STATE OF COLORADO

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Adequacy Review Response TR-4 / Lyons Quarry / M1977-141

Snyder, Travis <Travis.Snyder@hdrinc.com> Wed, Dec 2, 2020 at 7:45 PM
To: "Eschberger - DNR, Amy" <amy.eschberger@state.co.us>, Jeremy DEUTO <jeremy.deuto@lafargeholcim.com>
Cc: Chance ALLEN <chance.allen@lafargeholcim.com>, Kimberly DENNIS <kimberly.dennis@lafargeholcim.com>

Good evening Amy,

Attached is Revision #1 to Aggregate Industries – Lyons Quarry Permit Technical Revision #4 as well as a crosswalk spreadsheet of responses to your comments. We hope the responses satisfactorily address the concerns identified in Adequacy Review No. 1. If there are still any questions or unresolved issues regarding the Technical Revision, please let us know. Thank you.

Travis Snyder

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2 attachments

Reclamation Permit Technical Revision No.4_Rev.1_201202.pdf
6440K

DRMS Crosswalk and Cost Estimate Table Revisions.xlsx
18K

DRMS Comment Crosswalk

Comment #	Comment	Response
1	On Page 1, under Section 1.1, the Lyons Quarry is referred to as a "112d Reclamation Permit". However, this operation is not considered a Designated Mining Operation (DMO) for which the permit would be referred to as a 112d. This operation is considered a 112 Construction Materials operation for which the permit can be referred to as a 112c. While this is a minor error, it could lead someone to believe this is a DMO permit which has more stringent requirements. Therefore, please change "112d" to "112c" on this page.	Permit designation has been changed to 112c
2	On Page 1, under Section 1.2, the permit history timeline provided has an error and also does not include two revisions approved for this permit. For consistency, the Division recommends the following revisions be made to the timeline:a) The entry of "2016 – Permit Amendment Approved for Quarry Reclamation" is not accurate as there has only been one permit Amendment approved for this operation (AM-01), which was approved on June 11, 2003. However, on June 1, 2016, the Division did approve Technical Revision No. 1 (TR-01) for this operation to include a weed control plan. Please revise this entry accordingly. b) The Division approved Technical Revision No. 2 (TR-02) for this operation on May 19, 2017 to include a final grading plan and highwall configuration for the quarry area. Please add this entry to the timeline.c) The Division approved Technical Revision No. 3 (TR-03) for this operation on July 27, 2018 for the importation and placement of fill material into the quarry area from the Resilient St. Vrain Project. Please add this entry to the timeline.	The timeline has been revised to reflect AM-01 as the only permit amendment. TR-01, TR-02 and TR-03 have been revised to show correct dates and subjects.
3	On Page 4, in Table 1 – Lyons Quarry Reclamation Areas 2-5, the total acreage estimated for all four disturbance areas is 2.78 acres. This does not correlate with the acreages shown on Figures C-2 and C-3 Reclamation Plan Maps which show the four disturbance areas to total 5.9 acres, of which, 5.6 acres will be reclaimed with Type V Soil Riprap with staked in coir matting at slopes of 3H:1V or flatter, and 0.3 acres will be reclaimed with Type M Riprap at slopes of 2H:1V - 3H:1V. Please clarify and/or correct this discrepancy. Additionally, if any of the acreages are revised in Table 1, please ensure the associated volumes are revised accordingly.	Figures, narrative and Table 1 have been revised to be in concurrence with each other.
4	On Page 6, in the 1st paragraph, the text states "In areas where crusher fines are removed below the grade of the floodplain, clean fill will be brought in either from the vegetated berm (LQRA3) or from areas within the quarry that provide suitable backfill material characteristics. This fill material will be combined with riprap to create a soil riprap mixture." Additional details are needed for these tasks in order for the Division to calculate the required financial warranty for the proposed reclamation plan. Firstly, please specify the reclamation areas which will require crusher fines to be removed below the grade of the floodplain. Secondly, please explain where the riprap will be derived for the soil riprap mixture (sorted from on-site material and/or imported). Lastly, please describe the type of equipment which will be used for transporting backfill material from LQRA3 (or elsewhere on site) to the areas requiring backfilling, and for mixing and placing the soil riprap mixture into these areas.	Text in Page 6 Paragraph 2 has been revised to specify that LQRA4 and LQRA5 will be excavated below grade for crusher fines removal. Riprap for the soil riprap backfill material will be sourced on site and a section has been added to ITEM 6.0 of the reclamation plan for producing this material.
5	On Page 6, in the 2nd paragraph, the text states "The reclaimed areas will have slopes of at least 3H:1V with the exception of areas adjacent to South St. Vrain Creek which will be 1.5H:1V". The proposed 1.5H:1V slope for areas adjacent to the channel does not correlate with Figures C-2 and C-3 Reclamation Plan Maps, which show the areas adjacent to the channel (0.3 acres) will have slopes of 2H:1V – 3H:1V. Please clarify and/or correct this discrepancy.	Figures, narrative and Table 1 have been revised to be in concurrence with each other.
6	On Page 6, in the 4th paragraph, the text states "The subgrade of the reclamation areas will be prepared and then covered with a layer of growth medium materials comprised of a blend of available onsite topsoil, the soil materials developed from excavation and breakdown of the weathered fine-grained sedimentary overburden rock, and from imported topsoil, biosolids, or compost." Additional details are needed for these tasks in order for the Division to calculate the required financial warranty for the proposed reclamation plan. Firstly, please provide an estimated depth of growth medium replacement on reclamation areas. Secondly, please describe the anticipated location(s) on site from which topsoil will be derived (at a minimum, the Division requires an estimated average haul or push distance for its calculation). Thirdly, if enough topsoil is not available on site to reclaim these areas, please ensure the Exhibit L Reclamation Costs includes costs for importing additional growth media for reclamation. Lastly, please describe the type of equipment which will be used to extract and/or transport topsoil from its anticipated location(s) on site to the reclamation areas.	The following addition has been made to Section 3, pages 6-7: The estimated depth of growth medium for the reclaimed areas will be 6 inches to be incorporated in to the top 12 inches of soil. The 5.4 acres of reclamation in Table 1 will require approximately 4,356 CY of growth medium. Based on the soil profile shown in Image 1 below, it is estimated that the top 12 inches of soil from LQRA3 will provide a minimum of 2,096 CY of organic material. LQRA3 topsoil materials will be relocated the following distances using a front-end wheel loader and/or articulating haul truck: LQRA3 to LQRA2: Up to 450 feet;LQRA3 to LQRA3: Up to 350 feet;LQRA3 to LQRA4: Up to 400 feet; LQRA3 to LQRA5: Up to 700 feet. The remaining 2,260 CY will be developed from a composition of site-sourced weathered fine-grained sedimentary overburden rock and imported topsoil, biosolids, or compost. Until the Test Plot program can confirm the appropriate composition of this soil blend, Aggregate Industries assumes that 2,260 CY of organic material will need to be imported.
7	On Page 9, under Item 8.2 – Soil Conditioning, it is estimated that 3.5 acres in Reclamation Area 2 will require growth medium replacement. This acreage does not correlate with Table 1 – Lyons Quarry Reclamation Areas 2-5 (on Page 4) which estimates the four disturbance areas to total 2.78 acres, or with Figures C-2 and C-3 Reclamation Plan Maps which show the four disturbance areas to total 5.9 acres. Please clarify and/or correct this discrepancy.	This section has been revised to reflect the changes made in Table 1 and in Section 3. The area to receive soil conditioning will be 5.4 acres.
8	On Page 10, under Item c at the bottom of the page, the text states "It is assumed mulching and crimping will be applied to slopes flatter than 3H:1V or unless prohibited by access or topography. The slope analysis indicates approximately 18.3 acres are in this slope range." This acreage does not correlate with Table 1 – Lyons Quarry Reclamation Areas 2-5 (on Page 4) which estimates the four disturbance areas to total 2.78 acres, or with Figures C-2 and C-3 Reclamation Plan Maps which show the four disturbance areas to total 5.9 acres. Please clarify and/or correct this discrepancy.	Text in Item 8.3c has been revised to state 5.0 acres will receive straw mulch and crimping. Item 8.3b has been revised to state 0.1 acre will receive a jute netting and straw mulch primarily along the stream bank transition between riprap and soil conditioning areas.
9	On Figure C-3 – Reclamation Plan Map, the labels for reclamation areas LQRA 4 and 5 appear to be switched, as the text refers to LQRA4 as the crusher fines deposit within the staging area, and LQRA5 as the crusher fines deposit across the creek channel. Please correct these labels.	These call outs have been revised on Figure C-3
10	On Figure C-3 – Reclamation Plan Map, the reclamation area located north of the creek channel (labeled as LQRA4 on the map – but should be LQRA5 as mentioned above) appears to be located near an existing building which is not shown on this map, but is shown on Figures 1.2 and 1.3 included with the revision. Please describe any anticipated impacts to this structure by the proposed reclamation plan. What is the approximate distance between this structure and the nearest reclamation area?	The structure that is referenced was heavily damaged in the 2013 flood. Aggregate removed the building remains and foundation in 2017.
11	Please ensure Figures C-2 and C-3 Reclamation Plan Maps are updated as needed to include the correct volumes for the reclamation areas and to ensure the acreages provided in the map legend correlate with the acreages provided in the revision text.	The call outs in the figures have been revised to reflect the correct volumes and acreages.
12	Please ensure Figures B-1 and B-2 Grading Plan are updated as needed to reflect the correct labels (e.g., LQRA4, LQRA5) and volumes for the reclamation areas.	The call outs in the figures have been revised to reflect the correct volumes and acreages.
13	In the Exhibit L – Reclamation Costs, additional details are needed in order for the Division to calculate the required financial warranty for the proposed reclamation plan. Please provide the following additional information:	
13a	Please provide more details for the Mobilization/Demobilization task, including the anticipated type and number of equipment to be mobilized/demobilized for reclamation, and the approximate distance to the nearest location where such equipment can be obtained.	The Mob task was proportionately calculated based off the contractor bidding numbers from the Quarry Reclamation last year. The type/equipment was going to include the heavy equipment performing the re-grading of the quarry but could be much smaller if the floodplain work is done separately from the quarry work. Section 5.1, Item 1.0 has been revised to include the type and number of equipment to be mobilized and where this equipment can be locally sourced.
13b	For the Excavation task, please ensure the volume (16,200 cy) is accurate based on any revisions made to the reclamation area acreages and incorporates areas to be over-excavated by 18 inches. Additionally, please describe the anticipated type of equipment to be used for this task.	Text has been revised in Section 5.1, Item 6.1 to clarify the total volume of excavation, including over-excavation, to be 30,810 CY.
13c	Please provide a task item for transporting and placing excavated material from the floodplain reclamation areas into Quarry Pit #2, including a description of the anticipated type of equipment to be used for this task.	Section 5.1, Item 7.0 has been added to address Material Transport and Compaction in to Quarry 2.
13d	Please provide more details for the Backfill and Compaction task, including an explanation of how the volume (7,900 cy) was derived, a description of the backfill material, and the anticipated type of equipment to be used for this task.	Section 5.1, Item 6.2 has been revised to include the following: "The total volume of soil riprap backfill in these areas is estimated to be 19,340 minus the amount for soil growth medium (3,113 CY) for a net total of 16,226 CY". The soil riprap backfill will be placed using an excavator and wheel loader.
13e	Please provide a task item for grading all reclamation areas to the proposed slope gradient. Please be sure to include a description of the anticipated type of equipment to be used for this task.	The following text has been added to Section 5.1, Item 6.3, "Final Grading of all fill slopes, benches, crest areas, and toe areas will ensure that water is not allowed to pond on or adjacent to the fill slopes. Grading will be performed to the proposed slope gradients shown in the Grading Plan (Figures B1 and B2). Final sub-grades will be developed using survey equipment from Item 4.0 and a Caterpillar D6 bulldozer. Final grades with organic material included will be developed using an excavator or tracked skid-steer to lightly spread out the material and prevent compaction".
13f	Please provide a task item for placing riprap along the specified portions of the reclamation areas adjacent to the creek channel.	Section 5.1, Item 6.2 has been added to specify the requirements for riprap and soil riprap placement
13g	Please provide a task item for creating the soil riprap material and placing it into the reclamation areas requiring backfill. Please be sure to include a description of the anticipated type of equipment to be used for this task.	Section 5.1, Item 6.2 has been added to specify the requirements for riprap and soil riprap placement
13h	Please provide more details for the Soil Conditioning task, including an explanation of how the acreage (3.5 acres) was derived, an approximate depth of placement, the estimated haul/push distance from the location where growth medium will be derived, and the anticipated type of equipment to be used for this task	See response to Comment #6 above
13i	Please provide a task item for importing topsoil, biosolids, and/or compost to the site if required for reclamation	Specifications for the selection of imported organic material has been added to Section 5.1, Item 8.2.

13j	Please provide more details for the Revegetation task, including an explanation of how the acreage (3.5 acres) was derived, and itemized costs for all proposed revegetation activities such as seeding, fertilizing, scarifying, and mulching.	Section 5.1, Item 8.3 has been revised with the total acreage now being 5.10 acres. Re-vegetation costs in Exhibit L have been itemized.
14	For the Geotechnical Stability Exhibit, please address the following:	
14a	The 1st sentence refers to Technical Revision #3. However, this submittal is considered Technical Revision No. 4. To reduce any confusion this error may cause, please correct the Technical Revision number in this sentence.	Revisions to the Geotechnical Stability Exhibit have been made accordingly
14b	In the 4th paragraph, the text states "Any impacts to the existing channel slope (in areas LQRA4 and LQRA5) will be restored at a maximum slope of 2.5H:1V with Type M (D50 = 12 in) riprap". This slope gradient does not correlate with the 1.5H:1V slope gradient proposed for these areas in the text (on Page 6) or with the slope gradient shown for these areas on Figures C-2 and C-3 Reclamation Plan Maps, which is 2H:1V – 3H:1V. Please clarify and/or correct this discrepancy.	Revisions to the Geotechnical Stability Exhibit have been made accordingly
15	For the Grading Plan Verification Letter, please address the following:	
15a	The header and the 1st paragraph (in two places) refers to Technical Revision No. 3. However, this submittal is considered Technical Revision No. 4. To reduce any confusion this error may cause, please correct the Technical Revision number throughout this letter.	Revisions to the Grading Plan Verification Letter have been made accordingly
15b	In the last paragraph, the text states that over-excavated areas will be backfilled with soil riprap with a maximum finished grade of 4H:1V. This slope gradient does not correlate with the 3H:1V slope gradient proposed for these areas in the text (on Page 6) or with the slope gradient shown for these areas on Figures C-2 and C-3 Reclamation Plan Maps, which is > 3H:1V. Please clarify and/or correct this discrepancy.	Revisions to the Grading Plan Verification Letter have been made accordingly
15c	In the last paragraph, the text states that any grading impacts to the existing channel slope will be restored at a maximum slope of 2.5H:1V with loose riprap armoring. This slope gradient does not correlate with the 1.5H:1V slope gradient proposed for these areas in the text (on Page 6) or with the slope gradient shown for these areas on Figures C-2 and C-3 Reclamation Plan Maps, which is 2H:1V – 3H:1V. Please clarify and/or correct this discrepancy.	Revisions to the Grading Plan Verification Letter have been made accordingly

Aggregate Industries - WCR, Inc.

Lyons Quarry

112d Reclamation Permit Operations Technical Revision

Boulder County, Colorado

December 2020

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Contents

Attachments

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1 Introduction

1.1 Purpose and Objectives

The purpose of this document is to support the request to the Colorado Division of Reclamation Mining and Safety (DRMS) for a Technical Revision (TR) to the 112c Reclamation Permit Operations for Lyons Quarry (File number M-1977-141). The objectives of this document are to provide a narrative and updated Exhibits that explain the requested revisions to the approved Reclamation Plan based on changes in the mining operations at Lyons Quarry. Revised Exhibits include the following:

Exhibit E – Reclamation Plan

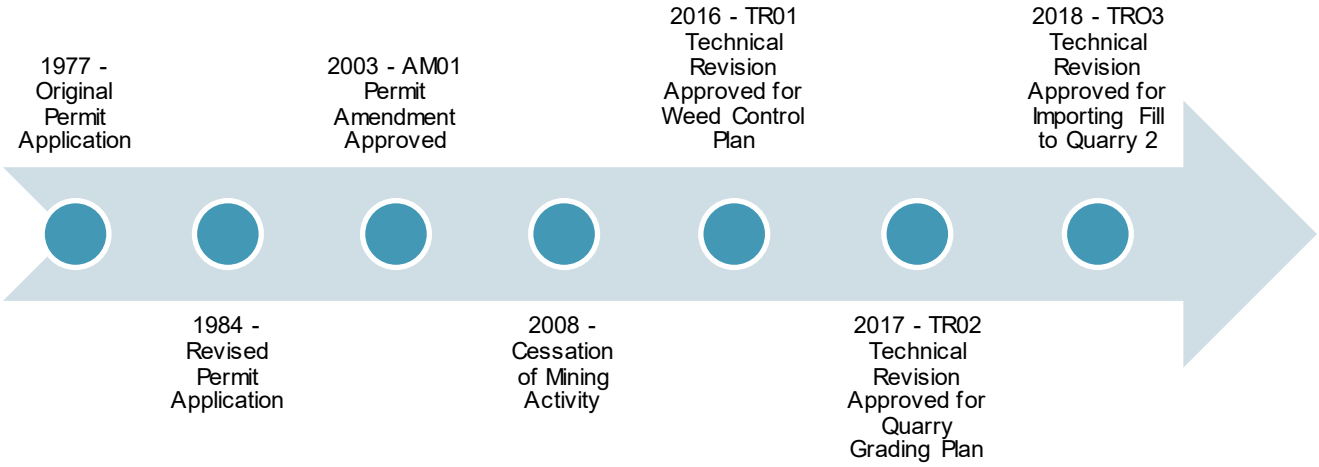
Exhibit F – Reclamation Plan Map

Exhibit L – Reclamation Costs

Rule 6.5 – Geotechnical Stability Exhibit

1.2 Background

Aggregate Industries operated the Lyons Quarry mine located 3 miles southwest of the town of Lyons, Colorado, in the South St. Vrain canyon area. Quartz monzonite was extracted from the mine between 1977 and 2008. A timeline of the approved Mining Plan and Reclamation Plan for the project, as described in the Lyons Quarry Colorado DMG File M-1977-141 (2004), is provided below (Technical Revisions to the permit are noted as TR).



Changes in the mining operations at Lyons Quarry resulted in much less mining (removal of quartz monzonite) than was originally planned. The reduction in mining activities resulted in less removal and stockpiling of overburden materials than were originally planned to support reclamation.

In 2013, flooding of South St. Vrain Creek destroyed several structures on the site and displaced stockpiled materials within the floodplain area. Access to the site was restored via construction of a new bridge and road improvements in 2017. In 2018, the remains of the structures, equipment and miscellaneous surface debris were removed from the floodplain area by Aggregate Industries; however, several areas impacted by the displacement of stockpiled site materials remain.

2 Project Location and Description

2.1 Location

Lyons Quarry is located southwest of Lyons, Colorado in Boulder County. **Figure 1.1,** Attachment A, shows the Lyons Quarry site just south of South St. Vrain Creek, along Colorado State Highway 7 in Sections 25 and 26 of Township 3 North, Range 71 West of the 6th Principle Meridian.

2.2 Recent Flooding

The floods in September 2013 changed the low-lying areas of the Lyons Quarry as up to 17 inches of rain fell over a three-day span raising the levels of the South St. Vrain Creek to 100 and 500-year floodplains (Boulder County's annual precipitation is 18 inches). The flooding washed away the access bridge that crossed the South St. Vrain from Highway 7. **Figure 1.2 and Figure 1.3,** Attachment A, display the pre- and post-flood conditions of the site as satellite images from October 7, 2012 and October 6, 2013, respectively. The extent of the flood destruction and change in creek alignment especially at the east end of the site is shown on these images.

Boulder County Parks and Open Space, the current property owner, contracted Matrix Design Group to develop restoration plans for the 3.2 mile stretch of South St. Vrain Creek, from the Forest Service boundary in the canyon to the Old Saint Vrain Bridge off Highway 7. These restoration plans include the floodplain area located between South St. Vrain Creek and the mined high walls at Lyons Quarry. Restoration of South St. Vrain Creek downstream of the site were completed in 2017. During this work, approximately 25,000 cubic yards (CY) of cobble material from impacted reaches of the South St. Vrain Creek downstream of the site were allowed to be disposed of within Quarry #2 of the Lyons Quarry. This saved the restoration project both time and transportation costs. The preliminary designs for the floodplain area adjacent to the Quarry call for realignment of the creek and will be taken in to consideration for how the reclamation of these areas is considered.

2.3 Lyons Quarry

Lyons Quarry is currently inactive and is being prepared for closure and reclamation in cooperation with the current landowner, Boulder County Parks and Open Space. The Quarry consists of mined and leveled ground along the north end of the site, adjacent to South St. Vrain Creek, with mined high walls and overburden waste piles extending less than 1,500 feet to the south of the creek. **Figure 1.4,** Attachment A, shows the mining operations at the site in September 2002. As of

September 2013, several one story buildings and processing equipment were present near the entrance of the site but most were destroyed or lost during the 2013 flooding. Most of these structures were cleaned up, stockpiled away from the drainageway or removed from the site during the initial flood recovery operations in 2013-2014. The remaining equipment and large debris was removed in 2017.

The surface elevation across the site ranges from elevation (El.) 5,508 feet near the entrance of the site to above El. 6,000 feet at the south end of the site. Existing natural slopes in sedimentary rock strata are as steep as 1.75 horizontal to 1.0 vertical (1.75H:1.0V), where the sedimentary strata are capped by the Lyons Sandstone. Where the sedimentary rocks are not capped by the Lyons Sandstone, these slopes ranged from 2.0H:1.0V to 4.0H:1.0V.

The area within the floodplain is relatively uniform with the exception of the incised channel which the South St. Vrain currently flows with grades of 0.5% to 2.5%. The channel is bounded on the north by Highway 7 and on the south by a vegetated berm. Additional site features within the floodplain area include an orphan stockpile of crusher fines in the northwest corner of the site, a deposit of crusher fines located across South St. Vrain Creek in the northeast corner of the site and a deposit of crusher fines at the entrance to the site. These four areas are currently slated as alternate tasks for removal and relocation in to the quarry pit during the reclamation work of the quarry itself.

Vegetation over most of the site is described by Boulder County ecologists as grasses, forbs, and shrubs/brush with various cottonwoods, willows, Virginia creeper and golden current found along the drainages. Several outcroppings of cottonwoods can be found at the transition between the quarry and the floodplain area as well as the vegetated berm area mentioned above.

Surface water is present along the north edge of the site, in South St. Vrain Creek as well as an existing pond located at the eastern end of the site. Groundwater is present, ponded in low areas and observed as wet areas along the transition zone between the quarry and floodplain areas. Groundwater is also anticipated to be perched above siltstone and shale layers in the Fountain Formation.

3 Exhibit E – Reclamation Plan

The post mining use remains unchanged with the land being reclaimed to cattle range and pasture land in the production, stockpile, and pit floor areas. A Reclamation Plan developed in the 2016 Technical Revision #2 addressed the areas within the quarry, known as Lyons Quarry Reclamation Area 1 (LQRA1), including re-grading the high walls, backfilling the pit areas, installation of runoff erosion control structures around the site perimeter and revegetation of approximately 81% of the LQRA1 total 37 acre area. The remaining 19% of the area includes steep slopes that will either be covered by talus riprap or remain open for nesting birds

This Technical Revision #4 addresses impacted locations within the floodplain area. This area is designated in the original Mining Permit as “Permitted Non-Mining Disturbance Area” is bounded on the north by the pre-2013 flood South St. Vrain Creek channel and on the south by the toe of the

quarry depicted on the design drawings as the "Scour Berm". The east and west boundaries correspond to the mining permit site perimeter.

The following paragraphs provide a summary of the proposed reclamation for Lyons Quarry Reclamation Areas 2 through 5 (LQRA2-LQRA5**)** identified in **Table 1**, which will address the following four discreet areas containing stockpiled materials from mining operations or deposits of crusher fines within the floodplain.

Table 1 - Lyons Quarry Reclamation Areas 2-5

LQRA #	Description	Area Acreage	Restore Acreage	Avg. Depth (FT)	Volume (CY)
2	Orphan pile located in northwest corner	0.24	0.24	5.50	2,130
3	Vegetated Berm along South St. Vrain Creek	1.30	1.30	4.45	9,340
4	Crusher fines deposit within Staging Area	2.76	2.58	3.06	13,610
5	Crusher fines deposit across channel	1.10	1.03	3.23	5,730
	Total	**5.40**	**5.15**		**30,810**

The Site Grading Plan, Attachment B, shows the proposed cut and fill slopes and final grading. Exhibit F – Reclamation Plan Map, Attachment C, shows the planned reclamation areas and the types of reclamation proposed in Reclamation Areas 2 through 5 (Images 1-3), based on a slope analysis of the final grading and the proximity within the floodplain. Section 5.1 provides more detail of the proposed Reclamation Plan and Scope of Work developed for estimating the costs for Exhibit L – Reclamation Cost, Attachment D. Rule 6.5-Geotechnical Stability Exhibit, Attachment E, provides the basis for the Site Grading Plan. The Geotechnical Stability Exhibit limitations include a 3-year limit on the use of the report due to possible changes over time in land use, site conditions, regulations, or other factors. This reclamation plan is based on the premise that the conditions described in the geotechnical report for the analyses performed and the conclusions and recommendations presented still exist at the site and should remain valid for the duration of the planned reclamation. A Grading Plan Verification Letter, signed and sealed by a registered professional engineer (Attachment F) is a letter verifying that the slopes and configurations shown on the Grading Plan meet the specifications of the Geotechnical Stability Exhibit.

Image 1 - Orphan Stockpile (LQRA 2)

Image 2 - Soil Profile of the Vegetated Berm (LQRA3)

Image 3 – Crusher fines across South St. Vrain Creek (LQRA 5)

Table 2 shows the proposed reclamation schedule with planned reclamation phases, sequence, and estimated durations for each phase.

Table 2 – Reclamation Schedule for LQRA1-5

Phase	Duration
Final Design and Construction Documents – Completed June 2019	6 months
Procurement of Construction Contractor – Completed August 2019	2 months
Mobilization, Site Prep. and Earthwork Construction	12 months
Revegetation Test Plot Monitoring	12 months
Revegetation	6 months

As a first step toward final reclamation, and prior to mobilization, an updated topographical survey of the site will be conducted to establish the 100 and 500-year floodplains as well as site perimeters and slope staking. An inventory will be taken of existing structures, utilities, and remaining equipment, if any, to be demobilized and/or disposed of. A project safety plan will be developed to be consistent with applicable MSHA and OSHA requirements prior to initiation of field activities. Utility locates will be conducted prior to any earthwork.

A number of permits and notices are required for construction within the floodplain area. The following permits have either been retained by Aggregate Industries since mining activities ceased or will be applied for prior to commencement of reclamation activities within the floodplain:

- Boulder County Floodplain Permit
  A Boulder County Floodplain Development Permit (FDP) is required for any work within the floodplain. FDP are acquired through the Boulder County Transportation Department. All development and proposed improvements are required to conform to the Article 4-400, Floodplain Overlay District of the Boulder County Land Use Code. A detailed hydraulic report was generated that meets the Hydraulic Modeling Report Guide provided by Boulder County.

- Boulder County Grading Permit
  A Boulder Count Grading Permit is required for grading, excavation or placement of fill in excess of 50 cubic yards. Grading permits must be reviewed by the Planning and Zoning Division, the Transportation and Engineering Department, and Building Safety and Inspection Services through the Land Use Department.

- Boulder County Land Use Permit
- CDPHE Dewatering Permit
- CDPHE Stormwater Discharge Permit
- USACE Pre-Construction Notice

Erosion control Best Management Practices (BMPs) and dust control measures will be established prior to any site grading to restrict sediment transport from the site and control dust generation during construction activities. BMPs will be established in accordance with Boulder County Storm Drainage Criteria Manual that requires the design of BMPs be consistent with the guidance in the Colorado Department of Transportation (CDOT) Erosion Control and Stormwater Quality Guide (CDOT, 2006) or the Mile High Flood District (MHFD), Urban Storm Drainage Criteria Manual Volume 3 (UDFCD, 2016).

Appropriate measures will be taken to ensure areas outside of the affected land are protected and any refuse associated with the flood-impacted area, or any identified hazardous materials, are disposed of properly. At this time there are no known hazardous materials on site and the construction documents will include specifications that require the contractor to stop work immediately and notify Aggregate Industries and the State if any hazardous materials are encountered.

Once the site controls are installed, the grading plan will be implemented. All reclamation slopes in the designated areas will be blended to match surrounding topography. In areas (LQRA4 and LQRA5 specifically) where crusher fines are removed below the grade of the floodplain (Image 3), clean fill will be brought in either from the vegetated berm (LQRA3) or from areas within the quarry that provide suitable backfill material characteristics. This fill material will be combined with riprap borrowed from on-site materials to create a soil riprap mixture as described in Section 5.1. Reclamation adjacent to South Saint Vrain Creek will be protected with Type M riprap. There is no planned reclamation within the creek channel and the proposed grading will not change the existing elevations or flow path of South St. Vrain Creek.

The reclaimed areas will have slopes of at least 4H:1V with the exception of areas adjacent to South St. Vrain Creek which will be 2.5H:1V. All soil riprap backfill will be moisture conditioned, placed, and compacted to achieve adequate density for stability. The revised Site Grading Plan is shown in Attachment B. The slopes shown on the Site Grading Plan are verified as meeting the geotechnical specifications of the Geotechnical Stability Report in a letter signed and sealed by a qualified Colorado registered Professional Engineer, Attachment F.

Soil riprap backfill within the floodplain reclamation areas will be placed in horizontal lifts not exceeding 12 inches in thickness, depending on the fill materials. Compaction requirements will depend on the lift thickness and the equipment used, but adequate compaction should be achievable with the routing of construction equipment traffic, provided material characteristics, moisture content and lift thickness are appropriate. Final grading of all fill slopes, benches, crest areas, and toe areas should ensure that water is not allowed to pond on or adjacent to the fill slopes.

All of the floodplain areas will be reclaimed using types of revegetation appropriate for the final grades and soil conditions present. The subgrade of the reclamation areas will be prepared and then covered with a layer of growth medium material comprised of a blend of available onsite topsoil, the soil materials developed from excavation and breakdown of the weathered fine-grained sedimentary overburden rock, and from imported topsoil, biosolids, or compost. Growth medium will only be imported as necessary and the appropriate blend of onsite and imported topsoil/growth medium for revegetation will be determined based on a Test Plot using the soil types and slopes planned for reclamation.

The estimated depth of growth medium for the reclaimed areas will be 6 inches to be incorporated in to the top 12 inches of soil. The 5.15 acres of reclamation in Table 1 will require approximately 4,154 CY of growth medium. Based on the soil profile shown in Image 2 above, it is estimated that the top 12 inches of soil from LQRA3 will provide a minimum of 2,096 CY of organic material. LQRA3 topsoil materials will be relocated the following distances using a front-end wheel loader and/or articulating haul truck:

- LQRA3 to LQRA2: Up to 450 feet
- LQRA3 to LQRA3: Up to 350 feet
- LQRA3 to LQRA4: Up to 400 feet
- LQRA3 to LQRA5: Up to 700 feet

The remaining 2,058 CY will be developed from a composition of site-sourced weathered fine-grained sedimentary overburden rock and imported topsoil, biosolids, or compost. Until the Test Plot program can confirm the appropriate composition of this soil blend, Aggregate Industries assumes that 2,058 CY of organic material will need to be imported.

The focus of revegetation will be native plant species, adapted to area climate, that require no irrigation. The floodplain area seed mix is expected to differ from the upland seed mix that is specified for the quarry reclamation and will include more riparian species. If irrigation is required, an estimated maximum 0.1 total acre feet is projected to establish vegetation with the goal of no watering once plants are established. The water would be pumped from an existing sedimentation pond at a rate of 40 to 80 gallons per minute, depending upon the irrigation system setup, season,

and weather conditions. Areas of revegetation will be maintained for up to one growing season to control weed infestation.

The existing sedimentation pond on site will be utilized for dust control, fill moisture conditioning, and watering vegetation as needed. The pond will then be backfilled at the end of construction to blend with the surrounding topography, unless post-mining use dictates otherwise. The final contours will be graded toward South St. Vrain Creek.

4 Exhibit F – Reclamation Plan Map

The Reclamation Plan Map is provided as Attachment C.

5 Exhibit L – Reclamation Costs

Estimated reclamation costs for each of the major work items described below are summarized and presented in Exhibit L – Reclamation Costs, Attachment D.

5.1 Planned Reclamation Scope of Work

The following tasks are specific to the reclamation work to be performed in the LQRA2-5 locations and do not include tasks to be performed within the reclamation of the quarry (LQRA1) itself which are covered in Technical Revision #2. The item numbers below correspond to the line item tasks for the contractor to perform as specified in the reclamation project manual.

Item 1.0 – Mobilization/Demobilization

This item includes all costs necessary and incidental to move equipment and supplies onto the project area, perform minimal road improvements, if required, move equipment within the project area during the course of the project, and any other requirements necessary for the successful completion of this project. The contractor will also operate and maintain such temporary works and equipment throughout the period of construction. This item also includes all labor, equipment, and costs associated with demobilization and clean-up of the project site following the completion of the project. For the scope of work proposed, Aggregate assumes that the following equipment will be mobilized to the site:

- (1) Front-end wheel loader with 4.5 CY bucket (Caterpillar 950 or equivalent)
- (2) Track excavator (Caterpillar 329 or equivalent)
- (1) Bulldozer (Caterpillar D6 or equivalent)
- (2) Articulating haul truck (Caterpillar 725 or equivalent)
- (1) Skid steer track loader (Caterpillar 262 or equivalent)

This equipment will most likely be provided by the selected contractor; however, the equipment can also be rented from Wagner Rents – Caterpillar Rental, 1317 E Mulberry St, Fort Collins, CO 80524.

Item 2.0 – Project Safety Plan and Implementation

The project will involve working around inactive quarry slopes and associated hazards, and the contractor must comply with all OSHA regulations. This task includes all the contractor's expenses for employee time, labor, materials, and safety equipment and safety training necessary for preparing and executing a job safety plan. The contractor will be required to prepare the Project Safety Plan implement the plan in conjunction with project implementation.

Item 3.0 – Erosion, Sedimentation, and Dust Control Plan

This item covers the design, installation, maintenance, and removal of temporary erosion, sedimentation, and dust control features. The contractor will be required to install these sediment control features prior to any ground disturbing activities and maintain them throughout the duration of the project. The work to reclaim areas within the floodplain is anticipated to be performed during low flow conditions on South St. Vrain Creek to minimize the impacts of snowmelt runoff within the work areas. The installed temporary erosion and sediment control features assume BMP's in accordance with Boulder County Storm Drainage Criteria Manual, including but not limited to Temporary Embankment Protectors, Silt Barriers and Sediment Control Logs.

Dust generated from the project area during work and off-work periods will be controlled and kept to a minimum. The contractor will be required to develop and implement a Dust Control Plan, including Wind Erosion/Dust Control BMP's and application of water to working areas during working and non-working periods, including weekends, throughout the duration of the project.

Item 4.0 – Site Survey

This task consists of performing all surveys, measurements, and computations required by the specifications to accurately track that the materials are imported and exported according to the design drawings.

Item 5.0 – Disposal of Excavated Materials

This item covers off-site disposal of debris materials that may be encountered during excavation of the floodplain areas. While most of the mining infrastructure has been accounted for, the potential for deposition of debris from upstream sources following the 2013 flood remains.

Item 6.0 – Earthwork Excavation, Backfill, and Compaction

Item 6.1 – Excavation

Once the site controls are installed, the grading plan will be implemented. All areas will be cleared and grubbed prior to excavation and backfilling. Trees with diameters greater than 12 inches will be removed with the root ball intact. Root wad materials will be available for use as stream bank protection for future restoration of South St. Vrain Creek.

All areas that require excavation down to surrounding grade will be over-excavated by 18 inches and backfilled with soil riprap. Excavated materials from the floodplain reclamation areas LQRA 2, 4 and 5 will be transported to Quarry Pit #2 for backfill material if no other appropriate uses for the material can be found. If the organic material from the vegetated berm (LQRA3) is suitable, it will be used for the floodplain areas that require soil conditioning. The total amount of excavation, including over-excavation, is estimated to be 30,810 CY as shown in Table 1.

Item 6.2 - Riprap Bank Armoring and Soil Riprap Backfill

Riprap material sourcing and placement will need to meet the following specifications:

A. Onsite, hard, durable, broken, quarried sandstone or igneous rock. Free from fractures, bedding planes, siltstone or shale layers, pronounced weathering, and earth or other adherent coatings.
B. Elongation: Minimum dimension not less than 1/3 maximum dimension.

C. Unconfined compressive strength: Minimum 4,000 psi in accordance with ASTM D 7012 on drilled core specimen.

D. Relative Density: Minimum 2.5 in accordance with ASTM C 127

E. Gradation: The size, gradation, and weight of riprap shall conform to the requirements specified in Attachment E – Rule 6.5 Geotechnical Stability Exhibit

Installation of riprap along streambanks

A. Place stone to produce a well-graded mass of stone with minimum percentage of voids.

B. Place to required thickness and grades.

C. Place stone to avoid displacing the underlying material.

D. Distribute entire mass to conform to gradation specified.

E. Do not place stone by dumping or similar method likely to cause segregation.

F. Keep finished stone placement free from objectionable pockets of small stones or clusters of larger stone.

G. Hand place smaller stone as necessary to obtain a well-graded distribution.

H. Place stone in schedule and sequence with excavation and embankment construction to prevent mixture of embankment and stone revetment materials.

I. Maintain stone until accepted.

J. Replace any displaced material to lines and grades shown.

The total amount of reclamation area soil riprap backfill and compaction will be performed in the LQRA 4 and LQRA5 which are below existing grades. The total volume of soil riprap backfill in these areas is estimated to be 19,340 minus the amount for soil growth medium (3,113 CY) for a net total of 16,226 CY.

Soil riprap fill materials will consist of overburden materials that are uniformly graded continuously from 9-inch D_{50} Type L riprap size to silt size, with a maximum particle size equal to one-half to two-thirds of the lift thickness and maximum 45 percent fines in the minus 3-inch fraction. Soil riprap backfill will be placed using an excavator and wheel loader as follows:

- Placed in horizontal lifts not to exceed 12 inches thick, based on the maximum particle size of the fill materials
- The soil material shall be native or topsoil and mixed with sixty-five percent (65%) riprap and thirty five percent (35%) soil by volume
- Soil riprap shall consist of a uniform mixture of soil and riprap without voids.
- Compacted to achieve greater than 90% of the maximum dry density in accordance with ASTM D698
- Placed in a manner that allows for a moisture content within 3% of optimum based on ASTM D698

Item 6.3 – Final Grading

Final Grading of all fill slopes, benches, crest areas, and toe areas will ensure that water is not allowed to pond on or adjacent to the fill slopes. Grading will be performed to the proposed slope gradients shown in the Grading Plan (Figures B1 and B2). Final sub-grades will be developed using survey equipment from Item 4.0 and a D6 dozer. Final grades with organic material included will be developed using an excavator or tracked skid-steer to lightly spread out the material and prevent compaction.

Item 7.0 – Fill Material Transport and Compaction in to Quarry 2

Crusher fines and additional soil, excluding organic materials, will be excavated from the reclamation areas to the proposed depths using an excavator. The estimated volume for this is approximately 27,000 CY. The material will be loaded in the articulating haul trucks using excavators or a wheel loader and transported to Quarry 2 where the trucks will dump directly on to the existing grade of the quarry. A D6 dozer will spread the material and compact to greater than 90% of the maximum dry density in accordance with ASTM D698. The fill material will be placed in a manner that allows for a moisture content within 3% of optimum based on ASTM D698. Final Grading of all fill slopes, benches, crest areas, and toe areas will ensure that water is not allowed to pond on or adjacent to the fill slopes. Restoration of Quarry 2 will be performed under the scope for the Quarry area (LQRA1) reclamation which will be covered under a separate Technical Revision.

Item 8.0 – Restoration - Test Plots, Soil Conditioning and Revegetation

Reclamation areas will be restored depending on their proximity to the current channel alignment and whether backfill material is required as shown on Exhibit F- Reclamation Plan Map, Attachment C.

8.1 – Test Plots

The final reclamation topsoil/growth medium, seeding, fertilization, and revegetation will be determined based on the results of Test Plots developed during the Quarry reclamation work using the soil types and slopes planned for reclamation to assist in determining the appropriate types and methods for reclamation.

The actual location of the restoration test plots will be determined by the Quarry reclamation contractor and based on their earthwork schedule and re-grading plan. However, the specifications will require that the contractor develops test plots with similar elevations and aspects as the planned

reclamation. The test plots will have 30'x30' dimensions with two variables per plot, or two 15'x30' subplots. There would be a total of 4 test plots, or 8 total subplots. For the purposes of the floodplain reclamation, an additional test plot will be dedicated to the restoration of the LQRA2-LQRA5 areas. The test plots will be seeded in the spring once the ground surface is exposed and there is sufficient moisture to obtain germination.

The test plots will be monitored periodically throughout the reclamation of the Quarry. The plots and plants would be photographed and a vegetative survey conducted to include plant type, plant height, plant density, overall, vegetation density, and presence of weeds. Monitoring would also include general observations such as evidence of erosion and pest issues. Soil samples would be collected in the fall for routine soil nutrient assessment, including major plant nutrients and micronutrients. Aggregate Industries may also conduct a bench top study to be conducted that could allow the start of reclamation activities sooner than the proposed 12 month schedule. The bench study would supplement the field plot information. By growing indoors, faster germination and vegetative growth can be achieved.

8.2 – Soil Conditioning

All reclamation areas within the floodplain will be reclaimed in a manner that allows for livestock grazing. These areas will be backfilled as described above then covered with a layer of growth medium material. The growth medium material will be developed from a blend of any available topsoil stockpiled on site and material available from the excavation and breakdown of the fine-grained sedimentary overburden rock, supplemented as needed by imported topsoil, biosolids, or compost, then blended, scarified, seeded and mulched. The materials will be transported using front end wheel loaders or articulating haul trucks. This material will then be uniformly spread and mixed with conventional earthmoving equipment, such as dozer rippers or the teeth of an excavator bucket, in to the top 12 inches of the subsoil. Adjusting for over-excavation and subtracting the areas along streambanks that will be covered with riprap, it is anticipated that the soil conditioning area covers approximately 5.15 acres.

Imported soil amendments shall be from a local source of material to be generated during test plot development and reclamation. Caked or lumpy soil amendments will not be accepted. If selected as the preferred source, manure shall be dry cow, horse or sheep manure that has been stockpiled a minimum of one (1) year. Manure shall not be so caked or lumpy that it cannot be spread uniformly.

Compost manure shall be stabilized through at least one heating cycle (120 to 140 F degrees), turned at least once, and windrow for at least 45 days and stockpile for a least 2 months. Biosolids or compost biosolids, containing municipal biosolids, shall meet Colorado Department of Public Health and Environment Water Quality Control Commission 5 CCR 1002-64 Biosolids Regulation No. 64, including permitting and regulatory approval procedures. Soil amendments shall not contain pathogens or toxic materials harmful to human health or vegetation growth.

8.3 – Revegetation

Adjusting for over-excavation and subtracting the areas along streambanks that will be covered with riprap, it is anticipated that the revegetation area covers approximately 5.15 acres. Seeding of the 5.15 acres of reclaimed areas assumes a native seed mix comprised of the species and mixtures recommended by Boulder County Parks and Open Space with updates provided in December 2019 by Senior Plant Ecologist, David Hirt. This seed mix incorporates species that have performed well.

Table 3 shows the native seed mix recommended for 5,500 to 7,000 feet elevation (reclaimed areas at the site range in elevation from 5,500 to 5,820 feet). The listed quantities and application rates are shown in pounds of pure live seed per acre (#PLS/Acre). Assumed application rates have been doubled to account for broadcast seeding. The seeding is anticipated to be completed from March - April 15, 2021. If any areas must be prepared in the summer, fall, or winter, then the topsoil will be mulched at that time and seeded the following spring.

Table 3 – Native Seed Mixes 5,500 Feet to 7,000 Feet Elevation

Common Name	Species Name	Variety	%of Mix	#PLS/ Acre
Canada Wildrye	*Elymus canadensis*	Mandan	12	3.64
Blue Grama	*Bouteloua gracilis*	Native, Alma, or Hachita	14	0.59
Slender Wheatgrass	*Elymus trachycaulus*	San Luis or First Strike	10	2.19
Squirrel Tail	*Elymus elymoides*	Pueblo	12	2.18
Thickspike Wheatgrass	*Elymus trachycaulus*	Critana	10	2.26
Sandberg Bluegrass	*Poa secunda*	Colorado Plateau	5	0.38
Switchgrass	*Panicum virgatum*	Blackwell or Nebraska 28 or BOCO	9	0.81
Green Needlegrass	*Stipa viridula*	Lodorm or Native	8	1.54
Fringed Sage	*Artemesia frigida*	VNS	4	0.03
Hairy Golden Aster	*Heterotheca viliosa*	VNS	5	0.20
Rocky Mtn. Bee Plant	*Cleome serrulata*	VNS	4	2.12
Rabbitbrush	*Ericameria nuaseousus*	VNS	7	0.61
		Totals:	**100**	**16.55**

Fertilization assumes a minimum of 300 pounds (lbs.) of available nitrogen and 50 lbs. of available phosphorous per acre will be supplied after seeding and not included with the seeding. A soil analysis will be performed as part of the Test Plots to determine the fertilizer needs. Immediately following the seeding and fertilizing, the area will be lightly scarified and mulched using various application processes, based on the final grade, soil conditions, and equipment access. These may include:

a. Excelsior and coir mats properly staked down

b. Long-stemmed native prairie straw (4000 lbs/acre) tied down with properly anchored jute netting. This will apply to areas where mechanical crimping is not feasible due to access limitations or slope configuration. We estimate this area to be less than 0.15 acre primarily along the stream bank transition between riprap and soil conditioning areas.

c. Long-stemmed native prairie straw (4000 lbs/acre) mechanically crimped into the soil a minimum of 2". It is assumed mulching and crimping will be applied to all reclaimed slopes flatter than 3H:1V or unless prohibited by access or topography (See Exhibit F – Reclamation Plan). The slope analysis indicates approximately 5.00 acres are in this slope range.

A

Attachment A. Figures

Figure 1.1 – Site Map and Location

Figure 1.2 – Pre-Flood Satellite Image

Figure 1.3 – Post-Flood Satellite Image

Figure 1.4 – Andesite Quarry Mining Map

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Figure 1.1 – Site Map and Location

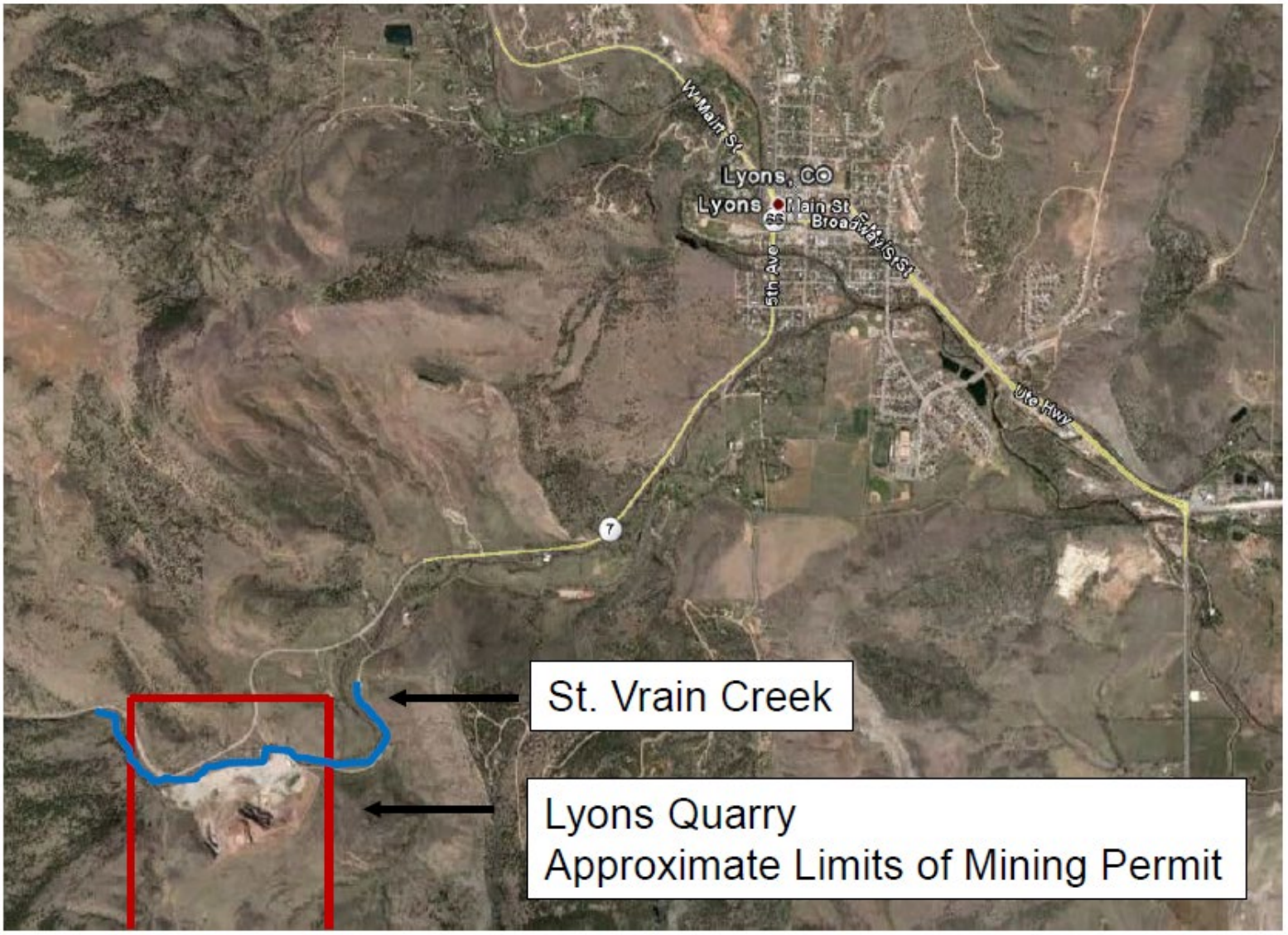

Figure 1.2 – Pre-Flood Satellite Image
October 6, 2012

Figure 1.3 – Post-Flood Satellite Image
October 7, 2013

Figure 1.4 – Andesite Quarry Mining Map

B

Attachment B.
Site Grading Plan

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Figure B-1 – Grading Plan

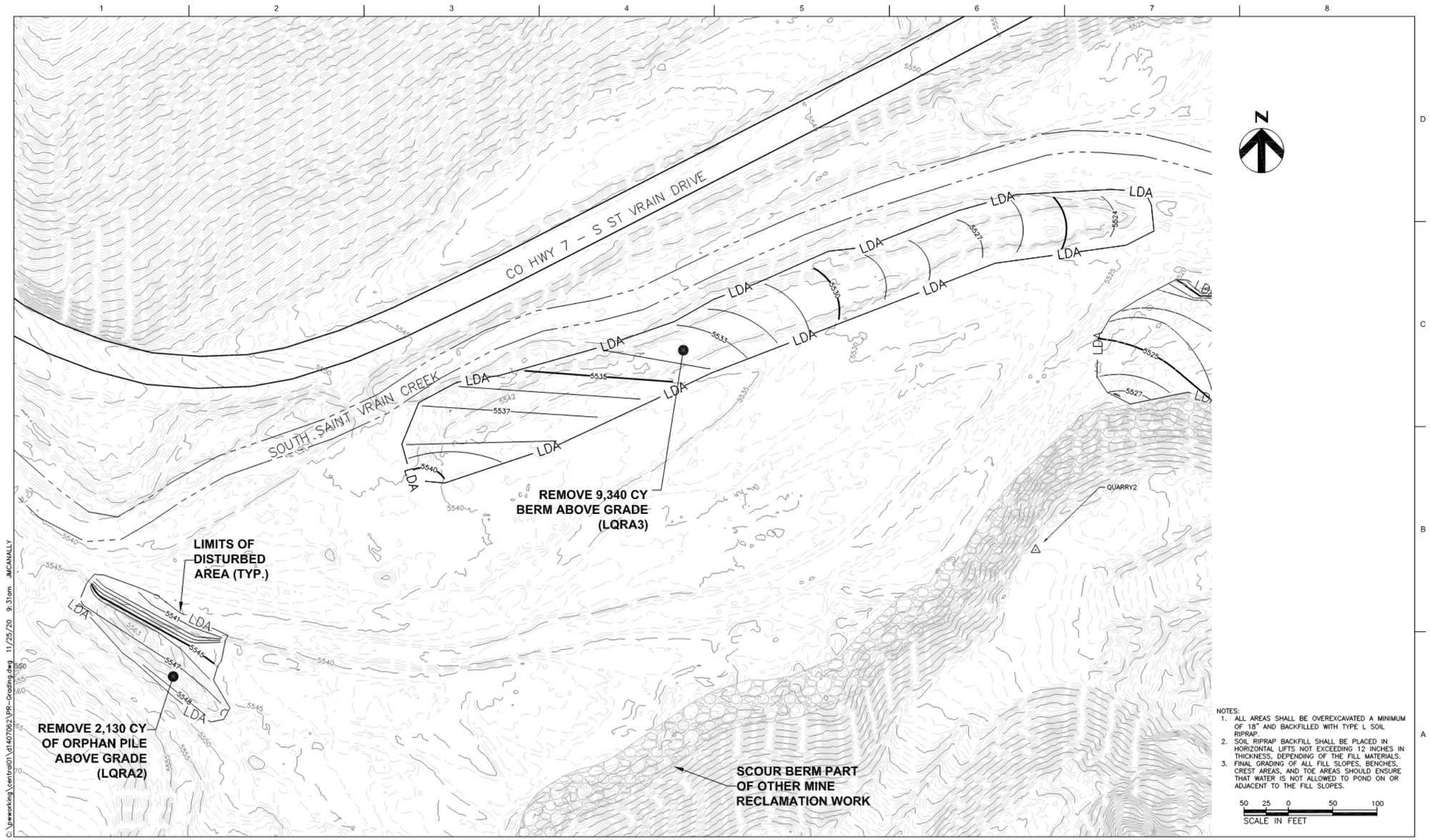
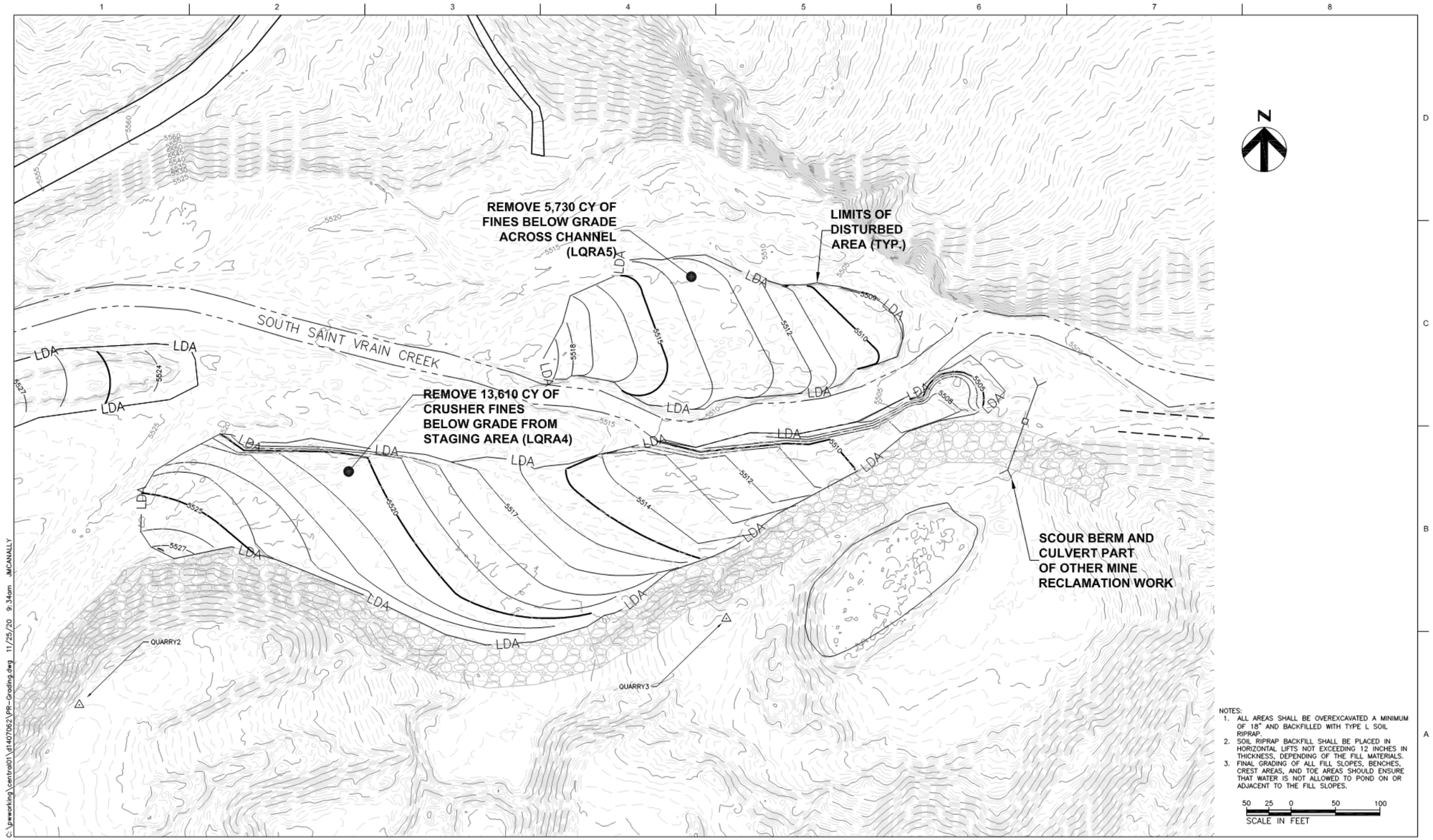


Figure B-2 – Grading Plan



ISSUE DATE DESCRIPTION	PROJECT MANAGER TRAVIS SNYDER DRAWN BY J. MCANALLY PROJECT NUMBER 10191853	AGGREGATE INDUSTRIES LYONS QUARRY RECLAMATION PROJECT

FLOODPLAIN SOIL REMOVAL AREAS SITE GRADING PLAN

FILENAME PR-Grading.dwg
SCALE AS NOTED
SHEET C0-02

C

Attachment C.
Exhibit F –

Reclamation Plan Map

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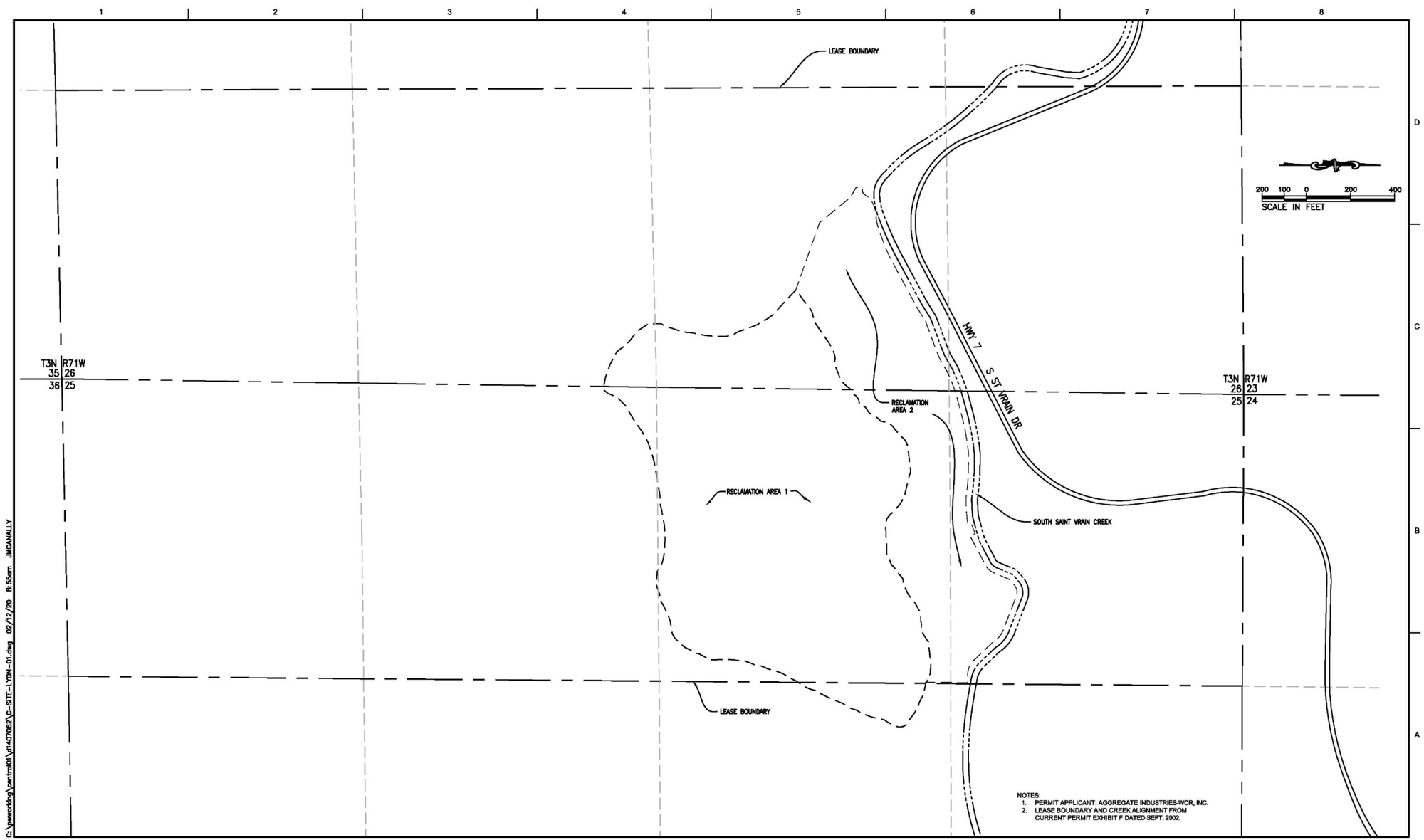
Figure C-1 – Reclamation Plan Map – Exhibit F



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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	TRAVIS SNYDER
DRAWN BY	J. MCANALLY
PROJECT NUMBER	10191853

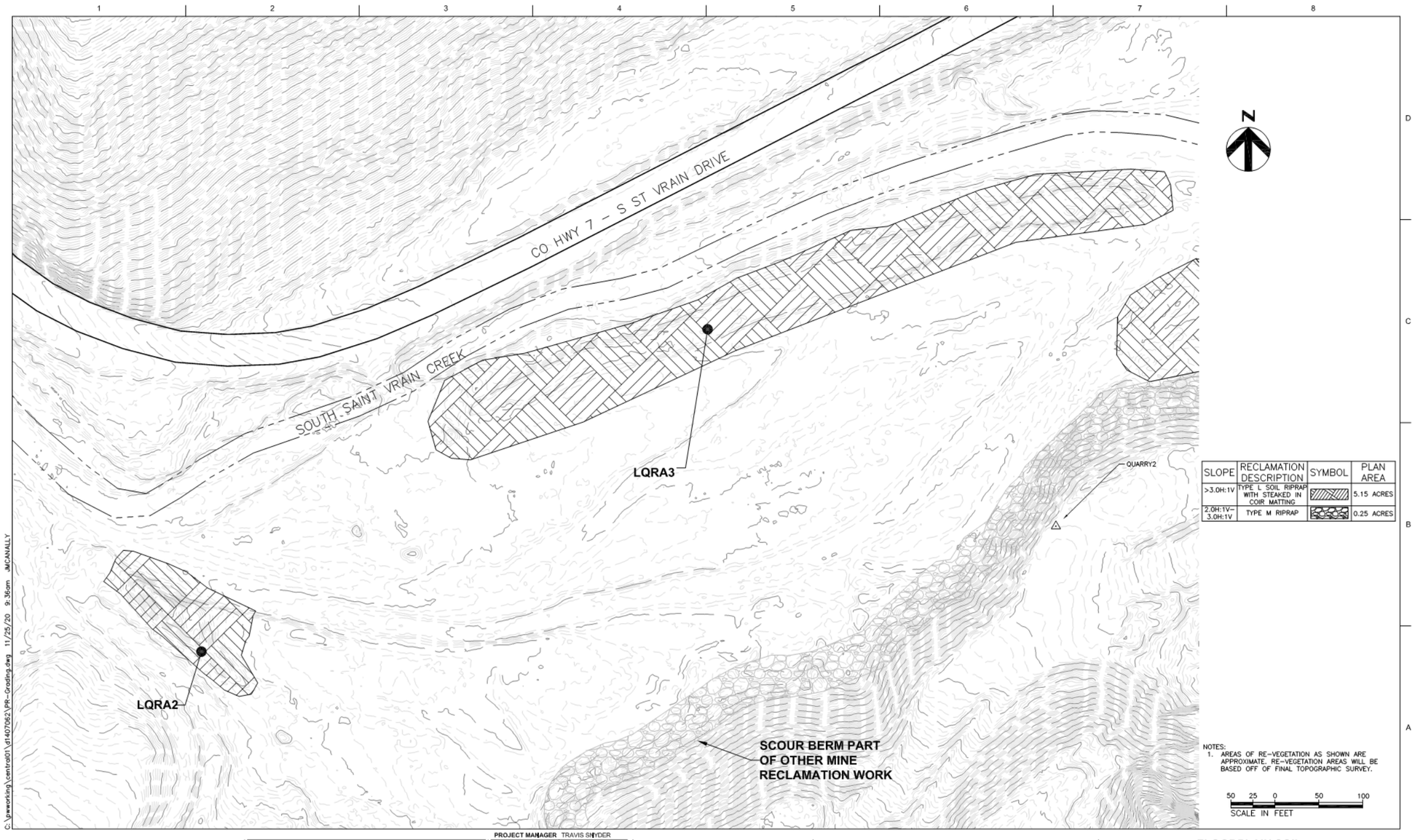
AGGREGATE INDUSTRIES
LYONS QUARRY
RECLAMATION PROJECT

EXHIBIT F
RECLAMATION PLAN

FILENAME	EXH-F-SHEET-01.dwg
SCALE	AS NOTED

SHEET **C0-03**

Figure C-2 – Reclamation Plan Map – Exhibit F



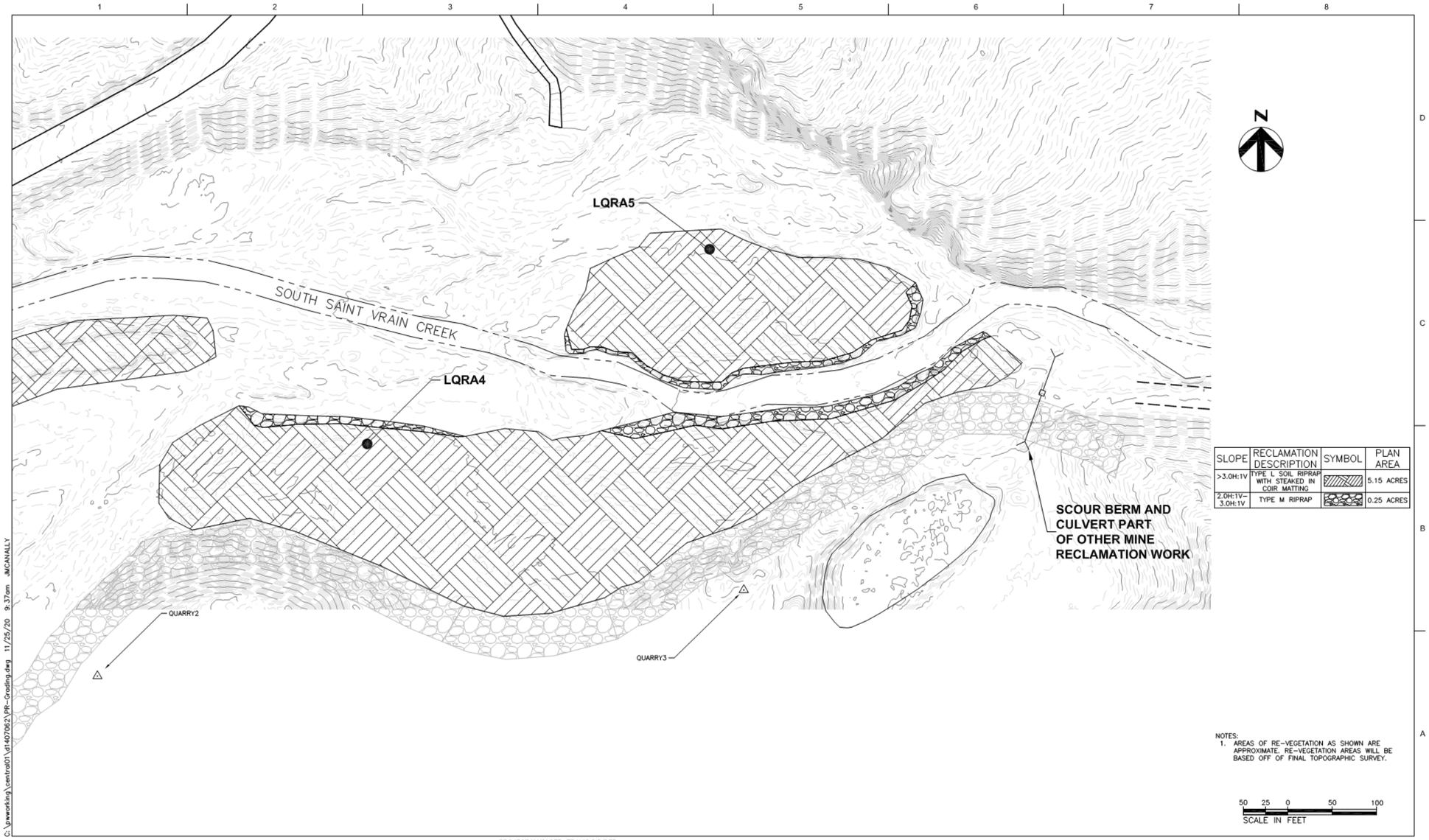
PROJECT MANAGER TRAVIS SNYDER
DRAWN BY J. MCANALLY
PROJECT NUMBER 10191853
ISSUE DATE DESCRIPTION

AGGREGATE INDUSTRIES
LYONS QUARRY
RECLAMATION PROJECT

FLOODPLAIN SOIL REMOVAL AREAS
RECLAMATION PLAN MAP

FILENAME PR-Grading.dwg
SCALE AS NOTED
SHEET C0-04

Figure C-3 – Reclamation Plan Map – Exhibit F



PROJECT MANAGER TRAVIS SNYDER
DRAWN BY J. MCANALLY
PROJECT NUMBER 10191853
ISSUE DATE DESCRIPTION

AGGREGATE INDUSTRIES
LYONS QUARRY
RECLAMATION PROJECT

FLOODPLAIN SOIL REMOVAL AREAS
RECLAMATION PLAN MAP

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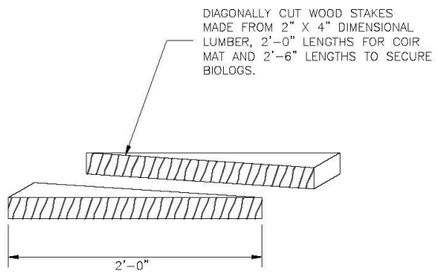
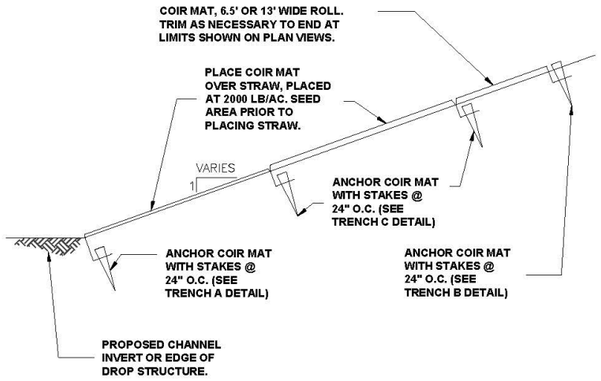
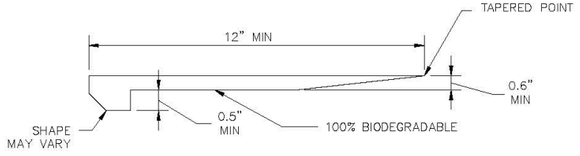
SCALE AS NOTED
SHEET C0-05



CUT WOOD



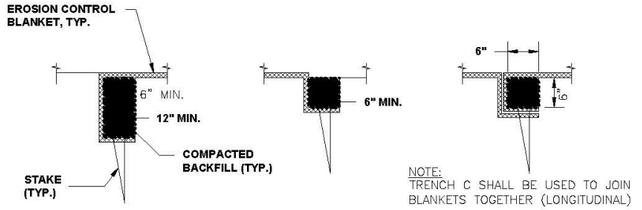
COIR MAT PLACEMENT DETAIL



PROPRIETARY

NOTES
1. PLACE STAKES 1'–6" O.C. TO 3' ABOVE WATER, THEN 2' O.C. TO UPPER LIMIT OF FABRIC.

STAKES



TRENCH A TRENCH B TRENCH C

ANCHOR TRENCH DETAILS FOR EROSION CONTROL BLANKETS

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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	TRAVIS SNYDER
DRAWN BY	J. MCANALLY
PROJECT NUMBER	10191853

AGGREGATE INDUSTRIES
LYONS QUARRY
RECLAMATION PROJECT

FLOODPLAIN SOIL REMOVAL AREAS RECLAMATION DETAILS

FILENAME	PR-Grading.dwg
SCALE	AS NOTED
SHEET	C0-06

D

Attachment D.
Exhibit L –

Reclamation Costs

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Exhibit L – Reclamation Costs

Floodplain Reclamation Cost Estimate					
Item No.	**Description**	**Unit**	**Estimated Quantity**	**Unit Price**	**Total Cost**
1.0	Mobilization/Demobilization	Job	15% of Items 5-8	N/A	$62,373.00
2.0	Project Safety Plan	Job	2% of Items 5-8	N/A	$8,316.00
3.0	Erosion Control	Job	10% of Items 5-8	N/A	$41,582.00
4.0	Survey	Job	3% of Items 5-8	N/A	$12,475.00
5.0	Debris Removal (10 ton/load)	Load	5	$1,600.00	$8,000.00
6.0	Earthwork				
6.1	Excavation	CY	30,810	$2.00	$61,620.00
6.2	Riprap & Soil-Riprap	CY	16,226	$10.00	$162,260.00
6.3	Final Grading	Acre	5.4	$1,000	$5,400.00
7.0	Transport/Compaction of Material in to Quarry 2	CY	27,000	$2.00	$54,000.00
8.0	Restoration	Acre	5.15		
8.1	Soil Test Plots	Each	1	$50,600.00	$50,600.00
8.2	Soil Conditioning	Acre	5.15	$2,000.00	$10,300.00
	Soil Growth Medium Import*	CY	2,260	$20.00	$41,160.00
8.3	Re-vegetation	Acre	5.15		
	Seeding	#PLS	85.0	$50.00	$4,250.00
	Fertilizing	Lbs.	1,785	$2.00	$3,570.00
	Scarifying	Acre	5.15	$866.00	$4,460.00
	Mulching	Lbs.	5,100	$2.00	$10,200.00
	Total of Items 1.0-8.0				**$540,566.00**

* = If Necessary

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E

Attachment E.
Rule 6.5 –

Geotechnical Stability Exhibit

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GEOTECHNICAL STABILITY EXHIBIT

Technical Revision #4 addresses impacted locations within the floodplain area and includes the removal of:

- An orphan pile in the northwest corner of the site (LQRA 2)
- A vegetated berm along South St. Vrain Creek (LQRA 3)
- Crusher fines extending below existing grade deposited within the mine staging area (LQRA 4)
- Crusher fines extending below existing grade deposited across the channel from the staging area (LQRA 5)

All areas that require excavation down to surrounding grade will be over-excavated by 18 inches and backfilled with buried soil riprap. Soil riprap shall consist of a mixture of 35% native soil and 65% Type L (D50 = 9in) riprap to eliminate voids.

In areas where crusher fines are removed below the grade of the floodplain, clean fill from either the vegetated berm (LQRA3) or from areas within the quarry will be used as the soil component.

Areas LQRA 4 and LQRA 5 are adjacent to South Saint Vrain Creek. Any grading impacts to the existing channel slope will be restored at a maximum slope of 2.5H: 1V with Type M (D50 = 12in) riprap.

From Table 2.5 in the SME Mining Reference Handbook, the soil riprap is best classified as a mix of granite, sand and gravel, and mixed grain size till. These materials have an internal angle of friction ranging from 30 to 50 degrees. An internal angle of friction of 45 degrees is assumed to for the riprap and 30 degrees for the buried soil riprap mixture. Any cohesion, or apparent cohesion, was conservatively neglected.

The Factor of Safety (FS) for soil riprap with a 4H: 1V (~14 degree) slope in a compacted mixed till with an assumed internal angle of friction of 30 degrees can be approximated by ignoring the cohesion component of the stability and simply evaluating the internal angle of friction as follows:

$$FS = \frac{Tangent\ of\ Internal\ Angle\ of\ Friction}{Tangent\ of\ Actual\ Angle\ of\ Failure\ Surface}$$

$$FS\ Soil\ Riprap = \frac{Tan\ 30°}{Tang\ 14°} = 2.3$$

The Factor of Safety for riprap with a 2.5H: 1V (~21.8 degree) slope with an assumed internal angle of friction of 45 degrees can be approximated by ignoring the cohesion component of the stability and simply evaluating the internal angle of friction as follows:

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$$FS\ Riprap = \frac{Tan\ 45°}{Tang\ 21.8°} = 2.5$$

Conclusion

The factor of safety is 2.5 in the permanent case along the channel banks and 2.3 everywhere else. Both are well above the minimum of 1.5 for permanent conditions.

Jonathan McAnally, P.E.
P.E. #52852

References

Lowrie, Raymond L. *SME Mining Reference Handbook*. Society for Mining, Metallurgy, and Exploration, 2002.

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Attachment F. Grading Plan Verification Letter

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November 20, 2020

Michael Cunningham
Colorado Division of Reclamation, Mining and Safety
1313 Sherman Street, Room 215
Denver, CO 80203

RE: Lyons Quarry; DRMS File No. M-1 977-141; Technical Revision No. 4; Verification of Grading Plan

Dear Mr. Cunningham,

This letter is to verify that the slopes and overall configuration shown on the grading plan presented in Technical Revision No. 4 meet the geotechnical specifications outlined in the Rule 6.5-Geotechnical Stability Exhibit. Technical Revision #4 addresses impacted locations within the floodplain area and includes the removal of:

- An orphan pile in the northwest corner of the site (LQRA 2)
- A vegetated berm along South St. Vrain Creek (LQRA 3)
- Crusher fines extending below existing grade deposited within the mine staging area (LQRA 4)
- Crusher fines extending below existing grade deposited across the channel from the staging area (LQRA 5)

All areas that require excavation down to surrounding grade will be over-excavated by 18 inches and backfilled with Type L buried soil riprap with a maximum finished grade of 4H: 1V. Any grading impacts to the existing channel slope will be restored at a maximum slope of 2.5H: 1V with Type M loose riprap armoring.

Sincerely,
HDR

Jon McAnally, PE
Project Engineer

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