

RESOURCE MANAGEMENT PLAN

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Prepared for:

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November 10, 2013



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1.0 INTRODUCTION

1.1 Purpose and Scope

This Resource Management Plan (Plan) has been prepared as a component of the Interim Use Permit (IUP) application by Jordan Gravel, LLC (Jordan Gravel), to operate a sand and gravel mine in portions of Sections 8 and 7, Township 114, Range 23, Scott County, Minnesota. Site location is shown on Figure 1. The Plan has been prepared in accordance with the requirements of the Scott County Zoning Ordinance (Ordinance), Chapter 6A-3-1 *Resource Management Plan*. The Plan includes sufficient information to evaluate the environmental characteristics of affected areas, the potential impacts of the proposed activity on water and soil resources, and the measures proposed by Jordan Gravel to prevent those impacts. It must be approved by the Scott County Planning Department prior to any land disturbance activities, and all such activities must be performed in accordance with the approved plan. This Plan supersedes all previous versions.

2.0 RESOURCE MANAGEMENT PLAN REQUIREMENTS

This section presents the information required to be included in a Resource Management Plan according to items [1] and [2] of Chapter 6A-3-1 of the Ordinance.

2.1 Site Plan

The Site boundary survey (Figure 2) and existing conditions map (Sheet 1 of Appendix A) contain pertinent information regarding the Site, including:

- Scale of plan
- North point indication
- Existing boundaries with lot dimension and area
- Existing site improvements
- All encroachments
- Easements of record
- Legal description of the property
- Creeks, wetlands, 100 year flood elevations and other waterways bordering on or running through the property
- Onsite septic areas

As required in Section 2-10-3 of the Scott County Zoning Ordinance.

2.2 Project Narrative

The overall project and the nature and extent of land disturbing activity is described fully in the IUP application. A summary of the project is provided here. The proposed Site contains abundant, high-quality aggregate reserves which will be mined, crushed and used in redi-mix concrete, asphalt and as base material for private and public construction projects. Mining will be conducted in phases and reclamation will be on-going following the completion of mining phases. Upon completion of the mining, the Site will be restored for end uses including a large, deep water lake and residential home building sites with access to this water feature. Currently large portions of the Site are used for agricultural. It is anticipated the Mining Operation will displace those uses.

The Mining Operation will occur in five phases over the approximately 85 acre site. Phasing is indicated on Sheet 2 of the IUP Drawings in Appendix A. Phases 1 and 2A (approximately 14.7 acres) will begin in the middle part of Phase 1 and move northwest into Phase 2. Minimal grading will occur on this portion of the Site for construction of the Mining Operation facilities. Initially the Mining Operation will include a screening plant and stockpiles in Phases 1 and 2A. Mining will then begin in the Pond Phase and progress through Phases 2b through 4; stormwater runoff will be contained on Site. Silt fence, diversion berms, temporary sediment basins, establishment of vegetation, erosion control blankets, and sediment logs will be used as they are needed to reduce erosion and ensure all stormwater

contacting mining areas is contained in the Mining Pond to contain sediment and control outflow. Implementation and inspection/maintenance of these measures is discussed on Section 4 of this Plan.

It is anticipated the Phases 1-4 will be completed within 1-2 years and the Pond Phase will be conducted for the life of the mine. Depending on market demand, it is possible that the Mining Operation could be completed in less than the estimated life expectancy. However, a conservative estimate of the Mining Operation's life is 20-25 years.

Reclamation of the Site will be an on-going process and will include the implementation of permanent best management practices (BMPs) such as the stormwater infiltration pond, slope stabilization, and establishment of vegetation. Reclamation shall begin after approximately 20 percent of the total area to be mined has been opened up and excavated. As mining progresses in accordance with the Mine Phasing, reclamation will occur as permissible in those areas where mining is complete. Reclamation will be completed within one (1) year after terminating the Mining Operation. Within three (3) months of completion of the Mining Operation, operational buildings, structures, and plants incidental to the mining shall be dismantled and removed by the mining operator, unless a suitable repurposing use can be found and approved by the appropriate government agency.

Project Contact Information:

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2.3 Existing Drainage Patterns and Receiving Bodies

Existing drainage patterns are shown on Sheet 1 of the mining plans, which are attached as Appendix A. The project area currently contains two watersheds. One watershed encompasses approximately 20% of the project area on the northwestern edge of the Site, along Valley View Drive. This watershed generally is characterized by soils with high infiltration capacity so little runoff from the site occurs except during the spring thaw when the ground is frozen. The other watershed encompasses the remaining area of the Site. The western half of the watershed drains to a ponding area in the center of the Site. Any overflow from this ponding area drains to the eastern half of the watershed which drains to the east into Sand Creek, which through a series of culverts and wetlands and the Louisville Swamp eventually discharges into the Minnesota River.

2.4 Locations of Existing wetlands, Protected Waters and Their 100-Year Flood Elevations

The locations of wetlands mapped by the National Wetlands Inventory (NWI) on and around the Site can be seen on Figure 3. In addition, a wetland delineation is being conducted on the Site, but is not yet complete at the time of publication of this document. Preliminary results of the wetland delineation are shown on Figure 4, which illustrates three wetlands or potential wetlands that are expected to be disturbed by mining operations. Once the delineation is finalized, the locations of the wetlands will be added to Sheet 1 of Appendix A, Existing Conditions, and submitted to Scott County.

2.5 Existing Vegetation

Historically, the majority of the Site has used for agricultural purposes, including cultivation of row crops, small grains, and alfalfa. The remaining vegetation consists of brush, wooded areas, and grass.

2.6 Soils Map

According to the Natural Resource Conservation Service, the predominant soil type located on-site is Hubbard/Sparta fine sand 0 to 12 percent (HdC2, HdB2, HdA). These soils are all Hydrologic Soil Group "A" soils. The southeastern area of the Site consists of soil type Alluvial land, frequent overflow, 0 to 6 percent slopes (Ab). This soil is a Hydrologic Soil Group "A/D" soil. The south central area of the Site consists of Alluvial land, 0 to 2 percent slopes (AaA). This soil is a Hydrologic Soil Group "B" soil. There are also two small pockets of Dickman sandy loam, 0 to 2 percent (DbA) on the north western edge of the Site. This soil is a Hydrologic Soil Group "A" soil. See Appendix B - Soil Map, for soil type boundaries, mapping units, soil names, and hydrologic soil groups.

2.7 100-year Floodplains

Based on data from the Federal Emergency Management Association (FEMA), the 100-year flood elevation of Sand Creek ranges from 733 feet in the southwest portion of the site to 731.5 feet in the northeast portion of the site. The 100-year flood elevation is delineated on Existing Conditions, Sheet 1 of Appendix A.

3.0 STORMWATER MANAGEMENT STANDARDS

3.1 General Standards

Stormwater management for the mining and reclamation operation has been developed in accordance with Article B of Chapter 6 of the Ordinance. The project will comply with runoff quantity, quality and rate control regulations as specified in the Ordinance as well as requirements of the National Pollutant Discharge Elimination System (NPDES) including obtaining a permit and adoption of a Pollution Prevention Plan (P2 Plan). The P2 Plan addresses stormwater management and is required for coverage under the NPDES Nonmetallic Mining and Associated Activities permit (MNG490000).

3.2 Pre-Settlement Conditions

The site presently drains in two directions as it lies on a ridge separating drainage from the Minnesota River and Sand Creek. The majority of the site, approximately 71 acres, drains to the southeast to Sand Creek via overland flows. The northwestern portion of the site, approximately 17 acres, drains to the north to the right of way along Valley View Drive. This area is landlocked and has no direct outlet to the Minnesota River at this time. Very little runoff from adjacent parcels enters this property due to its position along the ridge separating the Minnesota River and Sand Creek. Please see Sheet 1 of Appendix A for existing surface water flow direction.

3.3 Active Mining Condition

During mining operations, in the absence of flood conditions stormwater runoff will be completely contained within the mining area for the 2, 10, and 100-year storms and will subsequently infiltrate or evaporate. The pond that is created during mining will receive runoff during the active life of the mine. During conditions of flooding in Sand Creek, the mine floor within the floodplain and the mine pond will be inundated with floodwater. Flood conditions are discussed in Section 3.6 of this Plan.

Stormwater runoff chemical composition will not differ appreciably from current conditions. An increased sediment load can be expected for runoff from the active mining area, however this water will be contained on site and infiltrate into the subsurface so there will not be additional sediment transported to off-site water bodies.

3.4 Reclamation Condition

The site will be reclaimed to allow for two residential lots, please see Sheet 4 of Appendix A. The majority of the site, approximately 73 acres, will drain into the groundwater pond created by the mining operation. The northwestern portion of the site, approximately 26 acres, will drain to an infiltration pond with no outlet. The infiltration pond has the capacity to accept the stormwater runoff from the proposed residential use.

The proposed infiltration area is proposed in an area of high groundwater contamination susceptibility. As a result, it must meet the standard outlined in Scott County Zoning Ordinance Chapter 6, Article B, Section 6B-2.5.a and b. The maximum infiltration rate allowed is 5 minutes per inch (12 inches per hour) for a constructed infiltration basin. A liner must be provided to meet this standard if shown it is required by site-specific testing (double ring infiltrometer). Please see Sheet 4 of Appendix A for proposed surface water flow direction.

Due to the use of infiltration and evaporation to dispose of all stormwater onsite for the mining and reclamation phases, water quality, discharge rate and volume control will be maintained or improved from the pre-settlement conditions.

3.5 Created Groundwater Lake from Mining

A 32 acre groundwater lake will be created from the mining operation and will remain after reclamation. Stormwater analysis shows that the high water levels (HWL's) for the 2, 10, and 100-year storm events will not overflow the lake in non-flooding conditions. HWL's are as follows for the non-flooded reclamation condition:

NWL = 720.00'
2-yr HWL = 720.18'
10-yr HWL = 720.35'
100-yr HWL = 720.59'

The stormwater analysis was conducted using HydroCAD® stormwater modeling software. A copy of the analysis is attached as Appendix C.

3.6 Prevention of Downstream Nuisance or Damage

3.6.1 Flooding and Erosion Protection

Based on the flood elevation information obtained from Scott County, the 100-year flood elevation at the Property ranges from elevation 733 ft in the southwest to 731.5 ft in the northeast; therefore a significant portion of the mining area is located within the 100-year flood plain. There will be no change in the ability of Sand Creek to access its floodplain as a result of the proposed project as the berm will retain the present natural overflow elevations.

Permanent structures or equipment storage will not be located below the flood elevation. Neither the mining activities nor the reclamation plan involve placing any fill below the existing floodplain level, and in fact the project results in a net increase in flood storage of approximately 390 acre-feet.

For non-flooding events, peak rates and volumes will be less than pre-settlement conditions and therefore do not increase the risk of downstream nuisance or damage.

During flood conditions the lake level will overtop the mine edge. In order to mitigate the potential for erosion along the mine perimeter and re-channelization of Sand Creek during flood conditions a swale and spillway will be constructed at the natural saddle between Sand Creek and the mine boundary. The spillway will provide controlled flow of flood waters into and out of the mine during the rise and recession of Sand Creek flood waters. An outlet pipe will also be installed next to the spillway to facilitate and regulate drainage from the mine after flood water recedes to a level below the spillway elevation. Both the spillway and pipe outlet will be armored with three-dimensional turf mat to prevent erosion. Design details of the spillway and outlet pipe are presented in a technical memorandum and supporting figures which are attached as Appendix D.

3.6.2 Ice Jams

Ice will typically form on the mine pond during winter months. This ice may be present during the spring snow-melt period, during which time Sand Creek may undergo flood conditions. This condition would result in the potential for ice from the mine pond to be carried off site and downstream by flood water. Potential problems associated with the transport of ice from the mine pond include:

- Ice becoming lodged in the spillway – This type of ice jam could result in blocked flow through the spillway, causing water to flow over the top of the stream bank at other locations along the mine boundary. This could result in erosion of the stream channel bank ultimately lead to establishment of the Sand Creek channel through the mine pit.
- Ice flowing downstream to the 173rd Street bridge over Sand Creek – Ice jams at the 173rd Street bridge have occurred in the recent past and are a known hazard.

The flow of ice will be regulated using ice booms. According to the U.S. Army Corps of Engineers, ice booms are the most widely used type of ice-control structure¹. The booms will consist of a series of timbers or pontoons tethered together that restrict the movement of ice downstream from the mine pond. The booms will be placed along the southeast edge of the mine pond during the spring thaw.

3.7 Specific Standards for Areas of Moderate or High Susceptibility to Groundwater Contamination

After reclamation, the proposed infiltration area in the northwest portion of the Site is highly susceptible to groundwater contamination. See Section 3.4 for design requirements for infiltration pond in such areas.

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¹ U.S. Army Corps of Engineers, 2002. Ice Engineering, Engineering and Design Manual 1110-2-1612, Chapter 12 – Ice Jam Mitigation Techniques.

4.0 EROSION AND SEDIMENT CONTROL MEASURES

Soil erosion and sedimentation will be minimized on the Site throughout the duration of mining and reclamation activity by the following practices in order to prevent erosion or sedimentation that results in damages to water or off-site impacts. Additional detail on stormwater controls can be found in the P2 Plan.

4.1 Mining/Processing Construction and Operations

Site soils are granular and highly erodible; however no sediment resulting from mining activities will be allowed outside of the mining limits. Mine slopes will be a maximum grade of 1.5H:1V, during active mining only and sediment generated from erosion of the active mining face will be contained on-site within the excavation.

Depending on the locations of processed aggregate stockpiles, additional erosion controls such as silt fence or grading and/or berm construction may be necessary to contain or redirect sediment that may erode from the stockpiles. It is anticipated that silt fence will be maintained around unworked areas of recycled concrete and asphalt stockpiles to prevent erosion of this material and potential co-mingling with natural aggregate. Sand and gravel stockpiles will typically not require barrier-type erosion controls during active mining; however once adjacent phases are reclaimed silt fence should be installed around un-worked areas of the stockpiles to prevent sediment transport onto reclaimed areas. Temporary silt fence may be used around other portions of the mine during start-up activities such as topsoil stripping. Temporary stormwater ponds may also be employed as needed to prevent any off-site discharge during start-up, particularly during development of the processing plant site. As material is excavated, the natural embankment of the mine slope will contain eroded sediment and stormwater.

4.2 Reclamation Construction and Operations

Perimeter reclamation slopes will be graded to a slope of 5H:1V to an elevation of approximately 742 in the upland area, which is ten feet above the site-wide average 100-year flood level of 732 ft. An area of open water will be left in the center of the mine. As finished reclamation grades are established, the surface of the upland area will be seeded MNDOT seed mixture 25-151, while the lowland/wetland area will be planted with the appropriate species of trees and plants to establish the wetlands. Seeding time and fertilizer usage will be determined for vegetation on a case by case basis. Upon establishment of end-use conditions, erosion carried by stormwater over reclaimed areas will be collected within either the groundwater lake in the south or the infiltration pond in the north. Neither of the ponds has an outlet and therefore is not at risk for erosion.

4.3 Crushing and Screening Equipment

Equipment will be inspected daily during normal operations. Leaks and spills will be promptly cleaned up and reported to the supervisor and MPCA as appropriate. Maintenance of the equipment will be routinely conducted.

4.4 Fuel/Chemical Storage and Fueling

Any fuel or chemical stored onsite will be stored in compliance with all applicable MPCA requirements. Secondary containment will be provided for all tanks. Fueling will be conducted on impermeable areas or with portable pans.

4.5 Spills or Leaks

Spill cleanup material will be stored onsite in a covered area. Any spill will be reported to the Site Manager. If possible, any spill will be plugged or stopped. Absorbent materials and sand will be used to contain or isolate the spill and prevent it from contacting any surface water.

4.6 Roads and Vehicles

The majority of the internal haul roads will be gravel surfaced. The haul roads will be watered as needed to control dust. The main entrance to the Site will be monitored for dust and soil tracking and corrective action will be taken to reduce dust and tracking as necessary. Soil tracked onto public right of ways will be swept immediately.

Trucks will exit the Site over a rock construction exit and head north on Valley View Road. Trucks will then take a right on 173rd St and exit onto Highway 169.

4.7 Vehicle and Equipment Maintenance and Washing

All used oil from any oil changes performed onsite will be collected in a leak proof metal container and recycled offsite. No detergent or chemicals will be used to wash equipment onsite. Wash water will be directed to onsite infiltration areas and will not be discharged from the Site.

4.8 Undeveloped Areas Previously Used for Agriculture

Areas that will no longer be used for agricultural production and are not a part of the current phase of construction/operation will be vegetated with permanent vegetation using MNDOT Seed Mix 25-142.

Additional BMP's will be added as needed to insure that there are no offsite discharges so that violations of water quality standards do not occur. BMP's will also be added so that any floating solids, visible foams, oil or other substances are not discharged except in trace amounts. Temporary sediment basins may be required during certain construction/mining activities. Employees will be trained on an ongoing basis on SWPPP implementation/inspection, spill/leak detection and cleanup, and nuisance/noise reduction.

The following table summarizes anticipated erosion and sediment control devices and provides a schedule and timing of their installation, inspection and maintenance, and removal.

TABLE 4.1 Erosion and Sediment Control Device Implementation Schedule			
Item	Installation	Inspection/Maintenance	Removal
Construction Entrance	Install prior to any construction	Inspect daily. Maintain as required. Inspect for evidence of off-site sediment tracking. Remove any tracked sediment on a daily basis.	N/A
Temporary or Permanent Stormwater Pond	Install prior to rough grading. Direct surface water runoff to the pond.	Inspect a minimum of once every 14 days or 24 hours after a rain event greater than 0.5-inches in a 24 hour period. Drain pond and remove sediment when the depth of sediment in basin reaches ½ of the storage volume. Complete sediment removal within 72 hours of discovery	Remove temporary ponds once plant site grading is established
Temporary or Permanent Soil Stabilization	Install within 14 calendar days (7 calendar days for impaired waters) of the initial soil disturbance for all unworked exposed soil areas.	Inspect a minimum of once every 14 days or 24 hours after a rain event greater than 0.5-inches in a 24 hour period, or 24 hours after flood water recedes. Make any necessary repairs within 24 hours of discovery, or 24 hours after safe access conditions.	N/A
Protection of Temporary Stockpiles and Disturbed Areas	Immediately install silt fence, or other sediment controls, around stockpiles where off-site transport is possible.	Inspect a minimum of once every 14 days or 24 hours after a rain event greater than 0.5-inches in a 24 hour period. Remove sediment as required. Make necessary repairs within 24 hours of discovery	After stockpiles have been removed and disturbed areas have been stabilized.
Temporary or Permanent Drainage Ditch Stabilization	Install within 24 hours: 200 lineal feet from the point of discharge. Install within 14 calendar days (7 calendar days for impaired waters): beyond 200 lineal feet from the point of discharge.	Inspect a minimum of once every 14 days or 24 hours after a rain event greater than 0.5-inches in a 24 hour period. Make any necessary repairs within 24 hours of discovery.	N/A
Protection of Surface Waters (including stream bank)	N/A	Inspect a minimum of once every 14 days or 24 hours after a rain event greater than 0.5-inches in a 24 hour period, or 24 hours after flood water recedes. Remove all deltas and sediment deposited. Restabilize the areas where sediment removal results in exposed soil. Remove and stabilize within 7 days of discovery or safe access conditions.	N/A
Protection of Infiltration Areas	N/A	Inspect a minimum of once every 14 days or 24 hours after a rain event greater than 0.5-inches in a 24 hour period. Ensure that no sediment from ongoing construction activity is reaching the infiltration area and the area is protected from compaction due to construction traffic.	N/A
Flood Water Control Spillway	Install prior to excavation in flood plain. Excavate stilling basin as mining depth increases.	Inspect a minimum of once every 14 days or 24 hours after a rain event greater than 0.5-inches in a 24 hour period, or 24 hours after flood water recedes. Remove deposited sediment. Repair turf mat if damaged. Make necessary repairs within 7 days of safe access conditions.	N/A

5.0 WETLAND CONSERVATION

As stated in Section 2 of this Plan, there are wetlands mapped by the NWI within the mine boundary which are currently being delineated. These wetlands will be disturbed by the mining activities and will therefore be mitigated. Mitigation is expected to consist of purchasing wetland bank credits. Once the full delineation report is completed Jordan Gravel will apply for the appropriate permit(s) to remove the wetlands. Mining and construction activities will avoid the wetlands until the applicable permits are received.

Upon completion of mining, reclamation activities include the potential for development of approximately 22 acres of created wetlands on the former mine floor. This is illustrated on Sheet 5 of the Mining Plans.

6.0 FLOODPLAIN ALTERATIONS

Based on the flood elevation information obtained from Scott County, the 100-year flood elevation at the Property ranges from elevation 733 ft in the southwest to 731.5 ft in the northeast; therefore a significant portion of the mining area is located within the 100-year flood plain as shown on the mining plan sheets. During mining, the elevation of the excavation floor will be below the 100-year flood elevation.

Permanent structures or equipment storage will not be located below the flood elevation. Neither the mining activities nor the reclamation plan involve placing any fill below the existing floodplain level, and in fact the project results in a net increase in flood storage of approximately 390 acre-feet.

Approximately 8.6 acres of the Project Site lies within the Shoreland Zoning District. In order to perform grading and/or filling activities within the Shoreland District the user must demonstrate compliance with standards and informational requirements specified in Chapter 70 of the Scott County Zoning Ordinance.

These standards and informational requirements are addressed in this document and the Interim Use Permit Application that is to be submitted to Scott County, thereby eliminating the need for a separate shore land district permit.

7.0 CERTIFICATION

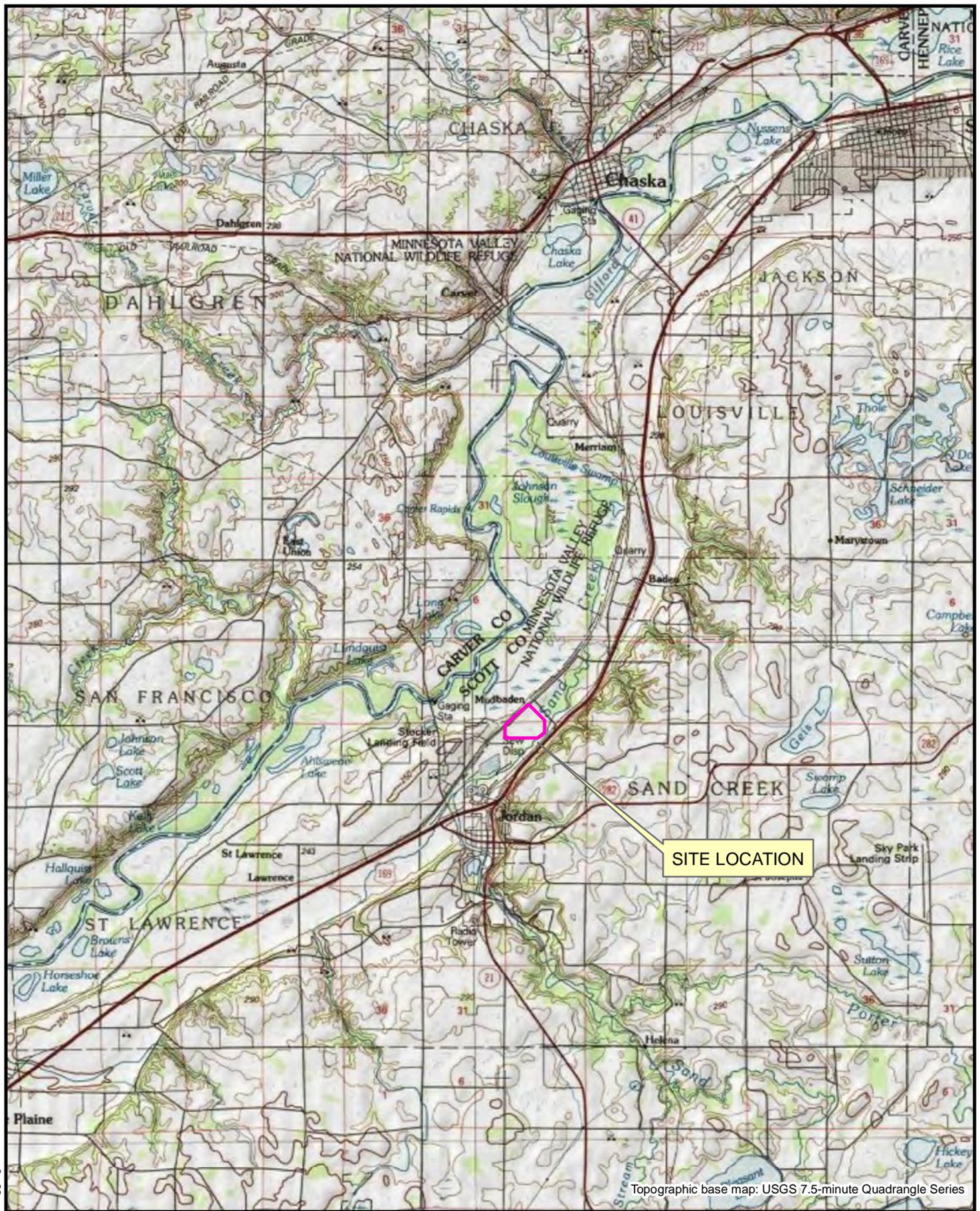
I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.



Nicholas Bonow, P.E., P.G.

Date: 11/10/14 License # 47510

Figures



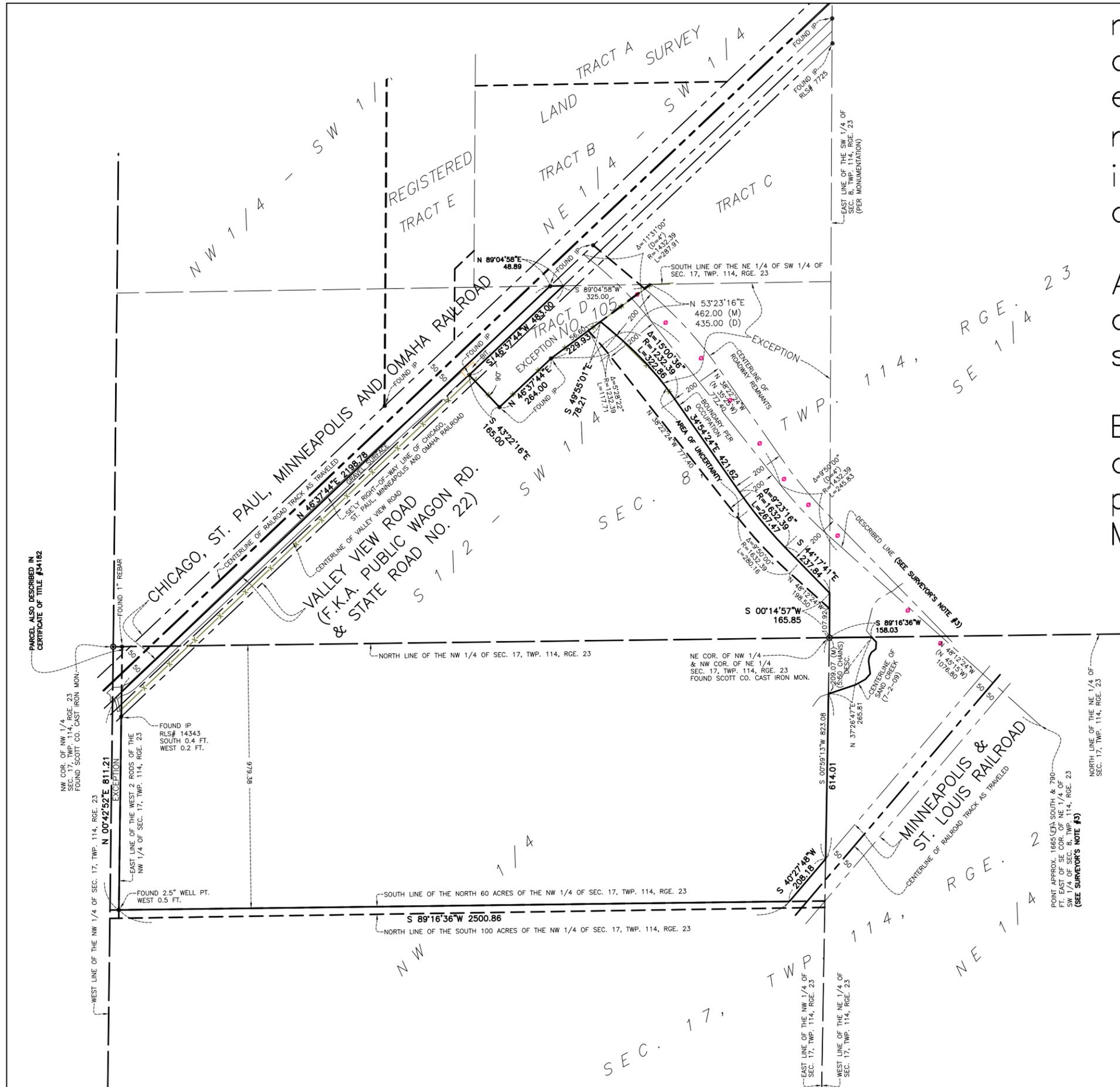
P:\GIS11_Projects\Jordan Aggregates\Site Location.mxd



INTERIM USE PERMIT APPLICATION

JORDAN GRAVEL, LLC
 SAND AND GRAVEL MINNE
 SEPTEMBER 2014

FIGURE 1
 SITE LOCATION



EXISTING DESCRIPTION (PER WARRANTY DEED DOC. NO. 89296):
 The North 60 acres of the Northeast Quarter of Section 17, Township 114, Range 23, excepting therefrom the West two (2) rods thereof. Also the following: Commencing at the Northwest corner of the Northeast Quarter of Section 17, Township 114, Range 23, and thence South 5.50 chains to the center of Sand Creek, thence down the center of Sand Creek to the place of beginning. Also all that part of the South one-half of the Southwest Quarter of Section 8, Township 114, Range 23, lying Southeasternly of the Chicago, St. Paul, Minneapolis and Omaha Railroad Company Right-of-Way, excepting therefrom the following described parcels of land:
 Commencing at a point on the South side of the public wagon road formerly known as State Road No. 22, at a point where said public road intersects the South line of the Northeast Quarter of the Southwest Quarter of Section 8, Township 114, Range 23 West, thence running Southeasternly along said road a distance of 483 feet, thence running in a Southeasternly direction and at right angles to said road a distance of 165 feet, thence running Northeasternly and parallel to said road a distance of 264 feet, thence running in a Northeasternly direction a distance of 435 feet to a point on the South line of said Northeast Quarter of said Southwest Quarter being 325 feet East from the place of beginning, thence running due West on said one-eighth (1/8th) Section line to the place of beginning.

A strip of land 200 feet wide on the Southernly side of the following described line: Starting at the center line of the pavement (formerly Minnesota Trunk Highway No. 5) at a point about 1665 feet South of and 790 feet East of the Southeast corner of the Northeast Quarter of the Southwest Quarter of Section 8, Township 114, Range 23 and running thence North 45 degrees, 15 minutes West, or at an angle 88 degrees 9 minutes with the center line of the pavement 1076.8 feet; thence to the right on a 4 degree curve 245.8 feet; thence North 35 degrees 25 minutes West 777.4 feet; thence to the left on a 4 degree curve 350 feet to a point on the road paralleling the Chicago, St. Paul, Minneapolis & Omaha Railroad. And also excepting all that part which lies Northernly of the above described line.

And further excepting from all of the lands above described the Rights-of-Ways of the Chicago, St. Paul, Minneapolis & Omaha Railroad Company and of the Minneapolis & St. Louis Railroad Company. Also subject to all roads and highway running over and across said lands.

PROPOSED DESCRIPTION

That part of the North 979.38 feet of the Northeast Quarter of Section 17, Township 114, Range 23, Scott County, Minnesota, lying southeasterly of the southeasterly right-of-way line of the Chicago, St. Paul, Minneapolis and Omaha Railroad, EXCEPT that part within Tract D, REGISTERED LAND SURVEY NO. 105, files of the Registrar of Title, Scott County, Minnesota, and EXCEPT that part lying northeasterly of the following described line:

Also
 That part of the Northeast Quarter of Section 17, Township 114, Range 23, Scott County, Minnesota, described as follows:
 Beginning at the northwest corner of said Northeast Quarter; thence southerly along the west line of said Northeast Quarter to the centerline of Sand Creek; thence northeasterly along said centerline, to the north line of said Northeast Quarter; thence westerly along said north line to the point of beginning.

Also
 That part of the South Half of the Southwest Quarter of Section 8, Township 114, Range 23, Scott County, Minnesota, lying southeasterly of the southeasterly right-of-way line of Chicago, St. Paul, Minneapolis and Omaha Railroad, EXCEPT that part within Tract D, REGISTERED LAND SURVEY NO. 105, files of the Registrar of Title, Scott County, Minnesota, and EXCEPT that part lying northeasterly of the following described line:

Commencing at the southeast corner of said Southwest Quarter; thence on an assumed bearing of North 00 degrees 14 minutes 57 seconds East a distance of 165.85 feet to the point of beginning of the line to be described; thence North 44 degrees 17 minutes 41 seconds West a distance of 237.84 feet; thence northwesterly a distance of 267.47 feet along a tangential curve, concave to the northeast, having a central angle of 09 degrees 23 minutes 16 seconds and a radius of 1832.39 feet; thence North 34 degrees 54 minutes 24 seconds West; tangent to said curve, a distance of 421.62 feet; thence northwesterly a distance of 322.86 feet along a tangential curve, concave to the southwest, having a central angle of 15 degrees 00 minutes 36 seconds and a radius of 1232.39 feet; thence North 49 degrees 55 minutes 01 seconds West a distance of 150.00 feet and there terminating.

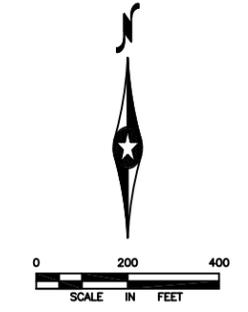
SURVEYORS NOTES:

- 1) Orientation of the bearing system is based upon Scott County coordinates (86 Adj.), Scott County, Minnesota.
- 2) This survey was performed, and the survey map prepared, without benefit of either a title insurance commitment or an attorney's title opinion. The record boundary and easement information (if any) shown hereon is based on information provided by the client. Research of documents affecting title to the property surveyed or adjoining properties has been limited to a cursory review of record information and it is recommended that all title matters affecting this property and survey be reviewed by an attorney or other title professional.
- 3) The angular orientation of the described line is based on MnDOT Road Map (S.P. 7009 (T.H. 169-5)).

AREA:
 Surveyed parcel (Gross) = 4,258,261 sq. ft. (97.76 ac.)
 Area of uncertainty = 93,651 sq. ft. (2.15 ac.)
 Road Right-of-Way = 133,076 sq. ft. (3.06 ac.)

July 6, 2009 REVISED: PROPOSED DESCRIPTION 7-7-09

REGISTERED LAND SURVEY NO. 105



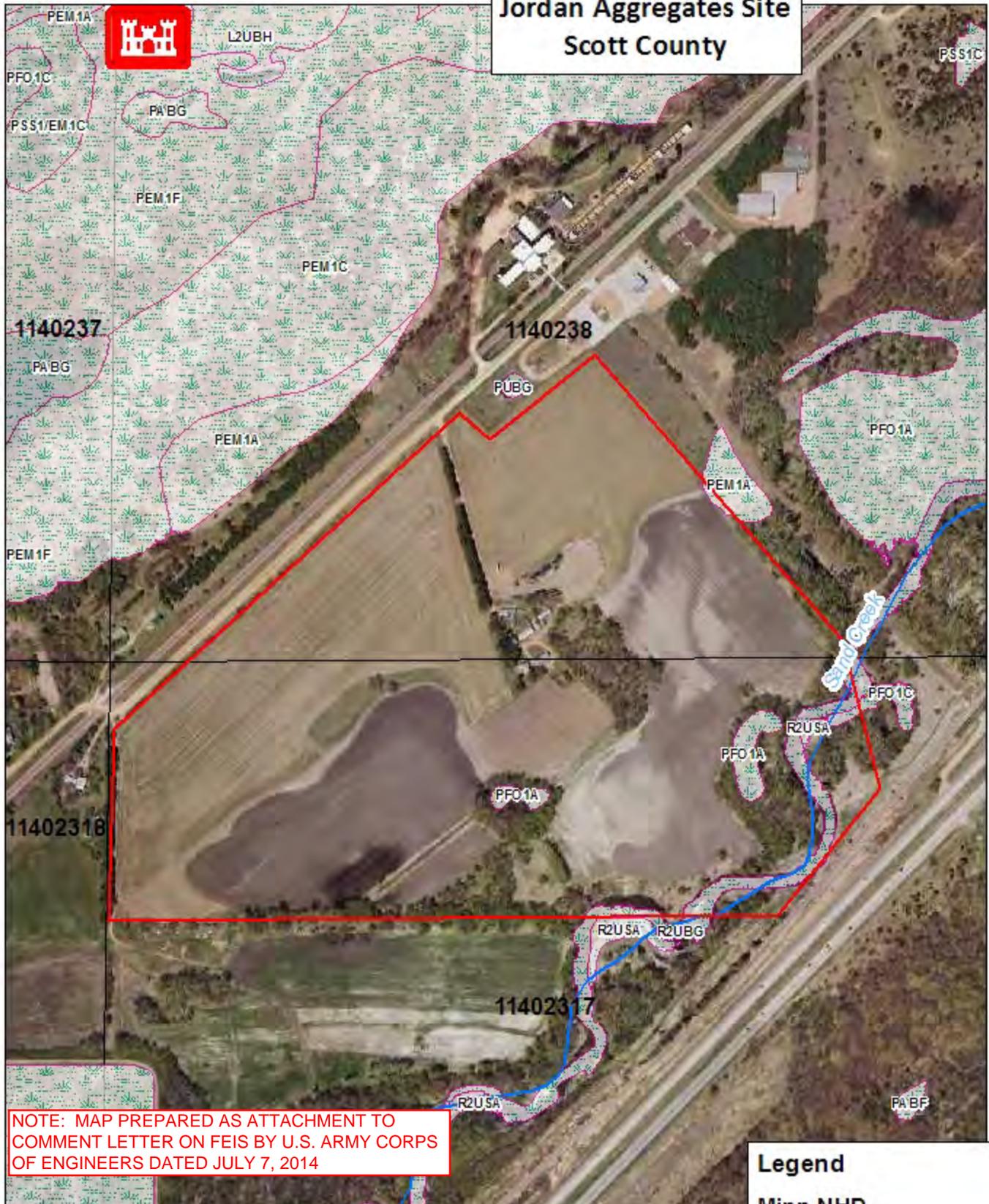
LEGEND

●	MONUMENT FOUND
⊙	CAST IRON MONUMENT FOUND
○	UTILITY POLE
— x —	FENCE LINE

FIGURE 2 - BOUNDARY SURVEY
JORDAN GRAVEL, LLC
RESOURCE MANAGEMENT PLAN

BOUNDARY SURVEY 17825 VALLEY VIEW DR., JORDAN, MN 55352 BOLTON & MENK, INC. Consulting Engineers & Surveyors 2638 SHADOW LANE, SUITE 200, CHASKA, MN 55318 (952)-448-8838 MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN WILLMAR, MN CHASKA, MN RAMSEY, MN AMES, IA		P/O S 1/2 OF SW 1/4 & SW 1/4 OF SE 1/4, 8-114-23 P/O N 1/2 OF NW 1/4 & NW 1/4 OF NE 1/4 OF 17-114-23 FOR: STEVE HENTGES
--	--	---

2013-04688-SEW
Jordan Aggregates Site
Scott County



NOTE: MAP PREPARED AS ATTACHMENT TO
COMMENT LETTER ON FEIS BY U.S. ARMY CORPS
OF ENGINEERS DATED JULY 7, 2014

FIGURE 3: NRCS-MAPPED WETLANDS

RESOURCE MANAGEMENT PLAN

JORDAN GRAVEL, LLC
SAND AND GRAVEL MINE

approx. project
location

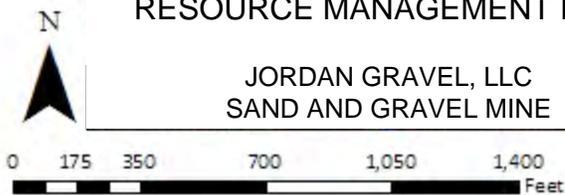
Legend

Minn NHD

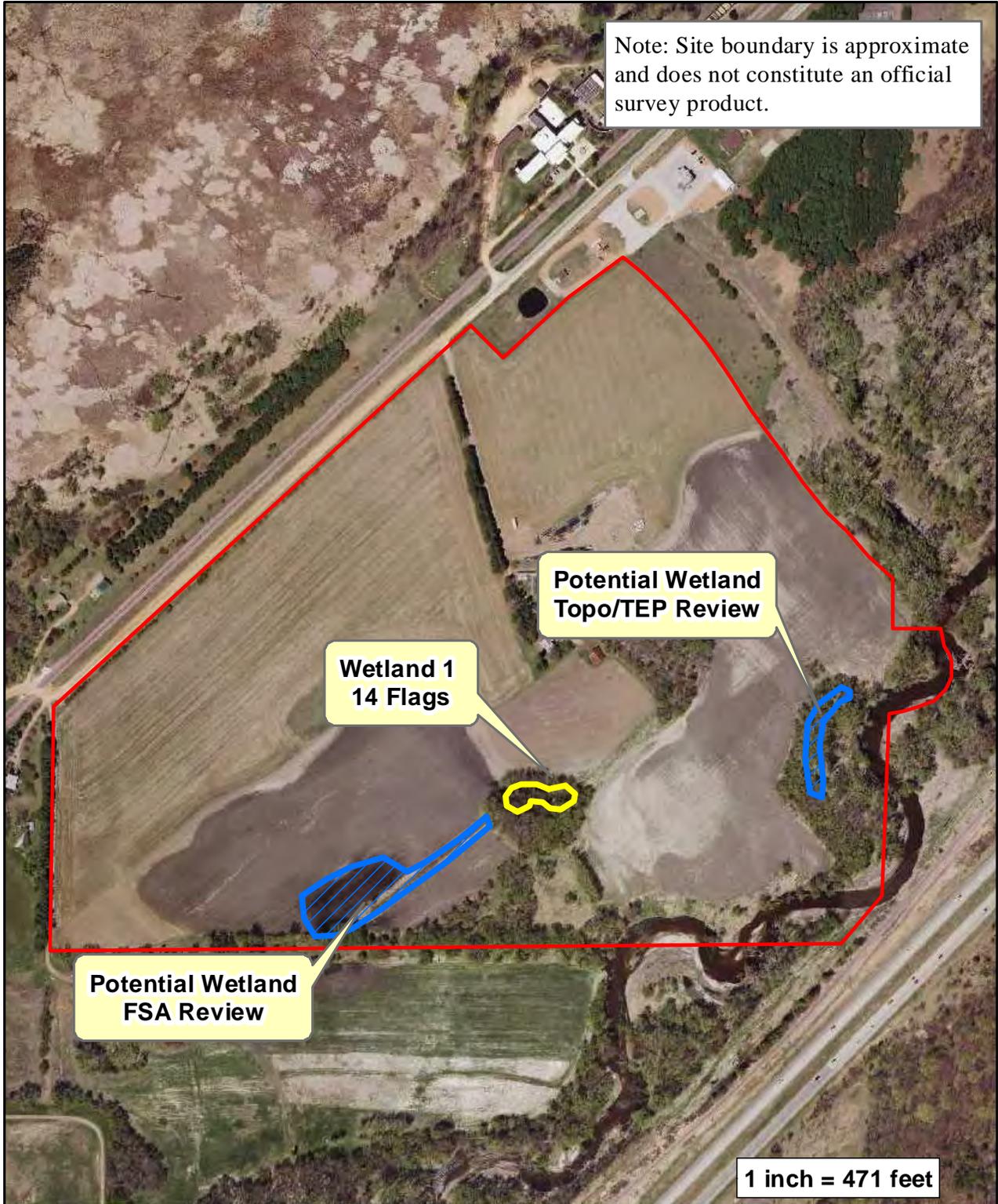
Flow

- Intermittent
- Perennial
- Unidentified

NWI 2013 Update - Metro



Base Map Source: FSA 2013
aerial photograph



10/17/14

2013 Image

Figure 4
Preliminary Wetland Delineation

Jordan Aggregate (KES 2014-XXX)
Jordan, Minnesota

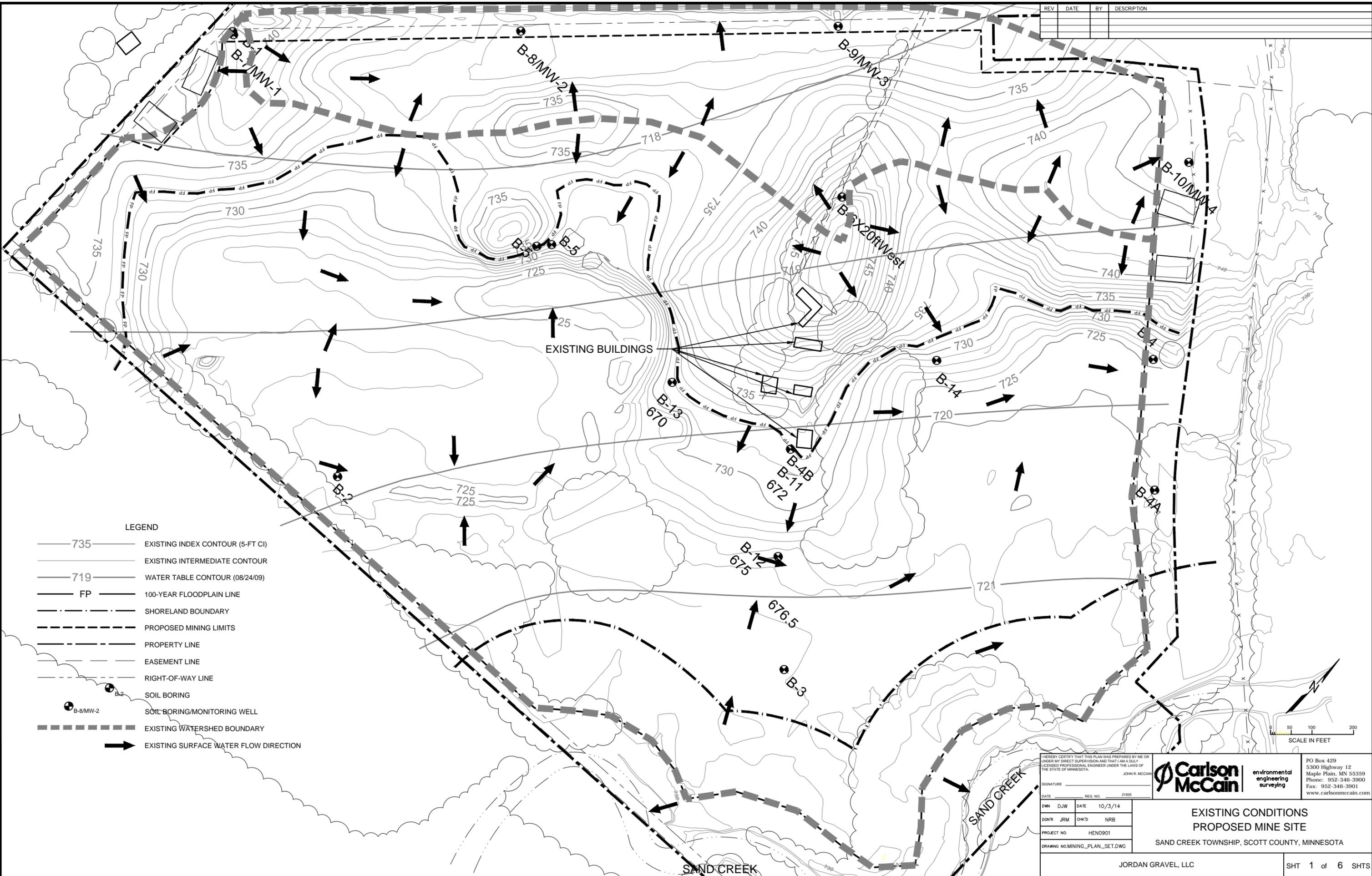


KJOLHAUG ENVIRONMENTAL SERVICES COMPANY



Appendix A
Interim Use Application Drawings

REV	DATE	BY	DESCRIPTION

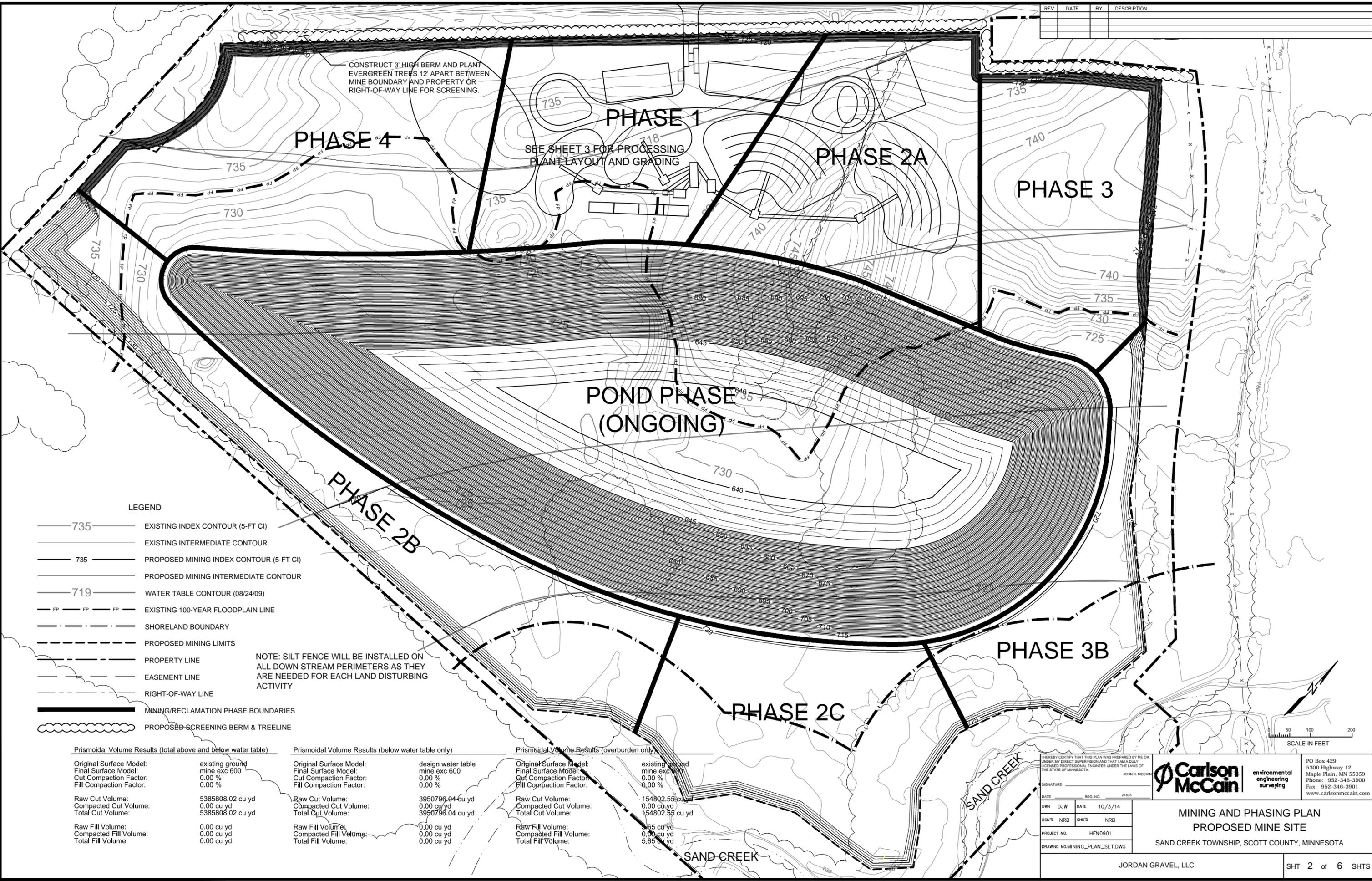


LEGEND

- 735 — EXISTING INDEX CONTOUR (5-FT CI)
- - - - - EXISTING INTERMEDIATE CONTOUR
- - - - - 719 — WATER TABLE CONTOUR (08/24/09)
- FP — 100-YEAR FLOODPLAIN LINE
- - - - - SHORELAND BOUNDARY
- - - - - PROPOSED MINING LIMITS
- - - - - PROPERTY LINE
- - - - - EASEMENT LINE
- - - - - RIGHT-OF-WAY LINE
- B-2 SOIL BORING
- B-8/MW-2 SOIL BORING/MONITORING WELL
- - - - - EXISTING WATERSHED BOUNDARY
- ➔ EXISTING SURFACE WATER FLOW DIRECTION

<small>HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.</small> JOHN R. MCCAIN SIGNATURE _____ DATE _____ REG. NO. 21835			PO Box 429 5300 Highway 12 Maple Plain, MN 55359 Phone: 952-346-3900 Fax: 952-346-3901 www.carlsonmccain.com
EXISTING CONDITIONS PROPOSED MINE SITE SAND CREEK TOWNSHIP, SCOTT COUNTY, MINNESOTA			
DWN DJW DATE 10/3/14 DGN'R JRM CHK'D NRB PROJECT NO. HEN0901 DRAWING NO. MINING_PLAN_SET.DWG	JORDAN GRAVEL, LLC		SHT 1 of 6 SHTS

REV	DATE	BY	DESCRIPTION



LEGEND

- EXISTING INDEX CONTOUR (5-FT CI)
- EXISTING INTERMEDIATE CONTOUR
- PROPOSED MINING INDEX CONTOUR (5-FT CI)
- PROPOSED MINING INTERMEDIATE CONTOUR
- WATER TABLE CONTOUR (08/24/09)
- EXISTING 100-YEAR FLOODPLAIN LINE
- SHORELAND BOUNDARY
- PROPOSED MINING LIMITS
- PROPERTY LINE
- EASEMENT LINE
- RIGHT-OF-WAY LINE
- MINING/RECLAMATION PHASE BOUNDARIES
- PROPOSED SCREENING BERM & TREELINE

NOTE: SILT FENCE WILL BE INSTALLED ON ALL DOWN STREAM PERIMETERS AS THEY ARE NEEDED FOR EACH LAND DISTURBING ACTIVITY

Prismoidal Volume Results (total above and below water table)

Original Surface Model:	existing ground
Final Surface Model:	mine exc 600
Cut Compaction Factor:	0.00 %
Fill Compaction Factor:	0.00 %
Raw Cut Volume:	5385808.02 cu yd
Compacted Cut Volume:	0.00 cu yd
Total Cut Volume:	5385808.02 cu yd
Raw Fill Volume:	0.00 cu yd
Compacted Fill Volume:	0.00 cu yd
Total Fill Volume:	0.00 cu yd

Prismoidal Volume Results (below water table only)

Original Surface Model:	design water table
Final Surface Model:	mine exc 600
Cut Compaction Factor:	0.00 %
Fill Compaction Factor:	0.00 %
Raw Cut Volume:	3950796.04 cu yd
Compacted Cut Volume:	0.00 cu yd
Total Cut Volume:	3950796.04 cu yd
Raw Fill Volume:	0.00 cu yd
Compacted Fill Volume:	0.00 cu yd
Total Fill Volume:	0.00 cu yd

Prismoidal Volume Results (overburden only)

Original Surface Model:	existing ground
Final Surface Model:	mine exc 600
Cut Compaction Factor:	0.00 %
Fill Compaction Factor:	0.00 %
Raw Cut Volume:	154802.55 cu yd
Compacted Cut Volume:	0.00 cu yd
Total Cut Volume:	154802.55 cu yd
Raw Fill Volume:	5.65 cu yd
Compacted Fill Volume:	0.00 cu yd
Total Fill Volume:	5.65 cu yd

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

JOHN R. MCCAIN



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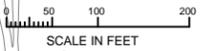
SIGNATURE _____
DATE _____ REG. NO. 21835

DWN	DJW	DATE	10/3/14
DGNR	NRB	CHK'D	NRB
PROJECT NO.	HEN0901		
DRAWING NO.	MINING_PLAN_SET.DWG		

MINING AND PHASING PLAN
PROPOSED MINE SITE
SAND CREEK TOWNSHIP, SCOTT COUNTY, MINNESOTA

JORDAN GRAVEL, LLC

SHT 2 of 6 SHTS



REV	DATE	BY	DESCRIPTION

100-YEAR FLOOD PLAIN: 732.5'
MINIMUM PLANT FLOOR ELEVATION: 733'

SITE ENTRANCE FROM VALLEY VIEW DRIVE. GRAVEL TO REDUCE TRACKING FROM TRUCKS EXITING THE SITE

TRUCKS WILL EXIT NORTH ONTO VALLEY VIEW DR. EAST ONTO 173RD ST, AND ONTO HIGHWAY 169

VALLEY VIEW DRIVE

TEMPORARY STOCKPILE LOCATION DURING PHASE 1/PHASE 2 PLANT SITE DEVELOPMENT SURROUND DOWNSTREAM AREAS WITH SILT FENCE. STABILIZE WITH MNDOT SEED MIX 22-112

EMPLOYEE PARKING AREA

FUEL STORAGE

RECYCLE CONCRETE/ ASPHALT STOCKPILE 20 FT HIGH (5,000 CY CAPACITY) SURROUND UNWORKED AREA WITH SILT FENCE

SCALEHOUSE AND SCALE

RECYCLE CONCRETE/ ASPHALT STOCKPILE 20 FT HIGH (8,000 CY CAPACITY) SURROUND UNWORKED AREA WITH SILT FENCE

PORTABLE ASPHALT/CONCRETE MIXING PLANT

EQUIPMENT PARKING AREA

RECYCLE CONCRETE/ ASPHALT STOCKPILE 20 FT HIGH (6,000 CY CAPACITY) SURROUND UNWORKED AREA WITH SILT FENCE

TRUCKS WILL LOAD/UNLOAD ON THESE ACCESS ROADS

SAND STOCKPILE 30 FT HIGH (36,000 CY CAPACITY)

COARSE AGGREGATE STOCKPILE, 30 FT HIGH (10,000 CY CAPACITY)

FINE AGGREGATE STOCKPILE, 30 FT HIGH (10,000 CY CAPACITY)

SAND STOCKPILE 30 FT HIGH (36,000 CY CAPACITY)

CLASSIFYING SCREENS

RADIAL STACKING CONVEYOR (TYP)

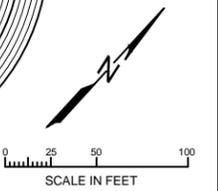
WASH PLANT

CRUSHER

WASH WATER RECYCLE BASIN(S)

ONCE ADJACENT PHASES ARE REDCLAIMED, SURROUND UNWORKED AREAS OF AGGREGATE AND SAND WITH SILT FENCE

LEGEND	
735	EXISTING INDEX CONTOUR (5-FT CI)
---	EXISTING INTERMEDIATE CONTOUR
690	PROPOSED MINING INDEX CONTOUR (5-FT CI)
735	PROPOSED PLANT SITE INDEX CONTOUR
---	PROPOSED PLANT SITE INT. CONTOUR
---	SHORELAND BOUNDARY
---	PROPOSED MINING LIMITS
---	PROPERTY LINE
---	EASEMENT LINE
---	RIGHT-OF-WAY LINE



I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

JOHN R. MCCAIN

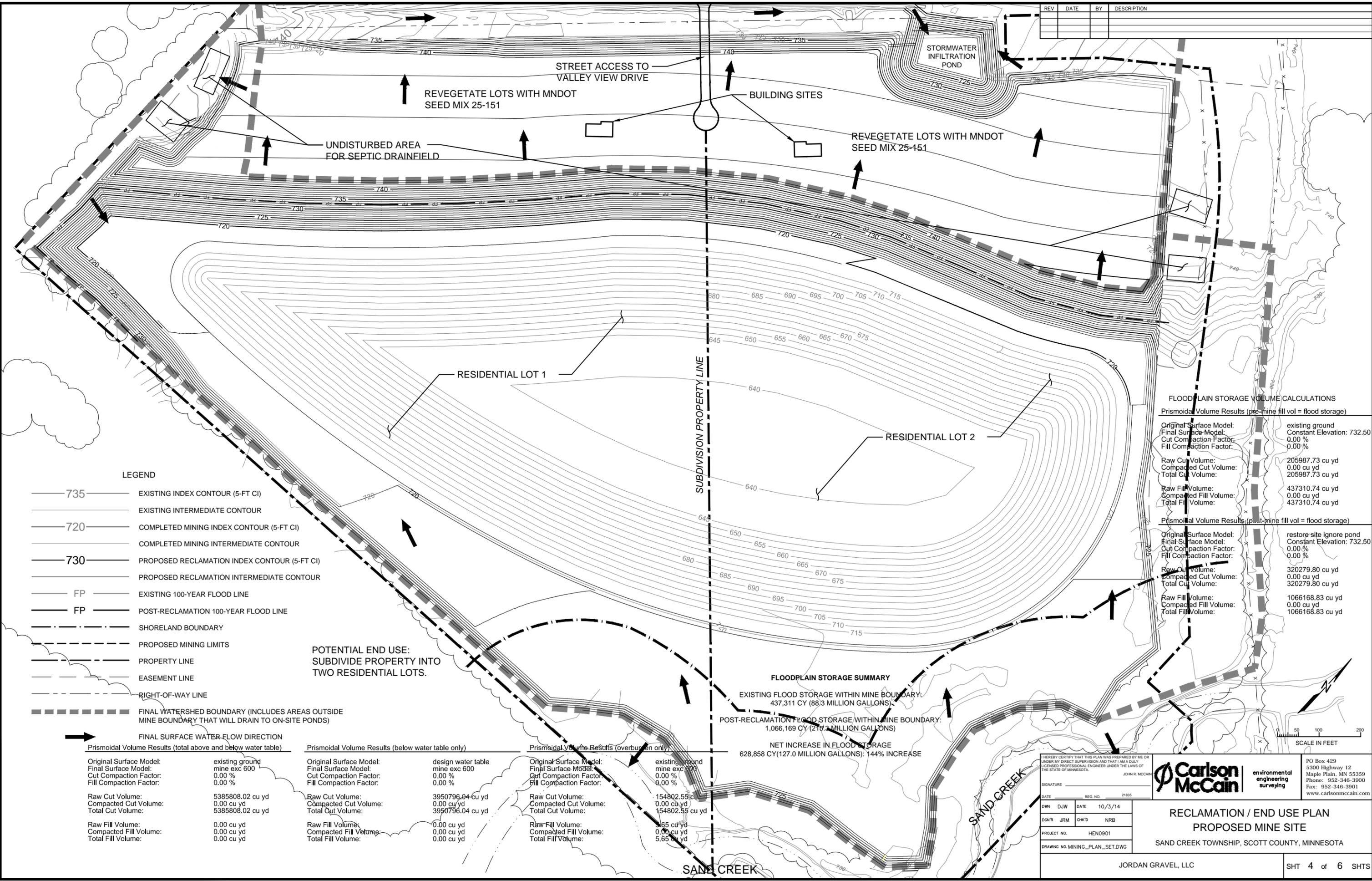


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Fax: 952-346-3901
www.carlsonmccain.com

SIGNATURE	
DATE	REG. NO. 21835
DWN DJW	DATE 10/3/14
DGN'R JRM	CHK'D NRB
PROJECT NO.	HEN0901
DRAWING NO.	MINING_PLAN_SET.DWG

PROCESSING PLANT LAYOUT
PROPOSED MINE SITE
SAND CREEK TOWNSHIP, SCOTT COUNTY, MINNESOTA

REV	DATE	BY	DESCRIPTION



LEGEND

— 735 —	EXISTING INDEX CONTOUR (5-FT CI)
— 720 —	EXISTING INTERMEDIATE CONTOUR
— 720 —	COMPLETED MINING INDEX CONTOUR (5-FT CI)
— 720 —	COMPLETED MINING INTERMEDIATE CONTOUR
— 730 —	PROPOSED RECLAMATION INDEX CONTOUR (5-FT CI)
— 730 —	PROPOSED RECLAMATION INTERMEDIATE CONTOUR
— FP —	EXISTING 100-YEAR FLOOD LINE
— FP —	POST-RECLAMATION 100-YEAR FLOOD LINE
— —	SHORELAND BOUNDARY
— —	PROPOSED MINING LIMITS
— —	PROPERTY LINE
— —	EASEMENT LINE
— —	RIGHT-OF-WAY LINE
— —	FINAL WATERSHED BOUNDARY (INCLUDES AREAS OUTSIDE MINE BOUNDARY THAT WILL DRAIN TO ON-SITE PONDS)
→	FINAL SURFACE WATER FLOW DIRECTION

**POTENTIAL END USE:
SUBDIVIDE PROPERTY INTO
TWO RESIDENTIAL LOTS.**

FLOODPLAIN STORAGE SUMMARY

EXISTING FLOOD STORAGE WITHIN MINE BOUNDARY:	437,311 CY (88.3 MILLION GALLONS)
POST-RECLAMATION FLOOD STORAGE WITHIN MINE BOUNDARY:	1,066,169 CY (217.2 MILLION GALLONS)
NET INCREASE IN FLOOD STORAGE	628,858 CY (127.0 MILLION GALLONS): 144% INCREASE

FLOODPLAIN STORAGE VOLUME CALCULATIONS
Prismoidal Volume Results (pre-mine fill vol = flood storage)

Original Surface Model:	existing ground	Constant Elevation: 732.50
Final Surface Model:		
Cut Compaction Factor:	0.00 %	
Fill Compaction Factor:	0.00 %	
Raw Cut Volume:	205987.73 cu yd	
Compacted Cut Volume:	0.00 cu yd	
Total Cut Volume:	205987.73 cu yd	
Raw Fill Volume:	437310.74 cu yd	
Compacted Fill Volume:	0.00 cu yd	
Total Fill Volume:	437310.74 cu yd	

Prismoidal Volume Results (post-mine fill vol = flood storage)

Original Surface Model:	restore site ignore pond	Constant Elevation: 732.50
Final Surface Model:		
Cut Compaction Factor:	0.00 %	
Fill Compaction Factor:	0.00 %	
Raw Cut Volume:	320279.80 cu yd	
Compacted Cut Volume:	0.00 cu yd	
Total Cut Volume:	320279.80 cu yd	
Raw Fill Volume:	1066168.83 cu yd	
Compacted Fill Volume:	0.00 cu yd	
Total Fill Volume:	1066168.83 cu yd	

Prismoidal Volume Results (total above and below water table)

Original Surface Model:	existing ground
Final Surface Model:	mine exc 600
Cut Compaction Factor:	0.00 %
Fill Compaction Factor:	0.00 %
Raw Cut Volume:	5385808.02 cu yd
Compacted Cut Volume:	0.00 cu yd
Total Cut Volume:	5385808.02 cu yd
Raw Fill Volume:	0.00 cu yd
Compacted Fill Volume:	0.00 cu yd
Total Fill Volume:	0.00 cu yd

Prismoidal Volume Results (below water table only)

Original Surface Model:	design water table
Final Surface Model:	mine exc 600
Cut Compaction Factor:	0.00 %
Fill Compaction Factor:	0.00 %
Raw Cut Volume:	3950796.04 cu yd
Compacted Cut Volume:	0.00 cu yd
Total Cut Volume:	3950796.04 cu yd
Raw Fill Volume:	0.00 cu yd
Compacted Fill Volume:	0.00 cu yd
Total Fill Volume:	0.00 cu yd

Prismoidal Volume Results (overburden only)

Original Surface Model:	existing ground
Final Surface Model:	mine exc 600
Cut Compaction Factor:	0.00 %
Fill Compaction Factor:	0.00 %
Raw Cut Volume:	154802.55 cu yd
Compacted Cut Volume:	0.00 cu yd
Total Cut Volume:	154802.55 cu yd
Raw Fill Volume:	65 cu yd
Compacted Fill Volume:	0.00 cu yd
Total Fill Volume:	5.65 cu yd

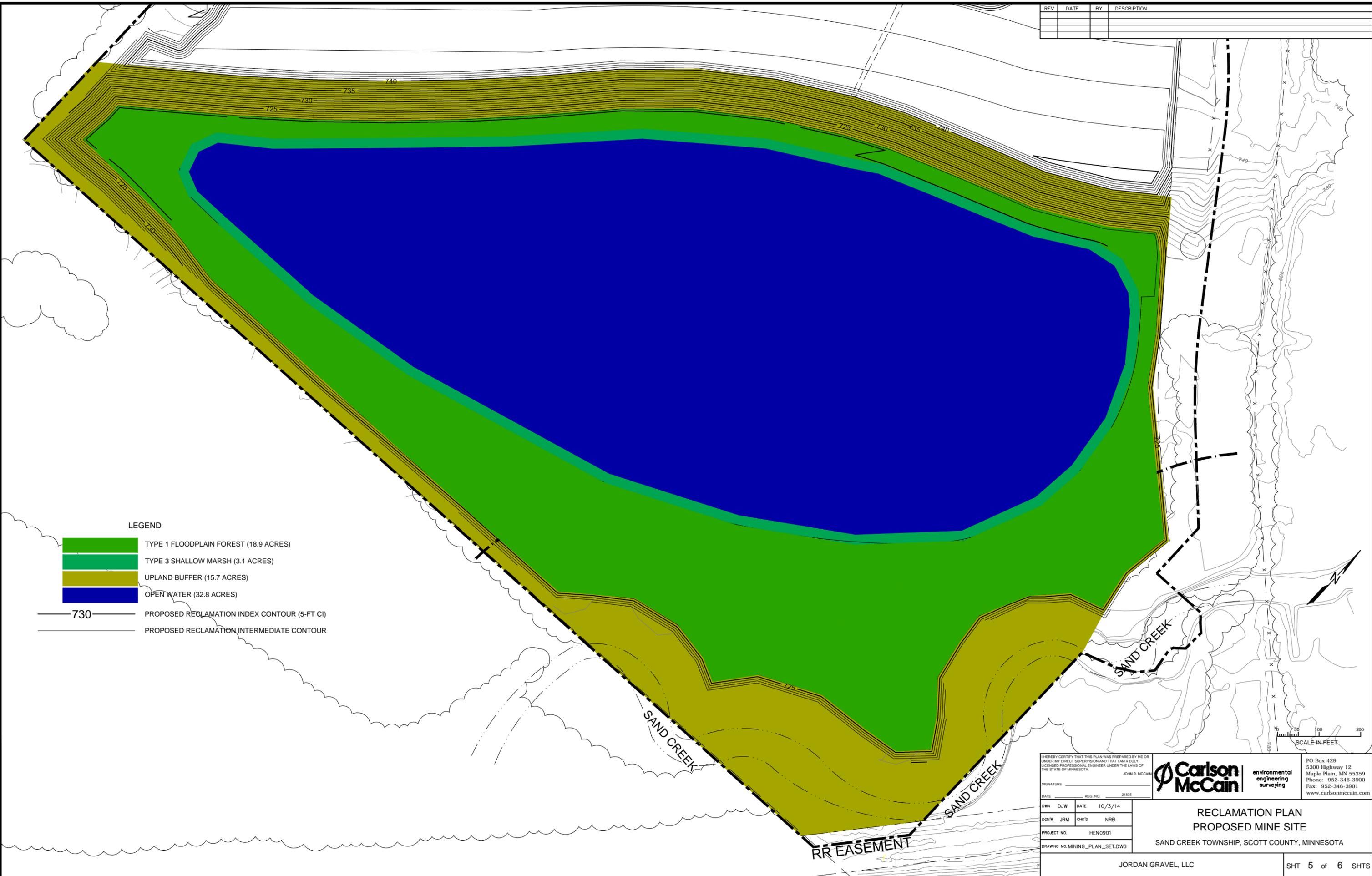
I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.
 JOHN R. MCCAIN
 REG. NO. 21835

Carlson McCain
 environmental engineering surveying
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 Fax: 952-346-3901
 www.carlsonmccain.com

DATE	10/3/14
DWN	DJW
DGN'R	JRM
PROJECT NO.	HEN0901
DRAWING NO.	MINING_PLAN_SET.DWG

**RECLAMATION / END USE PLAN
PROPOSED MINE SITE**
 SAND CREEK TOWNSHIP, SCOTT COUNTY, MINNESOTA

REV	DATE	BY	DESCRIPTION

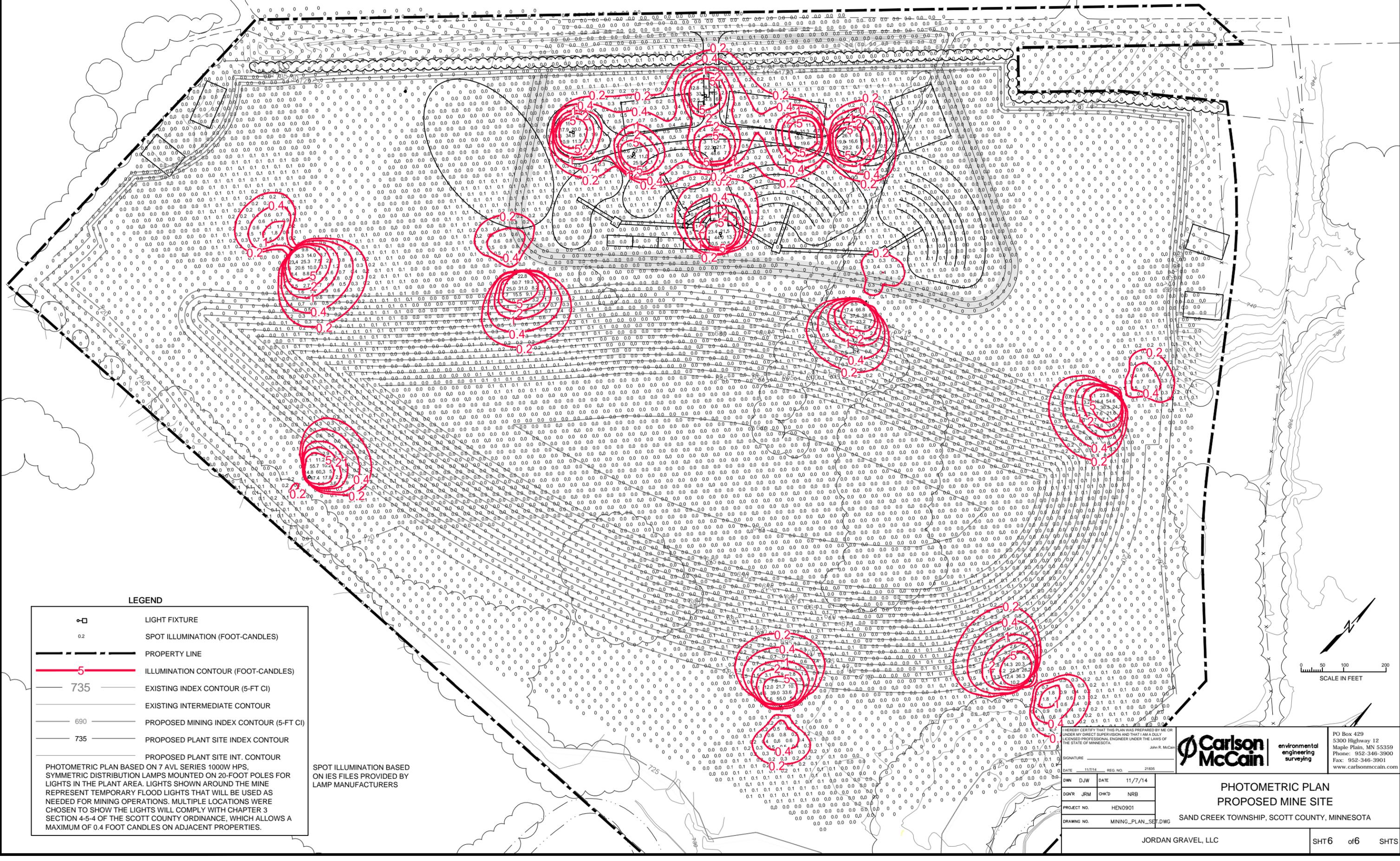


LEGEND

- TYPE 1 FLOODPLAIN FOREST (18.9 ACRES)
- TYPE 3 SHALLOW MARSH (3.1 ACRES)
- UPLAND BUFFER (15.7 ACRES)
- OPEN WATER (32.8 ACRES)
- 730 PROPOSED RECLAMATION INDEX CONTOUR (5-FT CI)
- PROPOSED RECLAMATION INTERMEDIATE CONTOUR

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA. JOHN R. MCCAIN REG. NO. 21835			PO Box 429 5300 Highway 12 Maple Plain, MN 55359 Phone: 952-346-3900 Fax: 952-346-3901 www.carlsonmccain.com
SIGNATURE _____ DATE _____			
DWN DJW DATE 10/3/14 DGNR JRM CHK'D NRB PROJECT NO. HEN0901 DRAWING NO. MINING_PLAN_SET.DWG	RECLAMATION PLAN PROPOSED MINE SITE SAND CREEK TOWNSHIP, SCOTT COUNTY, MINNESOTA		SCALE IN FEET
JORDAN GRAVEL, LLC		SHT 5 of 6 SHTS	

REV	DATE	BY	DESCRIPTION



LEGEND

	LIGHT FIXTURE
0.2	SPOT ILLUMINATION (FOOT-CANDLES)
	PROPERTY LINE
	ILLUMINATION CONTOUR (FOOT-CANDLES)
	735 EXISTING INDEX CONTOUR (5-FT CI)
	EXISTING INTERMEDIATE CONTOUR
	690 PROPOSED MINING INDEX CONTOUR (5-FT CI)
	735 PROPOSED PLANT SITE INDEX CONTOUR
	PROPOSED PLANT SITE INT. CONTOUR

PHOTOMETRIC PLAN BASED ON 7 AVL SERIES 1000W HPS, SYMMETRIC DISTRIBUTION LAMPS MOUNTED ON 20-FOOT POLES FOR LIGHTS IN THE PLANT AREA. LIGHTS SHOWN AROUND THE MINE REPRESENT TEMPORARY FLOOD LIGHTS THAT WILL BE USED AS NEEDED FOR MINING OPERATIONS. MULTIPLE LOCATIONS WERE CHOSEN TO SHOW THE LIGHTS WILL COMPLY WITH CHAPTER 3 SECTION 4-5-4 OF THE SCOTT COUNTY ORDINANCE, WHICH ALLOWS A MAXIMUM OF 0.4 FOOT CANDLES ON ADJACENT PROPERTIES.

SPOT ILLUMINATION BASED ON IES FILES PROVIDED BY LAMP MANUFACTURERS

HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

Carlson McCain environmental engineering surveying

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5300 Highway 12
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www.carlsonmccain.com

SIGNATURE: _____
DATE: 11/7/14 REG NO: 21885

DWN	DJW	DATE	11/7/14
DGNR	JRM	CHK'D	NRB
PROJECT NO.	HEN0901		
DRAWING NO.	MINING_PLAN_SET.DWG		

**PHOTOMETRIC PLAN
PROPOSED MINE SITE**

SAND CREEK TOWNSHIP, SCOTT COUNTY, MINNESOTA

JORDAN GRAVEL, LLC

SHT6 of 6 SHTS

Appendix B
Soils Map and Data

Soil Map—Scott County, Minnesota



Map Scale: 1:6,590 if printed on A landscape (11" x 8.5") sheet.
0 50 100 200 300 Meters
0 300 600 1200 1800 Feet
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

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

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: <http://websoilsurvey.nrcs.usda.gov>
 Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Scott County, Minnesota
 Survey Area Data: Version 9, Dec 27, 2013

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

Date(s) aerial images were photographed: Mar 16, 2012—Apr 6, 2012

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

Map Unit Legend

Scott County, Minnesota (MN139)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AaA	Alluvial land, 0 to 2 percent slopes	21.0	17.5%
Ab	Alluvial land, frequent overflow, 0 to 6 percent slopes	40.5	33.7%
DbA	Dickman sandy loam, 0 to 2 percent slopes	7.3	6.1%
HdA	Sparta fine sand, 0 to 2 percent slopes	2.5	2.1%
HdB	Sparta fine sand, 2 to 6 percent slopes	20.8	17.3%
HdB2	Sparta fine sand, 2 to 6 percent slopes	20.1	16.7%
HdC2	Sparta fine sand, 6 to 12 percent slopes	4.9	4.0%
INT	Water, intermittent	1.2	1.0%
W	Water	2.0	1.7%
Totals for Area of Interest		120.3	100.0%

Map Unit Description

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

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

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

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

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

Soils that have profiles that are almost alike make up a *soil series*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

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

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

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

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

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

Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

Report—Map Unit Description

Scott County, Minnesota

AaA—Alluvial land, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: gc90

Elevation: 700 to 1,600 feet

Mean annual precipitation: 23 to 35 inches

Mean annual air temperature: 43 to 50 degrees F

Frost-free period: 155 to 200 days

Farmland classification: Prime farmland if protected from flooding or not frequently flooded during the growing season

Map Unit Composition

*Alluvial land, occasionally flooded, and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.*

Description of Alluvial Land, Occasionally Flooded

Setting

*Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium*

Typical profile

*Ap - 0 to 10 inches: loam
A1 - 10 to 60 inches: stratified silt loam to sand*

Properties and qualities

*Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: About 30 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum in profile: 20 percent
Available water storage in profile: High (about 10.1 inches)*

Interpretive groups

*Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B*

Ab—Alluvial land, frequent overflow, 0 to 6 percent slopes

Map Unit Setting

*National map unit symbol: gc92
Elevation: 700 to 1,600 feet
Mean annual precipitation: 23 to 35 inches
Mean annual air temperature: 43 to 50 degrees F
Frost-free period: 155 to 200 days
Farmland classification: Prime farmland if protected from flooding or not frequently flooded during the growing season*

Map Unit Composition

*Alluvial land, frequent overflow, and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.*

Description of Alluvial Land, Frequent Overflow

Setting

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

Typical profile

A1 - 0 to 10 inches: loam
A2 - 10 to 60 inches: stratified silt loam to sand

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Calcium carbonate, maximum in profile: 20 percent
Available water storage in profile: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D

DbA—Dickman sandy loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: gc9y
Elevation: 700 to 1,600 feet
Mean annual precipitation: 23 to 35 inches
Mean annual air temperature: 43 to 50 degrees F
Frost-free period: 155 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Dickman and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dickman

Setting

Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Outwash

Typical profile

Ap - 0 to 12 inches: sandy loam
Bw - 12 to 21 inches: sandy loam
2C - 21 to 60 inches: sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A

Minor Components

Dickinson

Percent of map unit: 5 percent

Sparta

Percent of map unit: 5 percent

HdA—Sparta fine sand, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: gcc8
Elevation: 700 to 1,200 feet
Mean annual precipitation: 23 to 35 inches
Mean annual air temperature: 43 to 50 degrees F
Frost-free period: 155 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Sparta and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sparta

Setting

Landform: Stream terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Outwash

Typical profile

Ap - 0 to 12 inches: fine sand
Bw - 12 to 38 inches: fine sand
C - 38 to 60 inches: fine sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A

Minor Components

Dickinson

Percent of map unit: 10 percent

HdB—Sparta fine sand, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: gcc9
Elevation: 700 to 1,200 feet
Mean annual precipitation: 23 to 35 inches
Mean annual air temperature: 43 to 50 degrees F
Frost-free period: 155 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Sparta and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sparta

Setting

Landform: Stream terraces
Landform position (two-dimensional): Backslope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Outwash

Typical profile

Ap - 0 to 12 inches: fine sand

Bw - 12 to 38 inches: fine sand
C - 38 to 60 inches: fine sand

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A

Minor Components

Dickinson

Percent of map unit: 10 percent

HdB2—Sparta fine sand, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: gccb
Elevation: 700 to 1,200 feet
Mean annual precipitation: 23 to 35 inches
Mean annual air temperature: 43 to 50 degrees F
Frost-free period: 155 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Sparta and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sparta

Setting

Landform: Stream terraces
Landform position (two-dimensional): Backslope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Outwash

Typical profile

Ap - 0 to 12 inches: fine sand
Bw - 12 to 38 inches: fine sand
C - 38 to 60 inches: fine sand

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A

Minor Components

Dickinson

Percent of map unit: 10 percent

HdC2—Sparta fine sand, 6 to 12 percent slopes

Map Unit Setting

National map unit symbol: gccd
Elevation: 700 to 1,200 feet
Mean annual precipitation: 23 to 35 inches
Mean annual air temperature: 43 to 50 degrees F
Frost-free period: 155 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Sparta and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sparta

Setting

Landform: Stream terraces
Landform position (two-dimensional): Backslope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Outwash

Typical profile

Ap - 0 to 12 inches: fine sand
Bw - 12 to 38 inches: fine sand
C - 38 to 60 inches: fine sand

Properties and qualities

Slope: 6 to 12 percent

Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A

Minor Components

Dickinson

Percent of map unit: 10 percent

INT—Water, intermittent

Map Unit Composition

Water, intermittent: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water, Intermittent

Properties and qualities

Depth to water table: About 0 inches

W—Water

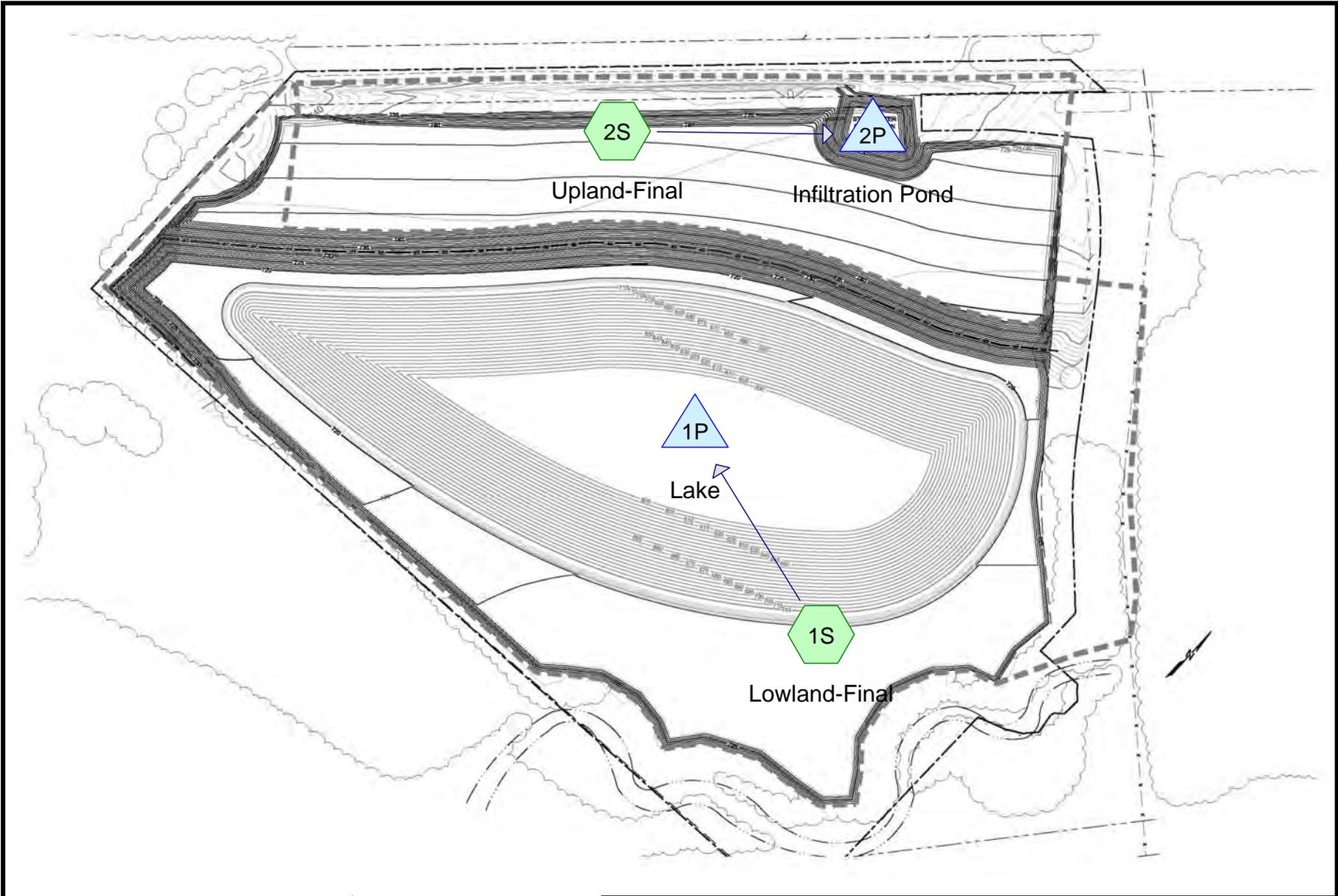
Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Data Source Information

Soil Survey Area: Scott County, Minnesota
Survey Area Data: Version 9, Dec 27, 2013

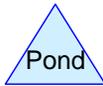
Appendix C
Stormwater Analysis



Subcat



Reach



Pond



Link

Drainage Diagram for Reclamation Conditions

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Reclamation Conditions

Type II 24-hr 2-year 24-hour Rainfall=2.80"

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Lowland-Final Runoff Area=3,161,786 sf 47.12% Impervious Runoff Depth=1.16"
Flow Length=550' Slope=0.0020 '/' Tc=105.6 min CN=81 Runoff=28.43 cfs 7.027 af

Subcatchment 2S: Upland-Final Runoff Area=1,119,499 sf 0.00% Impervious Runoff Depth=0.49"
Flow Length=1,880' Tc=56.6 min CN=67 Runoff=5.05 cfs 1.047 af

Pond 1P: Lake Peak Elev=720.18' Storage=306,098 cf Inflow=28.43 cfs 7.027 af
Outflow=0.00 cfs 0.000 af

Pond 2P: Infiltration Pond Peak Elev=724.55' Storage=39,821 cf Inflow=5.05 cfs 1.047 af
Discarded=0.13 cfs 0.247 af Primary=0.00 cfs 0.000 af Outflow=0.13 cfs 0.247 af

Total Runoff Area = 98.285 ac Runoff Volume = 8.074 af Average Runoff Depth = 0.99"
65.20% Pervious = 64.085 ac 34.80% Impervious = 34.200 ac

Reclamation Conditions

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Type II 24-hr 2-year 24-hour Rainfall=2.80"

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Summary for Subcatchment 1S: Lowland-Final

Runoff = 28.43 cfs @ 13.26 hrs, Volume= 7.027 af, Depth= 1.16"

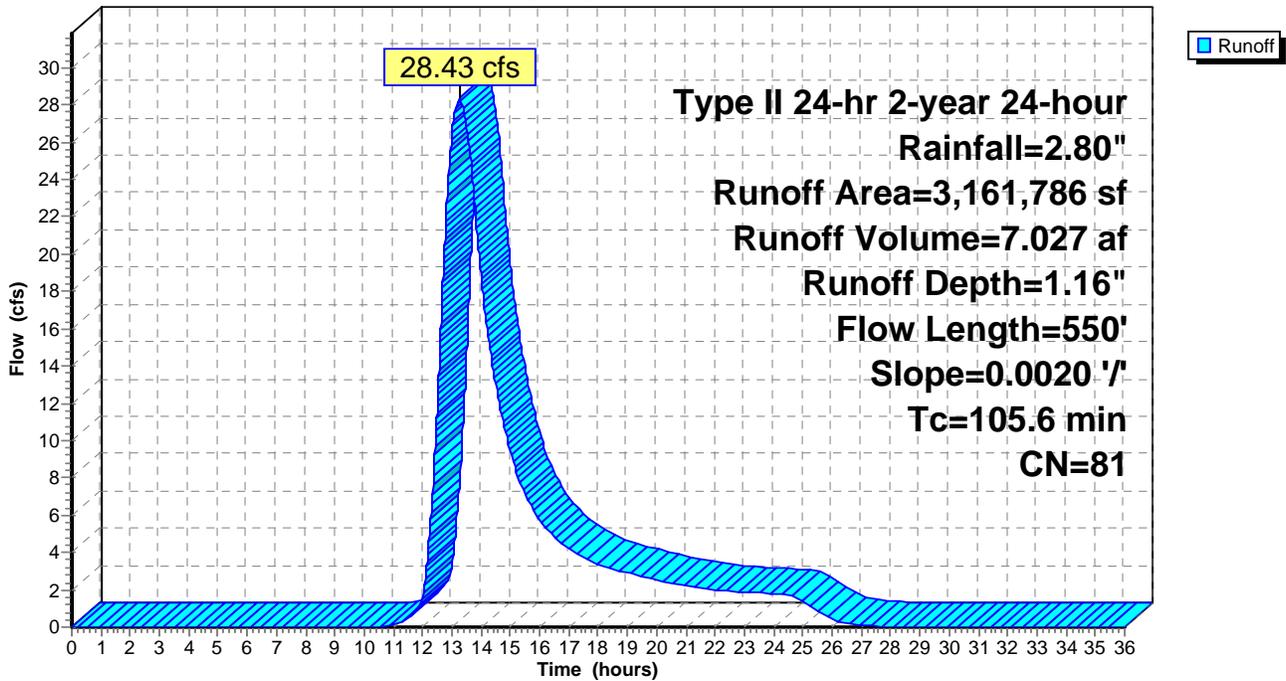
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Type II 24-hr 2-year 24-hour Rainfall=2.80"

	Area (sf)	CN	Description
*	1,672,034	65	
*	1,489,752	98	
	3,161,786	81	Weighted Average
	1,672,034		52.88% Pervious Area
	1,489,752		47.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
92.3	300	0.0020	0.05		Sheet Flow, Sheet Flow Grass: Dense n= 0.240 P2= 2.80"
13.3	250	0.0020	0.31		Shallow Concentrated Flow, Shallow Conc Flow Short Grass Pasture Kv= 7.0 fps
105.6	550	Total			

Subcatchment 1S: Lowland-Final

Hydrograph



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Type II 24-hr 2-year 24-hour Rainfall=2.80"

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Summary for Subcatchment 2S: Upland-Final

Runoff = 5.05 cfs @ 12.70 hrs, Volume= 1.047 af, Depth= 0.49"

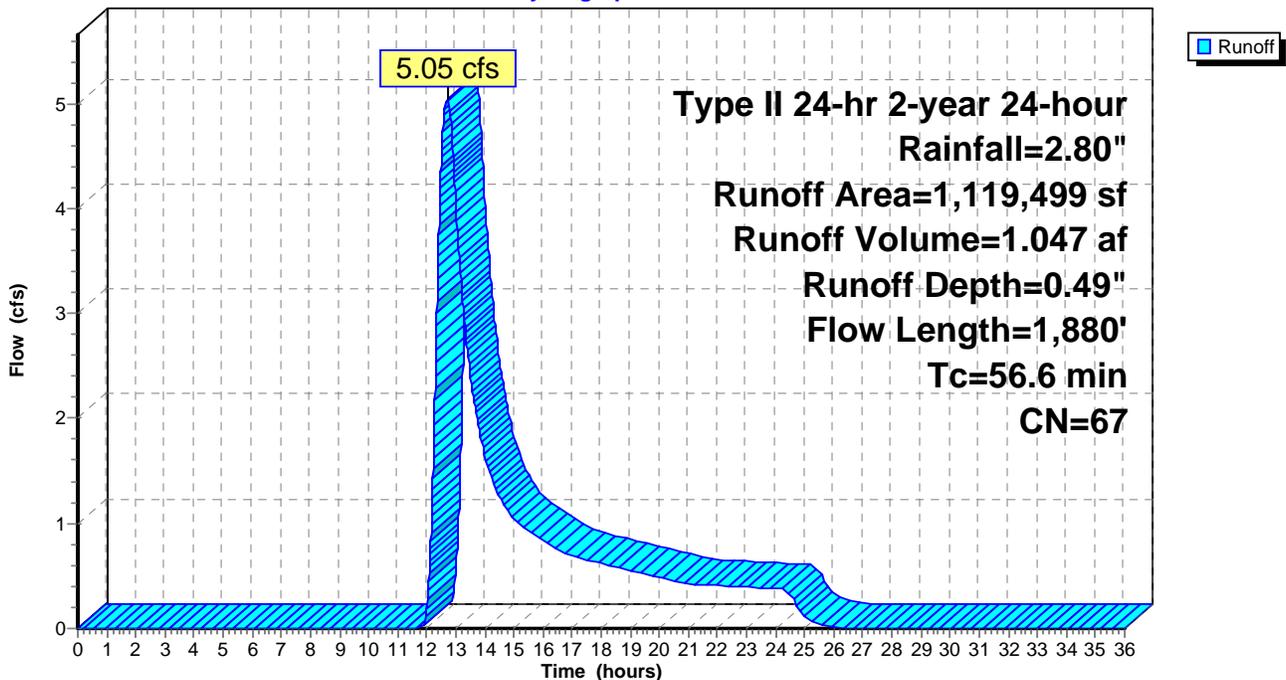
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Type II 24-hr 2-year 24-hour Rainfall=2.80"

Area (sf)	CN	Description
* 1,058,739	65	
* 60,760	95	
1,119,499	67	Weighted Average
1,119,499		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.3	300	0.0100	0.15		Sheet Flow, Sheet Flow Grass: Short n= 0.150 P2= 2.80"
4.7	520	0.0150	1.84		Shallow Concentrated Flow, Shallow Conc Flow Grassed Waterway Kv= 15.0 fps
18.6	1,060	0.0040	0.95		Shallow Concentrated Flow, Shallow Conc Flow Grassed Waterway Kv= 15.0 fps
56.6	1,880	Total			

Subcatchment 2S: Upland-Final

Hydrograph



Reclamation Conditions

Type II 24-hr 2-year 24-hour Rainfall=2.80"

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Summary for Pond 1P: Lake

Inflow Area = 72.585 ac, 47.12% Impervious, Inflow Depth = 1.16" for 2-year 24-hour event
 Inflow = 28.43 cfs @ 13.26 hrs, Volume= 7.027 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

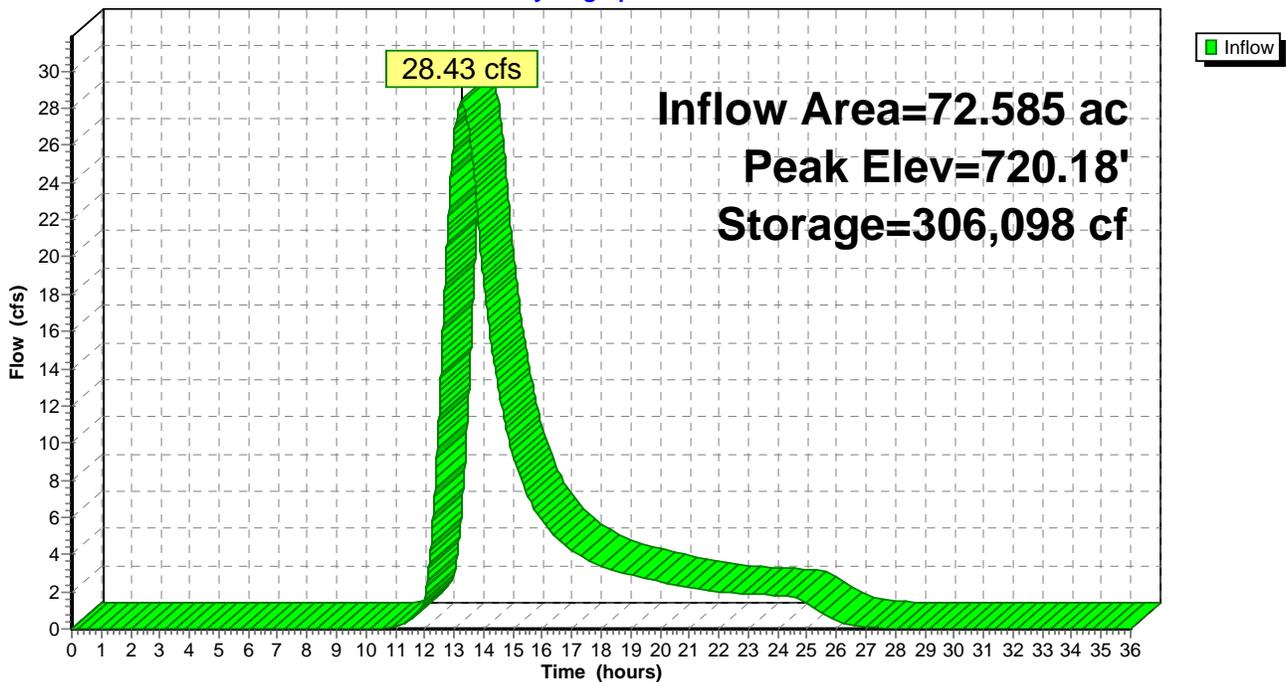
Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 720.18' @ 30.05 hrs Surf.Area= 1,689,755 sf Storage= 306,098 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	720.00'	1,727,674 cf	Custom Stage Data (Prismatic) Listed below
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
720.00	1,668,945	0	0
721.00	1,786,402	1,727,674	1,727,674

Pond 1P: Lake

Hydrograph



Reclamation Conditions

Type II 24-hr 2-year 24-hour Rainfall=2.80"

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Summary for Pond 2P: Infiltration Pond

Inflow Area = 25.700 ac, 0.00% Impervious, Inflow Depth = 0.49" for 2-year 24-hour event
 Inflow = 5.05 cfs @ 12.70 hrs, Volume= 1.047 af
 Outflow = 0.13 cfs @ 24.94 hrs, Volume= 0.247 af, Atten= 97%, Lag= 734.7 min
 Discarded = 0.13 cfs @ 24.94 hrs, Volume= 0.247 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 724.55' @ 24.94 hrs Surf.Area= 18,976 sf Storage= 39,821 cf

Plug-Flow detention time= 710.0 min calculated for 0.247 af (24% of inflow)
 Center-of-Mass det. time= 520.2 min (1,464.8 - 944.6)

Volume	Invert	Avail.Storage	Storage Description
#1	722.00'	361,640 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
722.00	12,479	0	0
723.00	14,890	13,685	13,685
724.00	17,471	16,181	29,865
725.00	20,225	18,848	48,713
726.00	23,149	21,687	70,400
727.00	26,245	24,697	95,097
728.00	29,513	27,879	122,976
729.00	38,449	33,981	156,957
730.00	48,800	43,625	200,582
731.00	71,356	60,078	260,660
732.00	130,604	100,980	361,640

Device	Routing	Invert	Outlet Devices
#1	Discarded	722.00'	0.300 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 0.00'
#2	Primary	731.50'	125.0' long x 30.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.13 cfs @ 24.94 hrs HW=724.55' (Free Discharge)
 ↑1=Exfiltration (Controls 0.13 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=722.00' (Free Discharge)
 ↑2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Reclamation Conditions

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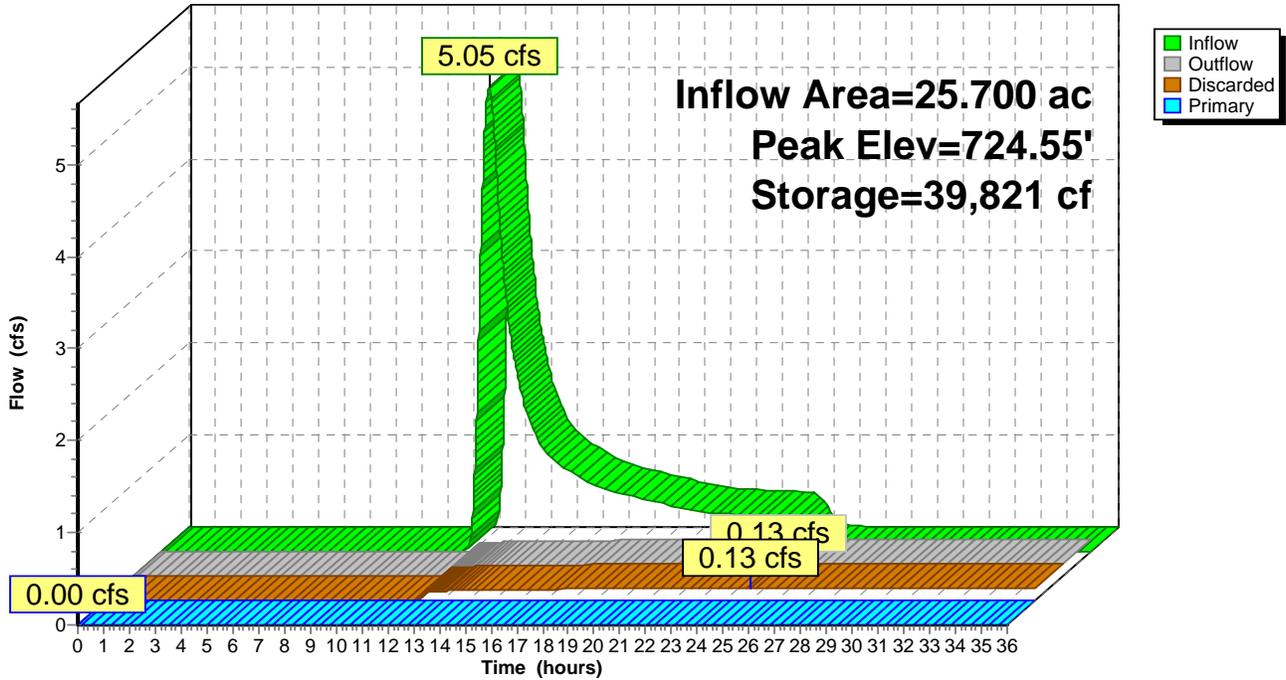
Type II 24-hr 2-year 24-hour Rainfall=2.80"

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Pond 2P: Infiltration Pond

Hydrograph



Reclamation Conditions

Type II 24-hr 10-year 24-hour Rainfall=4.20"

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Lowland-Final

Runoff Area=3,161,786 sf 47.12% Impervious Runoff Depth=2.29"
Flow Length=550' Slope=0.0020 '/' Tc=105.6 min CN=81 Runoff=58.01 cfs 13.856 af

Subcatchment 2S: Upland-Final

Runoff Area=1,119,499 sf 0.00% Impervious Runoff Depth=1.27"
Flow Length=1,880' Tc=56.6 min CN=67 Runoff=16.41 cfs 2.719 af

Pond 1P: Lake

Peak Elev=720.35' Storage=603,550 cf Inflow=58.01 cfs 13.856 af
Outflow=0.00 cfs 0.000 af

Pond 2P: Infiltration Pond

Peak Elev=727.55' Storage=109,969 cf Inflow=16.41 cfs 2.719 af
Discarded=0.20 cfs 0.363 af Primary=0.00 cfs 0.000 af Outflow=0.20 cfs 0.363 af

Total Runoff Area = 98.285 ac Runoff Volume = 16.575 af Average Runoff Depth = 2.02"
65.20% Pervious = 64.085 ac 34.80% Impervious = 34.200 ac

Reclamation Conditions

Type II 24-hr 10-year 24-hour Rainfall=4.20"

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Summary for Subcatchment 1S: Lowland-Final

Runoff = 58.01 cfs @ 13.26 hrs, Volume= 13.856 af, Depth= 2.29"

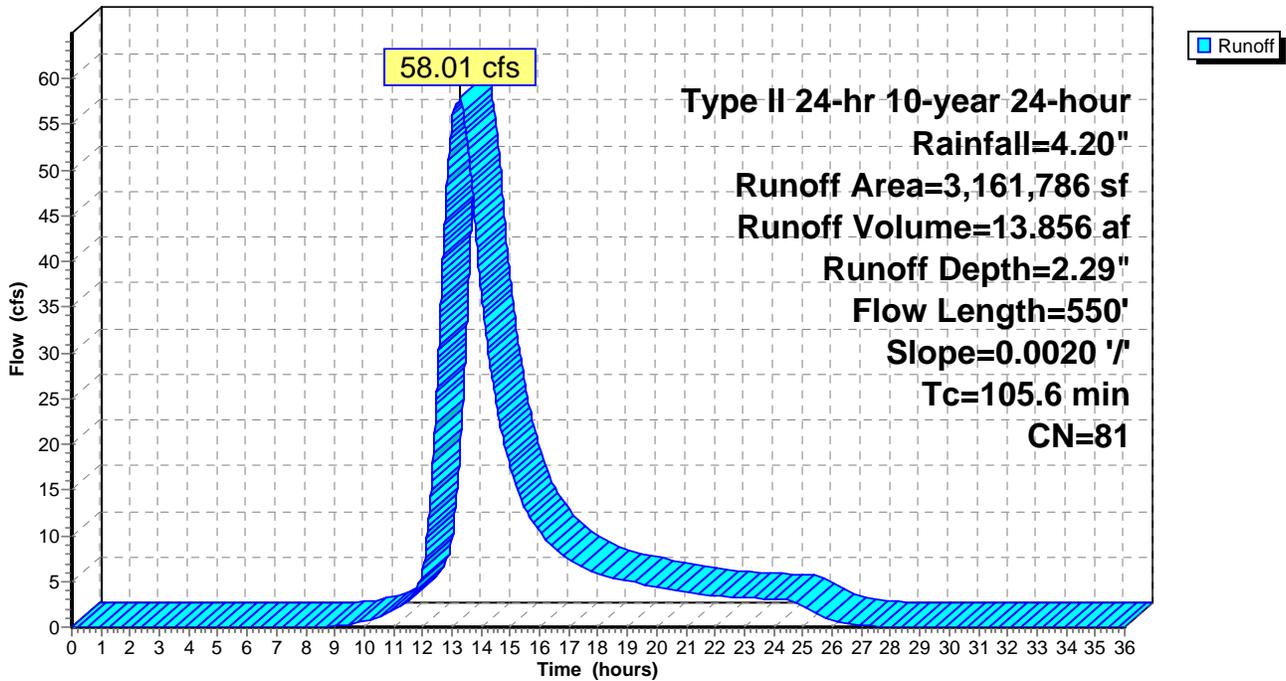
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Type II 24-hr 10-year 24-hour Rainfall=4.20"

	Area (sf)	CN	Description
*	1,672,034	65	
*	1,489,752	98	
	3,161,786	81	Weighted Average
	1,672,034		52.88% Pervious Area
	1,489,752		47.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
92.3	300	0.0020	0.05		Sheet Flow, Sheet Flow Grass: Dense n= 0.240 P2= 2.80"
13.3	250	0.0020	0.31		Shallow Concentrated Flow, Shallow Conc Flow Short Grass Pasture Kv= 7.0 fps
105.6	550	Total			

Subcatchment 1S: Lowland-Final

Hydrograph



Reclamation Conditions

Type II 24-hr 10-year 24-hour Rainfall=4.20"

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Summary for Subcatchment 2S: Upland-Final

Runoff = 16.41 cfs @ 12.64 hrs, Volume= 2.719 af, Depth= 1.27"

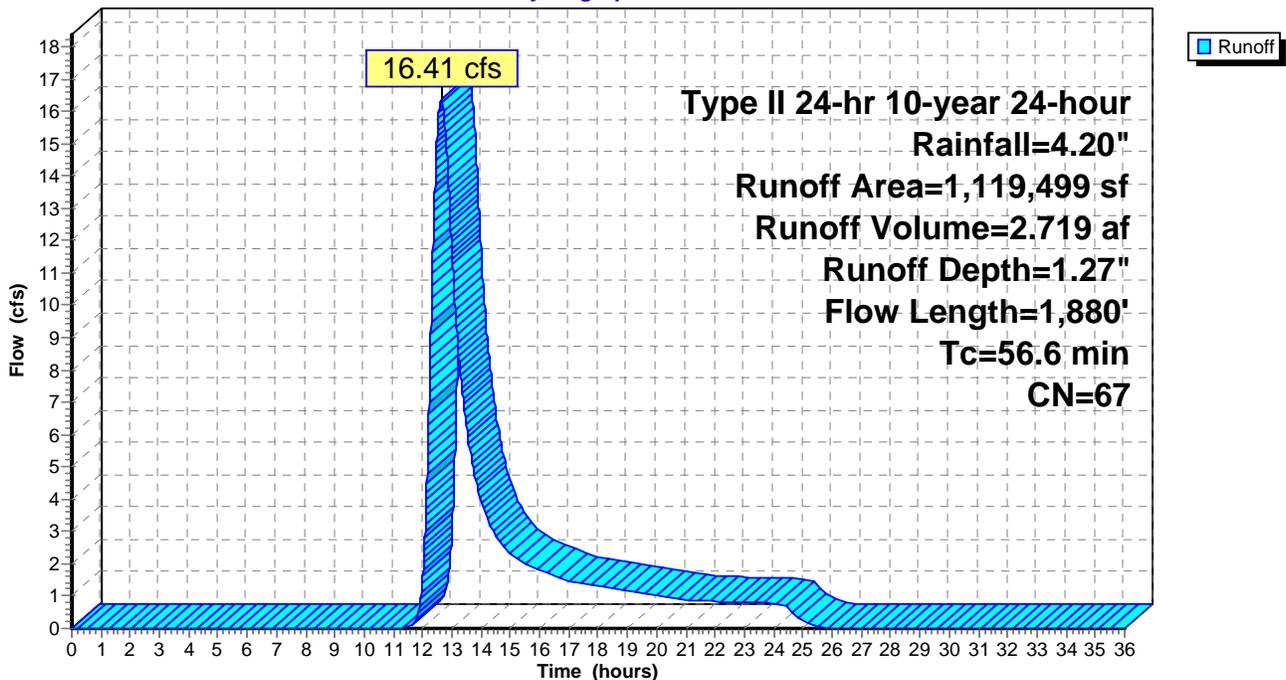
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Type II 24-hr 10-year 24-hour Rainfall=4.20"

Area (sf)	CN	Description
* 1,058,739	65	
* 60,760	95	
1,119,499	67	Weighted Average
1,119,499		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.3	300	0.0100	0.15		Sheet Flow, Sheet Flow Grass: Short n= 0.150 P2= 2.80"
4.7	520	0.0150	1.84		Shallow Concentrated Flow, Shallow Conc Flow Grassed Waterway Kv= 15.0 fps
18.6	1,060	0.0040	0.95		Shallow Concentrated Flow, Shallow Conc Flow Grassed Waterway Kv= 15.0 fps
56.6	1,880	Total			

Subcatchment 2S: Upland-Final

Hydrograph



Reclamation Conditions

Type II 24-hr 10-year 24-hour Rainfall=4.20"

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Summary for Pond 1P: Lake

Inflow Area = 72.585 ac, 47.12% Impervious, Inflow Depth = 2.29" for 10-year 24-hour event
 Inflow = 58.01 cfs @ 13.26 hrs, Volume= 13.856 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

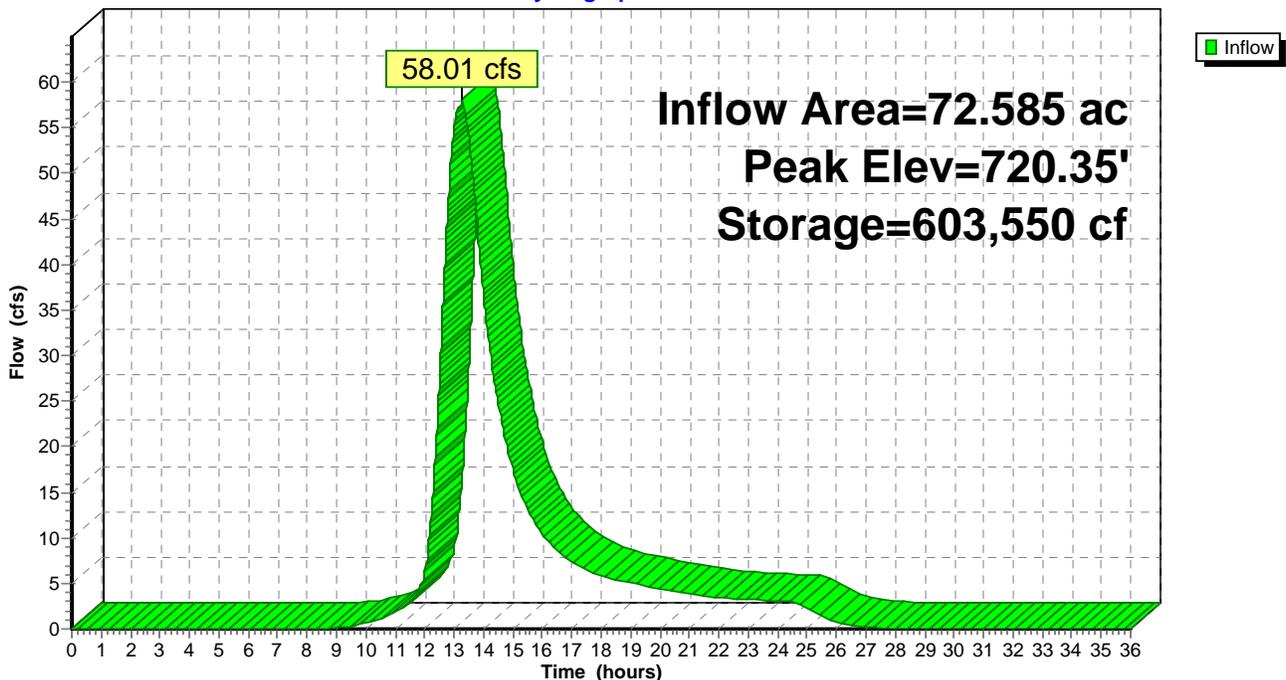
Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 720.35' @ 30.05 hrs Surf.Area= 1,709,978 sf Storage= 603,550 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	720.00'	1,727,674 cf	Custom Stage Data (Prismatic) Listed below
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
720.00	1,668,945	0	0
721.00	1,786,402	1,727,674	1,727,674

Pond 1P: Lake

Hydrograph



Reclamation Conditions

Type II 24-hr 10-year 24-hour Rainfall=4.20"

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Summary for Pond 2P: Infiltration Pond

Inflow Area = 25.700 ac, 0.00% Impervious, Inflow Depth = 1.27" for 10-year 24-hour event
 Inflow = 16.41 cfs @ 12.64 hrs, Volume= 2.719 af
 Outflow = 0.20 cfs @ 25.06 hrs, Volume= 0.363 af, Atten= 99%, Lag= 745.5 min
 Discarded = 0.20 cfs @ 25.06 hrs, Volume= 0.363 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 727.55' @ 25.06 hrs Surf.Area= 28,036 sf Storage= 109,969 cf

Plug-Flow detention time= 731.3 min calculated for 0.363 af (13% of inflow)
 Center-of-Mass det. time= 560.2 min (1,470.2 - 909.9)

Volume	Invert	Avail.Storage	Storage Description
#1	722.00'	361,640 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
722.00	12,479	0	0
723.00	14,890	13,685	13,685
724.00	17,471	16,181	29,865
725.00	20,225	18,848	48,713
726.00	23,149	21,687	70,400
727.00	26,245	24,697	95,097
728.00	29,513	27,879	122,976
729.00	38,449	33,981	156,957
730.00	48,800	43,625	200,582
731.00	71,356	60,078	260,660
732.00	130,604	100,980	361,640

Device	Routing	Invert	Outlet Devices
#1	Discarded	722.00'	0.300 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 0.00'
#2	Primary	731.50'	125.0' long x 30.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.20 cfs @ 25.06 hrs HW=727.55' (Free Discharge)
 ↑1=Exfiltration (Controls 0.20 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=722.00' (Free Discharge)
 ↑2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Reclamation Conditions

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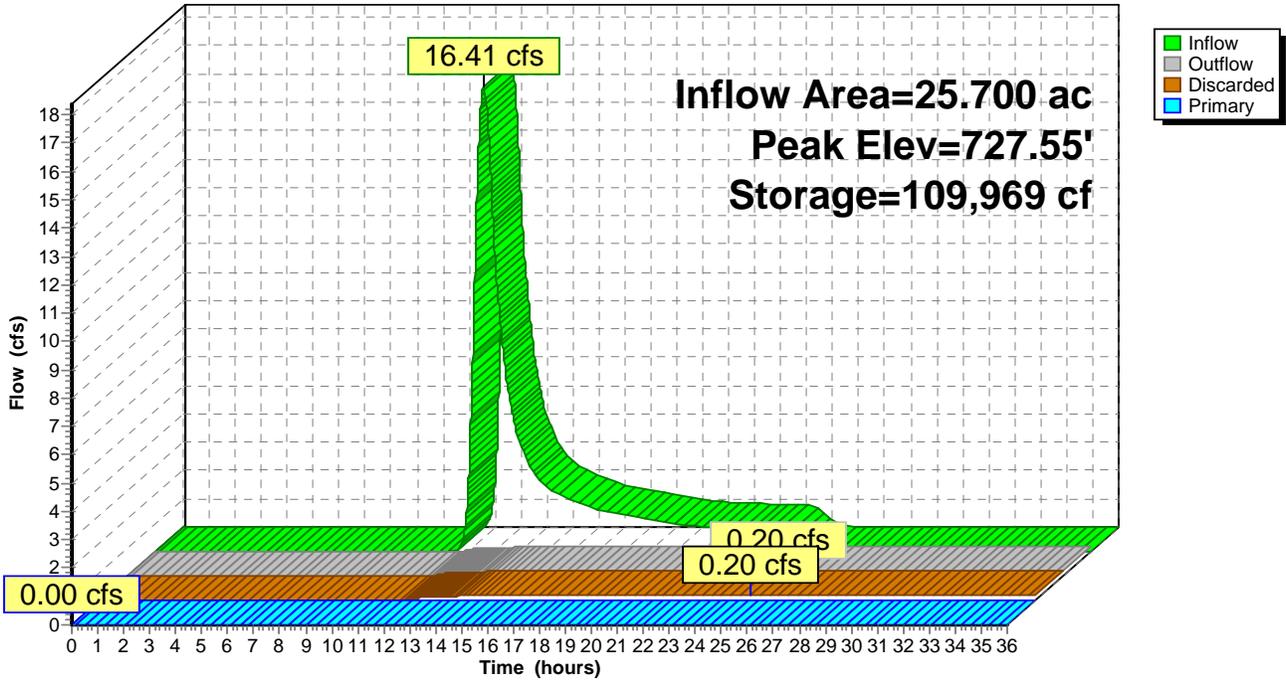
Type II 24-hr 10-year 24-hour Rainfall=4.20"

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Pond 2P: Infiltration Pond

Hydrograph



Reclamation Conditions

Type II 24-hr 100-year 24-hour Rainfall=6.00"

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Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Lowland-Final Runoff Area=3,161,786 sf 47.12% Impervious Runoff Depth=3.88"
Flow Length=550' Slope=0.0020 '/' Tc=105.6 min CN=81 Runoff=98.92 cfs 23.492 af

Subcatchment 2S: Upland-Final Runoff Area=1,119,499 sf 0.00% Impervious Runoff Depth=2.53"
Flow Length=1,880' Tc=56.6 min CN=67 Runoff=35.05 cfs 5.419 af

Pond 1P: Lake Peak Elev=720.59' Storage=1,023,297 cf Inflow=98.92 cfs 23.492 af
Outflow=0.00 cfs 0.000 af

Pond 2P: Infiltration Pond Peak Elev=730.37' Storage=220,451 cf Inflow=35.05 cfs 5.419 af
Discarded=0.40 cfs 0.690 af Primary=0.00 cfs 0.000 af Outflow=0.40 cfs 0.690 af

Total Runoff Area = 98.285 ac Runoff Volume = 28.910 af Average Runoff Depth = 3.53"
65.20% Pervious = 64.085 ac 34.80% Impervious = 34.200 ac

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Type II 24-hr 100-year 24-hour Rainfall=6.00"

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Summary for Subcatchment 1S: Lowland-Final

Runoff = 98.92 cfs @ 13.25 hrs, Volume= 23.492 af, Depth= 3.88"

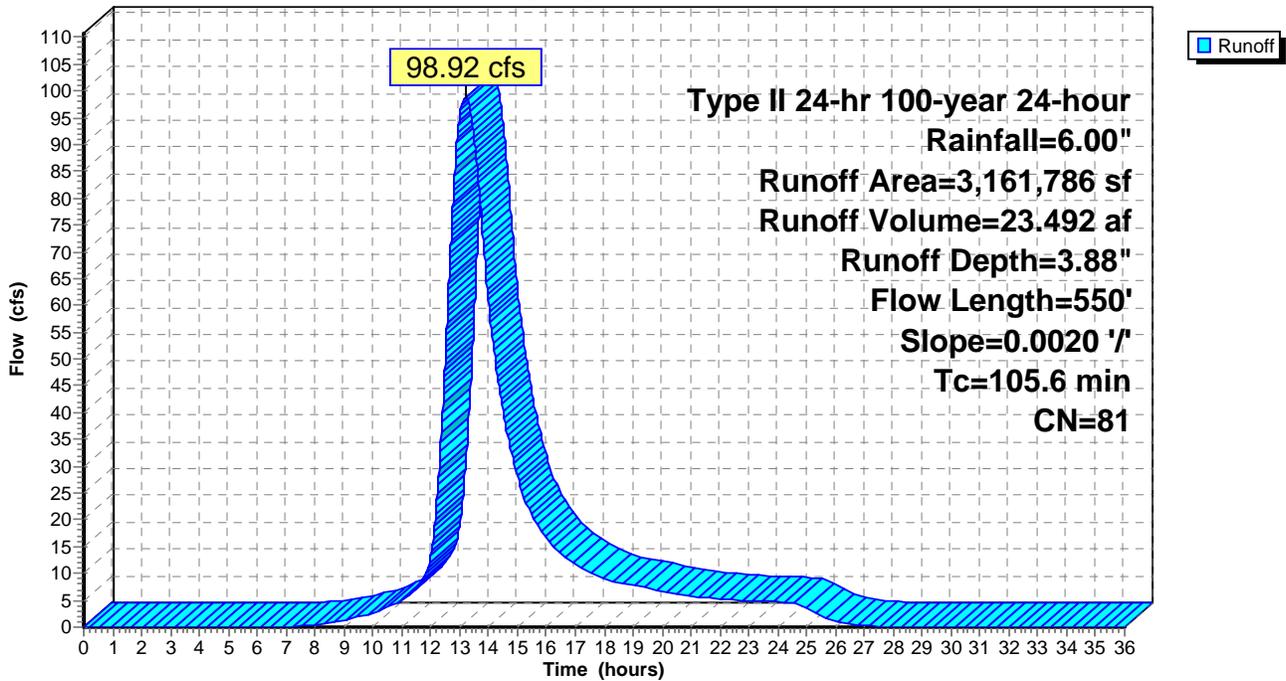
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Type II 24-hr 100-year 24-hour Rainfall=6.00"

	Area (sf)	CN	Description
*	1,672,034	65	
*	1,489,752	98	
	3,161,786	81	Weighted Average
	1,672,034		52.88% Pervious Area
	1,489,752		47.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
92.3	300	0.0020	0.05		Sheet Flow, Sheet Flow Grass: Dense n= 0.240 P2= 2.80"
13.3	250	0.0020	0.31		Shallow Concentrated Flow, Shallow Conc Flow Short Grass Pasture Kv= 7.0 fps
105.6	550	Total			

Subcatchment 1S: Lowland-Final

Hydrograph



Reclamation Conditions

Type II 24-hr 100-year 24-hour Rainfall=6.00"

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Summary for Subcatchment 2S: Upland-Final

Runoff = 35.05 cfs @ 12.63 hrs, Volume= 5.419 af, Depth= 2.53"

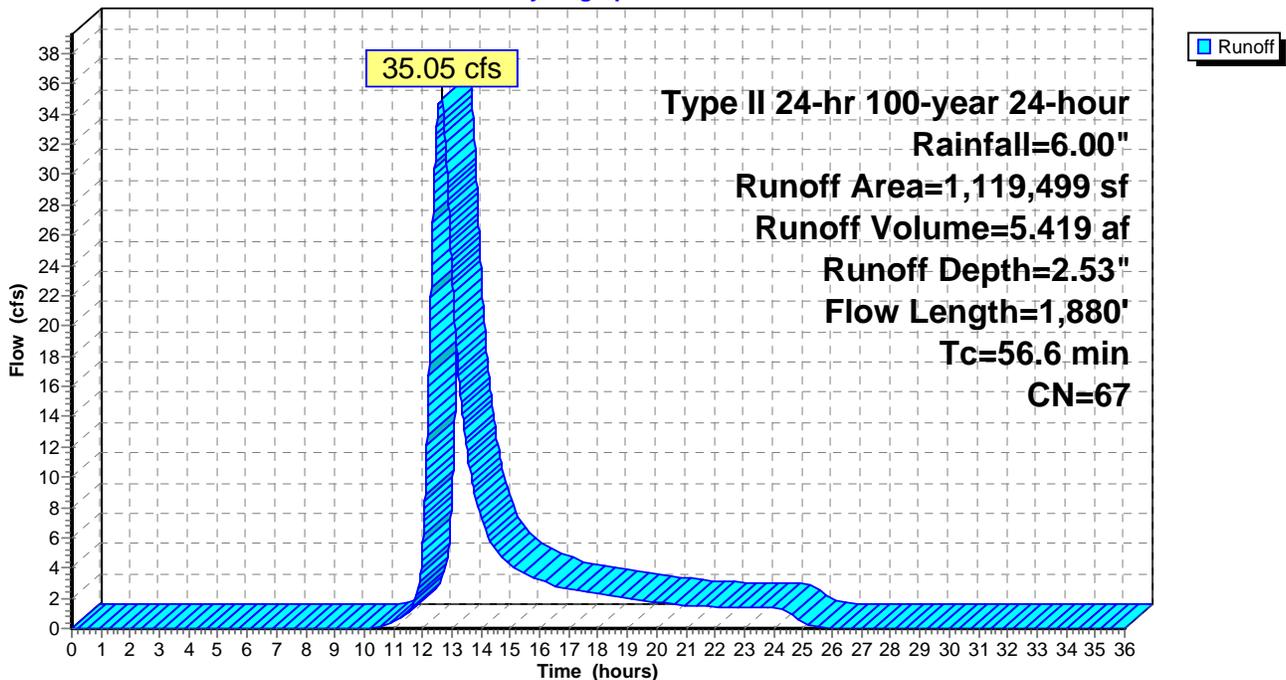
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Type II 24-hr 100-year 24-hour Rainfall=6.00"

Area (sf)	CN	Description
* 1,058,739	65	
* 60,760	95	
1,119,499	67	Weighted Average
1,119,499		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
33.3	300	0.0100	0.15		Sheet Flow, Sheet Flow Grass: Short n= 0.150 P2= 2.80"
4.7	520	0.0150	1.84		Shallow Concentrated Flow, Shallow Conc Flow Grassed Waterway Kv= 15.0 fps
18.6	1,060	0.0040	0.95		Shallow Concentrated Flow, Shallow Conc Flow Grassed Waterway Kv= 15.0 fps
56.6	1,880	Total			

Subcatchment 2S: Upland-Final

Hydrograph



Reclamation Conditions

Type II 24-hr 100-year 24-hour Rainfall=6.00"

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Summary for Pond 1P: Lake

Inflow Area = 72.585 ac, 47.12% Impervious, Inflow Depth = 3.88" for 100-year 24-hour event
 Inflow = 98.92 cfs @ 13.25 hrs, Volume= 23.492 af
 Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

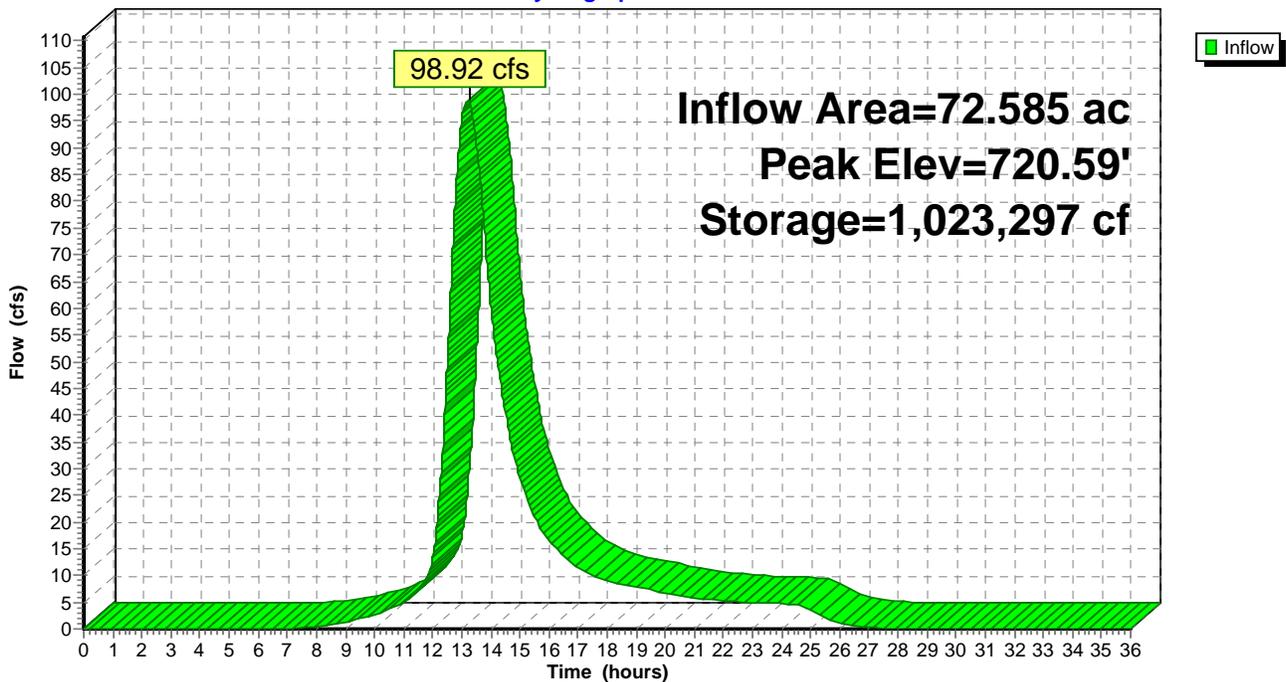
Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 720.59' @ 30.05 hrs Surf.Area= 1,738,514 sf Storage= 1,023,297 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
 Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	720.00'	1,727,674 cf	Custom Stage Data (Prismatic) Listed below
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
720.00	1,668,945	0	0
721.00	1,786,402	1,727,674	1,727,674

Pond 1P: Lake

Hydrograph



Reclamation Conditions

Type II 24-hr 100-year 24-hour Rainfall=6.00"

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Summary for Pond 2P: Infiltration Pond

Inflow Area = 25.700 ac, 0.00% Impervious, Inflow Depth = 2.53" for 100-year 24-hour event
 Inflow = 35.05 cfs @ 12.63 hrs, Volume= 5.419 af
 Outflow = 0.40 cfs @ 25.00 hrs, Volume= 0.690 af, Atten= 99%, Lag= 742.1 min
 Discarded = 0.40 cfs @ 25.00 hrs, Volume= 0.690 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
 Peak Elev= 730.37' @ 25.00 hrs Surf.Area= 57,252 sf Storage= 220,451 cf

Plug-Flow detention time= 758.8 min calculated for 0.690 af (13% of inflow)
 Center-of-Mass det. time= 597.1 min (1,486.1 - 888.9)

Volume	Invert	Avail.Storage	Storage Description
#1	722.00'	361,640 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
722.00	12,479	0	0
723.00	14,890	13,685	13,685
724.00	17,471	16,181	29,865
725.00	20,225	18,848	48,713
726.00	23,149	21,687	70,400
727.00	26,245	24,697	95,097
728.00	29,513	27,879	122,976
729.00	38,449	33,981	156,957
730.00	48,800	43,625	200,582
731.00	71,356	60,078	260,660
732.00	130,604	100,980	361,640

Device	Routing	Invert	Outlet Devices
#1	Discarded	722.00'	0.300 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 0.00'
#2	Primary	731.50'	125.0' long x 30.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.40 cfs @ 25.00 hrs HW=730.37' (Free Discharge)
 ↑1=Exfiltration (Controls 0.40 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=722.00' (Free Discharge)
 ↑2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

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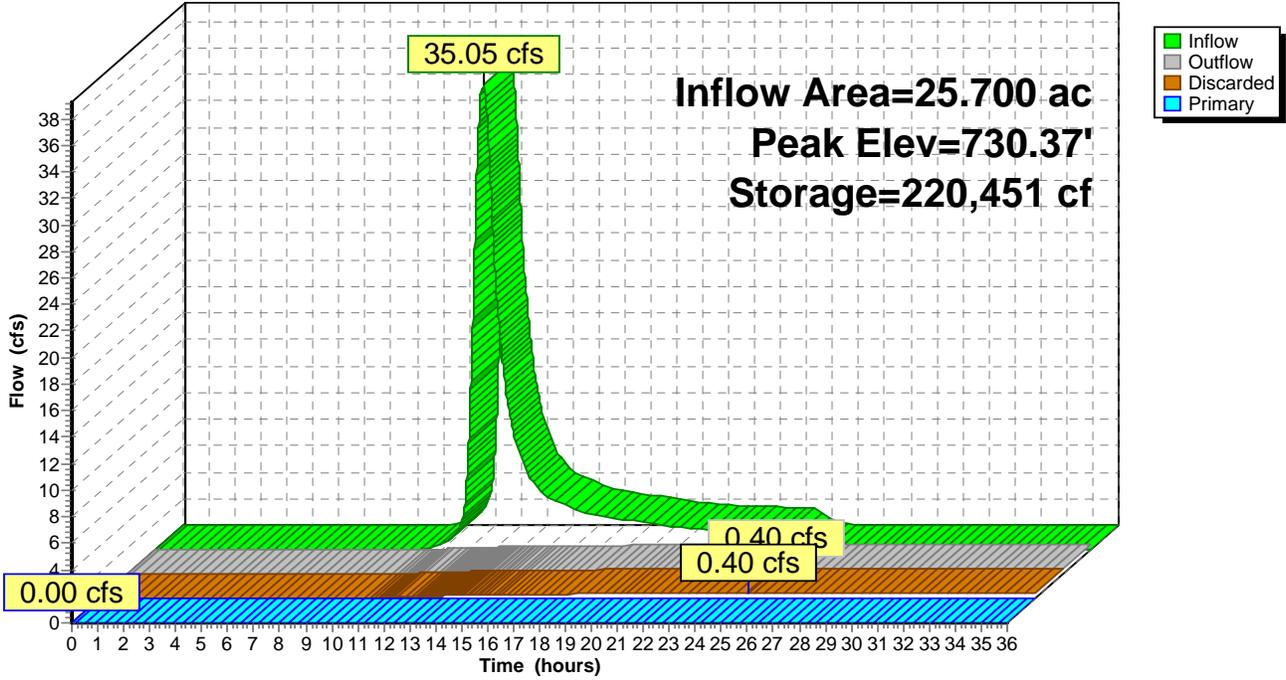
Type II 24-hr 100-year 24-hour Rainfall=6.00"

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Pond 2P: Infiltration Pond

Hydrograph



Appendix D
Mine Inundation Spillway Analysis



Memorandum

Date: April 2, 2012	From: John McCain
	Phone: 612-916-4400
To: Al Frechette, Kate Sedlacek	
Company: Scott County	
Re: Jordan Aggregates Mine Inundation Spillway	

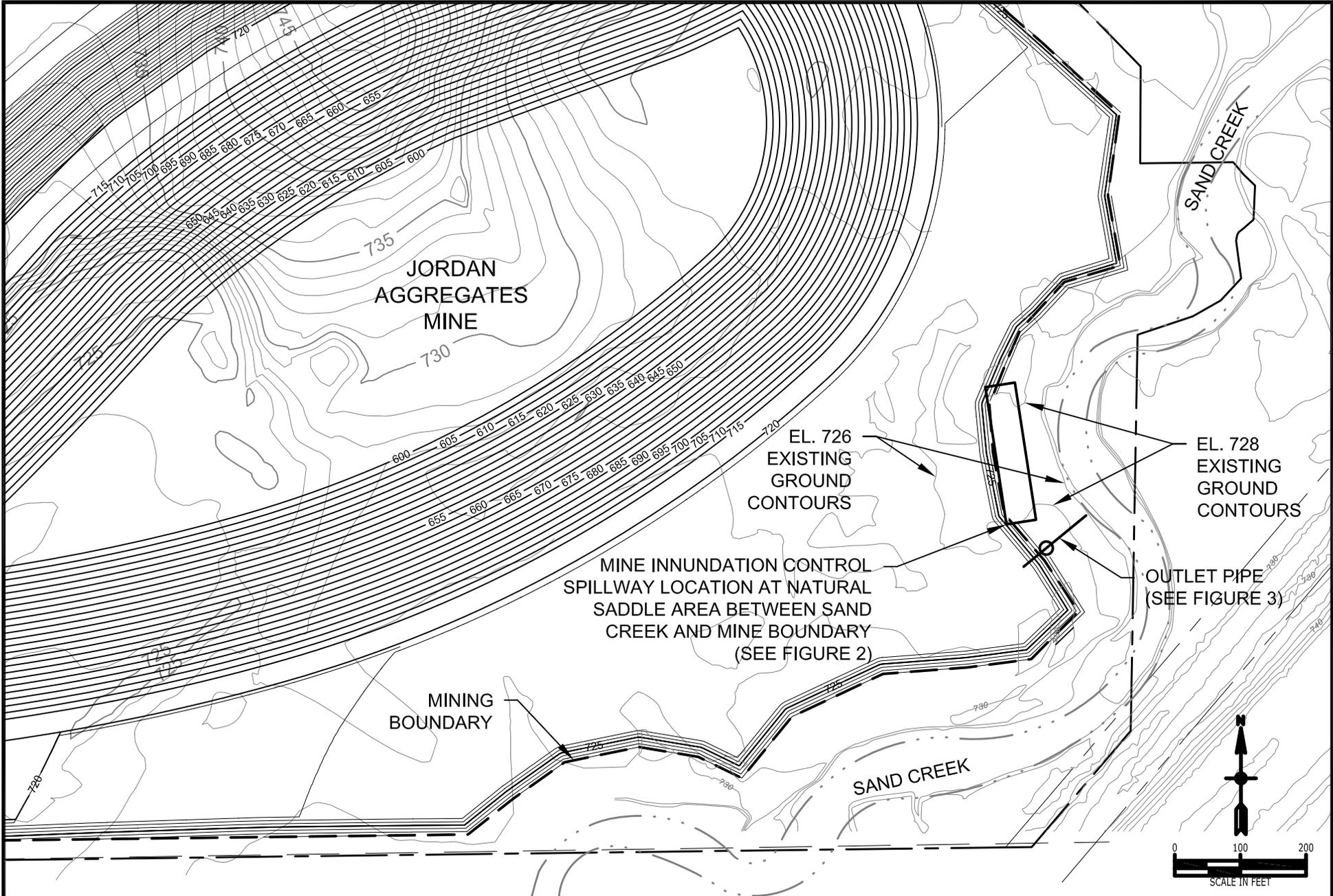
This memorandum provides design information for a spillway and outlet pipe between Sand Creek and the Jordan Aggregates mine to provide for controlled flow of flood waters into and out of the mine during the rise and recession of Sand Creek flood waters. Providing controlled movement of flood waters between Sand Creek and the mine will mitigate the potential for rechannelization of Sand Creek through the mine. The location of the spillway and outlet pipe are shown on attached Figure 1.

A spillway is proposed to be located on the mining boundary at a natural saddle location between the mine and Sand Creek as shown on Figure 1. The spillway crest will be placed at Elev. 726.0, bounded by natural ground at or above Elev. 728.0. The spillway length is approximately 200 feet. The spillway drops into the mine on a 5H:1V sloped surface that terminates in a two-foot deep stilling basin. The vertical drop from the spillway crest to the mine floor is approximately four feet. Design information is shown on attached Figure 2.

A spreadsheet analysis of the mine inundation process is provided as an attachment. The spreadsheet calculates floodwater movement into the mine through the spillway for a flood scenario where the water surface elevation is rising at a rate of 5 ft/day during the flood. The calculations demonstrate that the water elevation in the mine equilibrates with the flood elevation outside the mine while the flood water is still contained within the spillway (i.e. flood elevation below 728.0). Once the water levels are equal, the erosive force on the 100-foot wide buffer ground between Sand Creek and mine will be insignificant, thus mitigating the potential for rechannelization of Sand Creek into the mine area.

An 18-inch diameter concrete pipe outlet is proposed for draining floodwater from the mine back to Sand Creek (once the water level in the mine has receded below the spillway crest elevation). The pipe will be equipped with a one-way valve to prevent creek water from entering the mine through the pipe. Design information is shown on attached Figure 3. The spreadsheet also calculates water flow through the mine outlet pipe for a flood water recession rate of 1 foot/day. The calculations indicate a maximum discharge rate of 12 cubic feet per second and a discharge velocity of 6.8 ft/s.

The entire spillway crest, face, and stilling basin, and also the discharge end of the outlet pipe, will be armored with a vegetated 3-dimensional turf mat. Flow velocities will be less than seven ft/s across the spillway crest with a corresponding shear stress of 0.6 lbs/SF. Flow will accelerate to a velocity of 8 to 12 ft/s on the spillway face (depending upon the water surface elevation in the mine) with a corresponding shear stress of 4.4 to 6.6 lbs/SF. The proposed turf mat is rated for a maximum shear stress of 12 lbs/SF with mature vegetation, and thus has a minimum safety factor of 1.8 for this application.

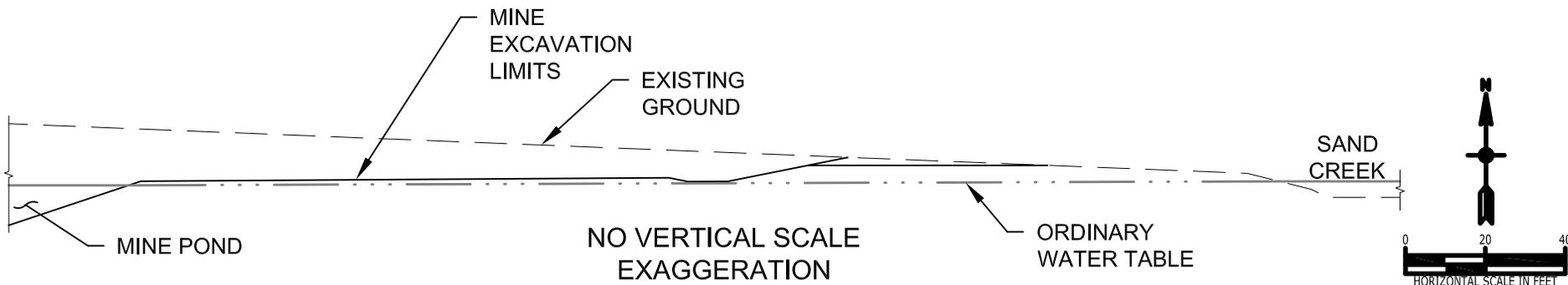
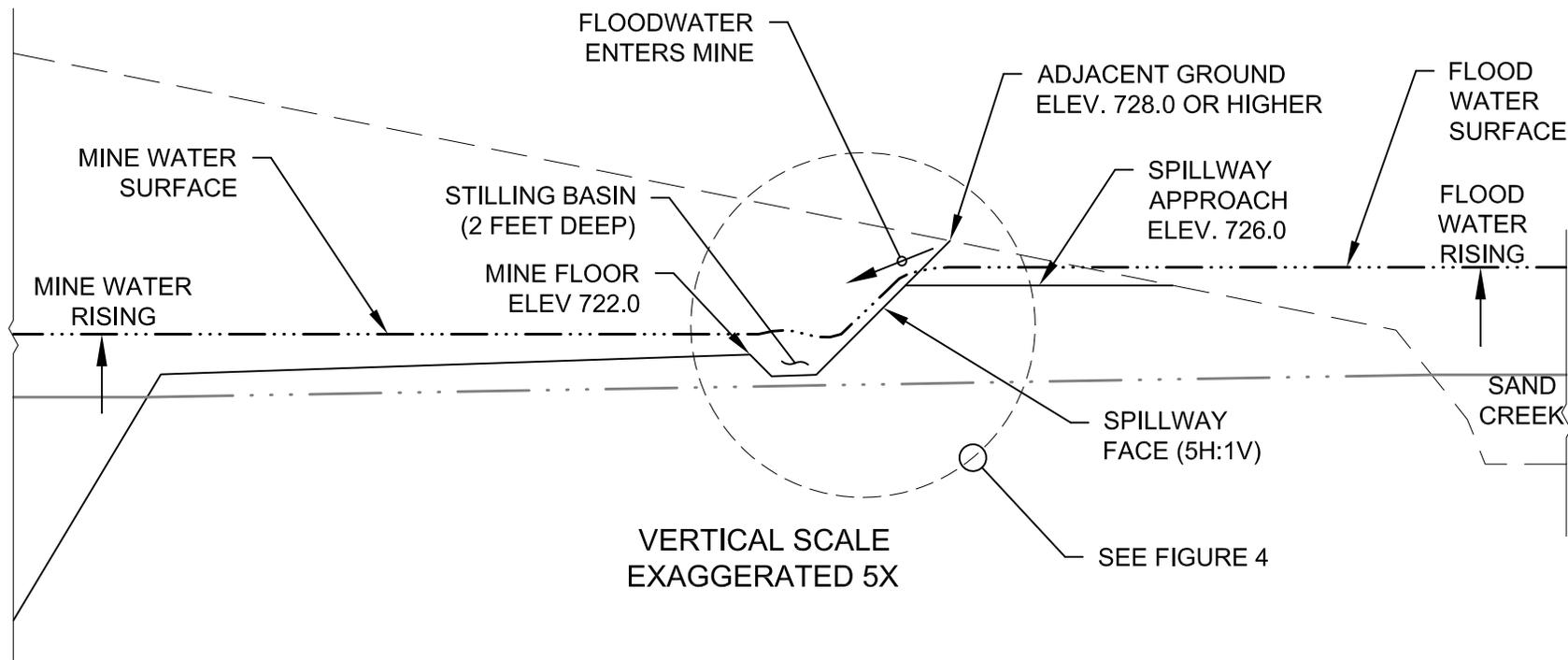


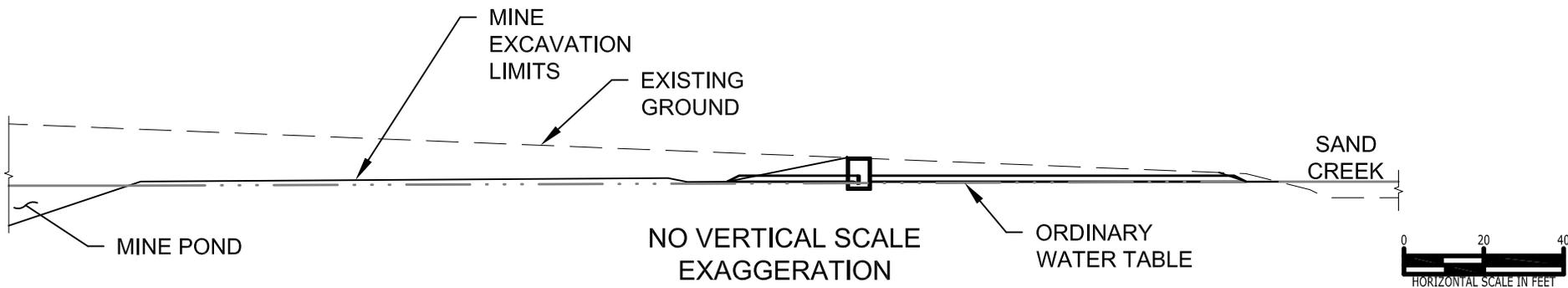
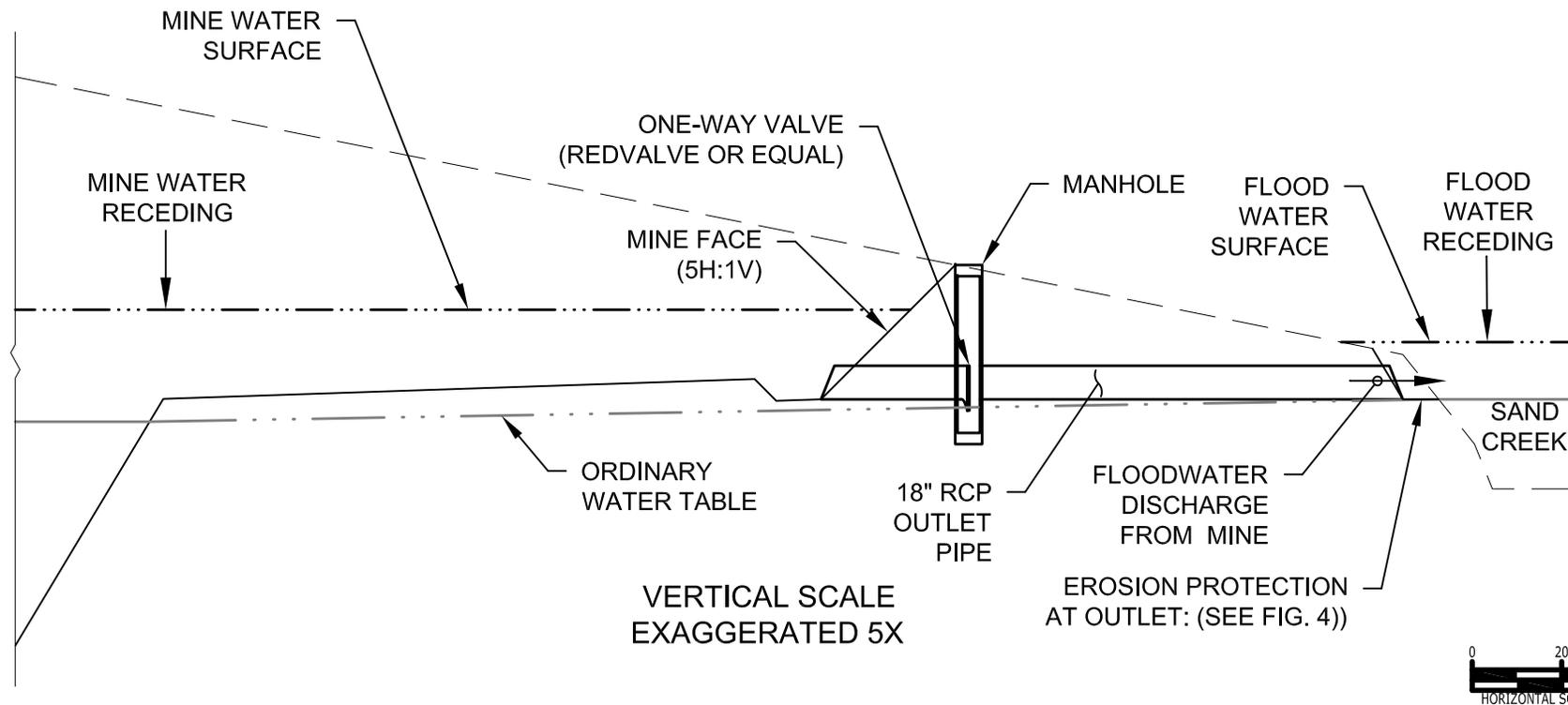
P:\Projects\HENHEN0901_Keefe\EIS\Mine Inundation x-section.dwg, Figure 1, 4/12/2012 4:36:06 PM



JORDAN AGGREGATES
 Sand Creek Township
 Scott County, MN

FIGURE 1
Spillway Location





ARMOR SPILLWAY CREST, FACE, AND STILLING BASIN WITH VEGETATED 3-DIMENSIONAL TURF MAT (NORTH AMERICAN GREEN C350 OR EQUAL)

5.0

10.0

SPILLWAY EROSION PROTECTION



MINE OUTLET PIPE

ARMOR CULVERT OUTLET WITH VEGETATED 3-DIMENSIONAL TURF MAT (NORTH AMERICAN GREEN C350 OR EQUAL)

MINE OUTLET EROSION PROTECTION



JORDAN AGGREGATES
Sand Creek Township
Scott County, MN

FIGURE 4
Erosion Protection

Jordan Aggregates Mine Inundation Analysis

spillway L 200 ft
 discharge C 3
 crest El 726 ft MSL
 weir height 2 ft
 Creek flood rise rate 5 ft/day

Time (min)	Sand Creek WSE (ft MSL)	Q in through spillway (CFS)	Volume in through spillway (CF)	Cumulative Volume in (CF)	Mine WSE (ft MSL)	Mine Filled to Weir Crest	Mine WSE = Creek WSE
0	726	0.00			720.00	NO	NO
5	726.02	1.70	509.1	509.1	720.00	NO	NO
10	726.04	4.80	1,440.0	1,949.1	720.00	NO	NO
15	726.06	8.82	2,645.4	4,594.6	720.00	NO	NO
20	726.08	13.58	4,072.9	8,667.5	720.01	NO	NO
25	726.1	18.97	5,692.1	14,359.6	720.01	NO	NO
30	726.12	24.94	7,482.5	21,842.1	720.01	NO	NO
35	726.14	31.43	9,429.0	31,271.0	720.02	NO	NO
40	726.16	38.40	11,520.0	42,791.0	720.02	NO	NO
45	726.18	45.82	13,746.2	56,537.2	720.03	NO	NO
50	726.2	53.67	16,099.7	72,636.9	720.04	NO	NO
55	726.22	61.91	18,574.0	91,210.9	720.05	NO	NO
60	726.24	70.55	21,163.6	112,374.5	720.07	NO	NO
65	726.26	79.54	23,863.4	136,237.9	720.08	NO	NO
70	726.28	88.90	26,669.2	162,907.1	720.09	NO	NO
75	726.3	98.59	29,577.0	192,484.1	720.11	NO	NO
80	726.32	108.61	32,583.5	225,067.6	720.13	NO	NO
85	726.34	118.95	35,685.4	260,753.0	720.15	NO	NO
90	726.36	129.60	38,880.0	299,633.0	720.17	NO	NO
95	726.38	140.55	42,164.6	341,797.6	720.20	NO	NO
100	726.4	151.79	45,536.8	387,334.4	720.22	NO	NO
105	726.42	163.31	48,994.4	436,328.8	720.25	NO	NO
110	726.44	175.12	52,535.3	488,864.2	720.28	NO	NO
115	726.46	187.19	56,157.7	545,021.8	720.32	NO	NO
120	726.48	199.53	59,859.7	604,881.5	720.35	NO	NO
125	726.5	212.13	63,639.6	668,521.1	720.39	NO	NO
130	726.52	224.99	67,495.9	736,017.1	720.43	NO	NO
135	726.54	238.09	71,427.1	807,444.2	720.47	NO	NO
140	726.56	251.44	75,431.8	882,876.0	720.51	NO	NO
145	726.58	265.03	79,508.7	962,384.7	720.56	NO	NO
150	726.6	278.85	83,656.4	1,046,041.1	720.61	NO	NO
155	726.62	292.91	87,873.9	1,133,915.0	720.66	NO	NO
160	726.64	307.20	92,160.0	1,226,075.0	720.71	NO	NO
165	726.66	321.71	96,513.6	1,322,588.6	720.77	NO	NO
170	726.68	336.45	100,933.6	1,423,522.2	720.82	NO	NO
175	726.7	351.40	105,419.2	1,528,941.4	720.88	NO	NO
180	726.72	366.56	109,969.2	1,638,910.6	720.95	NO	NO
185	726.74	381.94	114,583.0	1,753,493.6	721.01	NO	NO
190	726.76	397.53	119,259.5	1,872,753.1	721.08	NO	NO
195	726.78	413.33	123,997.9	1,996,751.0	721.14	NO	NO
200	726.8	429.33	128,797.5	2,125,548.5	721.21	NO	NO
205	726.82	445.52	133,657.5	2,259,206.0	721.29	NO	NO
210	726.84	461.92	138,577.1	2,397,783.1	721.36	NO	NO

Time (min)	Sand Creek WSE (ft MSL)	Q in through spillway (CFS)	Volume in through spillway (CF)	Cumulative Volume in (CF)	Mine WSE (ft MSL)	Mine Filled to Weir Crest	Mine WSE = Creek WSE
215	726.86	478.52	143,555.6	2,541,338.7	721.44	NO	NO
220	726.88	495.31	148,592.4	2,689,931.1	721.52	NO	NO
225	726.9	512.29	153,686.7	2,843,617.8	721.60	NO	NO
230	726.92	529.46	158,837.9	3,002,455.7	721.69	NO	NO
235	726.94	546.82	164,045.5	3,166,501.2	721.78	NO	NO
240	726.96	564.36	169,308.7	3,335,809.9	721.87	NO	NO
245	726.98	582.09	174,627.1	3,510,437.0	721.96	NO	NO
250	727	600.00	180,000.0	3,690,437.0	722.05	NO	NO
255	727.02	618.09	185,426.9	3,875,863.9	722.14	NO	NO
260	727.04	636.36	190,907.3	4,066,771.2	722.23	NO	NO
265	727.06	654.80	196,440.6	4,263,211.9	722.32	NO	NO
270	727.08	673.42	202,026.4	4,465,238.3	722.41	NO	NO
275	727.1	692.21	207,664.2	4,672,902.4	722.51	NO	NO
280	727.12	711.18	213,353.4	4,886,255.8	722.60	NO	NO
285	727.14	730.31	219,093.6	5,105,349.4	722.71	NO	NO
290	727.16	749.61	224,884.5	5,330,233.9	722.81	NO	NO
295	727.18	769.08	230,725.5	5,560,959.4	722.92	NO	NO
300	727.2	788.72	236,616.1	5,797,575.5	723.02	NO	NO
305	727.22	808.52	242,556.1	6,040,131.7	723.12	NO	NO
310	727.24	828.48	248,545.0	6,288,676.7	723.22	NO	NO
315	727.26	848.61	254,582.4	6,543,259.0	723.33	NO	NO
320	727.28	868.89	260,667.8	6,803,926.9	723.44	NO	NO
325	727.3	889.34	266,801.0	7,070,727.9	723.55	NO	NO
330	727.32	909.94	272,981.6	7,343,709.5	723.66	NO	NO
335	727.34	930.70	279,209.2	7,622,918.7	723.77	NO	NO
340	727.36	951.61	285,483.4	7,908,402.1	723.89	NO	NO
345	727.38	972.68	291,803.9	8,200,206.1	724.01	NO	NO
350	727.4	993.90	298,170.4	8,498,376.5	724.13	NO	NO
355	727.42	1,015.28	304,582.6	8,802,959.0	724.26	NO	NO
360	727.44	1,036.80	311,040.0	9,113,999.0	724.38	NO	NO
365	727.46	1,058.47	317,542.4	9,431,541.5	724.51	NO	NO
370	727.48	1,080.30	324,089.6	9,755,631.1	724.65	NO	NO
375	727.5	1,102.27	330,681.1	10,086,312.2	724.78	NO	NO
380	727.52	1,124.39	337,316.7	10,423,628.9	724.92	NO	NO
385	727.54	1,146.65	343,996.2	10,767,625.1	725.06	NO	NO
390	727.56	1,169.06	350,719.1	11,118,344.2	725.20	NO	NO
395	727.58	1,191.62	357,485.3	11,475,829.4	725.34	NO	NO
400	727.6	1,214.31	364,294.4	11,840,123.8	725.49	NO	NO
405	727.62	1,237.15	371,146.2	12,211,270.0	725.64	NO	NO
410	727.64	1,260.13	378,040.5	12,589,310.5	725.79	NO	NO
415	727.66	1,283.26	384,976.9	12,974,287.3	725.94	NO	NO
420	727.68	1,306.52	391,955.2	13,366,242.5	726.10	YES	NO
425	727.7	1,300.14	390,043.2	13,756,285.7	726.25	YES	NO
430	727.72	1,273.19	381,956.0	14,138,241.7	726.40	YES	NO
435	727.74	1,243.66	373,097.1	14,511,338.8	726.55	YES	NO
440	727.76	1,211.40	363,419.6	14,874,758.5	726.70	YES	NO
445	727.78	1,176.24	352,871.1	15,227,629.5	726.84	YES	NO
450	727.8	1,137.97	341,391.9	15,569,021.4	726.98	YES	NO
455	727.82	1,096.38	328,914.0	15,897,935.5	727.10	YES	NO
460	727.84	1,052.93	315,880.4	16,213,815.9	727.23	YES	NO
465	727.86	1,006.21	301,863.5	16,515,679.4	727.34	YES	NO
470	727.88	955.49	286,648.0	16,802,327.4	727.45	YES	NO
475	727.9	900.40	270,118.6	17,072,446.0	727.56	YES	NO
480	727.92	840.45	252,135.4	17,324,581.4	727.65	YES	NO
485	727.94	775.09	232,525.9	17,557,107.3	727.74	YES	NO

Time (min)	Sand Creek WSE (ft MSL)	Q in through spillway (CFS)	Volume in through spillway (CF)	Cumulative Volume in (CF)	Mine WSE (ft MSL)	Mine Filled to Weir Crest	Mine WSE = Creek WSE
490	727.96	703.58	211,073.3	17,768,180.6	727.83	YES	NO
495	727.98	625.00	187,499.4	17,955,680.0	727.90	YES	YES
500	728	0.00	0.0	17,955,680.0	728.00	YES	YES

Jordan Aggregates Mine Outlet Pipe

Creek Drop
 Rate 1 ft/day
 Culvert Dia 18 inch
 Culvert L 250 ft
 Culvert n 0.012

Time (min)	Sand Creek WSE (ft MSL)	Qout (CFS)	Volume out (CF)	Cumulative Volume (CF)	Mine WSE (ft MSL)	Head Diff	Day
0	726	0	0	13,122,635	726.00	0.00	0.0
15	725.99	0.74	663	13,121,972	726.00	0.01	0.0
30	725.98	1.03	931	13,121,041	726.00	0.02	0.0
45	725.97	1.26	1,136	13,119,905	726.00	0.03	0.0
60	725.96	1.45	1,308	13,118,597	726.00	0.04	0.0
75	725.95	1.62	1,459	13,117,138	726.00	0.05	0.1
90	725.94	1.77	1,594	13,115,544	726.00	0.06	0.1
105	725.93	1.91	1,719	13,113,825	726.00	0.07	0.1
120	725.92	2.04	1,834	13,111,991	726.00	0.08	0.1
135	725.91	2.16	1,942	13,110,048	725.99	0.09	0.1
150	725.90	2.27	2,044	13,108,004	725.99	0.10	0.1
165	725.89	2.38	2,141	13,105,863	725.99	0.11	0.1
180	725.88	2.48	2,233	13,103,629	725.99	0.12	0.1
195	725.86	2.58	2,321	13,101,308	725.99	0.13	0.1
210	725.85	2.67	2,406	13,098,902	725.99	0.14	0.1
225	725.84	2.76	2,488	13,096,414	725.99	0.15	0.2
240	725.83	2.85	2,566	13,093,848	725.99	0.16	0.2
255	725.82	2.94	2,642	13,091,206	725.99	0.16	0.2
270	725.81	3.02	2,716	13,088,490	725.99	0.17	0.2
285	725.80	3.10	2,787	13,085,702	725.99	0.18	0.2
300	725.79	3.17	2,857	13,082,845	725.98	0.19	0.2
315	725.78	3.25	2,925	13,079,921	725.98	0.20	0.2
330	725.77	3.32	2,990	13,076,930	725.98	0.21	0.2
345	725.76	3.39	3,055	13,073,875	725.98	0.22	0.2
360	725.75	3.46	3,118	13,070,758	725.98	0.23	0.3
375	725.74	3.53	3,179	13,067,579	725.98	0.24	0.3
390	725.73	3.60	3,239	13,064,340	725.98	0.25	0.3
405	725.72	3.66	3,298	13,061,042	725.98	0.26	0.3
420	725.71	3.73	3,356	13,057,686	725.97	0.27	0.3
435	725.70	3.79	3,412	13,054,274	725.97	0.27	0.3
450	725.69	3.85	3,468	13,050,806	725.97	0.28	0.3
465	725.68	3.91	3,522	13,047,284	725.97	0.29	0.3
480	725.67	3.97	3,576	13,043,708	725.97	0.30	0.3
495	725.66	4.03	3,628	13,040,080	725.97	0.31	0.3
510	725.65	4.09	3,680	13,036,400	725.97	0.32	0.4
525	725.64	4.15	3,731	13,032,669	725.96	0.33	0.4
540	725.63	4.20	3,781	13,028,887	725.96	0.34	0.4
555	725.61	4.26	3,830	13,025,057	725.96	0.35	0.4
570	725.60	4.31	3,879	13,021,178	725.96	0.36	0.4
585	725.59	4.36	3,927	13,017,251	725.96	0.36	0.4

	Sand Creek			Cumulative			
Time (min)	WSE (ft MSL)	Qout (CFS)	Volume out (CF)	Volume (CF)	Mine WSE (ft MSL)	Head Diff	Day
600	725.58	4.42	3,974	13,013,277	725.96	0.37	0.4
615	725.57	4.47	4,021	13,009,256	725.95	0.38	0.4
630	725.56	4.52	4,067	13,005,189	725.95	0.39	0.4
645	725.55	4.57	4,112	13,001,077	725.95	0.40	0.4
660	725.54	4.62	4,157	12,996,920	725.95	0.41	0.5
675	725.53	4.67	4,201	12,992,719	725.95	0.42	0.5
690	725.52	4.72	4,245	12,988,475	725.95	0.43	0.5
705	725.51	4.76	4,288	12,984,187	725.94	0.43	0.5
720	725.50	4.81	4,330	12,979,857	725.94	0.44	0.5
735	725.49	4.86	4,372	12,975,484	725.94	0.45	0.5
750	725.48	4.90	4,414	12,971,070	725.94	0.46	0.5
765	725.47	4.95	4,455	12,966,615	725.94	0.47	0.5
780	725.46	5.00	4,496	12,962,119	725.94	0.48	0.5
795	725.45	5.04	4,536	12,957,583	725.93	0.49	0.6
810	725.44	5.08	4,576	12,953,007	725.93	0.49	0.6
825	725.43	5.13	4,615	12,948,391	725.93	0.50	0.6
840	725.42	5.17	4,654	12,943,737	725.93	0.51	0.6
855	725.41	5.21	4,693	12,939,044	725.93	0.52	0.6
870	725.40	5.26	4,731	12,934,313	725.92	0.53	0.6
885	725.39	5.30	4,769	12,929,544	725.92	0.54	0.6
900	725.38	5.34	4,807	12,924,737	725.92	0.55	0.6
915	725.36	5.38	4,844	12,919,893	725.92	0.55	0.6
930	725.35	5.42	4,881	12,915,013	725.92	0.56	0.6
945	725.34	5.46	4,917	12,910,096	725.92	0.57	0.7
960	725.33	5.50	4,953	12,905,143	725.91	0.58	0.7
975	725.32	5.54	4,989	12,900,154	725.91	0.59	0.7
990	725.31	5.58	5,024	12,895,130	725.91	0.60	0.7
1005	725.30	5.62	5,060	12,890,070	725.91	0.61	0.7
1020	725.29	5.66	5,094	12,884,976	725.91	0.61	0.7
1035	725.28	5.70	5,129	12,879,847	725.90	0.62	0.7
1050	725.27	5.74	5,163	12,874,683	725.90	0.63	0.7
1065	725.26	5.77	5,197	12,869,486	725.90	0.64	0.7
1080	725.25	5.81	5,231	12,864,255	725.90	0.65	0.8
1095	725.24	5.85	5,264	12,858,991	725.89	0.66	0.8
1110	725.23	5.89	5,298	12,853,693	725.89	0.66	0.8
1125	725.22	5.92	5,331	12,848,362	725.89	0.67	0.8
1140	725.21	5.96	5,363	12,842,999	725.89	0.68	0.8
1155	725.20	6.00	5,396	12,837,603	725.89	0.69	0.8
1170	725.19	6.03	5,428	12,832,175	725.88	0.70	0.8
1185	725.18	6.07	5,460	12,826,715	725.88	0.70	0.8
1200	725.17	6.10	5,492	12,821,224	725.88	0.71	0.8
1215	725.16	6.14	5,523	12,815,701	725.88	0.72	0.8
1230	725.15	6.17	5,554	12,810,146	725.88	0.73	0.9
1245	725.14	6.21	5,585	12,804,561	725.87	0.74	0.9
1260	725.13	6.24	5,616	12,798,945	725.87	0.75	0.9
1275	725.11	6.27	5,647	12,793,298	725.87	0.75	0.9
1290	725.10	6.31	5,677	12,787,621	725.87	0.76	0.9
1305	725.09	6.34	5,707	12,781,913	725.86	0.77	0.9
1320	725.08	6.37	5,737	12,776,176	725.86	0.78	0.9
1335	725.07	6.41	5,767	12,770,408	725.86	0.79	0.9

	Sand Creek			Cumulative				
Time (min)	WSE (ft MSL)	Qout (CFS)	Volume out (CF)	Volume (CF)	Mine WSE (ft MSL)	Head Diff	Day	
1350	725.06	6.44	5,797	12,764,612	725.86	0.79	0.9	
1365	725.05	6.47	5,826	12,758,785	725.85	0.80	0.9	
1380	725.04	6.51	5,855	12,752,930	725.85	0.81	1.0	
1395	725.03	6.54	5,884	12,747,045	725.85	0.82	1.0	
1410	725.02	6.57	5,913	12,741,132	725.85	0.83	1.0	
1425	725.01	6.60	5,942	12,735,190	725.85	0.84	1.0	
1440	725.00	6.63	5,970	12,729,220	725.84	0.84	1.0	
1455	724.99	6.67	5,999	12,723,221	725.84	0.85	1.0	
1470	724.98	6.70	6,027	12,717,194	725.84	0.86	1.0	
1485	724.97	6.73	6,055	12,711,139	725.84	0.87	1.0	
1500	724.96	6.76	6,083	12,705,057	725.83	0.88	1.0	
1515	724.95	6.79	6,110	12,698,946	725.83	0.88	1.1	
1530	724.94	6.82	6,138	12,692,809	725.83	0.89	1.1	
1545	724.93	6.85	6,165	12,686,644	725.83	0.90	1.1	
1560	724.92	6.88	6,192	12,680,451	725.82	0.91	1.1	
1575	724.91	6.91	6,219	12,674,232	725.82	0.92	1.1	
1590	724.90	6.94	6,246	12,667,986	725.82	0.92	1.1	
1605	724.89	6.97	6,273	12,661,713	725.82	0.93	1.1	
1620	724.88	7.00	6,299	12,655,414	725.81	0.94	1.1	
1635	724.86	7.03	6,326	12,649,088	725.81	0.95	1.1	
1650	724.85	7.06	6,352	12,642,736	725.81	0.95	1.1	
1665	724.84	7.09	6,378	12,636,358	725.81	0.96	1.2	
1680	724.83	7.12	6,404	12,629,954	725.80	0.97	1.2	
1695	724.82	7.14	6,430	12,623,524	725.80	0.98	1.2	
1710	724.81	7.17	6,456	12,617,069	725.80	0.99	1.2	
1725	724.80	7.20	6,481	12,610,588	725.80	0.99	1.2	
1740	724.79	7.23	6,507	12,604,081	725.79	1.00	1.2	
1755	724.78	7.26	6,532	12,597,549	725.79	1.01	1.2	
1770	724.77	7.29	6,557	12,590,992	725.79	1.02	1.2	
1785	724.76	7.31	6,582	12,584,410	725.79	1.03	1.2	
1800	724.75	7.34	6,607	12,577,803	725.78	1.03	1.3	
1815	724.74	7.37	6,632	12,571,172	725.78	1.04	1.3	
1830	724.73	7.40	6,656	12,564,515	725.78	1.05	1.3	
1845	724.72	7.42	6,681	12,557,834	725.77	1.06	1.3	
1860	724.71	7.45	6,705	12,551,129	725.77	1.06	1.3	
1875	724.70	7.48	6,730	12,544,399	725.77	1.07	1.3	
1890	724.69	7.50	6,754	12,537,645	725.77	1.08	1.3	
1905	724.68	7.53	6,778	12,530,868	725.76	1.09	1.3	
1920	724.67	7.56	6,802	12,524,066	725.76	1.09	1.3	
1935	724.66	7.58	6,826	12,517,240	725.76	1.10	1.3	
1950	724.65	7.61	6,849	12,510,391	725.76	1.11	1.4	
1965	724.64	7.64	6,873	12,503,518	725.75	1.12	1.4	
1980	724.63	7.66	6,897	12,496,621	725.75	1.13	1.4	
1995	724.61	7.69	6,920	12,489,701	725.75	1.13	1.4	
2010	724.60	7.71	6,943	12,482,758	725.74	1.14	1.4	
2025	724.59	7.74	6,966	12,475,792	725.74	1.15	1.4	
2040	724.58	7.77	6,989	12,468,802	725.74	1.16	1.4	
2055	724.57	7.79	7,012	12,461,790	725.74	1.16	1.4	
2070	724.56	7.82	7,035	12,454,754	725.73	1.17	1.4	
2085	724.55	7.84	7,058	12,447,696	725.73	1.18	1.4	

	Sand Creek			Cumulative				
Time (min)	WSE (ft MSL)	Qout (CFS)	Volume out (CF)	Volume (CF)	Mine WSE (ft MSL)	Head Diff	Day	
2100	724.54	7.87	7,081	12,440,615	725.73	1.19	1.5	
2115	724.53	7.89	7,103	12,433,512	725.73	1.19	1.5	
2130	724.52	7.92	7,126	12,426,386	725.72	1.20	1.5	
2145	724.51	7.94	7,148	12,419,238	725.72	1.21	1.5	
2160	724.50	7.97	7,170	12,412,068	725.72	1.22	1.5	
2175	724.49	7.99	7,193	12,404,875	725.71	1.22	1.5	
2190	724.48	8.02	7,215	12,397,660	725.71	1.23	1.5	
2205	724.47	8.04	7,237	12,390,424	725.71	1.24	1.5	
2220	724.46	8.07	7,259	12,383,165	725.71	1.25	1.5	
2235	724.45	8.09	7,280	12,375,884	725.70	1.25	1.6	
2250	724.44	8.11	7,302	12,368,582	725.70	1.26	1.6	
2265	724.43	8.14	7,324	12,361,258	725.70	1.27	1.6	
2280	724.42	8.16	7,345	12,353,913	725.69	1.28	1.6	
2295	724.41	8.19	7,367	12,346,546	725.69	1.28	1.6	
2310	724.40	8.21	7,388	12,339,158	725.69	1.29	1.6	
2325	724.39	8.23	7,409	12,331,749	725.68	1.30	1.6	
2340	724.38	8.26	7,431	12,324,318	725.68	1.31	1.6	
2355	724.36	8.28	7,452	12,316,866	725.68	1.31	1.6	
2370	724.35	8.30	7,473	12,309,393	725.68	1.32	1.6	
2385	724.34	8.33	7,494	12,301,899	725.67	1.33	1.7	
2400	724.33	8.35	7,515	12,294,385	725.67	1.34	1.7	
2415	724.32	8.37	7,535	12,286,849	725.67	1.34	1.7	
2430	724.31	8.40	7,556	12,279,293	725.66	1.35	1.7	
2445	724.30	8.42	7,577	12,271,716	725.66	1.36	1.7	
2460	724.29	8.44	7,597	12,264,119	725.66	1.37	1.7	
2475	724.28	8.46	7,618	12,256,501	725.65	1.37	1.7	
2490	724.27	8.49	7,638	12,248,863	725.65	1.38	1.7	
2505	724.26	8.51	7,659	12,241,205	725.65	1.39	1.7	
2520	724.25	8.53	7,679	12,233,526	725.65	1.40	1.8	
2535	724.24	8.55	7,699	12,225,827	725.64	1.40	1.8	
2550	724.23	8.58	7,719	12,218,108	725.64	1.41	1.8	
2565	724.22	8.60	7,739	12,210,369	725.64	1.42	1.8	
2580	724.21	8.62	7,759	12,202,610	725.63	1.42	1.8	
2595	724.20	8.64	7,779	12,194,831	725.63	1.43	1.8	
2610	724.19	8.67	7,799	12,187,032	725.63	1.44	1.8	
2625	724.18	8.69	7,818	12,179,214	725.62	1.45	1.8	
2640	724.17	8.71	7,838	12,171,376	725.62	1.45	1.8	
2655	724.16	8.73	7,858	12,163,518	725.62	1.46	1.8	
2670	724.15	8.75	7,877	12,155,641	725.61	1.47	1.9	
2685	724.14	8.77	7,897	12,147,745	725.61	1.48	1.9	
2700	724.13	8.80	7,916	12,139,829	725.61	1.48	1.9	
2715	724.11	8.82	7,935	12,131,893	725.61	1.49	1.9	
2730	724.10	8.84	7,955	12,123,939	725.60	1.50	1.9	
2745	724.09	8.86	7,974	12,115,965	725.60	1.51	1.9	
2760	724.08	8.88	7,993	12,107,972	725.60	1.51	1.9	
2775	724.07	8.90	8,012	12,099,961	725.59	1.52	1.9	
2790	724.06	8.92	8,031	12,091,930	725.59	1.53	1.9	
2805	724.05	8.94	8,050	12,083,880	725.59	1.53	1.9	
2820	724.04	8.97	8,069	12,075,811	725.58	1.54	2.0	
2835	724.03	8.99	8,087	12,067,724	725.58	1.55	2.0	

	Sand Creek			Cumulative				
Time (min)	WSE (ft MSL)	Qout (CFS)	Volume out (CF)	Volume (CF)	Mine WSE (ft MSL)	Head Diff	Day	
2850	724.02	9.01	8,106	12,059,618	725.58	1.56	2.0	
2865	724.01	9.03	8,125	12,051,493	725.57	1.56	2.0	
2880	724.00	9.05	8,143	12,043,350	725.57	1.57	2.0	
2895	723.99	9.07	8,162	12,035,188	725.57	1.58	2.0	
2910	723.98	9.09	8,180	12,027,007	725.56	1.58	2.0	
2925	723.97	9.11	8,199	12,018,809	725.56	1.59	2.0	
2940	723.96	9.13	8,217	12,010,591	725.56	1.60	2.0	
2955	723.95	9.15	8,235	12,002,356	725.55	1.61	2.1	
2970	723.94	9.17	8,254	11,994,102	725.55	1.61	2.1	
2985	723.93	9.19	8,272	11,985,830	725.55	1.62	2.1	
3000	723.92	9.21	8,290	11,977,540	725.54	1.63	2.1	
3015	723.91	9.23	8,308	11,969,232	725.54	1.63	2.1	
3030	723.90	9.25	8,326	11,960,906	725.54	1.64	2.1	
3045	723.89	9.27	8,344	11,952,562	725.53	1.65	2.1	
3060	723.88	9.29	8,362	11,944,200	725.53	1.66	2.1	
3075	723.86	9.31	8,380	11,935,820	725.53	1.66	2.1	
3090	723.85	9.33	8,398	11,927,423	725.52	1.67	2.1	
3105	723.84	9.35	8,415	11,919,007	725.52	1.68	2.2	
3120	723.83	9.37	8,433	11,910,574	725.52	1.68	2.2	
3135	723.82	9.39	8,451	11,902,124	725.51	1.69	2.2	
3150	723.81	9.41	8,468	11,893,656	725.51	1.70	2.2	
3165	723.80	9.43	8,486	11,885,170	725.51	1.70	2.2	
3180	723.79	9.45	8,503	11,876,667	725.50	1.71	2.2	
3195	723.78	9.47	8,521	11,868,147	725.50	1.72	2.2	
3210	723.77	9.49	8,538	11,859,609	725.50	1.73	2.2	
3225	723.76	9.51	8,555	11,851,054	725.49	1.73	2.2	
3240	723.75	9.52	8,572	11,842,481	725.49	1.74	2.3	
3255	723.74	9.54	8,590	11,833,892	725.49	1.75	2.3	
3270	723.73	9.56	8,607	11,825,285	725.48	1.75	2.3	
3285	723.72	9.58	8,624	11,816,661	725.48	1.76	2.3	
3300	723.71	9.60	8,641	11,808,020	725.48	1.77	2.3	
3315	723.70	9.62	8,658	11,799,362	725.47	1.77	2.3	
3330	723.69	9.64	8,675	11,790,687	725.47	1.78	2.3	
3345	723.68	9.66	8,692	11,781,996	725.47	1.79	2.3	
3360	723.67	9.68	8,709	11,773,287	725.46	1.80	2.3	
3375	723.66	9.69	8,725	11,764,562	725.46	1.80	2.3	
3390	723.65	9.71	8,742	11,755,820	725.46	1.81	2.4	
3405	723.64	9.73	8,759	11,747,061	725.45	1.82	2.4	
3420	723.63	9.75	8,775	11,738,286	725.45	1.82	2.4	
3435	723.61	9.77	8,792	11,729,494	725.44	1.83	2.4	
3450	723.60	9.79	8,809	11,720,685	725.44	1.84	2.4	
3465	723.59	9.81	8,825	11,711,860	725.44	1.84	2.4	
3480	723.58	9.82	8,842	11,703,018	725.43	1.85	2.4	
3495	723.57	9.84	8,858	11,694,160	725.43	1.86	2.4	
3510	723.56	9.86	8,874	11,685,286	725.43	1.86	2.4	
3525	723.55	9.88	8,891	11,676,395	725.42	1.87	2.4	
3540	723.54	9.90	8,907	11,667,488	725.42	1.88	2.5	
3555	723.53	9.91	8,923	11,658,565	725.42	1.89	2.5	
3570	723.52	9.93	8,939	11,649,626	725.41	1.89	2.5	
3585	723.51	9.95	8,956	11,640,670	725.41	1.90	2.5	

	Sand Creek			Cumulative				
Time (min)	WSE (ft MSL)	Qout (CFS)	Volume out (CF)	Volume (CF)	Mine WSE (ft MSL)	Head Diff	Day	
3600	723.50	9.97	8,972	11,631,699	725.41	1.91	2.5	
3615	723.49	9.99	8,988	11,622,711	725.40	1.91	2.5	
3630	723.48	10.00	9,004	11,613,707	725.40	1.92	2.5	
3645	723.47	10.02	9,020	11,604,688	725.39	1.93	2.5	
3660	723.46	10.04	9,036	11,595,652	725.39	1.93	2.5	
3675	723.45	10.06	9,051	11,586,601	725.39	1.94	2.6	
3690	723.44	10.07	9,067	11,577,533	725.38	1.95	2.6	
3705	723.43	10.09	9,083	11,568,450	725.38	1.95	2.6	
3720	723.42	10.11	9,099	11,559,351	725.38	1.96	2.6	
3735	723.41	10.13	9,115	11,550,237	725.37	1.97	2.6	
3750	723.40	10.14	9,130	11,541,106	725.37	1.97	2.6	
3765	723.39	10.16	9,146	11,531,960	725.37	1.98	2.6	
3780	723.38	10.18	9,161	11,522,799	725.36	1.99	2.6	
3795	723.36	10.20	9,177	11,513,622	725.36	1.99	2.6	
3810	723.35	10.21	9,193	11,504,429	725.36	2.00	2.6	
3825	723.34	10.23	9,208	11,495,221	725.35	2.01	2.7	
3840	723.33	10.25	9,223	11,485,998	725.35	2.01	2.7	
3855	723.32	10.27	9,239	11,476,759	725.34	2.02	2.7	
3870	723.31	10.28	9,254	11,467,505	725.34	2.03	2.7	
3885	723.30	10.30	9,270	11,458,235	725.34	2.03	2.7	
3900	723.29	10.32	9,285	11,448,950	725.33	2.04	2.7	
3915	723.28	10.33	9,300	11,439,650	725.33	2.05	2.7	
3930	723.27	10.35	9,315	11,430,335	725.33	2.05	2.7	
3945	723.26	10.37	9,330	11,421,005	725.32	2.06	2.7	
3960	723.25	10.38	9,345	11,411,659	725.32	2.07	2.8	
3975	723.24	10.40	9,361	11,402,299	725.31	2.07	2.8	
3990	723.23	10.42	9,376	11,392,923	725.31	2.08	2.8	
4005	723.22	10.43	9,391	11,383,532	725.31	2.09	2.8	
4020	723.21	10.45	9,406	11,374,127	725.30	2.09	2.8	
4035	723.20	10.47	9,421	11,364,706	725.30	2.10	2.8	
4050	723.19	10.48	9,435	11,355,271	725.30	2.11	2.8	
4065	723.18	10.50	9,450	11,345,821	725.29	2.11	2.8	
4080	723.17	10.52	9,465	11,336,356	725.29	2.12	2.8	
4095	723.16	10.53	9,480	11,326,876	725.28	2.13	2.8	
4110	723.15	10.55	9,495	11,317,381	725.28	2.13	2.9	
4125	723.14	10.57	9,509	11,307,872	725.28	2.14	2.9	
4140	723.13	10.58	9,524	11,298,348	725.27	2.15	2.9	
4155	723.11	10.60	9,539	11,288,809	725.27	2.15	2.9	
4170	723.10	10.61	9,553	11,279,256	725.27	2.16	2.9	
4185	723.09	10.63	9,568	11,269,688	725.26	2.17	2.9	
4200	723.08	10.65	9,582	11,260,106	725.26	2.17	2.9	
4215	723.07	10.66	9,597	11,250,509	725.25	2.18	2.9	
4230	723.06	10.68	9,611	11,240,897	725.25	2.19	2.9	
4245	723.05	10.70	9,626	11,231,272	725.25	2.19	2.9	
4260	723.04	10.71	9,640	11,221,631	725.24	2.20	3.0	
4275	723.03	10.73	9,655	11,211,977	725.24	2.21	3.0	
4290	723.02	10.74	9,669	11,202,308	725.23	2.21	3.0	
4305	723.01	10.76	9,683	11,192,625	725.23	2.22	3.0	
4320	723.00	10.77	9,697	11,182,927	725.23	2.23	3.0	
4335	722.99	10.79	9,712	11,173,216	725.22	2.23	3.0	

	Sand Creek			Cumulative				
Time (min)	WSE (ft MSL)	Qout (CFS)	Volume out (CF)	Volume (CF)	Mine WSE (ft MSL)	Head Diff	Day	
4350	722.98	10.81	9,726	11,163,490	725.22	2.24	3.0	
4365	722.97	10.82	9,740	11,153,750	725.22	2.25	3.0	
4380	722.96	10.84	9,754	11,143,996	725.21	2.25	3.0	
4395	722.95	10.85	9,768	11,134,228	725.21	2.26	3.1	
4410	722.94	10.87	9,782	11,124,445	725.20	2.27	3.1	
4425	722.93	10.88	9,796	11,114,649	725.20	2.27	3.1	
4440	722.92	10.90	9,810	11,104,839	725.20	2.28	3.1	
4455	722.91	10.92	9,824	11,095,014	725.19	2.29	3.1	
4470	722.90	10.93	9,838	11,085,176	725.19	2.29	3.1	
4485	722.89	10.95	9,852	11,075,324	725.18	2.30	3.1	
4500	722.88	10.96	9,866	11,065,458	725.18	2.31	3.1	
4515	722.86	10.98	9,880	11,055,578	725.18	2.31	3.1	
4530	722.85	10.99	9,894	11,045,684	725.17	2.32	3.1	
4545	722.84	11.01	9,907	11,035,777	725.17	2.32	3.2	
4560	722.83	11.02	9,921	11,025,855	725.16	2.33	3.2	
4575	722.82	11.04	9,935	11,015,921	725.16	2.34	3.2	
4590	722.81	11.05	9,949	11,005,972	725.16	2.34	3.2	
4605	722.80	11.07	9,962	10,996,010	725.15	2.35	3.2	
4620	722.79	11.08	9,976	10,986,034	725.15	2.36	3.2	
4635	722.78	11.10	9,990	10,976,044	725.14	2.36	3.2	
4650	722.77	11.11	10,003	10,966,041	725.14	2.37	3.2	
4665	722.76	11.13	10,017	10,956,024	725.14	2.38	3.2	
4680	722.75	11.14	10,030	10,945,994	725.13	2.38	3.3	
4695	722.74	11.16	10,044	10,935,951	725.13	2.39	3.3	
4710	722.73	11.17	10,057	10,925,894	725.12	2.40	3.3	
4725	722.72	11.19	10,070	10,915,823	725.12	2.40	3.3	
4740	722.71	11.20	10,084	10,905,739	725.12	2.41	3.3	
4755	722.70	11.22	10,097	10,895,642	725.11	2.41	3.3	
4770	722.69	11.23	10,111	10,885,531	725.11	2.42	3.3	
4785	722.68	11.25	10,124	10,875,407	725.10	2.43	3.3	
4800	722.67	11.26	10,137	10,865,270	725.10	2.43	3.3	
4815	722.66	11.28	10,150	10,855,120	725.10	2.44	3.3	
4830	722.65	11.29	10,164	10,844,956	725.09	2.45	3.4	
4845	722.64	11.31	10,177	10,834,779	725.09	2.45	3.4	
4860	722.63	11.32	10,190	10,824,589	725.08	2.46	3.4	
4875	722.61	11.34	10,203	10,814,386	725.08	2.47	3.4	
4890	722.60	11.35	10,216	10,804,170	725.08	2.47	3.4	
4905	722.59	11.37	10,229	10,793,941	725.07	2.48	3.4	
4920	722.58	11.38	10,242	10,783,698	725.07	2.48	3.4	
4935	722.57	11.39	10,255	10,773,443	725.06	2.49	3.4	
4950	722.56	11.41	10,268	10,763,175	725.06	2.50	3.4	
4965	722.55	11.42	10,281	10,752,893	725.06	2.50	3.4	
4980	722.54	11.44	10,294	10,742,599	725.05	2.51	3.5	
4995	722.53	11.45	10,307	10,732,292	725.05	2.52	3.5	
5010	722.52	11.47	10,320	10,721,971	725.04	2.52	3.5	
5025	722.51	11.48	10,333	10,711,638	725.04	2.53	3.5	
5040	722.50	11.50	10,346	10,701,293	725.03	2.53	3.5	
5055	722.49	11.51	10,359	10,690,934	725.03	2.54	3.5	
5070	722.48	11.52	10,371	10,680,562	725.03	2.55	3.5	
5085	722.47	11.54	10,384	10,670,178	725.02	2.55	3.5	

	Sand Creek			Cumulative				
Time (min)	WSE (ft MSL)	Qout (CFS)	Volume out (CF)	Volume (CF)	Mine WSE (ft MSL)	Head Diff	Day	
5100	722.46	11.55	10,397	10,659,781	725.02	2.56	3.5	
5115	722.45	11.57	10,410	10,649,372	725.01	2.57	3.6	
5130	722.44	11.58	10,422	10,638,949	725.01	2.57	3.6	
5145	722.43	11.59	10,435	10,628,514	725.01	2.58	3.6	
5160	722.42	11.61	10,448	10,618,067	725.00	2.59	3.6	
5175	722.41	11.62	10,460	10,607,606	725.00	2.59	3.6	
5190	722.40	11.64	10,473	10,597,134	724.99	2.60	3.6	
5205	722.39	11.65	10,485	10,586,649	724.99	2.60	3.6	
5220	722.38	11.66	10,497	10,576,152	724.98	2.61	3.6	
5235	722.36	11.68	10,510	10,565,642	724.98	2.62	3.6	
5250	722.35	11.69	10,522	10,555,120	724.98	2.62	3.6	
5265	722.34	11.70	10,534	10,544,586	724.97	2.63	3.7	
5280	722.33	11.72	10,546	10,534,040	724.97	2.63	3.7	
5295	722.32	11.73	10,558	10,523,482	724.96	2.64	3.7	
5310	722.31	11.74	10,570	10,512,911	724.96	2.65	3.7	
5325	722.30	11.76	10,583	10,502,329	724.95	2.65	3.7	
5340	722.29	11.77	10,595	10,491,734	724.95	2.66	3.7	
5355	722.28	11.79	10,607	10,481,127	724.95	2.66	3.7	
5370	722.27	11.80	10,619	10,470,509	724.94	2.67	3.7	
5385	722.26	11.81	10,631	10,459,878	724.94	2.68	3.7	
5400	722.25	11.83	10,643	10,449,235	724.93	2.68	3.8	
5415	722.24	11.84	10,655	10,438,580	724.93	2.69	3.8	
5430	722.23	11.85	10,667	10,427,914	724.92	2.69	3.8	
5445	722.22	11.87	10,679	10,417,235	724.92	2.70	3.8	
5460	722.21	11.88	10,691	10,406,545	724.92	2.71	3.8	
5475	722.20	11.89	10,702	10,395,842	724.91	2.71	3.8	
5490	722.19	11.90	10,714	10,385,128	724.91	2.72	3.8	
5505	722.18	11.92	10,726	10,374,402	724.90	2.72	3.8	
5520	722.17	11.93	10,738	10,363,664	724.90	2.73	3.8	
5535	722.16	11.94	10,750	10,352,914	724.89	2.74	3.8	
5550	722.15	11.96	10,761	10,342,153	724.89	2.74	3.9	
5565	722.14	11.97	10,773	10,331,379	724.88	2.75	3.9	
5580	722.13	11.98	10,785	10,320,595	724.88	2.75	3.9	
5595	722.11	12.00	10,797	10,309,798	724.88	2.76	3.9	
5610	722.10	12.01	10,808	10,298,990	724.87	2.77	3.9	
5625	722.09	12.02	10,820	10,288,170	724.87	2.77	3.9	
5640	722.08	12.04	10,832	10,277,338	724.86	2.78	3.9	
5655	722.07	12.05	10,843	10,266,495	724.86	2.78	3.9	
5670	722.06	12.06	10,855	10,255,640	724.85	2.79	3.9	
5685	722.05	12.07	10,866	10,244,773	724.85	2.80	3.9	
5700	722.04	12.09	10,878	10,233,896	724.84	2.80	4.0	
5715	722.03	12.10	10,889	10,223,006	724.84	2.81	4.0	
5730	722.02	12.11	10,901	10,212,105	724.84	2.81	4.0	
5745	722.01	12.12	10,912	10,201,193	724.83	2.82	4.0	
5760	722.00	12.14	10,924	10,190,269	724.83	2.83	4.0	
5775	722.00	12.13	10,915	10,179,353	724.82	2.82	4.0	
5790	722.00	12.12	10,907	10,168,447	724.82	2.82	4.0	
5805	722.00	12.11	10,898	10,157,549	724.81	2.81	4.0	
5820	722.00	12.10	10,889	10,146,660	724.81	2.81	4.0	
5835	722.00	12.09	10,881	10,135,779	724.80	2.80	4.1	

	Sand Creek			Cumulative				
Time (min)	WSE (ft MSL)	Qout (CFS)	Volume out (CF)	Volume (CF)	Mine WSE (ft MSL)	Head Diff	Day	
5850	722.00	12.08	10,872	10,124,907	724.80	2.80	4.1	
5865	722.00	12.07	10,863	10,114,044	724.79	2.79	4.1	
5880	722.00	12.06	10,855	10,103,189	724.79	2.79	4.1	
5895	722.00	12.05	10,846	10,092,343	724.79	2.79	4.1	
5910	722.00	12.04	10,837	10,081,505	724.78	2.78	4.1	
5925	722.00	12.03	10,829	10,070,677	724.78	2.78	4.1	
5940	722.00	12.02	10,820	10,059,857	724.77	2.77	4.1	
5955	722.00	12.01	10,811	10,049,045	724.77	2.77	4.1	
5970	722.00	12.00	10,803	10,038,242	724.76	2.76	4.1	
5985	722.00	11.99	10,794	10,027,448	724.76	2.76	4.2	
6000	722.00	11.98	10,785	10,016,663	724.75	2.75	4.2	
6015	722.00	11.97	10,777	10,005,886	724.75	2.75	4.2	
6030	722.00	11.96	10,768	9,995,118	724.75	2.75	4.2	
6045	722.00	11.95	10,759	9,984,358	724.74	2.74	4.2	
6060	722.00	11.95	10,751	9,973,608	724.74	2.74	4.2	
6075	722.00	11.94	10,742	9,962,865	724.73	2.73	4.2	
6090	722.00	11.93	10,734	9,952,132	724.73	2.73	4.2	
6105	722.00	11.92	10,725	9,941,407	724.72	2.72	4.2	
6120	722.00	11.91	10,716	9,930,691	724.72	2.72	4.3	
6135	722.00	11.90	10,708	9,919,983	724.72	2.72	4.3	
6150	722.00	11.89	10,699	9,909,284	724.71	2.71	4.3	
6165	722.00	11.88	10,690	9,898,594	724.71	2.71	4.3	
6180	722.00	11.87	10,682	9,887,912	724.70	2.70	4.3	
6195	722.00	11.86	10,673	9,877,239	724.70	2.70	4.3	
6210	722.00	11.85	10,664	9,866,575	724.69	2.69	4.3	
6225	722.00	11.84	10,656	9,855,919	724.69	2.69	4.3	
6240	722.00	11.83	10,647	9,845,272	724.68	2.68	4.3	
6255	722.00	11.82	10,638	9,834,634	724.68	2.68	4.3	
6270	722.00	11.81	10,630	9,824,004	724.68	2.68	4.4	
6285	722.00	11.80	10,621	9,813,383	724.67	2.67	4.4	
6300	722.00	11.79	10,612	9,802,771	724.67	2.67	4.4	
6315	722.00	11.78	10,604	9,792,167	724.66	2.66	4.4	
6330	722.00	11.77	10,595	9,781,572	724.66	2.66	4.4	
6345	722.00	11.76	10,586	9,770,986	724.65	2.65	4.4	
6360	722.00	11.75	10,578	9,760,408	724.65	2.65	4.4	
6375	722.00	11.74	10,569	9,749,839	724.65	2.65	4.4	
6390	722.00	11.73	10,560	9,739,278	724.64	2.64	4.4	
6405	722.00	11.72	10,552	9,728,727	724.64	2.64	4.4	
6420	722.00	11.71	10,543	9,718,184	724.63	2.63	4.5	
6435	722.00	11.70	10,534	9,707,649	724.63	2.63	4.5	
6450	722.00	11.70	10,526	9,697,123	724.62	2.62	4.5	
6465	722.00	11.69	10,517	9,686,606	724.62	2.62	4.5	
6480	722.00	11.68	10,509	9,676,097	724.62	2.62	4.5	
6495	722.00	11.67	10,500	9,665,598	724.61	2.61	4.5	
6510	722.00	11.66	10,491	9,655,106	724.61	2.61	4.5	
6525	722.00	11.65	10,483	9,644,624	724.60	2.60	4.5	
6540	722.00	11.64	10,474	9,634,150	724.60	2.60	4.5	
6555	722.00	11.63	10,465	9,623,685	724.59	2.59	4.6	
6570	722.00	11.62	10,457	9,613,228	724.59	2.59	4.6	
6585	722.00	11.61	10,448	9,602,780	724.59	2.59	4.6	

	Sand Creek			Cumulative				
Time (min)	WSE (ft MSL)	Qout (CFS)	Volume out (CF)	Volume (CF)	Mine WSE (ft MSL)	Head Diff	Day	
6600	722.00	11.60	10,439	9,592,341	724.58	2.58	4.6	
6615	722.00	11.59	10,431	9,581,910	724.58	2.58	4.6	
6630	722.00	11.58	10,422	9,571,488	724.57	2.57	4.6	
6645	722.00	11.57	10,413	9,561,075	724.57	2.57	4.6	
6660	722.00	11.56	10,405	9,550,670	724.56	2.56	4.6	
6675	722.00	11.55	10,396	9,540,274	724.56	2.56	4.6	
6690	722.00	11.54	10,387	9,529,887	724.56	2.56	4.6	
6705	722.00	11.53	10,379	9,519,508	724.55	2.55	4.7	
6720	722.00	11.52	10,370	9,509,138	724.55	2.55	4.7	
6735	722.00	11.51	10,361	9,498,777	724.54	2.54	4.7	
6750	722.00	11.50	10,353	9,488,424	724.54	2.54	4.7	
6765	722.00	11.49	10,344	9,478,080	724.53	2.53	4.7	
6780	722.00	11.48	10,335	9,467,744	724.53	2.53	4.7	
6795	722.00	11.47	10,327	9,457,417	724.53	2.53	4.7	
6810	722.00	11.46	10,318	9,447,099	724.52	2.52	4.7	
6825	722.00	11.45	10,309	9,436,790	724.52	2.52	4.7	
6840	722.00	11.45	10,301	9,426,489	724.51	2.51	4.8	
6855	722.00	11.44	10,292	9,416,197	724.51	2.51	4.8	
6870	722.00	11.43	10,284	9,405,913	724.50	2.50	4.8	
6885	722.00	11.42	10,275	9,395,638	724.50	2.50	4.8	
6900	722.00	11.41	10,266	9,385,372	724.50	2.50	4.8	
6915	722.00	11.40	10,258	9,375,115	724.49	2.49	4.8	
6930	722.00	11.39	10,249	9,364,866	724.49	2.49	4.8	
6945	722.00	11.38	10,240	9,354,626	724.48	2.48	4.8	
6960	722.00	11.37	10,232	9,344,394	724.48	2.48	4.8	
6975	722.00	11.36	10,223	9,334,171	724.47	2.47	4.8	
6990	722.00	11.35	10,214	9,323,957	724.47	2.47	4.9	
7005	722.00	11.34	10,206	9,313,751	724.47	2.47	4.9	
7020	722.00	11.33	10,197	9,303,554	724.46	2.46	4.9	
7035	722.00	11.32	10,188	9,293,366	724.46	2.46	4.9	
7050	722.00	11.31	10,180	9,283,186	724.45	2.45	4.9	
7065	722.00	11.30	10,171	9,273,015	724.45	2.45	4.9	
7080	722.00	11.29	10,162	9,262,853	724.45	2.45	4.9	
7095	722.00	11.28	10,154	9,252,699	724.44	2.44	4.9	
7110	722.00	11.27	10,145	9,242,554	724.44	2.44	4.9	
7125	722.00	11.26	10,136	9,232,418	724.43	2.43	4.9	
7140	722.00	11.25	10,128	9,222,290	724.43	2.43	5.0	
7155	722.00	11.24	10,119	9,212,171	724.42	2.42	5.0	
7170	722.00	11.23	10,110	9,202,060	724.42	2.42	5.0	
7185	722.00	11.22	10,102	9,191,959	724.42	2.42	5.0	
7200	722.00	11.21	10,093	9,181,865	724.41	2.41	5.0	
7215	722.00	11.20	10,084	9,171,781	724.41	2.41	5.0	
7230	722.00	11.20	10,076	9,161,705	724.40	2.40	5.0	
7245	722.00	11.19	10,067	9,151,638	724.40	2.40	5.0	
7260	722.00	11.18	10,059	9,141,579	724.40	2.40	5.0	
7275	722.00	11.17	10,050	9,131,530	724.39	2.39	5.1	
7290	722.00	11.16	10,041	9,121,488	724.39	2.39	5.1	
7305	722.00	11.15	10,033	9,111,456	724.38	2.38	5.1	
7320	722.00	11.14	10,024	9,101,432	724.38	2.38	5.1	
7335	722.00	11.13	10,015	9,091,417	724.38	2.38	5.1	

	Sand Creek			Cumulative				
Time (min)	WSE (ft MSL)	Qout (CFS)	Volume out (CF)	Volume (CF)	Mine WSE (ft MSL)	Head Diff	Day	
7350	722.00	11.12	10,007	9,081,410	724.37	2.37	5.1	
7365	722.00	11.11	9,998	9,071,412	724.37	2.37	5.1	
7380	722.00	11.10	9,989	9,061,423	724.36	2.36	5.1	
7395	722.00	11.09	9,981	9,051,442	724.36	2.36	5.1	
7410	722.00	11.08	9,972	9,041,470	724.35	2.35	5.1	
7425	722.00	11.07	9,963	9,031,507	724.35	2.35	5.2	
7440	722.00	11.06	9,955	9,021,552	724.35	2.35	5.2	
7455	722.00	11.05	9,946	9,011,606	724.34	2.34	5.2	
7470	722.00	11.04	9,937	9,001,669	724.34	2.34	5.2	
7485	722.00	11.03	9,929	8,991,740	724.33	2.33	5.2	
7500	722.00	11.02	9,920	8,981,820	724.33	2.33	5.2	
7515	722.00	11.01	9,911	8,971,909	724.33	2.33	5.2	
7530	722.00	11.00	9,903	8,962,006	724.32	2.32	5.2	
7545	722.00	10.99	9,894	8,952,112	724.32	2.32	5.2	
7560	722.00	10.98	9,885	8,942,227	724.31	2.31	5.3	
7575	722.00	10.97	9,877	8,932,350	724.31	2.31	5.3	
7590	722.00	10.96	9,868	8,922,482	724.31	2.31	5.3	
7605	722.00	10.95	9,859	8,912,622	724.30	2.30	5.3	
7620	722.00	10.95	9,851	8,902,772	724.30	2.30	5.3	
7635	722.00	10.94	9,842	8,892,929	724.29	2.29	5.3	
7650	722.00	10.93	9,833	8,883,096	724.29	2.29	5.3	
7665	722.00	10.92	9,825	8,873,271	724.29	2.29	5.3	
7680	722.00	10.91	9,816	8,863,455	724.28	2.28	5.3	
7695	722.00	10.90	9,808	8,853,647	724.28	2.28	5.3	
7710	722.00	10.89	9,799	8,843,848	724.27	2.27	5.4	
7725	722.00	10.88	9,790	8,834,058	724.27	2.27	5.4	
7740	722.00	10.87	9,782	8,824,277	724.27	2.27	5.4	
7755	722.00	10.86	9,773	8,814,504	724.26	2.26	5.4	
7770	722.00	10.85	9,764	8,804,740	724.26	2.26	5.4	
7785	722.00	10.84	9,756	8,794,984	724.25	2.25	5.4	
7800	722.00	10.83	9,747	8,785,237	724.25	2.25	5.4	
7815	722.00	10.82	9,738	8,775,499	724.25	2.25	5.4	
7830	722.00	10.81	9,730	8,765,769	724.24	2.24	5.4	
7845	722.00	10.80	9,721	8,756,048	724.24	2.24	5.4	
7860	722.00	10.79	9,712	8,746,336	724.23	2.23	5.5	
7875	722.00	10.78	9,704	8,736,632	724.23	2.23	5.5	
7890	722.00	10.77	9,695	8,726,937	724.23	2.23	5.5	
7905	722.00	10.76	9,686	8,717,251	724.22	2.22	5.5	
7920	722.00	10.75	9,678	8,707,573	724.22	2.22	5.5	
7935	722.00	10.74	9,669	8,697,904	724.21	2.21	5.5	
7950	722.00	10.73	9,660	8,688,243	724.21	2.21	5.5	
7965	722.00	10.72	9,652	8,678,592	724.21	2.21	5.5	
7980	722.00	10.71	9,643	8,668,949	724.20	2.20	5.5	
7995	722.00	10.70	9,634	8,659,314	724.20	2.20	5.6	
8010	722.00	10.70	9,626	8,649,688	724.19	2.19	5.6	
8025	722.00	10.69	9,617	8,640,071	724.19	2.19	5.6	
8040	722.00	10.68	9,608	8,630,463	724.19	2.19	5.6	
8055	722.00	10.67	9,600	8,620,863	724.18	2.18	5.6	
8070	722.00	10.66	9,591	8,611,272	724.18	2.18	5.6	
8085	722.00	10.65	9,583	8,601,689	724.17	2.17	5.6	