

October 26, 2022

Bryan Rock Products Inc.

**PROPOSED LIMESTONE QUARRY
WATERFORD TOWNSHIP, MN
SUPPORTING DOCUMENTATION**



Sunde Engineering, PLLC

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Certification

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



Kirsten Pauly, PE, PG

Reg. No. 21842 October 26, 2022

1.0 Introduction:

Bryan Rock Products, Inc. is requesting a Mineral Extraction Permit to operate a limestone mining and processing facility in Waterford Township, (Site). The following supporting documentation is submitted as a requirement of the application for a mineral extraction permit. The proposed mine is subject to environmental review. Required review includes a Scoping Environmental Assessment Worksheet (SEAW) and a mandatory Environmental Impact Statement (EIS). The following supporting documentation will be further developed through the course of environmental review. Preliminary mine plans may be modified as a result of environmental review, for example to incorporate identified mitigation measures. The Waterford Zoning Ordinance indicates that the findings of the EAW may be a sufficient replacement to the required supporting documentation section of the application. As such, the following information, including the plan sheets, are preliminary in nature and are subject to modification pending the findings of environmental review. In addition, it is understood that through the course of review of the permit application, the Township may request additional information to complete their review of the proposed mining operation.

2.0 Project Description

Bryan Rock (Proposer) proposes to develop a limestone quarry on an approximately 317 acre property located in Waterford Township, Dakota County, MN (Site). Bryan Rock seeks to develop a limestone quarry with the establishment of mining limits, phasing, and reclamation plans (Project). The proposed mine limits include 223 acres of total quarry area. The quarry operations will include topsoil and overburden removal, drilling, blasting, dewatering, extraction, processing (crushing, washing, screening,) stockpiling, loading, hauling, and reclamation. The mine is anticipated to produce approximately 26 million cy of limestone over the next 50 years. Aggregates produced at the Site will be used in the construction industry throughout the southern metropolitan area. The Site is proposed to operate between the hours of 7 am and 6 pm Monday through Friday and Saturday between the hours of 7 am to 12 pm.

Vehicles and equipment to be operated at the Site includes loaders, excavators, rock drill, crushers, screeners, washplant, conveyors, haul trucks, generators, and water truck. Other specialty pieces of equipment may be brought to the site from time to time to perform various construction or reclamation activities at the Site. Aggregates produced at the Site will be stockpiled within the quarry, where they will be loaded into trucks and hauled from the Site. The majority of trucks hauling product from the Site will be on operator owned. A site access will be constructed to County Road 53 (Arkansas Avenue) and the haul route will be north on Arkansas Avenue to CSAH 86 then west to Minnesota Trunk Highway 3 or east to CSAH 47 (Northfield Boulevard.)

3.0 Supporting Documentation: (Zoning Ordinance No 2001-5 Amendment No 2019-3 Section 7.23 A.3.B)

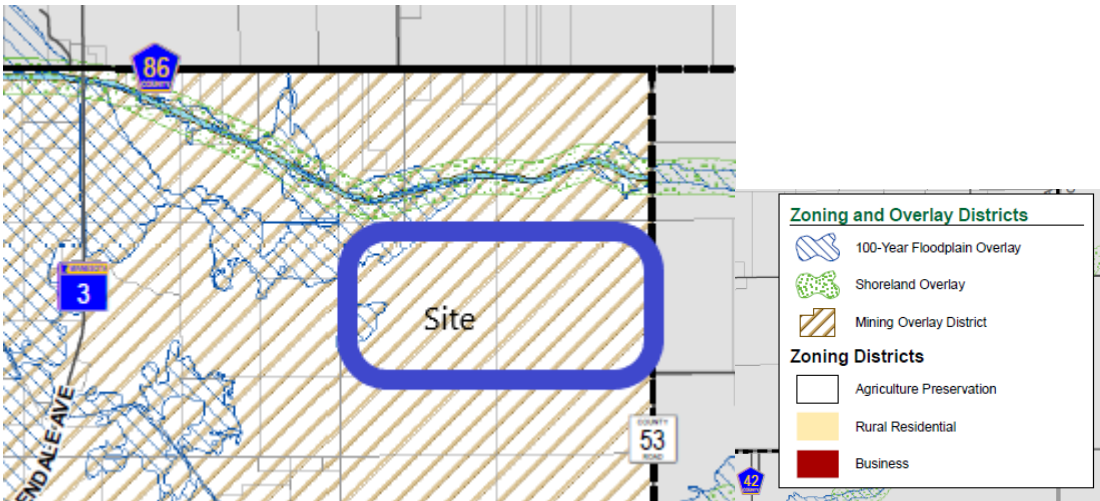
Every application for a mineral extraction permit shall include submission of supporting documentation provided by a registered engineer licensed within the State of Minnesota which shall include, but may not be limited to the following (note: the findings of an EAW may be deemed as a sufficient and acceptable replacement to any portion of the following, extending through the "supporting documentation" section:

a. A description of existing land uses on the subject property and all properties within one mile. One-quarter (1/4) mile

The existing land uses on the subject property are agricultural and a rural residential farmstead. The existing land uses on the properties within one-mile of the Site include predominantly agricultural with scattered rural residential land uses throughout the area. Sciota Township borders the Site to the east, and Castle Rock Township is located within one-mile to the north. Existing land uses within these townships within one-mile of the Site are predominantly agricultural and rural residential. There is also one area of commercial land use situated in Castle Rock Township that is located just under one mile to the northwest of the Site.

b. A description of land use designations in the Comprehensive Plan and zoning classifications of the subject property and all properties within one mile. One-quarter (1/4) mile

Future land use of the Site and surrounding area within one-mile of the Site is primarily designated as "Agricultural" with a small area of "Commercial" and a small area of "Rural or Large Lot Residential" located north and northwest of the site in Castle Rock Township. The Site is zoned Agricultural Preservation with a mining overlay district over the entire Site. The 100-year floodplain overlay district extends over the very northwestern and western portions of the Site (zoning map excerpt below). No mining is proposed within the 100-year floodplain. The zoning classification of surrounding lands is predominantly Agricultural Preservation or Ag with a small area of RR-1 Rural Residential zoning and a small area of COM/IND commercial/Industrial zoning located to the north in Castle Rock Township. The Shoreland Overlay District extends 300 feet on either side of Tributary No 1 to North Branch of Chub Creek, located just north of the Site. No mining is proposed within the Shoreland Overlay District.



EXCERPT FROM THE WATERFORD TOWNSHIP ZONING MAP OCTOBER 2022

- c. A description of the soil, vegetation, mineral content and current topography of the subject property. A minimum of three (3) soil boring logs representative of the site and an analysis of the subsurface materials on the subject property must be submitted by a registered engineer licensed in the State of Minnesota. Additional soil borings may be required by the Township Engineer for the subject site and any future expansion.**

The majority of the Site soils are classified as silt loam or loam. The soils have formed on an outwash plain and are derived from glaciofluvial sediments over bedrock. The typical soil profile of the most dominant soil types is approximately three feet of silt loam overlying sandy subsoils. The depth of topsoil and overburden over the limestone bedrock averages approximately 15 feet across the Site. Three soil borings representative of the Site and description of the subsurface materials are included as Attachment 1. In the area of the wetlands, muck soils are the dominant soil type. The typical soil profile of these very poorly drained soils is approximately 2-3 feet of muck overlying 6.5 feet of silty clay loam. No mining is proposed in the delineated wetland areas.

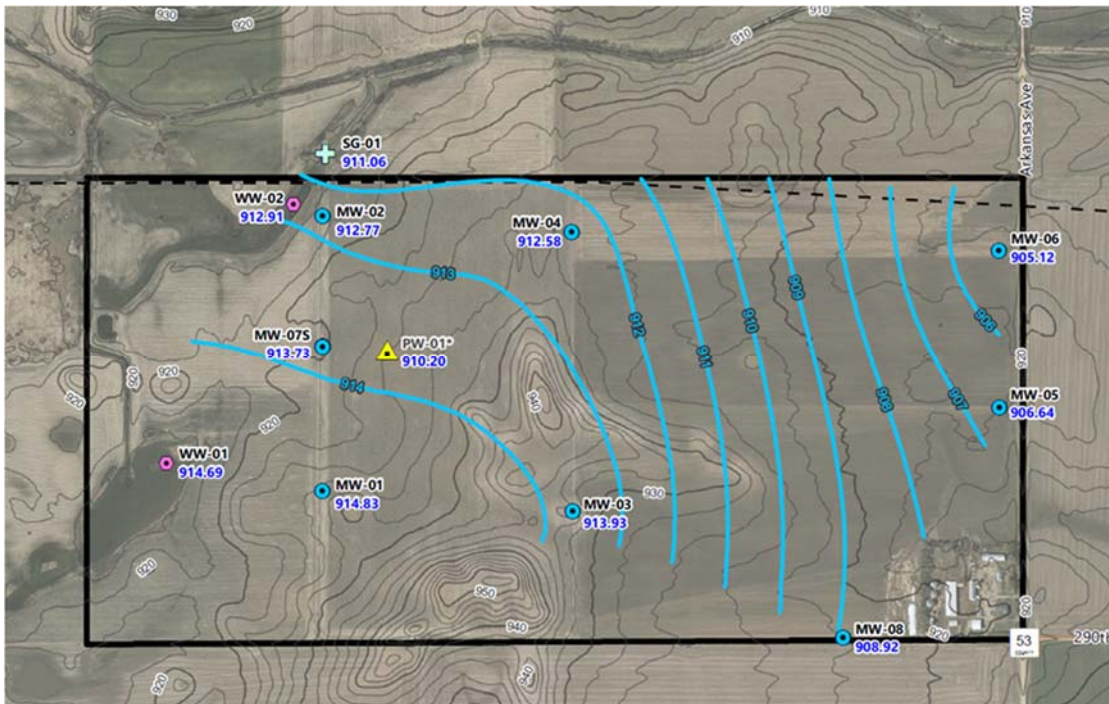
- d. A general description of surface waters, existing drainage patterns and groundwater conditions within one mile one-quarter (1/4) mile of the subject property.**

Surface waters within one-quarter mile of the Site include Tributary No. 1 to North Branch of Chub Creek (Tributary No. 1). Tributary No. 1 is a Minnesota Department of Natural Resources (MDNR) Protected Waterway that flows west to east and is located 330 feet to just over 1,000 feet north of the Site. There is also a wetland complex located on the western portion of the Site itself. The wetland complex extends to the west of the Site. Agricultural ditches drain the wetland complex into Tributary No. 1. These are county ditches and are subject to the MDNR buffer law.

A ridge, or topographic high, runs roughly north-south through the central portion of the Site. The western half of the Site drains to the northwest to the wetland complex and Tributary No. 1. The

majority of the east half of the Site drains to the northeast eventually into Tributary No. 1 and a portion of the eastern half drains and then eventually south and east into Chub Creek.

Groundwater flows to the north and east across the Site, controlled by the discharge area associated with the County ditches and Tributary No. 1. The Project will require dewatering to access the limestone resource. Dewatering will require a MDNR Water Appropriations Permit (WAP). A comprehensive description of surface waters, drainage patterns and groundwater conditions will be provided as part of the SEAW/EIS process. The figure below illustrates the elevation of the water table beneath the Site.



GROUNDWATER TABLE ELEVATIONS

e. A general description of any wells or private sewer systems of record, pipelines, power lines and other utilities or appurtenances on the subject property and adjacent properties.

There are three residential water supply wells located on and within ¼ mile of the Site. These three residential water supply wells are completed in the Jordan Sandstone. The Jordan Sandstone underlies the limestone deposit (Prairie du Chien Group) proposed for mining. There are six irrigation wells on or within ¼ mile of the Site. The Environmental Assessment Worksheet will include a comprehensive well survey of wells within one mile of the Site. Private sewer systems are associated with the on-site residence and at all surrounding residences. A natural gas pipeline runs across the northern boundary of the Site. There are overhead power lines in the Arkansas Avenue right-of-way (west side) and along the 280th Street right-of-way (north side).



WATER SUPPLY AND IRRIGATION WELLS

f. A general description of the depth, quantity, quality and intended uses of the mineral deposits on the subject property.

The generalized stratigraphic section at the Site is an average of 15 feet of overburden so consisting of topsoil and sandy soils/sandstone underlain by the Prairie du Chien Group, which contains the limestone resource proposed for mining. The Prairie du Chien Group is composed of two units, the upper Shakopee Formation, and the lower Oneota Dolomite. Both the Oneota Dolomite and overlying Shakopee Formation consist largely of carbonate components, collectively referred to as limestone throughout this application. The mineral deposit is characterized by thin to very thick, beds of dolostone, with negligible amounts of sandstone and other silica bearing rocks. At the Site, the Prairie du Chien Group is approximately 200-235 feet thick, although the entire thickness of the unit is not proposed to be mined. The quality of the limestone is excellent. The mine will supply the region with high quality construction aggregates to be used to build roads, infrastructure, and public and private buildings.

g. Current topography of the subject property, illustrated by contours not exceeding two-foot intervals.

Attached Plan Sheet C-1, Existing Conditions Plan illustrates the topography of the site with two foot contour intervals.

h. Proposed topography of the subject property after mineral extraction has been completed, illustrated by contours not exceeding two-foot intervals.

Attached Plan Sheet C3, Reclamation Conditions, illustrates proposed topography after mineral extraction has occurred.

i. A phasing plan which illustrates the sequencing of mineral extraction, the locations of processing equipment, mineral stockpiles, staging areas, accessory uses and access routes.

Attached Plan Sheet C2, Operations Plan illustrates sequence of mineral extraction. The location of processing and stockpiles may move across the mine floor as mining progresses across the Site. The proposed location of the main haul road is shown on this plan.

j. Copies of MPCA application documents, DNR application and/or review documents, EAW documents, EIS documents if required, and operating permits.

This information will be developed and provided to the Township through the course of required environmental review.

k. A description of the site hydrology and drainage characteristics during extraction for each phase. Identify any locations where drainage of any disturbed areas will not be controlled on the subject property and plans to control erosion, sedimentation and water quality of the runoff. Applicant must supply the Township a letter from the County Soil and Water District Manager or comparable official approving this description.

Generally, site drainage will be directed internally as mining removes the overburden and mineral extraction occurs. The Site will operate under an MPCA NPDES Stormwater Permit that regulates stormwater runoff from the Site and requires a site specific Stormwater Pollution Prevention Plan (SWPPP). The NPDES permit application and the SWPPP will be developed as part of the environmental review process.

l. A description of the potential impacts to adjacent properties resulting from mineral extraction and off-site transportation, including but not limited to noise, dust, surface water runoff, groundwater contamination, traffic and aesthetics.

The environmental review process will include an analysis of potential environmental impacts including noise, fugitive dust, stormwater, groundwater traffic, and other aesthetics. This information will be submitted to the Township as part of the environmental review process.

m. A description of the plan to mitigate potential impacts resulting from mineral extraction.

The environmental review process will include a mitigation alternative which will develop mitigation strategies to be incorporated into final Site design to mitigate potential impacts resulting from the mining operation.

n. A description of site screening, landscaping and security fencing.

The environmental review process will include an analysis of site screening, landscaping, and security fencing, to be developed into the mitigation alternative. These mitigation measures will be incorporated into final site design to address site screening and safety.

o. A description of site rehabilitation in each phase of operation and upon completion of mineral extraction on the subject property.

The reclamation plan will be further developed through the environmental review process.

p. A description of the method in which complaints about any aspect of the facility operation or off-site transportation are to be received and the method which complaints are to be resolved.

Persons with complaints during the operation of the facility will be encouraged to call the Site Operations Manager directly as this is the most efficient way to address operational issues that may arise. The contact information will be provided to the Township after completion of the environmental review process.

ATTACHMENT 1
SOIL BORINGS

Project: Devney Quarry	Surface Elevation: 917.1 ft
Job No.: 23191418	Drilling Method: Sonic
Location: Waterford, MN	Sampling Method: 3.5" Rock Core
Coordinates: UTM 15N N:4931363.97m, E:492013.20m	Completion Depth: 21.0 ft
Datum: NAD83	

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION	Major Unit	Graphic Log	Samples	Sample No.	% Recovery	SPT, N value or RQD %	STANDARD PENETRATION TEST DATA N in blows/ft @												
									10	20	30	40									
		Surface Elev.: 917.1 ft							0	2.5	5										
915	0.8ft	[TOPSOIL] SILTY SAND (SM): strong brown; with rootlets and forks; 1-2" peds.	Prairie du Chien (Op)			1	100														
914.1 ft	3.0ft	SANDSTONE; weak; pale brown; fine-grained; loose with fragments. Few dolostone fragments 1-2", weak HCl reaction, intermixed at 1 ft. Hard drilling at 3 ft.																			
910.1 ft	7.0ft	SANDY DOLOMITE; strong; red brown; microcrystalline; 1-3" fragments, pitted, fine grained sand in matrix.																			
908.1 ft	9.0ft	SANDSTONE; weak; dark brown to yellow brown; fine-grained; thickly bedded; unconformable contacts above and below.																			
903.1 ft	14.0ft	DOLOMITE; very strong; pale to red brown; microcrystalline; no sand in matrix, ~1" fragments with few 1-2" core lengths, few thin oolitic beds/fragments, few vugs 0.5cm wide, joints appear to be mechanical. Increase in vug density at 14 ft.																			
900.6 ft	16.5ft	SANDY DOLOMITE; very strong; pale yellow brown; microcrystalline; thinly bedded; pitted.																			
898.1 ft	19.0ft	SANDSTONE; weak; brown; fine-grained; few areas of glauconite/blue-green grains, unconformable contacts above and below.																			
896.1 ft	21.0ft	DOLOMITE; very strong; pale to red brown; microcrystalline; no sand in matrix. Glauconitic at 21 ft.																			
		Bottom of Boring at 21.0 feet																			

Date Boring Started: 11/5/21	Water Levels (ft)	Remarks: Monitoring well MW-06 installed at this location.
Date Boring Completed: 11/5/21		
Logged By: AKS3		
Drilling Contractor: Traut Wells		
Drill Rig: Full Size Truck Mounted Sonic		
Weather:		

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Project: Devney Quarry	Surface Elevation: 919.7 ft
Job No.: 23191418	Drilling Method: Sonic
Location: Waterford, MN	Sampling Method: 3.5" Rock Core
Coordinates: UTM 15N N:4931202.26m, E:490852.28m	Completion Depth: 150.0 ft
Datum: NAD83	

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION	Major Unit	Graphic Log	Samples	Sample No.	% Recovery	SPT, N value or RQD %	STANDARD PENETRATION TEST DATA N in blows/ft ©	
									REC%	RQD %
									SHEAR STRENGTH, tsf	
	0	Surface Elev.: 919.7 ft							0	2.5
	918.2	TOPSOIL (OL-OH): black; moist; clayey, trace fine grained sand (5%).								
	917.2	LEAN CLAY WITH SAND (CL): light olive brown; moist; subangular to subrounded; 10% fine grained to coarse grained sand, trace fine gravel.				1	68			
	915	SILTY SAND (SM): fine to medium grained; yellowish brown; moist; subangular to rounded; 10% coarse grained sand, 10% fine gravel.								
	913.2	POORLY GRADED SAND (SP): fine to medium grained; yellowish brown; wet; sub-rounded to rounded quartz sand, uncemented, few sub-angular pieces of dolomite gravel at base.	Os			2	100			
	910	DOLOMITE; brown to strong brown; yellowish brown by 11 ft.; moderately weathered; no reaction to HCl, clay and silty sand infilling of fractured dolomite.				3	100			
	907.7	SANDSTONE; orange at top grading to pale brown; fine- to medium-grained; mostly quartz with some feldspar; poorly cemented, generally homogeneous.								
	905	SANDY DOLOMITE; strong; yellow brown; slightly weathered; fine-grained; highly broken by sonic core.				4	78			
	900	0.5" thick green shale bed at 19.5 ft.								
	897.7	DOLOMITE; strong; yellowish brown; slightly weathered; microcrystalline; highly broken by sonic core, iron staining along fractures, 0.5" thick fine-grained sandstone bed near top.								
	895	SANDY DOLOMITE; strong; grayish brown; slightly weathered; fine-grained; medium to thick bedded, some staining along fractures. Driller noted a void or large fracture from 25-26.5 ft.				5	65			
	890	DOLOMITE; strong; pale brown to buff; slightly weathered; microcrystalline; thin to medium bedded, with a few pits and vugs.								

Continued Next Page

Date Boring Started: 11/1/21	Water Levels (ft)	Remarks: Nested monitoring wells MW-07S and MW-07D installed at this location.
Date Boring Completed: 11/3/21		
Logged By: KAM		
Drilling Contractor: Traut Wells		
Drill Rig: Full Size Truck Mounted Sonic		
Weather:		

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Barr Engineering Company
 4300 MarketPointe Drive Suite 200
 Minneapolis, MN 55435
 Telephone: 952-832-2600

LOG OF BORING B-105

Project: Devney Quarry	Surface Elevation: 919.7 ft
Job No.: 23191418	Drilling Method: Sonic
Location: Waterford, MN	Sampling Method: 3.5" Rock Core
Coordinates: UTM 15N N:4931202.26m, E:490852.28m	Completion Depth: 150.0 ft
Datum: NAD83	

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION	Major Unit	Graphic Log	Samples	Sample No.	% Recovery	SPT, N value or RQD %	STANDARD PENETRATION TEST DATA N in blows/ft ©			
									REC%	RQD %		
									10	20	30	40
									20	40	60	80
									SHEAR STRENGTH, tsf			
									0	2.5	5	
885	35	DOLOMITE; strong; pale brown to buff; slightly weathered; microcrystalline; thin to medium bedded, with a few pits and vugs. (Continued)				6	75					
	882.2 ft											
		DOLOMITE; strong; grayish brown; slightly weathered; fine-grained; thinly bedded; laminated at the bottom, pitted and vuggy.										
	881.2 ft											
880	40	DOLOMITE; strong; grayish brown; slightly weathered; microcrystalline; thin to medium bedded, with trace pits and vugs.										
	878.7 ft											
		SANDSTONE; moderate; grayish brown; slightly weathered; fine- to medium-grained; subrounded to round quartz sand, some iron staining present.										
	878.2 ft											
875	45	DOLOMITE; strong; grayish brown; slightly weathered; fine-grained; thinly bedded; a few sandy and oolitic beds, 0.5" chert bed observed at ~43 ft bgs., some iron staining, some pits and vugs.				7	90					
	876.7 ft											
		DOLOMITE; strong; buff; slightly weathered; microcrystalline; thin to medium bedded, some iron staining, few pits and vugs.										
	874.2 ft											
870	50	DOLOMITE; strong; buff to tan; slightly weathered; fine-grained; sandy near the top, few microcrystalline beds, thin to medium bedded, 4" thick fine to medium grained dolomitic sandstone bed observed at ~46.5 ft bgs.										
	871.2 ft											
		DOLOMITE; strong; buff to tan; slightly weathered; microcrystalline; thin to medium bedded, some iron staining.										
	869.7 ft											
		DOLOMITE; moderate to strong; buff to tan; thinly bedded; oolitic, few chert nodules and iron staining, few pits and vugs.										
865	55	DOLOMITE; microcrystalline to fine-grained, thin to medium bedded, iron staining along fractures, few thin sandy beds throughout, most of the core is badly broken. Few spots of glauconite observed at 53 ft.				8	60					
	868.7 ft											
860	60											
	856.7 ft											
		DOLOMITE; strong; buff to yellowish brown; fine-grained; thin to medium bedded, pinholed and vuggy (vugs up to 0.5"), few chert nodules, few glauconite on horizontal fractures/bedding planes.										
855	65					9	100					
	854.9 ft											

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Date Boring Started: 11/1/21	Water Levels (ft)	Remarks: Nested monitoring wells MW-07S and MW-07D installed at this location.
Date Boring Completed: 11/3/21		
Logged By: KAM		
Drilling Contractor: Traut Wells		
Drill Rig: Full Size Truck Mounted Sonic		
Weather:		

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Barr Engineering Company
 4300 MarketPointe Drive Suite 200
 Minneapolis, MN 55435
 Telephone: 952-832-2600

LOG OF BORING B-105

Sheet 3 of 5

Project: Devney Quarry	Surface Elevation: 919.7 ft
Job No.: 23191418	Drilling Method: Sonic
Location: Waterford, MN	Sampling Method: 3.5" Rock Core
Coordinates: UTM 15N N:4931202.26m, E:490852.28m	Completion Depth: 150.0 ft
Datum: NAD83	

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION	Major Unit	Graphic Log	Samples	Sample No.	% Recovery	SPT, N value or RQD %	STANDARD PENETRATION TEST DATA N in blows/ft ©	
									REC%	RQD %
									10	20
									20	40
									40	60
									60	80
									80	
									0	2.5
										5
		SANDSTONE; strong; pale brown; fine- to medium-grained; thinly bedded; dolomitic, some iron staining along fractures, one thin glauconitic bed, few pinholes and small vugs, subrounded to rounded quartz. 854.2 ft 853.2 ft								
850	70	DOLOMITE; strong; light grayish brown; microcrystalline; thinly bedded; iron staining and dendritic manganese mineralization along vertical fractures, few pin holes. (Continued)								
		SANDY DOLOMITE; strong; yellowish brown; fine-grained; thin to medium bedded, iron staining along fractures and pinholes, few to some pinholes. 1.5" microcrystalline bed at 67.5 ft. 1" dolomitic, fine-grained sandstone bed at 69.4 ft. 847.7 ft								
845	75	DOLOMITE; strong; yellowish brown to yellowish orange at bottom; fine grained to microcrystalline beds, iron staining along fractures, some pinholes and small vugs. Glauconite between 72-73 ft. 844.7 ft				10	90			
		SANDY DOLOMITE; strong; yellowish brown to yellowish orange; thinly bedded; fine grained sand in a microcrystalline matrix, some iron staining along fractures. Dolomitic sandstone bed from 76.5-77 ft (Driller reported the drill bit dropped at this depth suggesting a poorly cemented bed). Glauconite at 77.5 ft. Bed of microcrystalline dolostone from 81-82 ft. 836.2 ft								
835	85	DOLOMITE; yellowish brown to grayish brown; microcrystalline; thinly bedded; pitted and vuggy, glauconite present in pits and along some fractures. Sandy dolomite bed from 86.5-87.3 ft. 2" thick, soft, light grayish brown shale bed at 88.5 ft. 829.7 ft	Prairie du Chien (Op)			11	95			
830	90	DOLOMITE; strong; light grayish brown; microcrystalline; thinly bedded; few pits and vugs, some iron staining along fractures. 825.7 ft								
825	95	SANDSTONE; yellowish brown; fine- to medium-grained; generally well cemented, bioturbated near base, bioturbation tracks filled and replaced with dolomite, sub-rounded quartz and few to some feldspar. 824.7 ft				12	96			
		DOLOMITE; strong; brownish gray; microcrystalline; thinly bedded; few pits, some iron staining along fractures. 823.2 ft								

Continued Next Page

Date Boring Started: 11/1/21	Water Levels (ft)	Remarks: Nested monitoring wells MW-07S and MW-07D installed at this location.
Date Boring Completed: 11/3/21		
Logged By: KAM		
Drilling Contractor: Traut Wells		
Drill Rig: Full Size Truck Mounted Sonic		
		Weather:

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LOG OF BORING B-105

Project: Devney Quarry	Surface Elevation: 919.7 ft
Job No.: 23191418	Drilling Method: Sonic
Location: Waterford, MN	Sampling Method: 3.5" Rock Core
Coordinates: UTM 15N N:4931202.26m, E:490852.28m	Completion Depth: 150.0 ft
Datum: NAD83	

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION	Major Unit	Graphic Log	Samples	Sample No.	% Recovery	SPT, N value or RQD %	STANDARD PENETRATION TEST DATA N in blows/ft ©				
									REC%	RQD %			
									10	20	30	40	
									20	40	60	80	
									SHEAR STRENGTH, tsf				
									0	2.5	5		
820	100	DOLOMITE; strong; orangish gray; thinly bedded; microcrystalline to fine-grained, few pits and vugs, iron staining along fractures, few fractures and pin holes filled with calcite (bottom of core contains a significant amount of strong brown mud, suspect a thin shale bed may have been washed out by the sonic drilling). (Continued) Sandy dolomite bed at 101.2 ft. 816.2 ft	Prairie du Chien (Op)			13	100						
815	105	SANDSTONE; strong; yellowish brown; fine- to medium-grained; dolomitic, few pits, slight iron staining along fractures. 103.5ft 104.2ft 815.5 ft											
		DOLOMITE; strong; yellowish brown to rusty orange; fine-grained; thin to medium bedded, significant strong brown iron staining along fractures, Driller reported this zone drilled softer potentially indicating intense fracturing, few pits with dolomite recrystallization. 105.5ft 107.5ft 814.2 ft											
810	110	DOLOMITE; strong; grayish brown; fine-grained; thin to medium bedded, few pits, dolomite recrystallization in pits and along a few bedding planes/fractures. 812.2 ft											
		DOLOMITE; moderate to strong; tan to light gray; microcrystalline to fine-grained beds, thin to medium bedded, pitted and vuggy, pyrite mineralization present in pits, vugs and along fractures, few pyrite nodules present. Sandy dolomite bed from 108.3-108.8 ft. Trace pyrite at 111 ft. 113.0ft 806.7 ft									14	100	
805	115	DOLOMITE; strong; microcrystalline; thinly bedded; few pits and vugs. Zones of pyritization from 113.6-114 and 115.8-116.5 ft where dolomite is very dark gray. A few sandy and oolitic dolomite beds up to 1.5" thick between 114.5-115.2 ft.											
800	120	797.2 ft											
		DOLOMITE; strong; gray; microcrystalline; thin to medium bedded, few pits. Pyrite along bedding planes at 123.2 ft. Glauconitic sandy dolomite bed at 123.5 ft. Evidence of light gray shale bed at 123.7 ft. 122.5ft 125.0ft 794.7 ft				15	92						
795	125	DOLOMITE; strong; brownish gray; oolitic with a few fine-grained beds, thin to medium bedded, pitted with few to some vugs. Pyrite present from 126-127 ft.											
790	130	789.2 ft 130.5ft											

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Date Boring Started: 11/1/21	Water Levels (ft)	Remarks: Nested monitoring wells MW-07S and MW-07D installed at this location.
Date Boring Completed: 11/3/21		
Logged By: KAM		
Drilling Contractor: Traut Wells		
Drill Rig: Full Size Truck Mounted Sonic		
Weather:		

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Barr Engineering Company
 4300 MarketPointe Drive Suite 200
 Minneapolis, MN 55435
 Telephone: 952-832-2600

LOG OF BORING B-105

Project:	Devney Quarry	Surface Elevation:	919.7 ft
Job No.:	23191418	Drilling Method:	Sonic
Location:	Waterford, MN	Sampling Method:	3.5" Rock Core
Coordinates:	UTM 15N N:4931202.26m, E:490852.28m	Completion Depth:	150.0 ft
Datum:	NAD83		

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION	Major Unit	Graphic Log	Samples	Sample No.	% Recovery	SPT, N value or RQD %	STANDARD PENETRATION TEST DATA N in blows/ft ©									
									REC%	RQD % ◆								
									10	20	30	40						
									20	40	60	80						
									SHEAR STRENGTH, tsf									
									0	2.5	5							
785	135	SANDY DOLOMITE; moderate; grayish brown; fine-grained; thin to medium bedded, appears pebbly at base, pitted with a few small vugs and some iron staining along fractures. (Continued) 132.9ft 133.5ft 135.0ft	Prairie du Chien (Op)			16	100											
		DOLOMITE; light gray to brownish gray; microcrystalline; thinly bedded; few pits and vugs, pyrite on bedding planes (small crystals). 136.2ft 136.5ft																
		DOLOMITE; strong; pale grayish brown; bioturbated; oolitic, thin to medium bedded, and filled with recrystallized dolomite and chert. Dolomatized stromatolite fossil. 138.7ft 140.5ft																
780	140	SANDY DOLOMITE; strong; grayish brown and gray; fine-grained; thinly bedded; pitted with some vugs. 140.5ft																
		SANDSTONE; fine-grained; medium bedded; upper 4" well cemented with pyrite along bedding planes, loose and clayey (arkose) below to 138.3 ft. Weakly cemented orangish yellow medium-grained sandstone bed from 138.3 to 138.8 ft. Gray to white with indications (small pieces) of shale the same color, with some strong brown iron staining from 138.8-140 ft. 145.2ft																
775	145	SANDY DOLOMITE; tan to light grayish brown; thin to medium bedded, pitted with some vugs in oolitic beds, few pits/vugs elsewhere, dendritic iron staining and glauconite present throughout. Oolitic beds at 142, 143.2, 144 and 144.5 ft. 148.4ft																
		DOLOMITE; grayish brown; fine-grained; some microcrystalline beds, thin to medium bedded, strong where intact, intense iron staining with some glauconite throughout, some chert nodules. Core pulverized from 147-148.4 ft. but with significant dolomite crystallization on surfaces suggesting a vuggy decomposition. 150.0ft																
770	150	DOLOMITE; strong; light brownish gray; microcrystalline; thin to medium bedded, few pits and small vugs, no secondary mineralization observed, 0.5" thick grayish white shale bed observed at bottom of sample. 169.7ft																
		Bottom of Boring at 150.0 feet																

Date Boring Started:	11/1/21	Water Levels (ft)	Remarks: Nested monitoring wells MW-07S and MW-07D installed at this location.
Date Boring Completed:	11/3/21		
Logged By:	KAM		
Drilling Contractor:	Traut Wells		
Drill Rig:	Full Size Truck Mounted Sonic		
Weather:			

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Project: Devney Quarry	Surface Elevation: 936.5 ft
Job No.: 23191418	Drilling Method: Sonic
Location: Waterford, MN	Sampling Method: 4" Core Barrel
Coordinates: NAD83	Completion Depth: 180.0 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION	Graphic Log	Samples	Sample No.	% Recovery	SPT, N value or RQD %	STANDARD PENETRATION TEST DATA N in blows/ft ©						
								REC%	RQD %	SHEAR STRENGTH, tsf				
		Surface Elev.: 936.5 ft						0	2.5	5				
935	0	ORGANIC SOIL (OL-OH): black; clayey.												
	1.0	SILTY SAND (SM): brown to yellowish brown; fine to coarse grained; 15% fines..												
930	5	POORLY GRADED SAND (SP): dark yellowish brown; fine to coarse grained with approximately 5% fine gravel.			1	40								
925	10	SANDSTONE; yellowish brown to orange; generally medium-grained; quartz; subrounded to round grains; poorly cemented to uncemented and loose.												
920	15	Light grey; bed at 19'. 2" shale bed from 19.8' - 20'.			2	60								
915	21.0	SAND: dark brown; quartz; fine to medium grained; wet; with detritus; muddy, loose.												
910	23.0	DOLOMITE; brown to very light yellowish brown; weathered in a tan to yellow brown clayey matrix.			3	100								
905	30	SANDSTONE; white; beds from 27.6'-28'. SANDSTONE; orange; beds from 29'-29.2'. Shale bed at base.												
	31.6	SANDY DOLOMITE; strong brown oxidation along fractures. Thin sand laminae and oolites at 32'.												

Continued Next Page

Date Boring Started: 9/19/19	Water Levels (ft)	Remarks: Elevation estimated from MN DNR Lidar topo maps online
Date Boring Completed: 9/23/19	At Time of Drilling 16.3	
Logged By: KAM	At Time of Drilling 24.5	
Drilling Contractor: Traut Wells		
Drill Rig: Full size Truck Mounted Sonic		Weather:

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 Minneapolis, MN 55435
 Telephone: 952-832-2600

LOG OF BORING B-101

Project: Devney Quarry	Surface Elevation: 936.5 ft
Job No.: 23191418	Drilling Method: Sonic
Location: Waterford, MN	Sampling Method: 4" Core Barrel
Coordinates: NAD83	Completion Depth: 180.0 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION	Graphic Log	Samples	Sample No.	% Recovery	SPT, N value or RQD %	STANDARD PENETRATION TEST DATA N in blows/ft @	
								REC%	RQD %
								SHEAR STRENGTH, tsf	
35	901.5 ft	SANDY DOLOMITE; strong brown oxidation along fractures. (Continued) SHALE; at 33'. Glauconite at 33.3'. 901.5 ft			4	100			
900		SANDSTONE; pale brown to brown; medium- to coarse-grained; quartz grains; subround to round, poorly cemented to loose.							
	898.3 ft	SANDY DOLOMITE; lens at 37.2'. 898.3 ft							
40		SANDY DOLOMITE; greyish brown; fine-grained; thinly bedded; few pits/vugs.							
895		Chert and small glauconite nodules at ~42'. 892.0 ft							
45	892.0 ft	DOLOMITE; light grey to light greyish brown; microcrystalline; strong brown oxidation along fractures; some pits/vugs with calcite. 892.0 ft			5	100			
890		Crinoid stem at ~46'. 885.0 ft							
50	885.0 ft	DOLOMITE; dark grey; fine-grained. 885.0 ft							
885	883.5 ft	SANDY DOLOMITE; light yellow brown; fine-grained; thinly bedded. 883.5 ft							
55	880.5 ft	Glauconite; at 54.5'. 880.5 ft			6	78			
880		SANDSTONE; white to light grey; dolomitic; bedded with sandy dolomite. 877.5 ft							
60	877.5 ft	DOLOMITE; light grey to light greyish brown; oolitic; some pits/vugs. 877.5 ft							
875		DOLOMITE; greyish brown; microcrystalline; thin to medium bedded. 872.0 ft							
	872.0 ft	SANDY DOLOMITE; bed from 62-62.4'. 872.0 ft							
65	872.0 ft	DOLOMITE; very light brown to tan; microcrystalline; thin to medium bedded; few pits/vugs. 872.0 ft			7	92			

Continued Next Page

Date Boring Started: 9/19/19	Water Levels (ft)	Remarks: Elevation estimated from MN DNR Lidar topo maps online
Date Boring Completed: 9/23/19	At Time of Drilling 2019-09-19 PM 16.3	
Logged By: KAM	At Time of Drilling 2019-09-23 AM 24.5	
Drilling Contractor: Traut Wells		
Drill Rig: Full size Truck Mounted Sonic		Weather:

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Project: Devney Quarry	Surface Elevation: 936.5 ft
Job No.: 23191418	Drilling Method: Sonic
Location: Waterford, MN	Sampling Method: 4" Core Barrel
Coordinates:	Completion Depth: 180.0 ft
Datum: NAD83	

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION	Graphic Log	Samples	Sample No.	% Recovery	SPT, N value or RQD %	STANDARD PENETRATION TEST DATA N in blows/ft ©	
								REC%	RQD % ◆
								10 20 30 40	20 40 60 80
								SHEAR STRENGTH, tsf	
								0	2.5 5
870	871.3 ft	DOLOMITE; greyish brown; microcrystalline; thin to medium bedded; some pits/vugs with calcite; strong brown oxidation along fracture faces throughout. (Continued) Glaucanite; thin oolite bed at 66'.	[Brick pattern]						
70									
865									
75		SHALE; greyish green; bed at 75'.			8	92			
860		SANDSTONE; white; very fine grained; dolomitic; at 76' pitted and vuggy from 76'-77'.							
80		Light grey; microcrystalline; beds at 80.2', 80.8' and 81.2'.							
855									
85		Thin sandy bed at 83.2'. Snail shell at 83.8'. Glaucanite in vug at 84.5'.			9	89			
850		Minor sandy beds between 86'-88'.							
	848.5 ft								
		DOLOMITE; light greyish brown to light yellowish brown; microcrystalline; thinly bedded; few thin white shale beds. 88.0ft							
90		SANDY DOLOMITE; fine-grained; bed from 90'-91.2'.							
845									
	843.7 ft								
		SANDSTONE; very light grey to white; dolomitic; very fine grained; poorly cemented to loose with some well cemented beds. 92.8ft							
	841.7 ft								
95		DOLOMITE; yellowish brown to light grey; microcrystalline; thin to medium bedded; few pits/vugs. 94.8ft			10	86			
840		Glaucanite; at 95.5'.							
	838.0 ft								

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Date Boring Started: 9/19/19	Water Levels (ft)	Remarks: Elevation estimated from MN DNR Lidar topo maps online
Date Boring Completed: 9/23/19	At Time of Drilling 16.3	
Logged By: KAM	At Time of Drilling 24.5	
Drilling Contractor: Traut Wells	At Time of Drilling 2019-09-23 AM	
Drill Rig: Full size Truck Mounted Sonic		Weather:

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LOG OF BORING B-101

Project: Devney Quarry	Surface Elevation: 936.5 ft
Job No.: 23191418	Drilling Method: Sonic
Location: Waterford, MN	Sampling Method: 4" Core Barrel
Coordinates: NAD83	Completion Depth: 180.0 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION	Graphic Log	Samples	Sample No.	% Recovery	SPT, N value or RQD %	STANDARD PENETRATION TEST DATA N in blows/ft ©	
								REC%	RQD % ◆
								10 20 30 40	20 40 60 80
								SHEAR STRENGTH, tsf	
								0	2.5 5
100	835.5	SANDSTONE; very light greyish brown; dolomitic; very fine grained to fine grained; 98.5ft with few dolomitized shale partings; laminated at base. (Continued)							
		DOLOMITE; very light brown and light grey; fine-grained; thin to medium bedded; 101.0ft abundant pits/vugs.							
		Bioturbated from 103.5'-105.5'.			11	90			
		Greyish brown; microcrystalline; few thin sandy beds below 105.5'.							
		826.5 ft							
		DOLOMITE; light yellowish brown to yellowish brown; microcrystalline; thin to medium bedded; few fine grained sandy beds at top, few pits/vugs; strong brown oxidation along fracture faces.							
		110.0ft							
		821.0 ft							
		DOLOMITE; grey to dark grey; microcrystalline; thin to medium bedded; with minor thin sandy dolomite beds to 122'.			12	86			
		Pyrite crystals below 118'.							
		3" bed of dolomitic sandstone at 120.2'.							
		809.3 ft							
		Abundant pits/vugs below 126'.							
		DOLOMITE; light grey to tan; fine- to medium-grained; microcrystalline beginning at 127.8'; thinly bedded; with grey chert nodules and some pyrite throughout.							
		127.2ft							
		Oolitic beds below 129'.							
		Greyish green; shale bed at 129.5'.			13	85			
		Some glauconite from 131'-136'.							

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Date Boring Started: 9/19/19	Water Levels (ft)	Remarks: Elevation estimated from MN DNR Lidar topo maps online
Date Boring Completed: 9/23/19	At Time of Drilling 16.3	
Logged By: KAM	At Time of Drilling 24.5	
Drilling Contractor: Traut Wells	At Time of Drilling 2019-09-23 AM	
Drill Rig: Full size Truck Mounted Sonic		Weather:

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Project: Devney Quarry	Surface Elevation: 936.5 ft
Job No.: 23191418	Drilling Method: Sonic
Location: Waterford, MN	Sampling Method: 4" Core Barrel
Coordinates: NAD83	Completion Depth: 180.0 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION	Graphic Log	Samples	Sample No.	% Recovery	SPT, N value or RQD %	STANDARD PENETRATION TEST DATA N in blows/ft ©												
								REC%	RQD %	SHEAR STRENGTH, tsf										
		DOLOMITE; light grey to tan; fine- to medium-grained; microcrystalline beginning at 127.8'; thinly bedded; with grey chert nodules and some pyrite throughout. (Continued)																		
	800.5 ft				14	100														
	799.5 ft	DOLOMITE; grey; microcrystalline; pyrite crystals throughout.																		
	137.0ft	DOLOMITE; tan; oolitic; thin to medium bedded; pitted where oolites are dissolved.																		
	140	1-cm greyish green shale bed at 139.6'.																		
	795.0 ft																			
	795	SANDY DOLOMITE; brownish grey; fine-grained; thin to medium bedded; some pits/vugs.																		
	145				15	100														
	790.0 ft																			
	790	Pebbles at 146'.																		
	789.0 ft	DOLOMITE; tan; microcrystalline; thin to medium bedded; few thin shale partings/laminae.																		
	150	DOLOMITE; grey brown; oolitic; few grey shale partings.																		
	787.0 ft																			
	786.5 ft	DOLOMITE; grey; with white laminations; trace pyrite along fractures.																		
	785																			
	784.5 ft	SANDSTONE; light brownish grey; dolomitic; top 2" fine grained sandy dolostone with few pits.																		
	155	SANDSTONE; very light grey to white; fine- to medium-grained; quartz; subround to round grains, poorly cemented with few moderately well cemented beds.																		
	780.5 ft				16	82														
	780	DOLOMITE; light greyish brown; fine-grained; few thin oolitic beds.																		
		Pyrite at 157.5'.																		
	160	Glauconite at 158.5' and 161'.																		
	775																			
	774.5 ft	DOLOMITE; light brownish grey; microcrystalline; thin to medium bedded; abundant pits/vugs with calcite and dolomitic secondary mineralization along bedding planes and pits/vugs; bioturbated at the top; trace lauconite at bottom.																		
	165																			

Continued Next Page

Date Boring Started: 9/19/19	Water Levels (ft)	Remarks: Elevation estimated from MN DNR Lidar topo maps online
Date Boring Completed: 9/23/19	At Time of Drilling 2019-09-19 PM 16.3	
Logged By: KAM	At Time of Drilling 2019-09-23 AM 24.5	
Drilling Contractor: Traut Wells		
Drill Rig: Full size Truck Mounted Sonic		Weather:

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LOG OF BORING B-101

Project: Devney Quarry	Surface Elevation: 936.5 ft
Job No.: 23191418	Drilling Method: Sonic
Location: Waterford, MN	Sampling Method: 4" Core Barrel
Coordinates: NAD83	Completion Depth: 180.0 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION	Graphic Log	Samples	Sample No.	% Recovery	SPT, N value or RQD %	STANDARD PENETRATION TEST DATA N in blows/ft @	
								REC%	RQD %
165		DOLOMITE; light brownish grey; microcrystalline; thin to medium bedded; abundant pits/vugs with calcite and dolomitic secondary mineralization along bedding planes and pits/vugs; bioturbated at the top; trace laconite at bottom. (Continued)			17	88			
770									
170									
765									
	762.5 ft								
175		DOLOMITE; very light greyish brown; fine-grained; thin to medium bedded; bioturbated at top; some pits/vugs with calcite; few very small pyrite crystals along fracture faces.			18	70			
760									
	756.5 ft								
180		Bottom of Boring at 180.0 feet							
					19	92			

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Date Boring Started: 9/19/19	Water Levels (ft)	Remarks: Elevation estimated from MN DNR Lidar topo maps online
Date Boring Completed: 9/23/19	At Time of Drilling 16.3	
Logged By: KAM	At Time of Drilling 24.5	
Drilling Contractor: Traut Wells		
Drill Rig: Full size Truck Mounted Sonic		Weather:

