Attention: M.L. Richardson
Director of Strategy and Sustainable Development

Subject: Additional Slope Evaluation
Ralston Reservoir
Golden, Colorado

Ladies and Gentlemen:

Brierley Associates (Brierley) has conducted additional geotechnical evaluation for the Asphalt Paving Co. (APC's) rock quarry located at 6569 Highway 93, just west of the intersection with West 64th Parkway, in Golden, Colorado. Brierley has previously produced a Geotechnical Evaluation and Initial Opinion Report – Phase 1, dated August 2011, and a Geotechnical Evaluation Report - Phase II, dated November 2013, for the same site.

Based on discussions with APC and Greg Lewicki and Associates, PLLC on July 8, 2014, Brierley understands that the Division of Reclamation, Mining and Safety required minimum factor of safety (FOS) is 1.3 for mine slopes. Brierley has evaluated the allowable slope configuration based on the minimum FOS to allow for flexibility for the quarry operator during mining. This letter presents the results of this analysis.

1.1 Existing Conditions

General observations during previous mapping indicate that existing slopes were mined nearly vertical with a series of benches and haul roads traversing the site. The basalt across the site does present a few local failures along dip-slope joint orientations, however no large-scale slope failures were observed at the mine site.

1.2 Evaluation of Slope Stability

Material properties for the rock mass and its joints for this evaluation were consistent with those used in the previous evaluation; refer to the November 2013 report for values and further discussion. Brierley utilized these material properties in the computer program Swedge by Rocscience, Inc. to model the stability of potential rock wedges formed by discontinuities. Brierley analyzed three-dimensional wedge failures that could occur based on various slope configurations to achieve a minimum allowable FOS of 1.3 for wedge stability.

1.3 Analyses Geometrical Configurations

Two major geometries were analyzed: a bench-scale and the overall slope-scale. The bench-scale geometries were used to analyze local failures and consisted of a single bench 40 ft tall or a double bench up to 80 ft tall. These benches were modeled as a vertical rock face. The overall mine slope-scale geometries were determined based on the anticipated overall height to the floor of the reservoir, either 200 or 400 ft depending on existing elevations and aspect.

Six slope configurations were analyzed in total: three strikes corresponding to South, West, and East dip directions with each strike being analyzed for the single bench and overall slope cases.

1.4 Results

The results of the analyses are presented in the table below.

Analysis	Slope Dip Direction (deg)	Slope Dip Angle (deg)	Analysis Height (ft)	Lowest Calculated Wedge FOS
West Dipping Overall	251	90	200	1.37
West Dipping Bench	251	90	80	2.89
South Dipping Overall	180	79	400	1.35
South Dipping Bench	180	90	80	2.33
East Dipping Overall	120	73	400	1.35
East Dipping Bench[1]	120	90	80	1.32

[1] The width of this wedge failure was restricted to mimic practical distance between repeating near-vertical joint sets observed in the field.

The outputs from Swedge are presented in Appendix A. Wedges for the General analyses were limited to a persistence of 500 ft along any given joint. Limiting the persistence or "scaling" of the wedge in this manner results in more realistic wedges being calculated by the program as any particular joint is not likely to be continuous and connected throughout the rock mass.

Initial results for a vertical bench with an east dipping orientation were below the allowable FOS. Since a repeating, nearly-vertical joint set was observed during mapping, Brierley elected to limit the allowable width of the wedge failure to a practical joint spacing of approximately 90 ft, which is a more conservative distance than generally observed in the field. Utilizing this reasonable restriction resulted in a minimum FOS of 1.3.

1.5 Discussion

The results from Swedge indicate the steepest allowable bench and overall slope configurations for the long term stability of the slope. The analyses for 80-ft vertical benches on all aspects demonstrate an acceptable FOS; consequently, the 40-ft vertical benches result in the same or higher FOS and therefore are not presented in the table.

It should be noted that the East dipping slopes will be controlled by the shale/basalt contact. As such, it is unlikely that the final slopes will be as steep as the overall slope analyzed for the full 400-ft depth and so the FOS will be higher than projected.

As previously noted, a few local failures along dip-slope joint orientations are present within the existing quarry benches, generally where east-west trending vertical joints act as the sidewall releases for the dip-slope surfaces. However, the majority of exposed benches with similar aspect and geometries are stable. Occasional failures of similar scale may occur during future mining operations due to slight variations in the site geology which is not representative of the overall site. Future mining operations that adhere to the maximum slope dip angles indicated above, or shallower, should be considered stable.

Sincerely,
BRIERLEY ASSOCIATES

Rebecca Brock, PG, PE
Associate

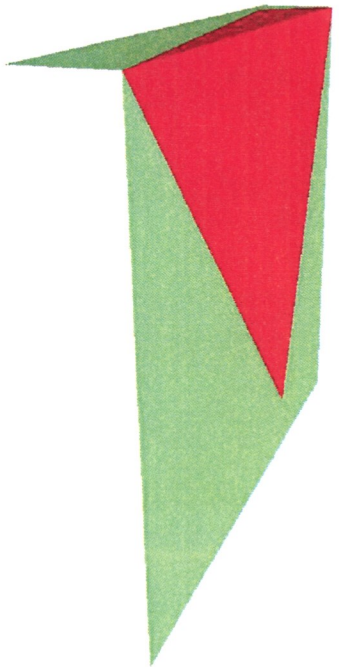
Bill Zietlow, PE
Associate

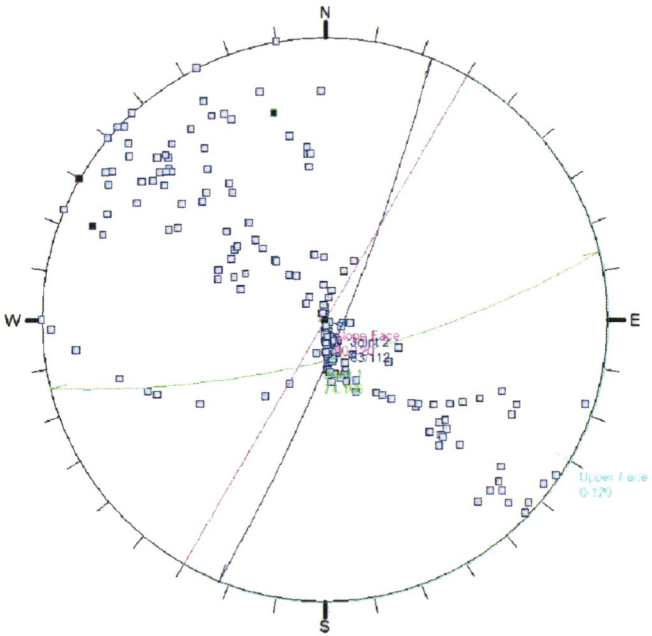
COLORADO REGISTERED
WILLIAM K. ZIETLOW
37230
PROFESSIONAL ENGINEER

BRIERLEY ASSOCIATES
Creating Space Underground

BRIERLEY ASSOCIATES
Creating Space Underground

APPENDIX A





Combination Analysis
Number of Combinations: 19306
Number of Valid Wedges=10383
Number of Failed Wedges=0
Number of Stable Wedges=10383

Min FS Wedge Data
Factor of Safety: 1.3195
Volume: 11738.272 ft3
Weight: 1038.84 tons
Area (joint1): 565.86 ft2
Area (joint2): 2832.55 ft2
Area (slope): 3161.92 ft2
Area (upper face): 501.17 ft2
Normal Force (joint1): 286.34 tons
Normal Force (joint2): 0.00 tons
Normal Stress (joint1): 0.51 t/ft2
Normal Stress (joint2): 0.00 t/ft2
Shear Strength (joint1): 2.33 t/ft2
Shear Strength (joint2): 0.00 t/ft2
Driving Force: 998.59 tons
Resisting Force: 1317.67 tons
Mode: Sliding on joint1

Line of Intersection
Plunge: 73.71 deg
Trend: 177.16 deg
Length: 73.20 ft

Trace Length
Joint1: 75.64 ft
Joint2: 93.70 ft

Persistence
Joint1: 75.64 ft
Joint2: 93.70 ft

Combination Info
Dip (joint1): 74.00 deg
Dip Direction (joint1): 166.00 deg
Dip (joint2): 83.00 deg
Dip Direction (joint2): 112.00 deg

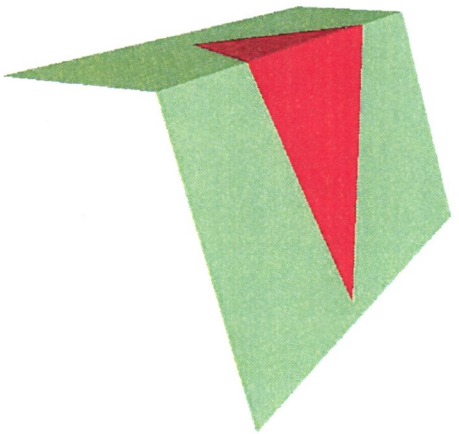
BRIERLEY ASSOCIATES
Creating Space Underground
990 S. BROADWAY, SUITE 222, DENVER, CO 80209
303.703.1405 FAX 303.534.1777

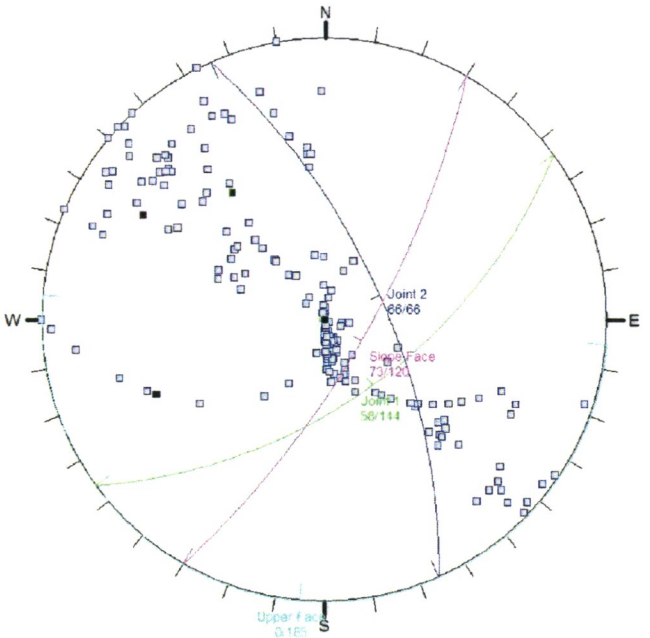
CLIENT:
CONSOLIDATED MUTUAL WATER CO.

PROJECT NO. L10035-001
RALSTON QUARRY
GOLDEN, CO

SWEDGE OUTPUT
EAST DIPPING SLOPE
80 FT BENCH SECTION

E-1





Combination Analysis
Number of Combinations: 19306
Number of Valid Wedges=9042
Number of Failed Wedges=0
Number of Stable Wedges=9042

Min FS Wedge Data
Factor of Safety: 1.3464
Volume: 3975172.147 ft3
Weight: 351802.74 tons
Area (joint1): 79098.77 ft2
Area (joint2): 36916.09 ft2
Area (slope): 84808.75 ft2
Area (upper face): 32135.41 ft2
Normal Force (joint1): 154442.86 tons
Normal Force (joint2): 84925.86 tons
Normal Stress (joint1): 1.95 t/ft2
Normal Stress (joint2): 2.30 t/ft2
Shear Strength (joint1): 3.27 t/ft2
Shear Strength (joint2): 3.49 t/ft2
Driving Force: 287785.87 tons
Resisting Force: 387477.59 tons
Mode: Sliding on joints 1&2

Line of Intersection
Plunge: 54.89 deg
Trend: 116.71 deg
Length: 453.65 ft

Trace Length
Joint1: 500.00 ft
Joint2: 406.72 ft

Persistence
Joint1: 500.00 ft
Joint2: 453.65 ft

Combination Info
Dip (joint1): 58.00 deg
Dip Direction (joint1): 144.00 deg
Dip (joint2): 66.00 deg
Dip Direction (joint2): 66.00 deg

BRIERLEY ASSOCIATES
Creating Space Underground
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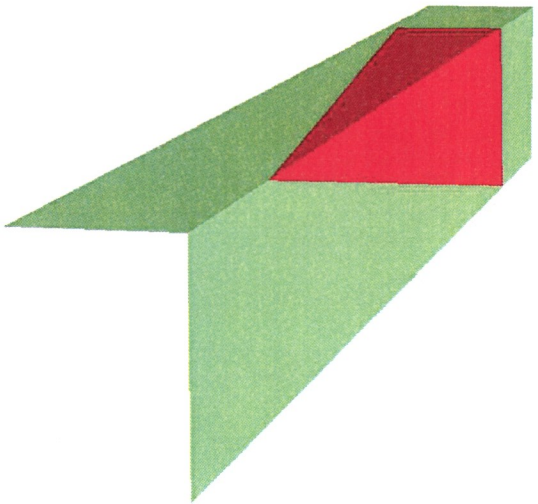
303.703.1405 FAX 303.534.1777

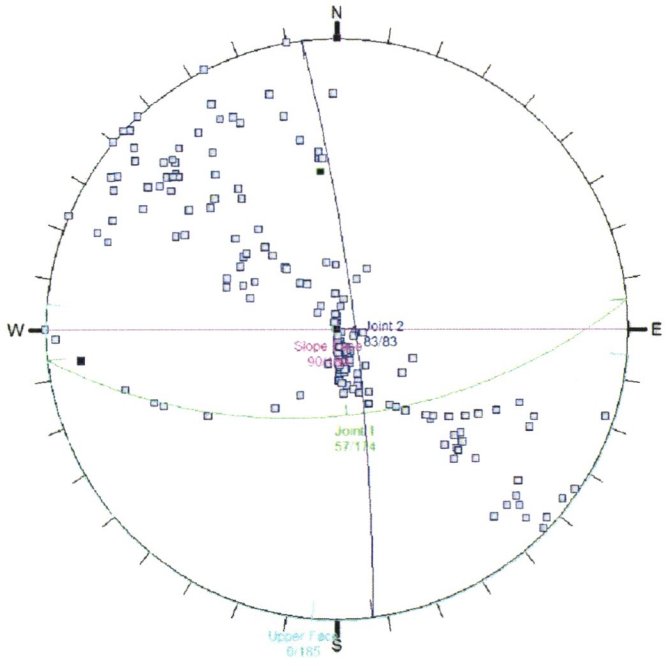
CLIENT:
CONSOLIDATED MUTUAL WATER CO.

PROJECT NO. L10035-001
RALSTON QUARRY
GOLDEN, CO

SWEDGE OUTPUT
EAST DIPPING SLOPE
AVERAGE SLOPE OVER 400 FT VERTICAL

E-2





Combination Analysis
Number of Combinations: 19306
Number of Valid Wedges=6489
Number of Failed Wedges=0
Number of Stable Wedges=6489

Min FS Wedge Data
Factor of Safety: 2.3277
Volume: 321658.535 ft3
Weight: 28466.78 tons
Area (joint1): 22751.47 ft2
Area (joint2): 2024.58 ft2
Area (slope): 19221.35 ft2
Area (upper face): 12144.60 ft2
Normal Force (joint1): 15504.12 tons
Normal Force (joint2): 0.00 tons
Normal Stress (joint1): 0.68 t/ft2
Normal Stress (joint2): 0.00 t/ft2
Shear Strength (joint1): 2.44 t/ft2
Shear Strength (joint2): 0.00 t/ft2
Driving Force: 23874.25 tons
Resisting Force: 55571.43 tons
Mode: Sliding on joint1

Line of Intersection
Plunge: 56.45 deg
Trend: 162.33 deg
Length: 95.34 ft

Trace Length
Joint1: 500.00 ft
Joint2: 80.06 ft

Persistence
Joint1: 500.00 ft
Joint2: 95.34 ft

Combination Info
Dip (joint1): 57.00 deg
Dip Direction (joint1): 174.00 deg
Dip (joint2): 83.00 deg
Dip Direction (joint2): 83.00 deg

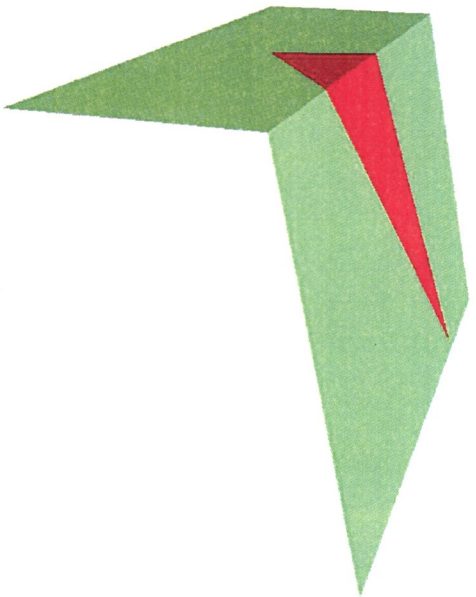
BRIERLEY ASSOCIATES
Creating Space Underground
990 S. BROADWAY, SUITE 222, DENVER, CO 80209
303.703.1405 FAX 303.534.1777

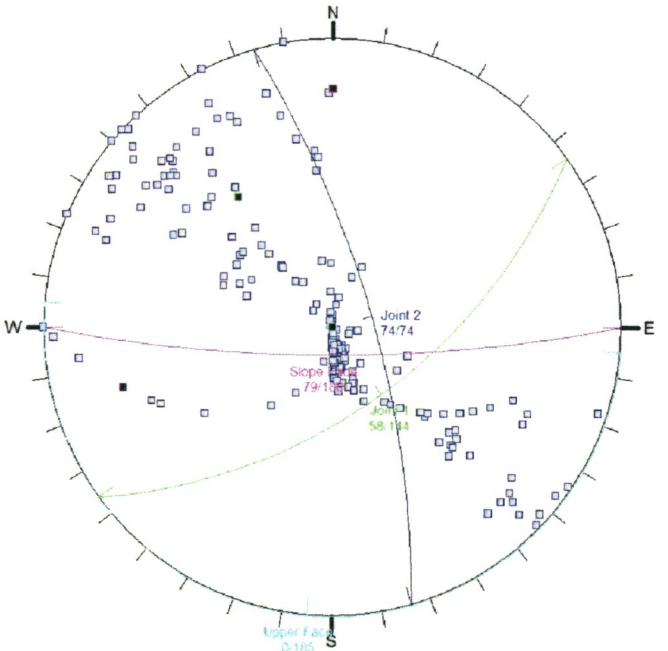
CLIENT:
CONSOLIDATED MUTUAL WATER CO.

PROJECT NO. L10035-001
RALSTON QUARRY
GOLDEN, CO

SWEDGE OUTPUT
SOUTH DIPPING SLOPE
80 FT BENCH SECTION

E-3





Combination Analysis
Number of Combinations: 19306
Number of Valid Wedges=6172
Number of Failed Wedges=0
Number of Stable Wedges=6172

Min FS Wedge Data
Factor of Safety: 1.3448
Volume: 1130772.370 ft3
Weight: 100073.36 tons
Area (joint1): 39846.74 ft2
Area (joint2): 21495.56 ft2
Area (slope): 33652.00 ft2
Area (upper face): 8769.47 ft2
Normal Force (joint1): 53030.80 tons
Normal Force (joint2): 0.00 tons
Normal Stress (joint1): 1.33 t/ft2
Normal Stress (joint2): 0.00 t/ft2
Shear Strength (joint1): 2.86 t/ft2
Shear Strength (joint2): 0.00 t/ft2
Driving Force: 84867.02 tons
Resisting Force: 114132.08 tons
Mode: Sliding on joint1

Line of Intersection
Plunge: 57.80 deg
Trend: 136.91 deg
Length: 457.13 ft

Trace Length
Joint1: 500.00 ft
Joint2: 417.19 ft

Persistence
Joint1: 500.00 ft
Joint2: 457.13 ft

Combination Info
Dip (joint1): 58.00 deg
Dip Direction (joint1): 144.00 deg
Dip (joint2): 74.00 deg
Dip Direction (joint2): 74.00 deg

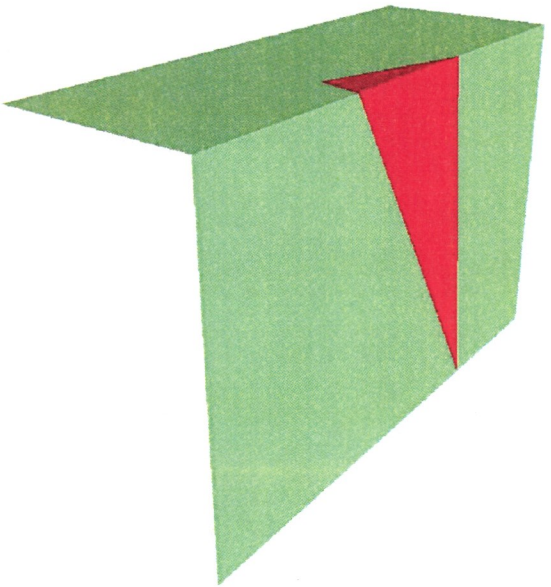
BRIERLEY ASSOCIATES
Creating Space Underground
990 S. BROADWAY, SUITE 222, DENVER, CO 80209
303.703.1405 FAX 303.534.1777

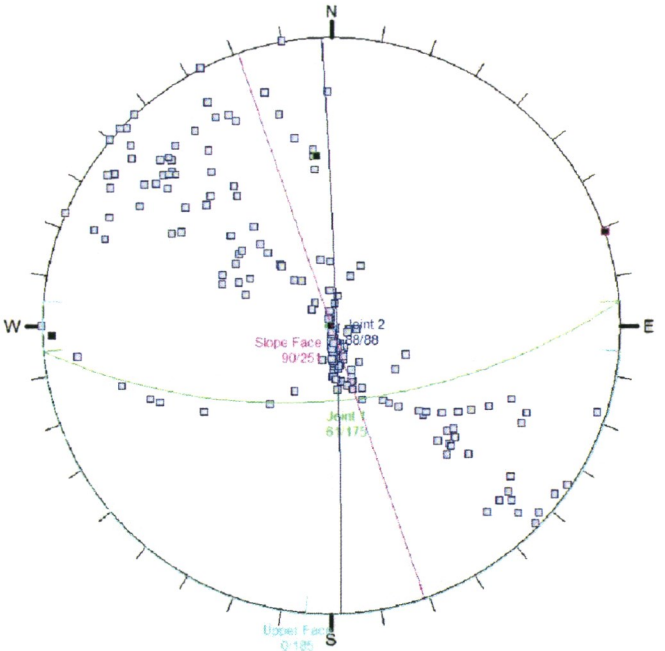
CLIENT:
CONSOLIDATED MUTUAL WATER CO.

PROJECT NO. L10035-001
RALSTON QUARRY
GOLDEN, CO

SWEDGE OUTPUT
SOUTH DIPPING SLOPE
AVERAGE SLOPE OVER 400 FT VERTICAL

E-4





Combination Analysis
Number of Combinations: 19306
Number of Valid Wedges=7164
Number of Failed Wedges=0
Number of Stable Wedges=7164

Min FS Wedge Data
Factor of Safety: 2.8869
Volume: 4949.039 ft3
Weight: 437.99 tons
Area (joint1): 484.00 ft2
Area (joint2): 1405.72 ft2
Area (slope): 1445.88 ft2
Area (upper face): 185.59 ft2
Normal Force (joint1): 212.34 tons
Normal Force (joint2): 0.00 tons
Normal Stress (joint1): 0.44 t/ft2
Normal Stress (joint2): 0.00 t/ft2
Shear Strength (joint1): 2.28 t/ft2
Shear Strength (joint2): 0.00 t/ft2
Driving Force: 383.07 tons
Resisting Force: 1105.90 tons
Mode: Sliding on joint1

Line of Intersection
Plunge: 61.00 deg
Trend: 174.39 deg
Length: 91.47 ft

Trace Length
Joint1: 92.13 ft
Joint2: 80.57 ft

Persistence
Joint1: 92.13 ft
Joint2: 91.47 ft

Combination Info
Dip (joint1): 61.00 deg
Dip Direction (joint1): 175.00 deg
Dip (joint2): 88.00 deg
Dip Direction (joint2): 88.00 deg

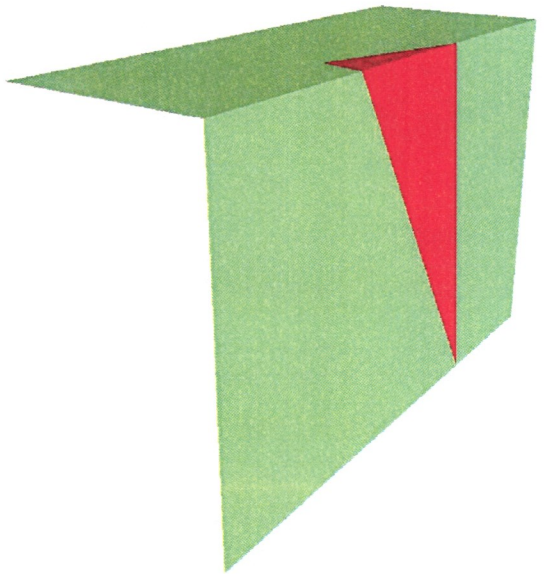
BRIERLEY ASSOCIATES
Creating Space Underground
990 S. BROADWAY, SUITE 222, DENVER, CO 80209
303.703.1405 FAX 303.534.1777

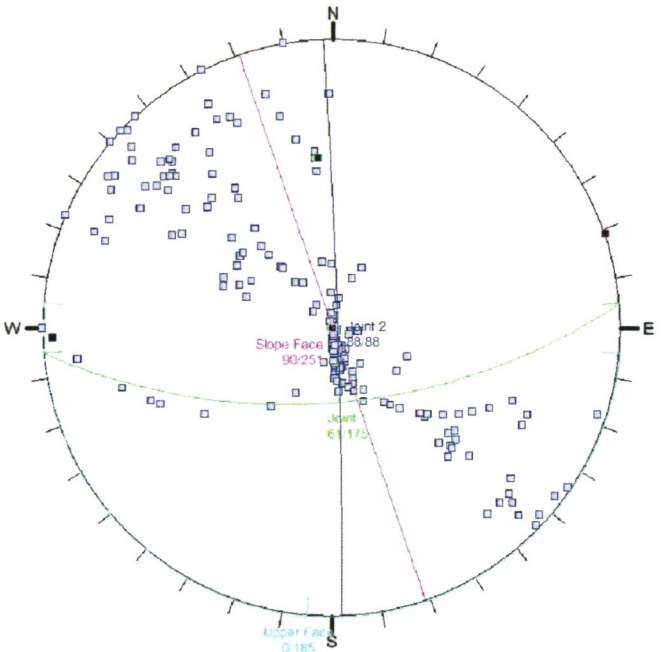
CLIENT:
CONSOLIDATED MUTUAL WATER CO.

PROJECT NO. L10035-001
RALSTON QUARRY
GOLDEN, CO

SWEDGE OUTPUT
WEST DIPPING SLOPE
80 FT BENCH SECTION

E-5





Combination Analysis
Number of Combinations: 19306
Number of Valid Wedges=7164
Number of Failed Wedges=0
Number of Stable Wedges=7164

Min FS Wedge Data
Factor of Safety: 1.3707
Volume: 77328.732 ft3
Weight: 6843.59 tons
Area (joint1): 3025.00 ft2
Area (joint2): 8785.73 ft2
Area (slope): 9036.78 ft2
Area (upper face): 1159.93 ft2
Normal Force (joint1): 3317.84 tons
Normal Force (joint2): 0.00 tons
Normal Stress (joint1): 1.10 t/ft2
Normal Stress (joint2): 0.00 t/ft2
Shear Strength (joint1): 2.71 t/ft2
Shear Strength (joint2): 0.00 t/ft2
Driving Force: 5985.54 tons
Resisting Force: 8204.63 tons
Mode: Sliding on joint1

Line of Intersection
Plunge: 61.00 deg
Trend: 174.39 deg
Length: 228.67 ft

Trace Length
Joint1: 230.34 ft
Joint2: 201.42 ft

Persistence
Joint1: 230.34 ft
Joint2: 228.67 ft

Combination Info
Dip (joint1): 61.00 deg
Dip Direction (joint1): 175.00 deg
Dip (joint2): 88.00 deg
Dip Direction (joint2): 88.00 deg

BRIERLEY ASSOCIATES
Creating Space Underground
990 S. BROADWAY, SUITE 222, DENVER, CO 80209
303.703.1405 FAX 303.534.1777

CLIENT:
CONSOLIDATED MUTUAL WATER CO.

PROJECT NO. L10035-001
RALSTON QUARRY
GOLDEN, CO

SWEDGE OUTPUT
WEST DIPPING SLOPE
AVERAGE SLOPE OVER 200 FT VERTICAL

E-6

APPENDIX 3 – RECENT BLASTING REPORT

Ralston Quarry, November 2014

Vibra-Tech

VibraTechinc.com

4818 E. Ben White Blvd.
Suite 202
Austin, TX 78741

Phone 512.442.6464
Fax 512.442.6552

January 14, 2014

Mr. Mark Martin
Asphalt Paving Company
14802 West 44th Avenue
Golden, CO 80403

Dear Mr. Martin:

Attached you will find our report covering the registration and analysis of the ground vibration and air-borne effects transmitted from the blasting conducted during the fourth quarter of 2013 (October 1 – December 30) by Asphalt Paving Company, Golden, Colorado. Please place this information in your Blast Data Management Book.

The attached report contains the original seismograph records obtained from the blasting along with a comparison of the recorded vibrations to the latest recommended U.S. Bureau of Mines (USBM) Variable Particle Velocity vs. Frequency Limits Report of Investigations (RI)-8507 (Nov. 1980).

The recorded ground vibrations **satisfy** the Variable Particle Velocity vs. Frequency Limits recommended by the USBM RI-8507 (Nov. 1980).

The recorded air-borne effects **satisfy** the recommended levels set forth in the USBM RI-8485 (Nov. 1980).

If we can be of further assistance in this matter, please advise.

Respectfully submitted,

VIBRA-TECH, INC

Geoffrey Rigsby
Southwest Regional Manager
cc: Mr. Mike Miller
Denver Water Administration Bldg.
1600 W. 12th Ave.
Denver, CO 80204-3412

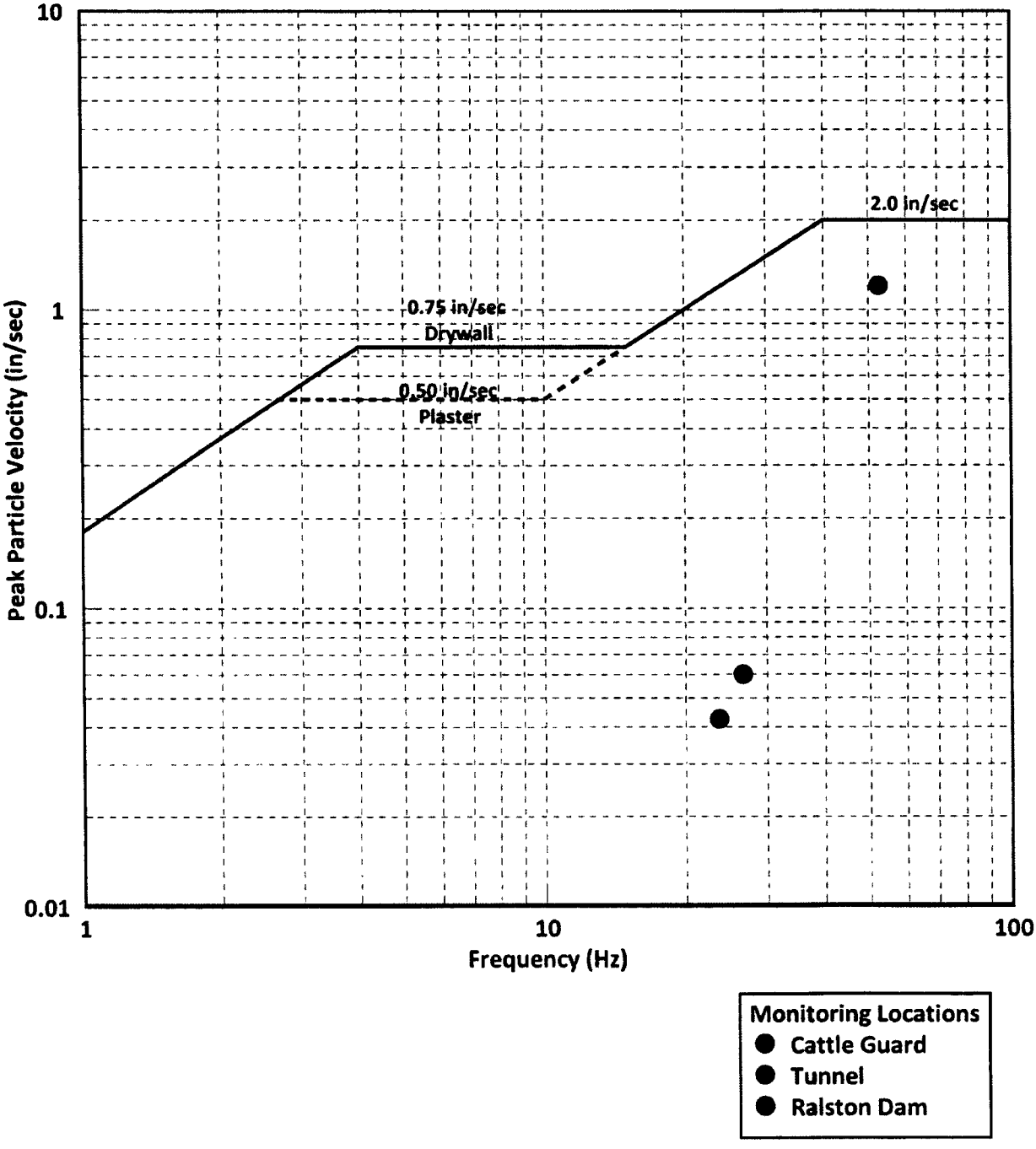
ASPHALT PAVING COMPANY
RALSTON QUARRY
GOLDEN, COLORADO
4TH QUARTER 2013

DATE	SHOT #	TIME	PPV (in/sec)	FREQ (Hz)	AIR (dB)	MAX/LBS DELAY	DIST (Ft)	LOCATION
10/03/13	9-2013	10:57	NT	NT	NT	1,047	>1500	CATTLE GUARD
10/14/13	10-2013	13:17	0.060	26.6	100	1,522	1,000	RALSTON DAM
10/24/13	11-2013	10:46	1.20	52.6	122.9	1,015	700	TUNNEL
11/05/13	12-2013	10:22	NT	NT	NT	503	>1500	CATTLE GUARD
12/17/13	13-2013	9:10	0.0425	23.6	109.5	299	>1500	RALSTON DAM

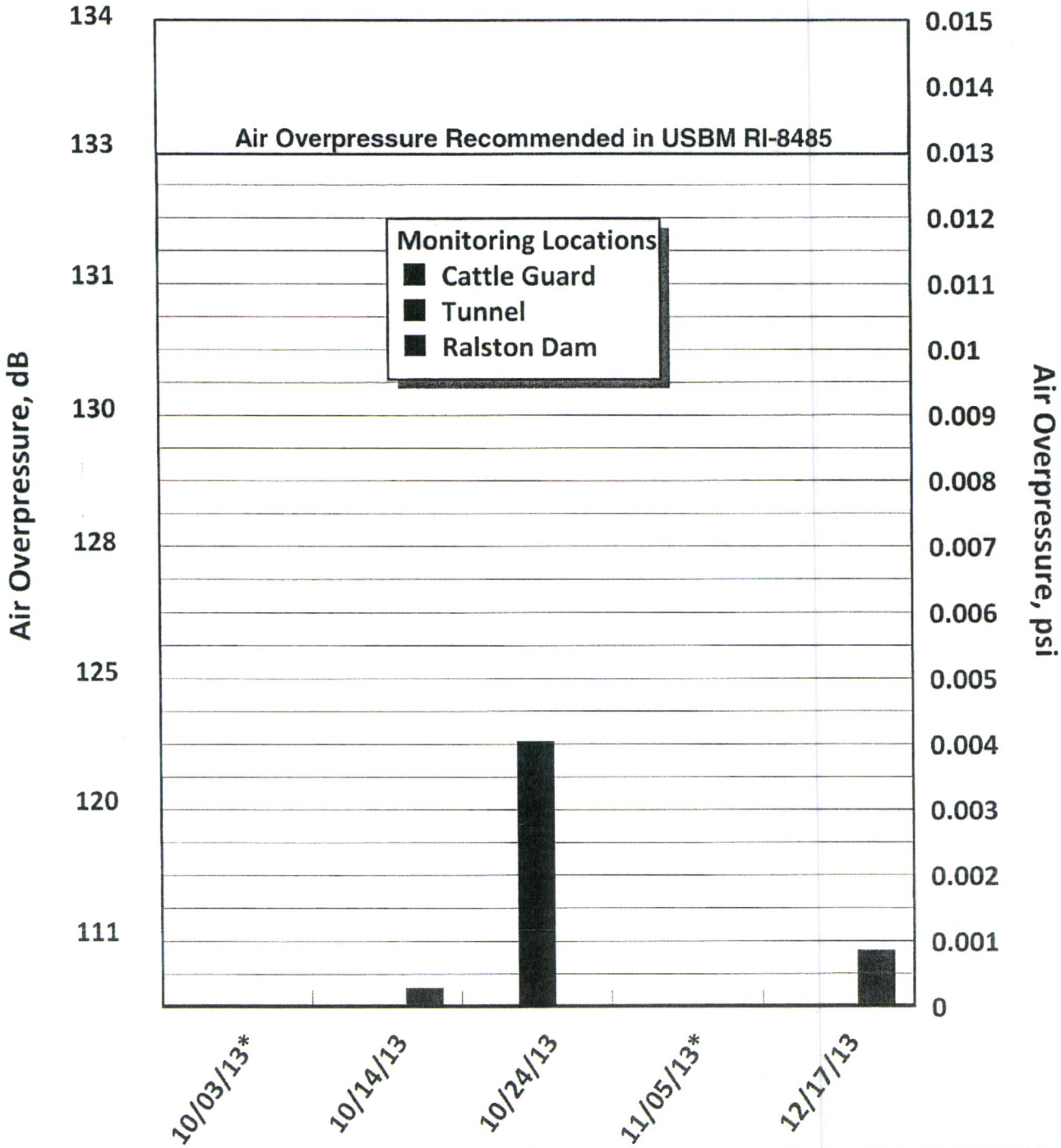
NT = No Trigger, <0.020 ips.

* Information not provided.

ASPHALT PAVING COMPANY
RALSTON QUARRY
GOLDEN, COLORADO
4TH QUARTER 2013



ASPHALT PAVING COMPANY
AIR OVERPRESSURE LEVELS
RALSTON QUARRY
GOLDEN, COLORADO
4TH QUARTER 2013



Note: Air Overpressure Level Recommended in USBM RI-8485 (133 dB)
Air Overpressure Level Required to Crack Window Panes (150 dB)
* No Trigger

APPENDIX 4 – MAPS

Ralston Quarry, November 2014

Division of Reclamation, Mining, and Safety

Fee Receipt for M1974086

Asphalt Paving Company

000000000

Receipt #: 18545
Date: 11/14/2014
Permit: M1974086

Payment Method	Revenue Code	Fee Description/Notes	Amount
00121641 msr	4300-MAMD	Minerals Amendment Fees M1974-086 paid by APC	$2,229.00
		Receipt Total:	**$2,229.00**