WSI Weiland, Inc.
Environmental & Engineering

7/22/2022

Brock Bowles
Environmental protection Specialist
Colorado Division of Mining Reclamation & Safety
1313 Sherman St., Room 215
Denver, Colorado 80202

Re: Technical Revision, Goose Haven Reservoir M-2010-071
Brock,

I have copied your comments from the Adequacy Review 1 letter dated November 30, 2021 below followed by my responses in italics.

Rule 1.6.2(1)(d) and 1.6.5(2) – Proof of Publication

1. Please submit proof of publication in a newspaper of general circulation in the locality of the proposed operation.

   I have enclosed my email correspondence and invoice payment to the Dailey Camera as Attachment I -Proof of Publication in Local Newspaper

Rule 1.6.2.(e) Notice of Land Owners –

2. Please submit proof of notice to owners of record for all land surface within 200 feet of the boundary of the affected land.

   Proof of Notice to owners of Record within 200ft is also included in Attachment II – Proof of Mailing to Surface Owners Within 200ft

Rule 6.2.1(2) Maps and Exhibits –

3. The text states that Exhibit C-2 Mining Plan Map has been changed to add Sheet 3. Sheet 3 was not submitted with the application. Please submit Exhibit C-2, Sheet 3 for review.

   The text erroneously referred to Exhibit C-2 Sheets 1,2 & 3, however the mine plan maps were labeled Exhibit D Mine Plan Map, Sheets 1, 2, 3 and all of which were submitted with the AM-2 application. The text in Exhibit D has been corrected.

Rule 6.4 - Specific Exhibit Requirements - 112 Reclamation Operation

6.4.1 EXHIBIT A - Legal Description - Adequate as submitted.

6.4.2 EXHIBIT B - Index Map - Adequate as submitted.

6.4.3 EXHIBIT C - Pre-mining & Mining Plan Map(s) of Affected Lands

4. See #3 above.***See response to #3 above also.***

6.4.4 EXHIBIT D - Mining Plan

5. In Item (c) it states that no surface water diversions are planned for the site. In Appendix A, Item 2.4, page 3, it states that a diversion swale will collect surface runoff south and west of Cell 2A and route the water around the reservoir. No other details were included in the application. Please clarify the following:

a. Will a swale be constructed around Cell 2A?

Not during the mining plan, however as part of the reclamation plan, a swale will be constructed around Cell 2A for the purpose of diverting stormwater runoff from being impounded by the reservoir.

b. If a swale is planned, include a discussion addressing: the purpose, anticipated impact to the surface water and if it's a permanent feature.

Text has been added to Exhibit E- Reclamation Plan to point to the Goose Haven Reservoir Complex Expansion Project Cell 2A Hydrology Report. (Exhibit E Attachment B)

c. Submit construction designs.

The grading plan for the swale is given in Exhibit F Sheet 2 previously submitted. Additional details can be found in the dam design documents and drawings previously submitted in Exhibit E Attachment A.

6. Cell 2A is being constructed in accordance with Rule 8 of the 2020 Rules and Regulations for Dam Safety and Dam Construction and is being overseen by the Colorado State Engineer. Please commit to submitting the final dam construction report, as-built plans and the final certification for inclusion into the permit when these documents are obtained.

The City of Lafayette will commit to submitting the final dam construction report, as-built plans and the final certification for inclusion into the permit when these documents are complete.

6.4.7 EXHIBIT G - Water Information -

7. A well location map for the surrounding area was submitted with the original permit application in 2010. Please submit an updated well location map and include depth of wells as part of the data set.

The location of Piezometers has been added to Exhibit C. The well depths and drill logs have been added to Exhibit G Attachment A.

8. There are two properties within 200 feet of the western permit boundary. There are several structures and private ponds located on each of these properties. The houses on these properties will be within 200 feet of the proposed clay lined pond. A ground water hydrological analysis of the potential impacts to these properties needs to be submitted as part of the application package.

These ponds are lined ponds fed by surface water from Lyner Cottonwood Ditch and are not in hydrologic communication with groundwater. A 6" perforated perimeter drain along the south boundary of Cell 2A has been installed and has been observed to flow up to approximately 0.25 c.f.s. during periods when the fields to the south are being irrigated. This drain has been effectively keeping the south slope of the

excavation dry and as such is thought to be diverting the majority of the groundwater around Cell 2A.

9. The two houses along the western permit boundary are within 200 feet of the clay lined pond. The closest piezometer monitoring groundwater levels is more than 1500 feet to the east. Two piezometers should be installed on the western side of Pond 2A in the vicinity of these homes. The piezometers should be up-gradient and down-gradient of the pond to measure the lined pond's effect on the groundwater. These wells should be monitored and reported on the same schedule as the current water monitoring plan.

   Since a perimeter drain has been installed and is functional, we request the Division reconsider the need for groundwater monitoring in this area.

6.4.19 EXHIBIT S - Permanent Man-made Structures -

10. A list of 10 structures was provided in the application. The text states that 5 agreements have been secured and 2 are currently in process. Tom Schwartz is listed as one of the agreements that has been secured but he is not listed as a structure owner. Please update this list and submit updated structure agreements for all the structures listed.

   The Tom Schwartz house is actually greater than 200 ft from the Cell 2 excavation and is not part of the 10 listed. Frank Schwartz is however and Exhibit S has been updated accordingly. Exhibit S has been updated to include the status of the remaining agreements

   The Division of Water Resources and History Colorado submitted comments for this application. The comment letters are attached. Please address any concerns raised by these agencies in your response letter.

   The applicant has been working with the Division of Water Resources to address all of their concerns. Issuance of an approved SWSP and well permit is expected in the next week.

Sincerely

Peter Wayland

Peter Wayland
President

Encl. Attachment I -Proof of Publication in Local Newspaper, Attachment II – Proof of Mailing to Surface Owners Within 200ft, 6.4.3 Exhibit C – Pre-mining and Mining Plan Map(s) of Affected Lands (txt) and Exhibit C Pre-Mine Plan Map, 6.4.4 Exhibit D – Mining Plan, 6.4.5 Exhibit E – Reclamation Plan, Exhibit E Attachment B Goose Haven Reservoir Complex Expansion Project Cell 2A Hydrology Report, 6.4.7 Exhibit G - Water Information, Exhibit G- Attachment A Piezometer Drill Logs and 6.4.19 Exhibit S - Permanent Man-made Structures, Exhibit S Attachment A

6.4.3 Exhibit C – Pre-mining and Mining Plan Map(s) of Affected Lands

Exhibit C Pre-mining and Mining Plan Maps have been changed. The Pre-Mining Plan Map Exhibit C-1 has been changed to show the different adjoining landowner names to the west and the locations of the existing piezometers have been added. Exhibit D Mining Plan Map has been changed to add Sheet 3 to the existing Sheets 1 and 2. Exhibit D Sheet-3 shows mining plans for Cell 2A.

6.4.4 Exhibit D – Mining Plan

The following sections detail changes from the existing Exhibit D.

(a) Description of Methods

Both Cells 2 and 4 will utilize conventional dry mining techniques whereby dewatering trenches are first constructed around the perimeter of the active excavation. Mining highwalls will vary from 1H:1V to 3H:1VTopsoil is then removed with scrapers and stockpiled separately form overburden. Overburden materials are then striped with an excavator loading into non-road haul trucks (rock trucks) where it is hauled to the overburden stockpile area to the west.

(b) Earthmoving

The primary earthmoving activity will be:

1. Stripping of topsoil and stockpiling in areas shown in Exhibit D Sheet-2
2. Excavation of overburden and hauling to the stockpile area shown in Exhibit D Sheet-2
3. Excavation of pit run and hauling to the conveyor feed

Table 6.4.4-1. Mining Earthmoving Quantities Summary

CELL 2 30-45ft deep				
ITEM	**VOLUMES**		**AREAS**	
Total Excavation	1,886,178.00	yd^3		
Overburden Excavation	1,163,592.00	yd^3		
Gravel	722,586.00	yd^3		
Excavation Area			170,917.35	yd^2
Excavation Area			35.32	ac

CELL 4 25-30ft deep				
ITEM	**VOLUMES**		**AREAS**	
Total Excavation	1,031,447.00	yd^3		
Overburden Excavation	746,915.00	yd^3		
Gravel	284,532.00	yd^3		
Excavation Area			124,461.16	yd^2
Excavation Area			25.72	ac

CELL 2A 25-30ft deep				
ITEM	**VOLUMES**		**AREAS**	
Total Excavation	980,130.00	yd^3		
Overburden Excavation	730,130.00	yd^3		
Gravel	250,000.00	yd^3		
Excavation Area			217,385.0	yd^2
Excavation Area			45.0	ac

(c) Water Diversions and Impoundments

No surface water diversions are planned during mining of the site. Groundwater shall be diverted by pumping from dewatering trenches to a settling pond impoundment as shown in Exhibit D Sheet-2. It should be noted that as part of the reclamation plan, a stormwater diversion swale will be constructed around Cell 2A for the purpose of diverting stormwater runoff from being impounded by the reservoir.

(d) The Size of Areas to be Worked at Any One Time

Since both Cells 2 and 4 and 2A will be worked at the same time, the size of area to be worked at any one time is approximately 100 acres.

(e) Mining Timetable

Currently, the only remaining pit run occurs in Cell 4. Mining of Cell 4 is expected to be completed by the end of 2021 or beginning of 2022. Additional excavation of Cell 2A will occur 2021-2022 to advance the reservoir volume, however no saleable material remains in Cell 2A.

(f) The Nature of Deposit to be Mined and Overburden

The thickness of sand and gravel to be mined varies from 0-14 ft. The thickness of overburden varies from 5-13 ft. The stratum underneath the sand and gravel deposit is weathered claystone followed by indurated claystone.

(g) Secondary Commodities

Overburden will be used as structural fill for various local construction projects.

(h) Use of Incidental products

Other than structural fill identified above, no other incidental products are expected to be extracted from the site.

(i) Explosives

No explosives will be used

6.4.5 Exhibit E – Reclamation Plan

(a) Description of the Type of Reclamation

The site will be reclaimed to developed water resource and will construct three additional water storage reservoirs Reservoir #2, Reservoir #4, and Reservoir #2A which correspond to Cells 2, 4 and 2A respectively. Reservoir #2 shall have a normal pool water surface area of approximately 32 acres. Reservoir #4 will have a normal pool water surface area of approximately 24 acres. Reservoir 2A will have a normal pool water surface area of 38.3 acres. Both reservoirs #2 and #4 will be constructed with a compacted clay liner around the perimeter of the mining highwall as shown in Figure 6.4.5 – 1 Typical Section, and Exhibit F, Sheets 1-4. Reservoir 2A will be constructed with an embankment dam along the north, east and west sides as shown in Exhibit F AM-2 Sheets 1 and 2. Detailed engineering plans for the embankment dam have been submitted to the Office of the State Engineer along with the application form. These documents are given in Attachment A. The south portion of the perimeter of Cell 2A which is not part of the embankment dam will be reclaimed by constructing a compacted clay liner to the same specifications as Cells 2, and 4. Finally, a grass lined stormwater diversion swale will be constructed around the perimeter of reservoir 2A to divert stormwater from entering the Cell 2A reservoir. The design of the swale is given in Exhibit E Attachment B *Goose Haven Reservoir Complex Expansion Project Cell 2A Hydrology Report.*

Reclamation Earthwork/Compacted Clay Liner Construction

A summary table of reclamation earthwork volumes, areas and lengths is given as Table 6.4.5-1.

Table 6.4.5-1. Reclamation Earthwork Summary

CELL 2	30-45ft deep					
ITEM	**VOLUMES**		**LENGTH**		**AREAS**	
Total Embankment	163,040.00	yd^3				
Clay Liner	90,507.25	yd^3				
Slope fill	76,550.00	yd^3				
Keyway Volume	4017.25	yd^3				
Keyway Length			4338.63	ft		

Pit Floor Area					150,390.76	yd^2
Pit Floor Area					31.13	ac
Pit Floor Depth of Excavation			1.81	ft		
Topsoil / Revegetation Replacement Area					34,061.02	yd^2
Topsoil / Revegetation Replacement Area					7.05	ac
Topsoil Replacement Depth			0.5	ft		
Topsoil Replacement Volume	5,678	yd^3				
CELL 4	25-30ft deep					
ITEM	**VOLUMES**		**LENGTH**		**AREAS**	
Total Embankment	117,205.00	yd^3				
Clay Liner	66,240.00	yd^3				
Slope fill	50,965.00	yd^3				
Keyway Volume		yd^3				
Keyway Length			3903.28	ft		
Pit Floor Area					112,577.51	yd^2
Pit Floor Area					23.30	ac

Pit Floor Depth of Excavation			1.77	ft		
ITEM	**VOLUMES**		**LENGTH**		**AREAS**	
Topsoil / Revegetation Replacement Area					21,053.98	yd^2
Topsoil / Revegetation Replacement Area					4.36	ac
Topsoil Replacement Depth			0.5	ft		
Topsoil Replacement Volume	3,510	yd^3				
Cell 2A						
Embankment Fill	246,510	yd^3				
Compacted Clay Core (including key)	37,037	yd^3				
Pit Floor Area					138,479	yd^2
Pit Floor Area					26.6	ac
Pit Floor Depth of Excavation for Borrow Clay			0.74	ft		
Topsoil / Revegetation Replacement Area					108,613	yd^2
Topsoil / Revegetation Replacement Area					22.4	ac
Topsoil Replacement Depth			0.5	ft		
Topsoil Replacement Volume	18,106	yd^3				

Reservoir #2 shall be reclaimed first. Following mining of Cell 2, reclamation will begin by constructing a the subsurface drain as specified in engineering documents in the existing permit. Following installation of the drain, preparation of the borrow material on the excavation floor will be performed by disking the weathered claystone in preparation for moisture conditioning. Geotechnical investigations conducted by CTL Thompson indicate the weathered claystone is a suitable borrow material with plasticity indices near or above 20 (see Table 6.4.5-2). The liner borrow material shall also meet the following criteria;

a) Percent fines (should contain at least 20% fines on a dry weight basis).
b) Percentage of gravel (material retained on a No. 4 sieve should not exceed 10%).
c) Stones and rocks (no rocks larger than 2 inches should be in the liner material).

A drain pipe will then be installed at the toe of the mining highwall and into the weathered shale with a filter pack which will be in hydraulic communication with the gravel layer to facilitate dewatering during liner construction. The Keyway surrounding the perimeter of the excavation and offset approximately 6ft from the toe of slope will then be excavated as specified in Figure 6.4.5 – 1 Typical Section. Once the borrow material is within the moisture specification (0 to +3% of optimum moisture content), the compacted clay liner will then be constructed by making passes with Miskin Scrapers towed by JD 9520's in 8" lifts. This type of scraper will provide significant compaction energy to bring each lift to 95% standard proctor maximum dry density. *Following placement, each lift shall be scarified to a depth approximately 2" to ensure adequate bonding between lifts. Scarification shall be achieved with disking equipment*. Once the compacted clay liner is completed to the approximate geometry/specifications given in Figure 6.4.5 – 1 Typical Section, the slope will be backfilled to 3H:1V with overburden stored to the west of Reservoir #2. This controlled backfill shall be placed in 8" lifts to 95% standard proctor maximum dry density at 0 to +3% optimum moisture content. Following backfilling of the slopes, a protective shell shall be constructed from the ground surface above to 10ft below the normal pool elevation. The specifications for the protective shell are given in Figure 6.4.5 – 1 Typical Section. Following Mining of Cell 4, reclamation / construction of Reservoir #4 will occur in the same fashion as Reservoir #2.

Table 6.4.5-2. Weathered Claystone Geotechnical Data

BORING	CELL	DEPTH	MOISTURE CONTENT	DRY DENSITY	LIQUID LIMIT	PLASTICITY INDEX	PASSING #200 SIEVE	PERME - ABILITY
		[ft]	[%]	[PCF]			[%]	[cm/sec]
TH-2	4	24	12.6	124	39	22		
TH-3	4	24	9	120	36	19	94	

TH-5	4	24	13.6	121	44	25	91	
TH-5	4	29	12.7	123	39	22	93	$6X10^{-8}$
TH-9	4	24	11.9	121	41	23	77	
TH-11	2	19	10	119	33	18	91	
TH-11	2	29	9.3	107	35	20	94	
TH-14	2	49	12.4	ND	38	24	64	
TH-16	2	29	9.6	130	40	28	98	
TH-19	2	31-34	20.3	ND	36	21	58.9	

Compacted Clay Liner Quality Assurance/Quality Control Plan

Please see Attachment 6.4.5 – 1

Following construction of the compacted clay liner final construction report and certification for the pit liner shall be completed and submitted to the Division.

The operator shall commit to no modifications to the design specifications without prior Division approval.

(b) Post Mining Land Use Comparison

The site is currently used as a developed water resource facility and is consistent with the Town of Lafayette's master plan. Other land uses surrounding the site include rural residential and agricultural and Boulder County Conservation easements. The Goose Haven reservoir site is compatible with those land uses.

(c) Description of How the Reclamation Plan will Meet the Requirements of Section 3.1

Completion of the reclamation plan described herein shall meet the requirements of Section 3.1

(d) Topsoil Segregation

Topsoil shall be segregated as shown in Exhibit D Sheet-2.

(e) Reclamation Sequence and Timetable

An estimate of the sequence and periods of time for each reclamation activity is given in Table 6.4.5-1.

Table 6.4.5-1. Reclamation Sequence Summary

Mining Cell / Size	Reclamation Activity	Approximate Time Period
Cell 2 / 35 acres	Construct Compacted Clay Liner and Construct Appurtenant Pipeworks	Following Mining of Cell 2
Cell 2 / 35 acres	Perform Topsoiling /	Following Construction of

	Revegetation	Compacted Clay Liner
Cell 4 / 26 acres	Construct Compacted Clay Liner and Construct Appurtenant Pipeworks	Following Mining of Cell 4
Cell 4 / 26 acres	Perform Topsoiling / Revegetation	Following Construction of Compacted Clay Liner
Cell 2A	Perform Topsoiling / Revegetation	Following Construction of Embankment dam and Clay Liner

(f) Descriptions and Specification of Reclamation activities

(i) Final Grading

Final slopes will be graded to 3H:1V

(ii-v) Seeding, Fertilization, Revegetation, Topsoiling

Topsoil Replacement / Revegetation

Topsoil will be replaced to an approximate depth of 1 ft for the areas shown in as topsoil/revegetation areas in Exhibit F Sheets 1-2. The overburden stockpile to the west of Cell 2 will continue to supply fill material after the reservoirs are reclaimed, therefore only revegetation will occur in that area. Once the fill has been removed from the site, the underlying topsoil will be reseeded again.

Seeding and Fertilizing

The proposed seeding areas are shown on Exhibit F – Reclamation Plan Map. The recommended seeding method is by drill and seeding rates assume this method. The species composition of the seed mixture recommended for reclamation is shown in Table E-3 below.

Table E-3. Recommended Seed Mixture

Species (Variety)	***Rate – pure live seed (PLS) lbs/ac***	***Native/ Introduced***	***W/C Season***
Thickspike wheatgrass (Critana)	8.0 to 10.0	Native	Cool
Sideoats grama (Vaughn)	5.0 to 7.0	Native	Warm
Switchgrass (Nebraska-28)	4.0 to 6.0	Native	Warm
Alfalfa (Nomad)	3.0 to 5.0	Introduced	NA
TOTAL	20.0 to 28.0		

Based on this seed mixture, an application rate of approximately 20.0 to 28.0 lbs PLS/ac will be used. Topsoil should be disked prior to seeding. It is recommended that fertilizer be utilized for reclamation. A standard application of fertilizer will be used and applied at a rate of 250 lbs/ac as shown in Table E-4.

Table E-4. Fertilizer Application

Fertilizer	***Standard rate lbs/acre***
Diammonium phosphate (18-46-0) (46-53% available P_2O_5 with 18-21% N)	250

Fertilizer will not be used near the edge of the reservoir, since the possibility of nitrate contamination in the pond water exists. The total disturbed area to be seeded is approximately 53acres. The total area to be fertilized is approximately 53 acres. Seeding and fertilizing will be completed after the overburden and topsoil is replaced, smoothed to conform to the existing topography and disked. Optimal periods of seeding are in the fall (after November 1st) or in the spring from late March up to April 30th. Mulching will not be completed as the quality soils and availability of water should facilitate the rapid establishment of perennial grasses.

Following revegetation, weed management strategies will be implemented to facilitate and achieve native grassland. Years 1 thru 5 following revegetation will include an aggressive mowing program to prevent the growth and establishment of weeds, specifically, eight noxious weeds including: Canada thistle (*Cirsium arvense*), Dalmation toadflax (*Linaria dalmatica*), diffuse knapweed (*Centaurea diffusa*), leafy spurge (*Euphorbia esula*), musk thistle (*Carduus nutans*), Russian knapweed (*Centaurea repens*), spotted knapweed (*Centaurea maculosa*) and Yellow toadflax (*Linaria vulgaris*) as mandated by Colorado State Law (35-5.5CRS1990, 1996). If needed, herbicide application will be applied as needed to further control these weeds. Herbicides will also be used to control salt cedar (*Tamarix* spp.) if it becomes established in the reclaimed area. Table E-5 presents recommended herbicides, application rate, and time of application for each of the 9 species. It may be necessary to replant treated areas.

Table E-5 Recommended Herbicide Application Table

Weed Species	***Herbicide***	***Application Rate***	***Application Time***
Canada thistle	Curtail	2-3 qt/ac	October or 1 mo after last mowing
	Clopyralid	2/3 - 1 pint/ac	Spring or fall, during rosette to bud growth stages in spring
	2,4-D	1lb ai/ac	Spring prebud to early early bud growth stages

	picloram	1lb ai/ac	Spring prebud to early early bud growth stages
Dalmation toadflax	picloram	0.5 - 1 lb ai/ac	Fall
	picloram + 2,4-D		Pre-bloom or fall
Diffuse knapweed	Tordon	1 pint/ac	Spring rosette to early-bolt growth stages
	Banvel/Vanquish/ Clarity + 2,4-D	0.5 + 1 qt/ac	Spring rosette to early-bolt growth stages
	Curtail	2-3 qt/ac	Spring rosette to early-bolt growth stages
	Transline	2/3 - 1 pint/ac	Spring rosette to early-bolt growth stages
Leafy spurge	Tordon	1 qt/ac	Fall 1month after last mowing
	Tordon + 2,4-D	0.5 - 0.75 + 1 qt/ac	Fall 1month after last mowing
	Vanquish/Clarity	1 qt/ac	Fall 1month after last mowing
Musk thistle	Curtail	0.25 lb ai/ac	Spring 10-14 days before bolting
	dicamba	1 lb ai/ac	Spring 10-14 days before bolting
	picloram	0.25 lb ai/ac	Fall, apply to rosettes when other plants are dormant
Russian knapweed	Curtail		Fall on dormant plants, need to reseed during following year
	picloram	1 lb ai/ac	Anytime
Spotted knapweed	picloram	1 lb ai/ac	Anytime
	dicamba or 2,4-D	1 lb ai/ac	
Yellow toadflax	picloram or dicamba	1 lb ai/ac	Spring during flowering
Saltcedar	imazapyr		Late summer early fall foliar application

	imazapyr or triclopyr	To resprouted stems
	imazapyr or triclopyr	To perimeters of cut stems immediately after cutting

Sources: Colorado Natural Areas Program. 2000. Creating an Integrated Weed Management Plan.

http://parks.state.co.us/cnap, and Colorado State University Cooperative Extension. No date.

Weed Management for Small Rural Acreages. No. 3.106.
http://www.ext.colostate.edu/PUBS/Natres/03106.html

Alternative Reclamation Plan

There is no alternative reclamation plan.

6.4.7 Exhibit G - Water Information

(1) The operation will affect groundwater systems, however through execution of the temporary substitute water supply plan, there will not be a net change to tributary groundwater flow to Boulder Creek.

(2) (a) Surface water structures are shown in Exhibit C Pre-Mining Plan Map

(b) The sand and gravel deposit to be mined is an alluvial aquifer tributary to Boulder Creek.

(c) Water from dewatering operations is routed to sediment pond to allow for settling of suspended sediment. A stormwater management plan has been prepared for the site which identifies BMP’s to prevent pollution to surface waters due to stormwater runoff.

(3) Under full operation, the project will consume approximately 20 acre-ft / year due to evaporative loss of exposed groundwater in dewatering trenches, water lost within the mined product and water consumed for dust control.

(4) The replacement source for all depletions to Boulder Creek is fully consumable water rights owned by the City of Lafayette.

(5) The applicant has applied for and received a NPDES Stormwater Discharge Permit. The permit number is COG501535

The groundwater Monitoring and Mitigation plan has been revised as follows;

Step 1 - Establish Monitoring Well Grid and Baseline Ground Water Elevations

CTL Thompson, Inc. had supervised the installation of 7 piezometers (4 up gradient and 3 down gradient from the proposed mining operations) within the City of Lafayette property surrounding the proposed mining operations. Piezometers 1 through 3 have been in service for several years and piezometers 4 through 7 were installed on July 1,9 and 16, 2009. The piezometers are at the locations shown on Exhibit C Pre-Mine Plan Map and the drill logs are given in Exhibit G Attachment A. Water level measurements were made at the time of drilling and several days after drilling. Since that time the City of Lafayette has continued monitoring of the piezometers. The measurements are attached as an appendix. From these measurements, we have established the following seasonal baseline ground water elevations;

	Winter Baseline December 31	Spring Baseline March 31	Summer Baseline June 30	Fall Baseline September 31
Piezometer	Water Elevation	Water Elevation	Water Elevation	Water Elevation
1	5037.9	5036.4	5039.3	5038.8
2	5036.2	5035.9	5036.7	5036.3
3	5030.4	5030.3	5033.7	5031.7
4	5062.6	5062.6	5064.8	5064.1
5	5060.7	5060.7	5061.9	5061.3
6	5044.2	5043.3	5045.9	5045.8
7	5039.1	5039.0	5041.5	5041.4

Ground water elevations will continue to be measured at the established piezometers quarterly starting at the time of permit approval from the DRMS. This will further confirm seasonal water surface elevations for the site prior to mining. In addition, just prior to beginning Compacted Clay and drain installation, an additional measurement at each well will be completed. Measurements will be provided to the RMS as part of an annual report.

Step 2 - Monitoring

Following compacted Clay Liner and drain installation and through mining, piezometers will continue to be measured quarterly with measurements provided to the DRMS as part of the annual report.

Step 3 - Mitigation Triggers

A ground water modeling study was prepared for the proposed operation to include estimated effects as a result of Groundwater Barrier and drain installation. The anticipated effects modeled at the locations of the proposed piezometers are as follow:

Piezometer	Predicted Change in Water Elevation (Feet)
1	0
2	-0.5
3	0
4	0
5	0
6	3.0
7	0

As can be seen the highest anticipated change occurs in piezometer 6 in the south east corner of the proposed mining operation and most near the Swartz residence. Despite this change, the ground water surface is anticipated to stay well below (approximately 11 feet) the basement floor elevation of the home following drain and Compacted Clay Liner construction.

If a change in groundwater elevation greater than two feet beyond the seasonal baseline plus the anticipated (modeled) change in ground water elevations occurs, then an intermediate second measurement will be taken 45 days after the initial reading. If the reading is still outside the mitigation trigger and an impact is imminent (i.e. a flooded basement or field), mitigation will be performed.

Step 4 - Mitigation Alternatives

Mitigations to a raised or lowered water table will be completed by the City under the following conditions.

1. Monitoring data demonstrates that a change in ground water surface elevation has occurred beyond that anticipated through Compacted Clay Liner and drain installation and as a result of seasonal variation.
2. The change in ground water elevation has caused an impact to adjacent water supply, an impact is imminent, or has caused an impact to basement or field as a result of high groundwater elevation.

Lowering of water table

If mitigation from a lowered water table is required, one of the two following actions will be completed by the City.

1. Alternative 1 - The City will provide the well owner with water, until the water level returns to normal.
2. Alternative 2 - The City will drill the affected party's well deeper to restore well production to pre project conditions.

Raising of Water Table

If mitigation to lower the water table is required, one of the two following actions will be completed by the City.

1. Alternative 1 - A well and pump will be installed and operated to locally reduce the water elevations in the aquifer.
2. Alternative 2 - An additional subsurface drain may be installed to reduce the water surface elevations in the vicinity of the impacted structure or field.

Commitment

Operator shall commit to the mitigation measures above regardless of whether the mitigation triggers are the result of installing a clay liner on Reservoir #2 or Reservoir #4

Cell 2A

As specified in Exhibits E and F, Cell 2A will construct a compacted clay embankment around the perimeter of the reservoir. For the purpose of mitigating potential groundwater mounding up-gradient of the reservoir. The Cell 2A underdrain was designed as follows:

Since the only historical onsite water table data in the vicinity of Cell 2A includes elevation data form piezometers P4 and P5, regional water table elevation contours published by the USGS Front Range Infrastructure Resources Project (FRIRP) Fact Sheet 113-98, were used to determine baseline upgradient and westerly water table information. This was done by developing a 3 dimensional surface of the USGS data, then lowering it by a uniform value to correspond with the Goose Haven site datum. The 3d surface water table surface from onsite data was then merged with the USGS data to yield an approximate overall water table contour map which is shown in Exhibit G Sheet 1. An analytical solution to groundwater flow based on Darcy's law was then used to determine the volumetric flow requirement of the drain. Given a conservative assumption that that groundwater mounding could saturate the full vertical extent of the soil profile above the historical water table, the calculation is as follows;

Darcy's Law ; Q=(K*dh/dl)*A

where;

Q= volumetric flow

K= saturated hydraulic conductivity = 28 ft/day (from NRCS web soil survey)

dh/dl = hydraulic gradient = .02 (from Exhibit G – Sheet-1)

A= Cross sectional area = 2300 ft x 4ft= 9,200 ft^2

Therefore Q= 28 ft/day x .02 x 9,200 ft^2 = 5,152 ft^3 /day = **0.06 c.f.s.**

The underdrain alignment extends for 30+95.34 ft of which 2,300 ft are perforated pipe and

Exhibit G, Attachment A gives the modeled flow capacity for 2300 ft of perforated section and 795.34 ft of solid pipe. Both sections are calculated to exceed the design flow of 0.06 c.f.s.

The end of the underdrain alignment ties into an existing 8" pipe which daylights into the lower Boulder Ditch. This existing pipeline to Lower Boulder Ditch was historically used to drain the agricultural fields occupied now by Cell 2A.

<u>Underdrain Construction</u>

The underdrain was constructed by excavating a trench to the elevations shown in **Exhibit G Cell 2A Underdrain Plan & Profile Sheets 2-7**. For the first 2,300 ft, 6" SDR-22 PVC pipe was perforated with 2 tows of 3/8" holes spaced 1 ft apart. The pipe was backfilled with 6" of d50 = 1" rock surrounded with mirifi geotextile fabric surrounded by 6" of sand to create a filter pack. The remaining trench solid 795.34 ft section was bedded with 6" of sand. The entire trench was then backfilled with native silty sand (ML).

6.4.19 Exhibit S – Permanent Man-Made Structures

Permanent Man-Made Structures not owned by the applicant are shown in Exhibits C and Exhibit D, Sheets 1-3. The corresponding numbers are as follows:

NUMBER	STRUCTURE	OWNER
1	WATER CANAL	NEW CONSOLIDATED LOWER BOULDER RESERVOIR & DITCH CO. ATTN: DAN GRANT
2	36" UNDERGROUND WATER PIPELINE	NORTHER COLORADO WATER CONSERVANCY DISTRICT ATTN: JIM STRUBLE
3a-3h	UTILITY POLES	XCEL ENERGY ATTN: CHRIS HENDRICKS
4	RESIDENTIAL STRUCTURE	SCHWARTZ FRANKLIN D REVOCABLE TRUST ET AL (FORMERLY FRANK AND KATHLEEN SWARTZ)
5	UNDERGROUND WATER PIPELINE	LEFTHAND WATER DISTRICT
6	UNDERGROUND PHONE LINE	CENTURYLINK ATTN: SAM BAULIS (FORMERLY QWEST)
7	ROADWAY	COLORADO DEPARTMENT OF TRANSPORTATION REGION 4 ACCESS MANAGEMENT GROUP
8	3 BARNS	REGINA & CRAWFOR WINDSOR (FORMERLY MARC & CONNIE LENART)
9	RESIDENTIAL STRUCTURE & BARN	ROBERT & ALEXANDRA SCHNEIDER (FORMERLY MARK CLAPP)
10	UNDERGROUND IRRIGATION WATER LINE	BOULDER COUNTY

Agreements previously executed as part of the original application and Amendment-1 include:

- Qwest/Century Link
- Frank and Kathleen Schwartz
- Left hand Water District
- Tom Schwartz (this structure occurs greater than 200ft and therefore not listed above)
- New Consolidated Lower Boulder Reservoir & Ditch Co

For structures listed as 8, 9 and 10, Those owners were sent letters requesting agreements on the forms provided by DRMS Regular 112c application form by certified mail. Proof of mailing is given in Exhibit S Attachment A. Agreements.

The Schneider and Windsor owners have both contacted Peter Wayland of Weiland Inc by phone and agreed verbally to sign the agreement forms provided in the mailing. This agreement will be submitted to the Division when finalized. In lieu of agreements with the remaining owners, the setbacks provided in geotechnical slope stability analysis given in AM-1 are observed.

EN RESERVOIR COMPLEX
PROJECT - CELL-2A

Y REPORT

ORADO

MERRICK

JANUARY 2019
PROJECT NO. 65420069

MERRICK®

January 18, 2019

Mr. Brad Dallam, PE
City of Lafayette
1290 S. Public Road
Lafayette, Colorado 80026

RE: Goosehaven Reservoir Complex, Expansion Project – Cell-2A, Hydrology Report

Dear Brad:

Attached please find a hydrology report for the Goosehaven Reservoir Complex, Cell 2A. The project is located just south of Boulder Creek, west of Highway 285. This report was prepared to support design for the addition of Cell 2A.

The report describes site hydrology and it describes two significant features of the planned improvements. First, an interceptor swale will be constructed upstream of the reservoir complex. The swale will intercept all overland runoff up to and including the 100-year event from upstream basins and divert the runoff from the reservoirs. Therefore, there will be no additional inflow from upstream during rainfall events, which simplifies the reservoir operations and any safety concerns.

Secondly, the design includes 3.5' of freeboard from the normal pool to the reservoir embankment. This freeboard is more than sufficient to contain the 100-year 24-hour rainfall of 5.1 inches. The reservoir site meets the State's criteria for a low hazard dam, and the State requires that the facility can handle an event of this magnitude for the low hazard classification.

Furthermore, this report shows dam break calculations to support the low hazard classification. All calculations and support for the hydrology above are found in the report appendices.

Thank you for the opportunity to assist you. If you have any questions, please contact Brian Chevalier at 303-800-9048.

Sincerely,
MERRICK & COMPANY

Brian Chevalier, PE, PMP
Project Manager

COLORADO REGISTERED BRIAN E. CHEVALIER 24003 PROFESSIONAL ENGINEER

Magdiel Garcia, EI
Design Engineer

cc: File

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Appendices
Appendix A. Dam Components
Appendix B. Drainage Basin Exhibit
Appendix C. Basin Soils Map
Appendix D. Drainage Calculations
Appendix E. Dam Break Analysis

Section 1 - Introduction

1.1 Background

The City of Lafayette is planning to construct a raw water reservoir for its municipal water supply. Over the past few years, the City's water system has undertaken multiple construction projects to sustain the water needs as the City grows. Currently two reservoirs within the Goose Haven Reservoir Complex feed the City of Lafayette Water Treatment Plant. A third cell, Reservoir 2 is under construction. Recurring demands for Goose Haven storage water have highlighted the need for additional storage. This hydrology report and concurrent reservoir design for the construction of Reservoir Cell-2A are one portion of the project that will address the City's need for raw water supply and storage.

A Goose Haven Reservoir expansion study conducted by McLaughlin Water Engineers (2010) evaluated alternative reservoirs sites for increasing storage capacity so as to maximize the usability of the City's water rights. At that time, the study determined that an expansion project of Reservoir 2 should be undertaken. Construction of multiple intercell facilities was the most economical and cost-effective solution due to the topography of the site, and nature of the subsurface. Preliminary investigation of the area, including topographical survey, and geology test pits, indicate the need for a 15 to 20 feet high dam to achieve anticipated storage requirements of 700 acre-ft. Subsequently, a modified designed, which combines the two western cells into one reservoir was proposed and is the subject of this report.

The proposed dam is located west of US 287, north of Isabelle Road, in Section 21, Township 1 North, Range 69 West of the 6th Principal Meridian in Boulder County. The latitude/longitude of the project area is 40° 2'33.01"N / 105° 6'58.15"W. Figure 1.1 shows the dam location.

The reservoir drainage will be filled primarily with Boulder Creek water. The contributing basin area above the proposed reservoir is approximately 145 acres. However, the site will be graded such that the only contributory area to the reservoir will be the reservoir itself. Runoff generated from the upstream basin will be intercepted and diverted west around the complex and ultimately into Boulder creek.

This Hydrology Report is prepared in support of the design documents which depict the construction of the proposed dam and reservoir for the Goose Haven Reservoir Cell-2A.

1.2 Dam/Reservoir Classification

At the proposed height of 16 feet and volume of 700 acre-feet at the normal high water surface elevation, the dam will be considered "small" in size classification by the SEO. For the purposes of this study, an SEO Class III hazard rating is assumed due to the absence of inhabited properties or permanent structures directly downstream to the reservoir. In accordance with these criteria the inflow design flood (IDF) will be the flood produced by the 100-yr recurrence, 24-hr duration from direct precipitation. In order to validate the assumed hazard classification of the structure, a dam breach analysis was completed and is presented below as support documentation.

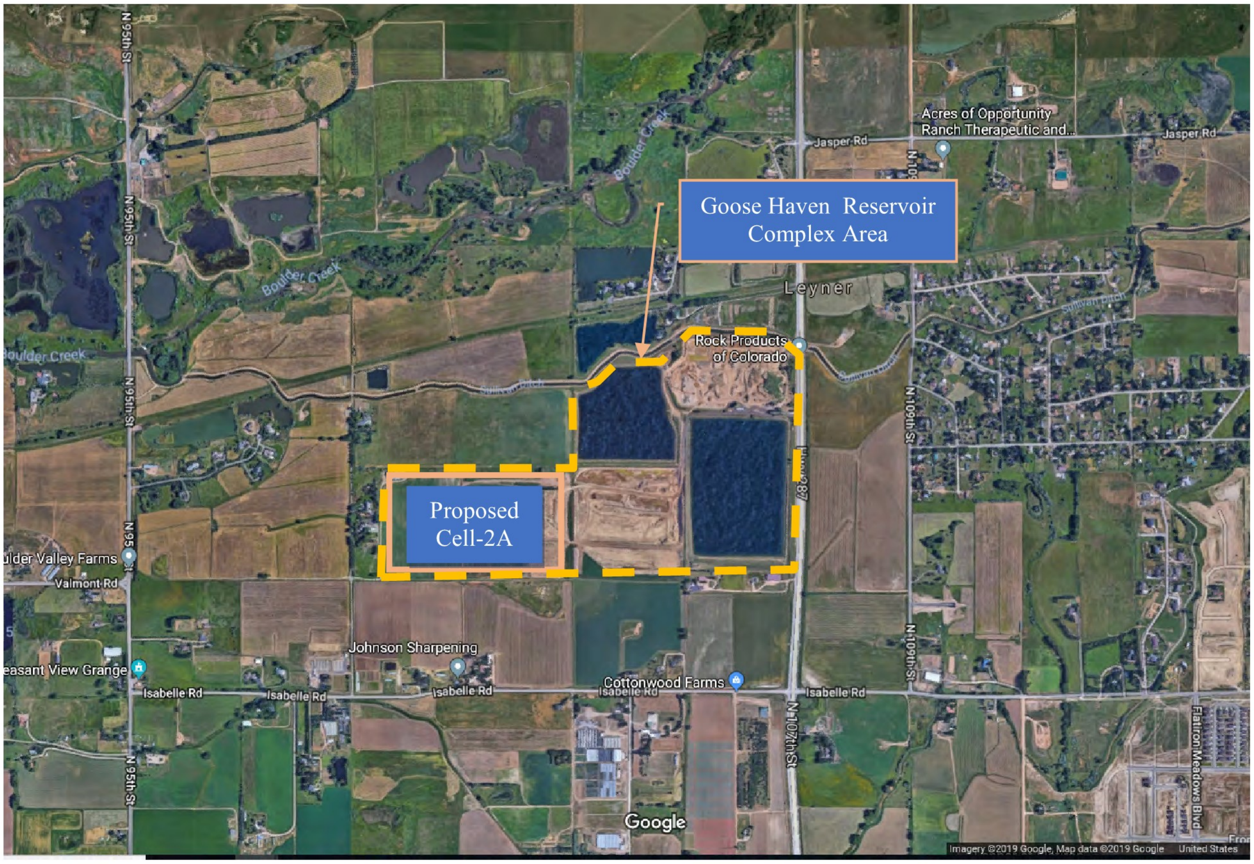


Figure 1.1 – Location Map

Section 2 – Dam Components

Appendix-A contains two drawings that illustrate the general layout of the dam and related components. However, a final layout of the dam will be provided in the final design documents for the project.

2.1 Proposed Project

The proposed earthfill dam will have a maximum storage capacity of 700 acre-feet. The dam will be approximately 16 feet tall at the toe, with a length of approximately 1,900 feet, and a top of dam width of 20 feet. Normal pool elevation is 5062.0 feet (NAVD 88). This elevation is 3.5 feet lower than the top of the dam, elevation 5065.5 feet. It is intended to operate the reservoir so that the normal pool elevation is never exceeded, therefore the reservoir has 3.5’ of freeboard. The upstream and downstream dam faces slope to the natural terrain at a ratio of 4:1, and 3:1 respectively. Beneath the natural surface of the ground, the upstream face of the dam will slope at a 3:1 ratio to the bottom of the reservoir. The dam embankment will be constructed of on-site material, mixed and moisture treated for uniformity. The dam will include a 3-foot wide chimney drain to protect the dam core against internal erosion. A keyway will be extended down into the very hard bedrock along the dam cutoff to minimize underflow, and seepage flow across the dam. The downstream face will be covered with topsoil and seeded to establish a good vegetative cover, and the upstream face will be protected with rock riprap, and bedding material.

Overall, grading of the reservoir and surrounding areas will be such that the only contributory area for rainfall will be the reservoir itself. Direct rainfall flow generated on the reservoir area will be routed to Reservoir #2; Hence, through other cells to Boulder Creek using the proposed transfer structure as service spillway.

2.2 Principal Outlet

The primary outlet for the reservoir will consist of a concrete transfer structure with an overflow weir and a conduit pipeline used for discharging from the reservoir. Flows from the outlet will be directed into Reservoir No.2, where they will be transmitted to either Reservoir#4, the Lafayette Water Treatment Plant or released to Boulder Creek to satisfy downstream water rights.

Section 3 - Drainage Basin Characteristics

3.1 Basin Description

The total contributing drainage area upstream of the Goose Haven reservoir complex is about 145 acres consisting primarily of agricultural land. The drainage basin was delineated using a 1-foot contour DEM surface derived from the National Elevation Data Set USGS website. Upstream runoff will be intercepted and diverted around the reservoir. Runoff generated from this area generally flows northerly in a sheet flow pattern. The drainage area was divided into three sub-basins A, B, and C for calculation of peak flows and sizing of the routing channel. Appendix B illustrates the basins and physical characteristics. The basins are similar in slope, land use and vegetative cover. A percent imperviousness value of 2% was selected to calculate runoff from rugged agricultural terrain with an average slope of about 3.5% for all sub-basins.

3.2 Basin Soils

Soils in Boulder County within the drainage basin for the reservoir have been mapped by the Natural Resources Conservation Service (NRCS). In addition, a detailed soils and geotechnical investigation has been conducted by Brierley Associates at the location of the proposed dam. The soils within the basin are generally very deep well drained soils formed by residual parent materials derived from moderate texture calcareous, eolian or outwash deposits. These soils exist in upland hillslopes and tableland plain and are used as dry and irrigated croplands or for grazing. These soils characterize for being well to somewhat excessively drained with high infiltration rates due to high hydraulic conductivity. A graphical depiction of the soils encountered within the study area can be seen on the soils map included in Appendix C. A breakdown of the soils mapped for the basins is provided below in Table 3.1.

Basin Soils			
Map Unit Symbol	Soil Description	Area (Acres)	Hydrologic Soil Group
AcA	Ascalon Sandy Loam, 0 to 3 percent slopes	9.6	B
MdB	Manter Sandy Loam, 1 to 3 percent slopes	128.4	A
MdD	Manter Sandy Loam. 3 to 9 percent slopes	43.3	A

Table 3.1: Basin Soil Classification

Section 4 - Hydrologic Analysis

4.1 Frequency Based Floods

The 100-yr, 24-hr duration rainfall point data (5.11 inches) for the area was obtained from the National Oceanic and Atmosphere Administration (NOAA), and utilized for calculation of peak flow volumes produced by direct precipitation on each of the reservoir within the complex. This methodology was used as all tributary flows from the upstream drainage area will be diverted and, therefore will not enter the reservoir. The resulting peak volumes for each of the reservoirs within the complex for the frequency-based storm analyzed are summarized in Table 3.2.

Reservoir Name	Area (Acres)	Peak Volume (Cu.ft.)
Reservoir No. 1	29.7	550,915
Reservoir No. 2	35.9	665,920
Reservoir No. 3	50.2	931,175
Reservoir No. 4	27.7	513,815
Reservoir 2A	33.9	628,821

Table 3.2: Calculated Peak Volumes, 100-yr rainfall, 24-hr duration

4.2 Drainage Area Peak Runoff

The rational method was used to estimate runoff generated from the upstream drainage basins. Calculations were completed using the latest UDFCD runoff spreadsheet (UD-Rational 2.0). The resulting peak flows for each of the basins for the 100-yr precipitation event are shown in Table 3.3.

Basin	$Q_{100\text{-yr}}$ (cfs)
A	22.0
B	20.0
C	12.0

Table 3.3: Basins Calculated Peak Runoff

Runoff from these tributary basins will enter the site through sheet flow rather than in developed channels. Flow from Basin A, B and C will be captured in an unlined channel that will extend along the southern boundaries of the complex. The flow will be conveyed to Design Point 1. At Design Point 1, we anticipate that a 36-inch diameter conduit will be needed to transmit the combined runoff north into the downstream fields. Erosion control measures will potentially be needed at the downstream toe of the channel for flow energy dissipation. All calculations and spreadsheet results are included in Appendix D. The drainage swale and conduit pipe has been sized so to their actual capacity is greater than the combined runoff generated from the total contributing area ($Q100_{peak}$ = 54.0 cfs).

Section 5 – Dam Breach Analysis

5.1 Dam Break

A dam breach analysis was completed in accordance with the methodology outlined by the Office of State Engineer, Dam Safety Branch - Guidelines for Dam Breach Analysis, 2010. The analysis was performed to determine the downstream hazard caused by potential flooding due to a hypothetical dam break. Due to the size, location, and downstream conditions of the proposed dam/reservoir, the “screening” method was used to estimate the dam-break peak discharge. The Froelich empirical equations were used to estimate breach parameters such as average breach width and time of formation, and then used for input into the SMPDBK peak discharge equation. The hydraulic conditions downstream of the dam were analyzed using normal depth calculations assuming that the peak flow releases instantaneously at a steady uniform rate. A cross section of the area downstream of the dam (approximately 500 feet downstream) was cut from the DEM surface for purpose of this analysis and used as a typical section for downstream conditions. Flow Master Bentley Software was utilized to compute average flow depth and velocities based on peak flow and downstream cross section geometry. The calculations and results for this analysis can be found in Appendix E.

5.2 Hazard Classification

Based on the above analysis the SEO hazard classification for the proposed dam-break scenario is rated “Low Hazard Classification” because of the absence of permanent structures in the downstream inundation area. Permanent dwellings are presented in the vicinity of the reservoir, but none are believed to be at risk from dam overtopping with or without dam break in response to the estimated peak discharge (2,731 cfs). Based on calculations at the typical section, the inundation in the dam-break scenario is estimated to be less than 2.5 feet deep, and the velocity is in the range of 2 to 3 feet per second. When combined, the product of flow depth and velocity yields a number less than seven which generally is not considered to be life threatening (Colorado Department of Natural Resources – Dam Safety Branch, 2010).

Section 6 – Conclusions

The design for the proposed Reservoir Cell-2A includes an interceptor swale to divert overland runoff from upstream basins around the reservoir site. The swale has 100-yr capacity. The reservoir surface area can fully contain a 100-yr, 24-hr (5.11 inches) within the 3.5-foot freeboard that will exist between the normal pool and the reservoir embankment.

Dam breach calculations show that the reservoir site is a Low Hazard facility according to the SEO guidelines and regulations.

Section 7 – References

1. Dam Safety Branch, 2007. "Rules and Regulations for Dam Safety and Dam Construction," Department of Natural Resources, Division of Water Resources, Office of the State Engineer, Denver, Colorado.

2. Dam Safety Branch, 2010. "Guidelines for Hazard Classification," Department of Natural Resources, Division of Water Resources, Office of the State Engineer, Denver, Colorado.

3. Dam Safety Branch, 2010. "Guidelines for Dam Breach Analysis," Department of Natural Resources, Division of Water Resources, Office of the State Engineer, Denver, Colorado.

4. Dam Safety Branch, 2014. "Dam Safety Project Review Guide," Department of Natural Resources, Division of Water Resources, Office of the State Engineer, Denver, Colorado.

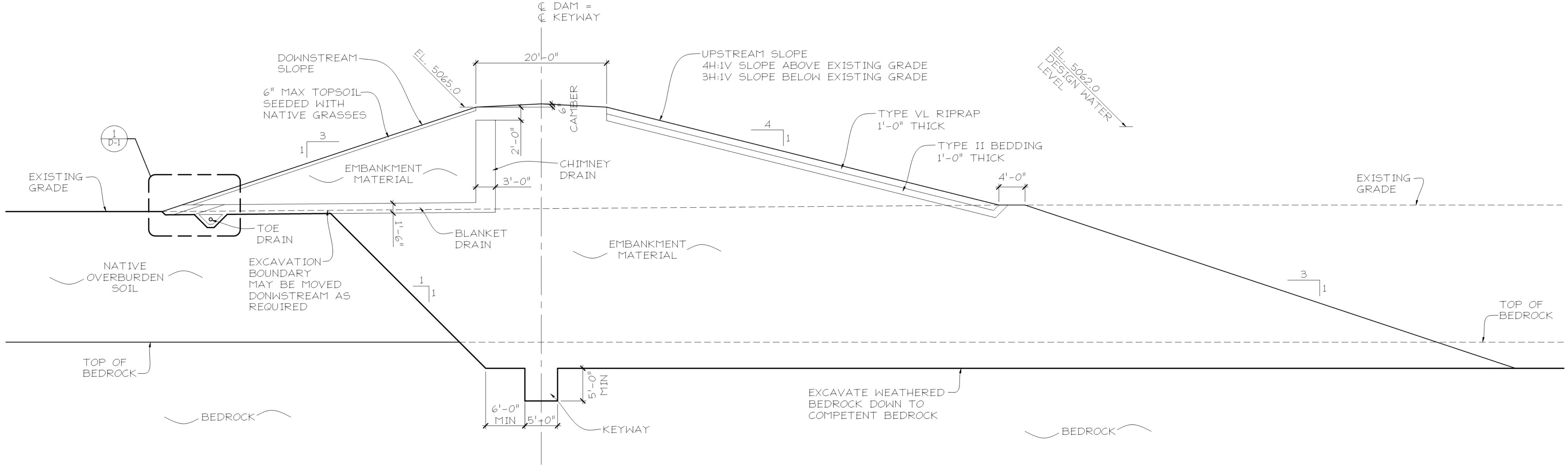
5. McLaughlin Water Engineers, 2010. "Master Plan Goose Haven Raw Water Storage Complex". Report prepared for the City of Lafayette, Colorado.

6. National Oceanic and Atmospheric Administration, 1993. "Precipitation-Frequency Atlas, Volume III-Colorado," U.S. Department of Commerce, National Weather Service, Washington D.C.

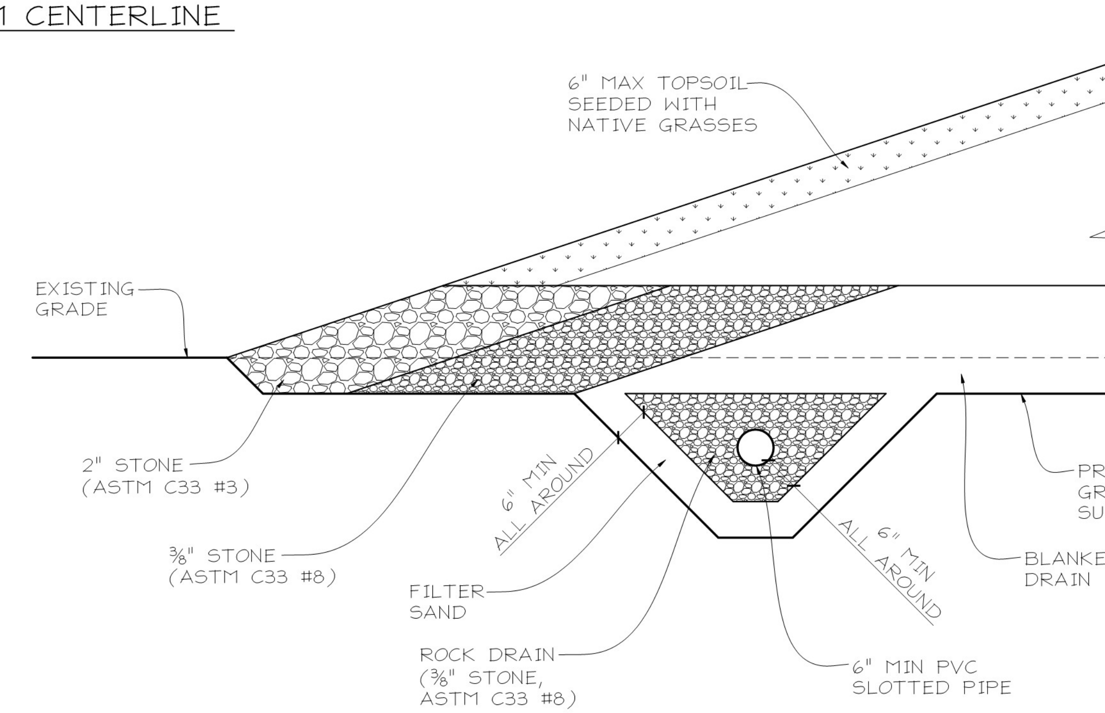
7. Natural Resources Conservation Service, 2018." Web Soil Survey". Soil Survey Area for Boulder County, Colorado. Retrieved from https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

8. Urban Drainage and Flood Control District, 2018. "Urban Storm Drainage Criteria Manual - Volumes 1 Management, Hydrology and Hydraulics." Urban Drainage and Flood Control District, 2018 Update, Denver, Colorado.

APPENDIX A
DAM COMPONENTS



A TYPICAL DAM SECTION - KEYWAY AT DAM CENTERLINE
SCALE: 1/8" = 1'-0"



1 D-1 TOE DRAIN
SCALE: 3/4" = 1'-0"

CONCEPT - NOT FOR CONSTRUCTION

NO.	DATE	REVISIONS	BY	CK

OWNER: CITY OF LAFAYETTE

GRAPHIC SCALE 0 ½" 1" 1½" 2" 2½" 3"

CADD FILE NAME: SECTIONS2.DWG | PLOT DATE

CLIENT: ROCK PRODUCTS OF COLORADO

APPROVED | DATE

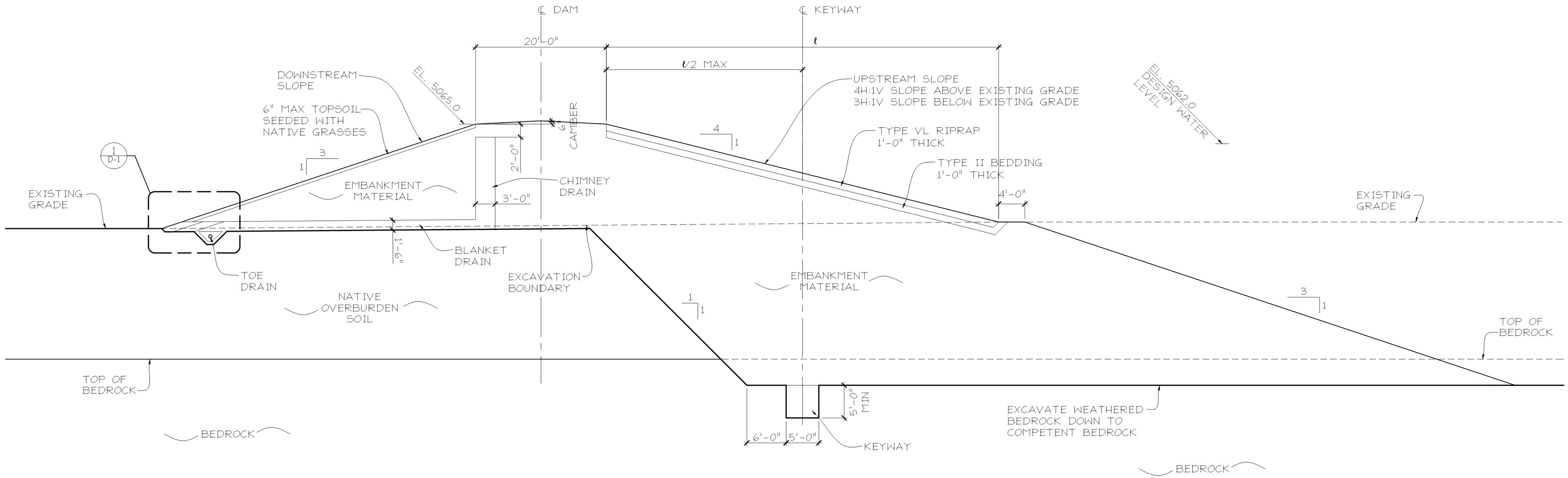
BRIERLEY ASSOCIATES
Creating Space Underground
990 S BROADWAY, SUITE 222, DENVER, CO
303.703.1405 FAX 303.534.1777

DESIGNED – | CHECKED – | DRAWN REB

GOOSE HAVEN RESERVOIRS
CELL 2A
TYPICAL DAM SECTION

SHEET: D-1
DRAWING NO. 1 OF 2
REVISION 0

CONTRACT – | DATE OCT. 3, 2018 | JOB 113136–000 | SCALE 113136–000



B TYPICAL DAM SECTION - KEYWAY UPSTREAM OF DAM CENTERLINE
SCALE: 1/8" = 1'-0"

CONCEPT - NOT FOR CONSTRUCTION

NO.	DATE	REVISIONS	BY	CK

OWNER: CITY OF LAFAYETTE

CLIENT: ROCK PRODUCTS OF COLORADO

GRAPHIC SCALE 0 ½" 1" 1½" 2" 2½" 3"

CADD FILE NAME: SECTIONS2.DWG | PLOT DATE | APPROVED | DATE

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

DESIGNED – | CHECKED – | DRAWN REB

GOOSE HAVEN RESERVOIRS
CELL 2A
TYPICAL DAM SECTION

SHEET D-2
DRAWING NO. 2 OF 2
REVISION 0

CONTRACT – | DATE OCT. 3, 2018 | JOB 113136–000 | SCALE 113136–000

APPENDIX B
DRAINAGE BASIN EXHIBIT

NORTH

300' 0 150' 300' 600'

1" = 300' HOR.

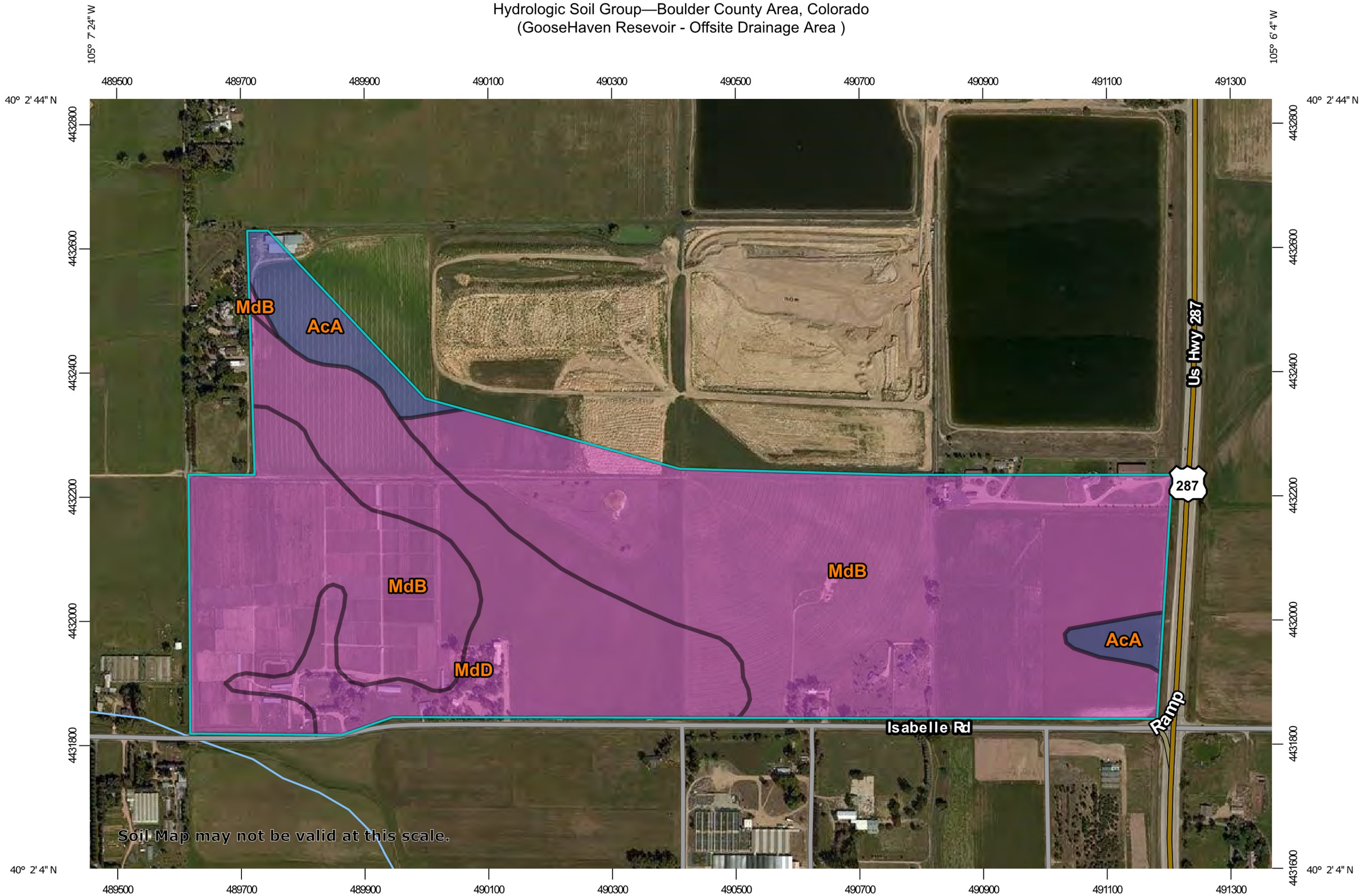
LEGEND

- RESERVOIR BOUNDARY
- SUB-BASIN BOUNDARY
- A 61.5 AC 2 — BASIN ID W/ AREA (ACRES) AND % IMPERVIOUS
- FLOW ARROWS
- A — BASIN DESIGN POINT
- EXISTING CONTOUR INTERVAL
- PROPERTY BOUNDARY

Number	Revision Description	By	Date						
				XXX XXX	CITY OF LAFAYETTE, CO. BOULDER, COUNTY	GOOSEHAVEN RESERVOR COMPLEX DRAINAGE BASIN	MERRICK® 2480 W. 26th Ave. Suite B225 Denver, CO 80211 T303.964.3333 F303.964.3355	DESIGN: XXX DETAIL: XXX CHECK: XXX DATE: XXX, 2005	PROJECT NUMBER XXX	Drawing Number: B-1

APPENDIX C
BASIN SOILS MAP

Hydrologic Soil Group—Boulder County Area, Colorado
(GooseHaven Resevoir - Offsite Drainage Area)



Map Scale: 1:8,740 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 100, 200, 400, 600

Feet: 0, 400, 800, 1600, 2400

N

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

Hydrologic Soil Group—Boulder County Area, Colorado
(GooseHaven Resevoir - Offsite Drainage Area)

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

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

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Boulder County Area, Colorado
Survey Area Data: Version 15, Sep 10, 2018

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

Date(s) aerial images were photographed: Aug 30, 2014—Sep 18, 2014

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AcA	Ascalon sandy loam, 0 to 3 percent slopes	B	9.6	5.3%
MdB	Manter sandy loam, 1 to 3 percent slopes	A	128.4	70.8%
MdD	Manter sandy loam, 3 to 9 percent slopes	A	43.3	23.9%
Totals for Area of Interest			**181.3**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

APPENDIX D
DRAINAGE CALCULATIONS

Calculation of Peak Runoff using Rational Method

Designer: MJG
Company: Merrick
Date: 1/18/2019
Project: GooseHaven Reservoir Drainage Basin A
Location: Lafayette, Colorado

Version 2.00 released May 2017

Cells of this color are for required user-input
Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_i^{0.33}}$$

$$t_t = \frac{L_t}{60K\sqrt{S_t}} = \frac{L_t}{60V_t}$$

$$\text{Computed } t_c = t_i + t_t$$

$$\text{Regional } t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

$t_{minimum}$ = 5 (urban)
$t_{minimum}$ = 10 (non-urban)

$$\text{Selected } t_c = \max\{t_{minimum}, \min(\text{Computed } t_c, \text{Regional } t_c)\}$$

Select UDFCD location for NOAA Atlas 14 Rainfall Depths from the pulldown list OR enter your own depths obtained from the NOAA website (click this link)

	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
1-hour rainfall depth, P1 (in) =	0.83	1.09	1.33	1.69	1.99	2.31	3.14

	a	b	c
Rainfall Intensity Equation Coefficients =	28.50	10.00	0.786

$$I(in/hr) = \frac{a * P_1}{(b + t_c)^c}$$

$$Q(cfs) = CIA$$

Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C							Overland (Initial) Flow Time					Channelized (Travel) Flow Time							Time of Concentration		
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)	Overland Flow Time t_i (min)	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V_t (ft/sec)	Channelized Flow Time t_t (min)	Computed t_c (min)	Regional t_c (min)	Selected t_c (min)
A	61.16	A	2.0	0.01	0.01	0.01	0.01	0.04	0.13	0.27	500.00			0.031	30.33	1928.00			0.036	10	1.89	17.01	47.34	43.99	43.99

Subcatchment Name	Rainfall Intensity, I (in/hr)							Peak Flow, Q (cfs)						
	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
A	1.02	1.35	1.65	2.09	2.47	2.86	3.89	0.32	0.48	0.71	1.39	6.35	21.99	63.54

Calculation of Peak Runoff using Rational Method

Designer: MJG
Company: Merrick
Date: 1/18/2019
Project: GooseHaven Reservoir Drainage Basin B
Location: Lafayette, Colorado

Version 2.00 released May 2017

Cells of this color are for required user-input
Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_i^{0.33}}$$

$$t_t = \frac{L_t}{60K\sqrt{S_t}} = \frac{L_t}{60V_t}$$

$$\text{Computed } t_c = t_i + t_t$$

$$\text{Regional } t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

$t_{minimum} = 5$ (urban)
$t_{minimum} = 10$ (non-urban)

$$\text{Selected } t_c = \max\{t_{minimum}, \min(\text{Computed } t_c, \text{Regional } t_c)\}$$

Select UDFCD location for NOAA Atlas 14 Rainfall Depths from the pulldown list OR enter your own depths obtained from the NOAA website (click this link)

	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
1-hour rainfall depth, P1 (in) =	0.81	1.10	1.37	1.80	2.17	2.58	3.69

	a	b	c
Rainfall Intensity Equation Coefficients =	28.50	10.00	0.786

$$I(in/hr) = \frac{a * P_1}{(b + t_c)^c}$$

$$Q(cfs) = CIA$$

Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C: 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Overland (Initial) Flow Time: Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)	Overland Flow Time t_i (min)
Basin B	52.50	A	2.0	0.01	0.01	0.01	0.01	0.04	0.13	0.27	500.00			0.025	32.65

Subcatchment Name	Channelized (Travel) Flow Time: Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V_t (ft/sec)	Channelized Flow Time t_t (min)	Time of Concentration: Computed t_c (min)	Regional t_c (min)	Selected t_c (min)	Rainfall Intensity, I (in/hr): 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Peak Flow, Q (cfs): 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
Basin B	2065.00			0.025	10	1.58	21.77	54.41	49.12	49.12	0.93	1.27	1.58	2.08	2.50	2.98	4.26	0.25	0.39	0.58	1.19	5.53	19.63	59.68

Calculation of Peak Runoff using Rational Method

Designer: MJG
Company: Merrick
Date: 1/18/2019
Project: Goosehaven Rservoir Drainage Basin C
Location: Lafayette, Colorado.

Version 2.00 released May 2017

Cells of this color are for required user-input
Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_i^{0.33}}$$

$$t_t = \frac{L_t}{60K\sqrt{S_t}} = \frac{L_t}{60V_t}$$

$$\text{Computed } t_c = t_i + t_t$$

$$\text{Regional } t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

$t_{minimum}$ = 5 (urban)
$t_{minimum}$ = 10 (non-urban)

$$\text{Selected } t_c = \max\{t_{minimum}, \min(\text{Computed } t_c, \text{Regional } t_c)\}$$

Select UDFCD location for NOAA Atlas 14 Rainfall Depths from the pulldown list OR enter your own depths obtained from the NOAA website (click this link)

	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
1-hour rainfall depth, P1 (in) =	0.81	1.10	1.37	1.80	2.17	2.58	3.69

	a	b	c
Rainfall Intensity Equation Coefficients =	28.50	10.00	0.786

$$I(in/hr) = \frac{a * P_1}{(b + t_c)^c}$$

$$Q(cfs) = CIA$$

Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
Basin C	31.47	A	2.0	0.01	0.01	0.01	0.01	0.04	0.13	0.27

Subcatchment Name	Overland (Initial) Flow Time: Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)	Overland Flow Time t_i (min)	Channelized (Travel) Flow Time: Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V_t (ft/sec)	Channelized Flow Time t_t (min)
Basin C	500.00			0.025	32.65	1698.00			0.020	10	1.41	20.01

Subcatchment Name	Time of Concentration: Computed t_c (min)	Regional t_c (min)	Selected t_c (min)
Basin C	52.66	47.22	47.22

Subcatchment Name	Rainfall Intensity, I (in/hr) 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Peak Flow, Q (cfs) 2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
Basin C	0.96	1.30	1.62	2.13	2.57	3.05	4.37	0.16	0.24	0.36	0.73	3.40	12.07	36.70

Drainage Diversion Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.020	
Channel Slope	0.01000	ft/ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	6.00	ft
Discharge	54.00	ft^3/s

Results

Normal Depth	1.00	ft
Flow Area	8.97	ft^2
Wetted Perimeter	12.31	ft
Hydraulic Radius	0.73	ft
Top Width	11.99	ft
Critical Depth	1.12	ft
Critical Slope	0.00645	ft/ft
Velocity	6.02	ft/s
Velocity Head	0.56	ft
Specific Energy	1.56	ft
Froude Number	1.23	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.00	ft
Critical Depth	1.12	ft
Channel Slope	0.01000	ft/ft

Drainage Diversion Channel

GVF Output Data

Critical Slope	0.00645	ft/ft

Diversion Channel

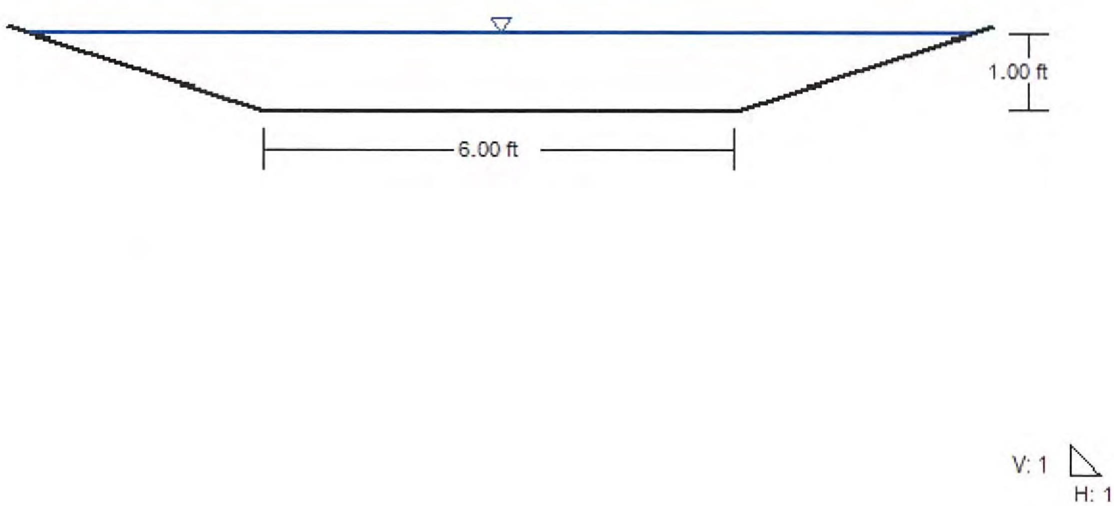
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.020	
Channel Slope	0.01000	ft/ft
Normal Depth	1.00	ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	6.00	ft
Discharge	54.00	ft^3/s

Cross Section Image



Worksheet for Circular Pipe - 1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.024	
Channel Slope	0.02000	ft/ft
Diameter	3.00	ft
Discharge	53.70	ft³/s

Results

Normal Depth	2.63	ft
Flow Area	6.56	ft²
Wetted Perimeter	7.26	ft
Hydraulic Radius	0.90	ft
Top Width	1.98	ft
Critical Depth	2.38	ft
Percent Full	87.6	%
Critical Slope	0.02350	ft/ft
Velocity	8.18	ft/s
Velocity Head	1.04	ft
Specific Energy	3.67	ft
Froude Number	0.79	
Maximum Discharge	54.96	ft³/s
Discharge Full	51.09	ft³/s
Slope Full	0.02210	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	87.56	%
Downstream Velocity	Infinity	ft/s

Worksheet for Circular Pipe - 1

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	2.63	ft
Critical Depth	2.38	ft
Channel Slope	0.02000	ft/ft
Critical Slope	0.02350	ft/ft

Cross Section for Circular Pipe - 1

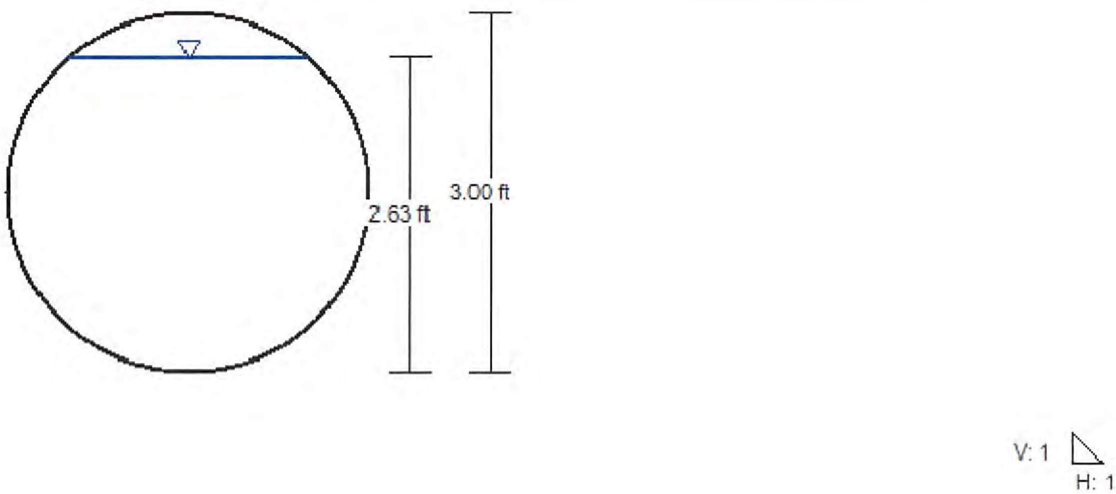
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.024	
Channel Slope	0.02000	ft/ft
Normal Depth	2.63	ft
Diameter	3.00	ft
Discharge	53.70	ft³/s

Cross Section Image



APPENDIX E
DAM BREACH ANALYSIS

Dam Name:	GooseHaven Reservoir	Prepared by:	MJG
Location:	Lafayette, Colorado	Date:	January, 2019
Breach Scenario:	Dam Break		

Height of Dam (ft):	16
Breach Bottom Elevation:	0
Height of water above breach bottom (ft):	12
Reservoir Storage Volume at Failure (acre-feet):	700
Reservoir Surface Area at Failure (acres):	30.5
Failure Scenario:	Overtopping
Discharge through spillways at failure (Q_o, cfs):	0

Breach Parameters

Froelich (2008)

Avg. Breach Width (ft):	96.3	Breach Side Slopes:	1.0	H:1V
Breach Bottom Width (ft):	80.3	K_o Factor:	1.3	
Time of failure (hrs):	1.42			

Froelich (1995)

Avg. Breach Width (ft):	90.9	Breach Side Slopes:	1.4	H:1V
Breach Bottom Width (ft):	68.5	K_o Factor:	1.0	
Time of failure (hrs):	1.34			

MacDonald & Langridge-Monopolis (1984)

[For Piping Scenario Only when Storage Volume is less than 100 acre-feet]

Avg. Breach Width (ft):	79.0	Breach Side Slopes:	0.5	H:1V
Breach Bottom Width (ft):	71.0	Upstream Slopes:	3.0	H:1V
Time of failure (hrs):	0.31	Downstream Slopes:	4.0	H:1V
	Storage exceeds 100 ac-ft	Crest Width (ft):	20	

Wavg	76	Ver	3431.1934	Bff	8400

VALUES USED FOR ANALYSIS (To be Entered by Engineer)

Avg. Breach Width (ft):	96.3	Breach Side Slopes:	1	H:1V
Breach Bottom Width (ft):	80.3	(based on on selected values)		
Time of failure (hrs):	1.42			

Check for: Time of Failure too long

Check for: Time of Failure less than recommended minimum value

Notes:

- The average breach width cannot be wider than The width of The stream valley at The particular elevation.
- The check for time of failures are based on minimum reasonable value (based on MDE experience) and the maximum reasonable valuesbased on expected erosion rate (Von Thun & Gillette (1990)).

Dam Name:	GooseHaven Reservoir	Prepared by:	MJG
Location:	Lafayette, Colorado	Date:	January, 2019
Breach Scenario:	Dam Break		

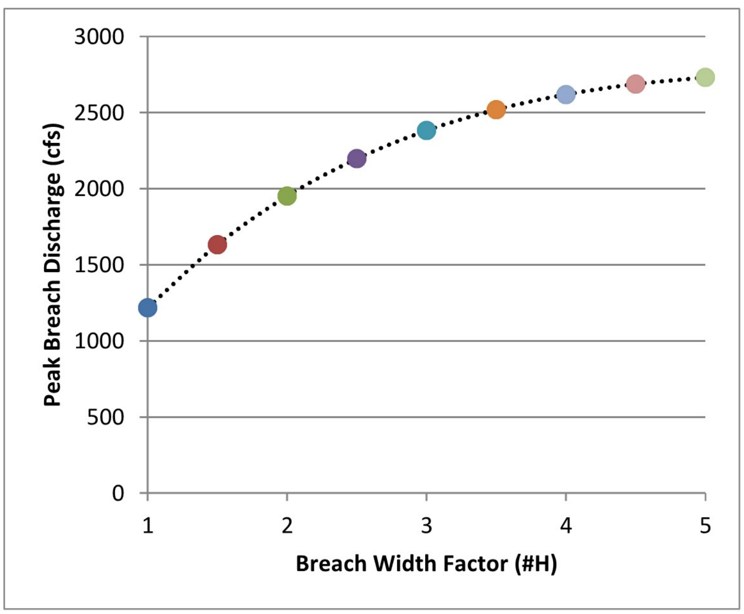
Peak Breach Discharge

National Weather Service Simple Dam Break Equation

Avg. Breach Width (ft) from previous sheet:	96
Time of failure (hrs) from previous sheet:	1.42
Height of water above breach bottom (ft):	12
Reservoir Surface Area at Failure (acres):	30.5
Discharge through spillways at failure (Q_o, cfs):	0

$$Q_b = Q_o + 3.1 B_r (C / (T_f + C / \sqrt{H}))^3$$

Q_b = Peak breach discharge plus discharge through spillways (cfs)
Q_o = Discharge through principal and emergency spillways with water surface at failure level
B_r = Avg. Breach Width (ft), typically 1 to 5 times height of dam
A_s = Reservoir Surface Area at with water surface at failure level (acres)
H = Height of water above breach bottom (ft)
T_f = Time to failure (hrs)
C = $23.4 * A_s / B_r$



Breach Width Factor	Breach Width (feet)	C	Q_b (cfs)
[H]	12	59.48	**1218**
[1.5H]	18	39.65	**1632**
[2H]	24	29.74	**1952**
[2.5H]	30	23.79	**2197**
[3H]	36	19.83	**2382**
[3.5H]	42	16.99	**2520**
[4.0H]	48	14.87	**2619**
[4.5H]	54	13.22	**2688**
[5.0H]	60	11.90	**2731**
Froehlich Eq.	96	7.41	**2687**

Peak Breach Discharge: 2731.4 cfs

Floodplain XS

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00800	ft/ft
Discharge	2731.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	5059.00
0+50	5054.97
1+10	5055.21
3+72	5055.00
7+73	5051.00
10+00	5051.00
13+93	5050.90
17+03	5050.48
20+68	5048.70
22+69	5052.00

Roughness Segment Definitions

Start Station & Elevation	End Station & Elevation	Roughness Coefficient
(0+00, 5059.00)	(22+69, 5052.00)	0.035

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	2.41	ft
Elevation Range	5048.70 to 5059.00 ft	
Flow Area	952.77	ft²

Floodplain XS

Results

Wetted Perimeter		1452.93	ft
Hydraulic Radius		0.66	ft
Top Width		1452.90	ft
Normal Depth		2.41	ft
Critical Depth		1.97	ft
Critical Slope		0.01891	ft/ft
Velocity		2.87	ft/s
Velocity Head		0.13	ft
Specific Energy		2.54	ft
Froude Number		0.62	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.41	ft
Critical Depth	1.97	ft
Channel Slope	0.00800	ft/ft
Critical Slope	0.01891	ft/ft

Typical Floodplain XS

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00800	ft/ft
Normal Depth	2.41	ft
Discharge	2731.00	ft³/s

Cross Section Image

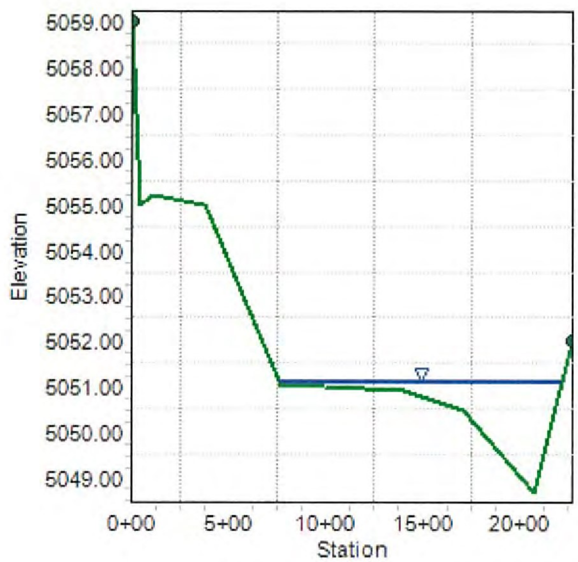
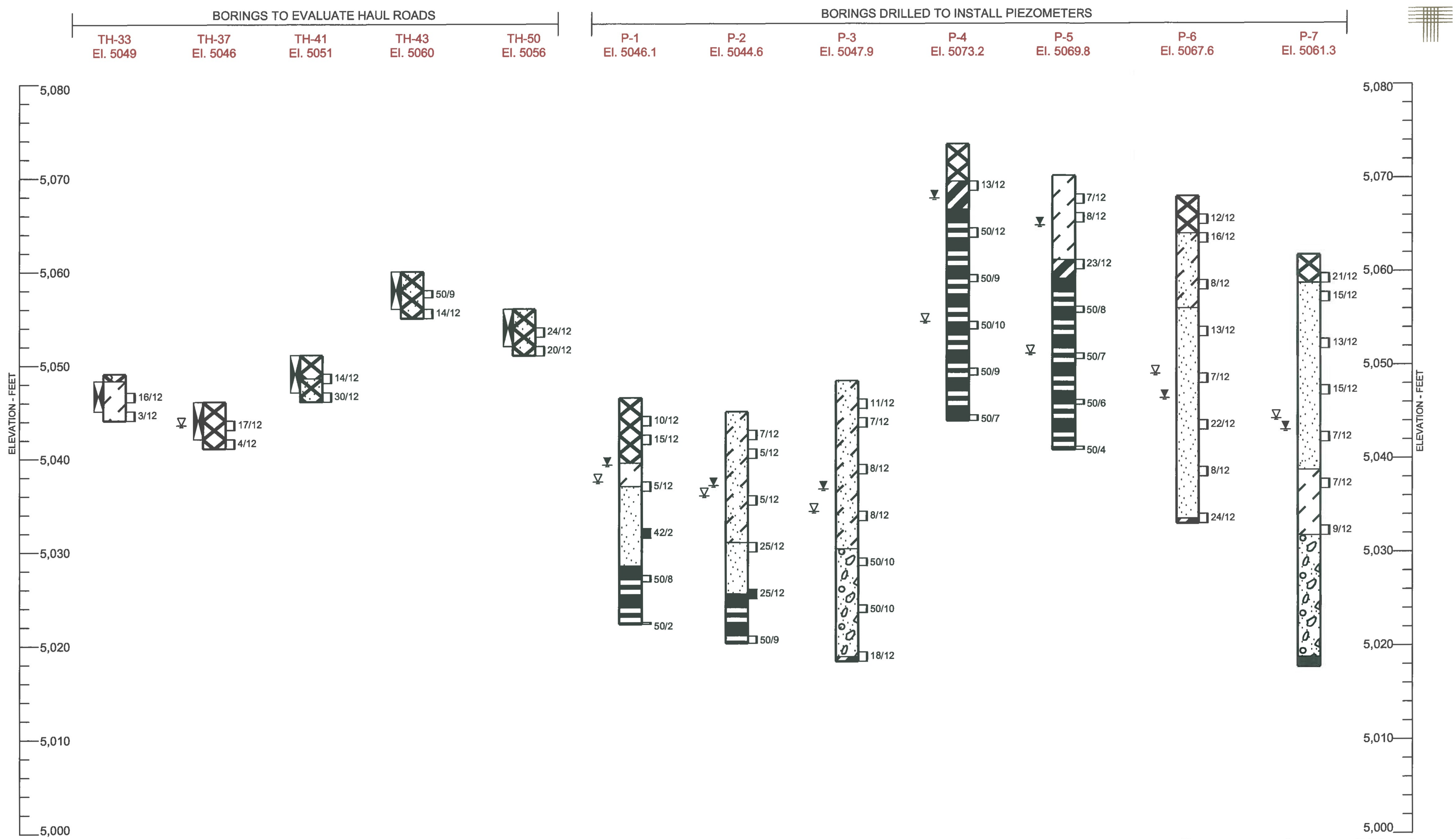


EXHIBIT G Attachment A - Piezometer Drill Logs



Summary Logs of Exploratory Borings and Test Pits

FIGURE A-4

McLAUGHLIN WATER ENGINEERS, LTD
GOOSE HAVEN RESERVOIR COMPLEX EXPANSION
CTL I T PROJECT NO. FC04797-145

7015 0640 0001 5691 2946

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Extra Services & Fees (check box, add fee as appropriate)
- ☐ Return Receipt (hardcopy) $
- ☐ Return Receipt (electronic) $
- ☐ Certified Mail Restricted Delivery $
- ☐ Adult Signature Required $
- ☐ Adult Signature Restricted Delivery $

Postage $

Total Postage and Fees $ 7.58

Postmark Here

BROADWAY PHARMACY BOULDER CO 80304

Schneider Robert W & Alexandra
9907 Isabelle Rd
Lafayette, CO 80026

for Instructions

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Schneider Robert W & Alexandra
9907 Isabelle Rd
Lafayette, CO 80026

9590 9403 0398 5163 4159 12

2. Article Number: 7015 0640 0001 5691 2946

COMPLETE THIS SECTION ON DELIVERY

A. Signature X ☐ Agent ☐ Addressee

B. Received by (Printed Name) ALEXAN DRA

C. Date of Delivery 6-9-22

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
- ☐ Adult Signature
- ☐ Adult Signature Restricted Delivery
- ☑ Certified Mail®
- ☐ Certified Mail Restricted Delivery
- ☐ Collect on Delivery
- ☐ Collect on Delivery Restricted Delivery
- ☐ Insured Mail
- ☐ Insured Mail Restricted Delivery (over $500)
- ☐ Priority Mail Express®
- ☐ Registered Mail™
- ☐ Registered Mail Restricted Delivery
- ☑ Return Receipt for Merchandise
- ☐ Signature Confirmation™
- ☐ Signature Confirmation Restricted Delivery

PS Form 3811, April 2015 PSN 7530-02-000-9053 Domestic Return Receipt

7015 0640 0001 5691 2953

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Extra Services & Fees (check box, add fee as appropriate)
- ☐ Return Receipt (hardcopy) $
- ☐ Return Receipt (electronic) $
- ☐ Certified Mail Restricted Delivery $
- ☐ Adult Signature Required $
- ☐ Adult Signature Restricted Delivery $

Postage $

Total Postage and Fees $ 7.58

Postmark Here

BROADWAY PHARMACY BOULDER CO 80304

Windsor Regina Crawford et al
9905 Isabelle Rd
Lafayette, CO 80026

for Instructions

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Windsor Regina Crawford et al
9905 Isabelle Rd
Lafayette, CO 80026

9590 9403 0398 5163 4159 05

2. Article Number: 7015 0640 0001 5691 2953

COMPLETE THIS SECTION ON DELIVERY

A. Signature X ☐ Agent ☐ Addressee

B. Received by (Printed Name) Dan Goodman

C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

LAFAYETTE CO 80026 JUN 21 2022 USPS

3. Service Type
- ☐ Adult Signature
- ☐ Adult Signature Restricted Delivery
- ☑ Certified Mail®
- ☐ Certified Mail Restricted Delivery
- ☐ Collect on Delivery
- ☐ Collect on Delivery Restricted Delivery
- ☐ Insured Mail
- ☐ Insured Mail Restricted Delivery (over $500)
- ☐ Priority Mail Express®
- ☐ Registered Mail™
- ☐ Registered Mail Restricted Delivery
- ☐ Return Receipt for Merchandise
- ☐ Signature Confirmation™
- ☐ Signature Confirmation Restricted Delivery

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☐ Return Receipt (hardcopy) $
☐ Return Receipt (electronic) $
☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage
$
Total Postage and Fees
$ 7.58

Postmark Here

BROADWAY P... JUN ... BOULDER CO 80304

County of Boulder
5201 St Vrain Rd Bldg 1
Longmont, CO 80503

for Instructions

SENDER: *COMPLETE THIS SECTION*

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

County of Boulder
5201 St Vrain Rd Bldg 1
Longmont, CO 80503

9590 9403 0398 5163 4159 36

2. Article Number (*Transfer from service label*)

7015 0640 0001 5691 2977

PS Form 3811, April 2015 PSN 7530-02-000-9053

COMPLETE THIS SECTION ON DELIVERY

A. Signature
X
☐ Agent
☒ Addressee

B. Received by (*Printed Name*)

C. Date of Delivery
6/8/22

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type
☐ Adult Signature
☐ Adult Signature Restricted Delivery
☒ Certified Mail®
☐ Certified Mail Restricted Delivery
☐ Collect on Delivery
☐ Collect on Delivery Restricted Delivery
...Mail
...Mail Restricted Delivery
...0)
☐ Priority Mail Express®
☐ Registered Mail™
☐ Registered Mail Restricted Delivery
☐ Return Receipt for Merchandise
☐ Signature Confirmation™
☐ Signature Confirmation Restricted Delivery

DENVER CO 802

Domestic Return Receipt

7015 0640 0001 5691 2939

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Domestic Mail Only

For delivery information, visit our website at www.usps.com.

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Extra Services & Fees (check box, add fee as appropriate)
☐ Return Receipt (hardcopy) $
☐ Return Receipt (electronic) $
☐ Certified Mail Restricted Delivery $
☐ Adult Signature Required $
☐ Adult Signature Restricted Delivery $
Postage
$ 7.58
Total Postage and Fees
$

Postmark Here

...-BROADWAY PHARMAC... JUN 6 2022 BOULDER CO 803...

NCWCD
Attn: Jim Struble
424 E County Rd 10
Berthoud, CO 80513

for Instructions