# ESTATE LAND AUCTION

## +/-650.88 Acres of Extremely Well Located DeSmet Twp. North, Kingsbury County, SD Land ATTENTION – Aggregate, Gravel & Material Producers, Contractors, Livestock/Row Crop Producers, Farm Operators, Investors & Others in the Market for a Multi-faceted Parcel or Parcels of Well Located Kingsbury County SD Land Located Directly North of DeSmet, SD and Adjacent or Nearby to SD Hwy. #25

We will offer the following Land at public auction "On Site" at FARM #1 – Located from DeSmet, SD – 1½ miles north on SD Hwy. #25 to the Sale Site - The NE Corner of the Land is located at the Jct. of SD Hwy. #25 & 204th St. (**Note - The +/-15 Acreage Site in the SE Corner of the Section is owned by Thomas Cummins and is not included with the portion being sold**).

## TUESDAY SEPTEMBER 21, 2021 Sale Time: 10:00 AM

**AUCTIONEER'S NOTE: In order to settle the estate of Doris Cummins, we will offer the following land at public auction. Portions of this land has been in the Cummins Family for over +/-85 years, hence this auction provides a once in a lifetime opportunity to purchase this land. One Area on this land has historical significance in connection with the Laura Ingalls Wilder lore that is prevalent in the DeSmet community, evidenced by the historic marker located next to Farm #1 on Hwy. #25 – indicating that an area on this property was the Homestead Claim of Almanzo & Laura Ingalls Wilder. This land in recent years has been utilized in a mode of operation conducive to a diversified crop/livestock operation, although FSA information indicates more acres have been under cultivation at one time. It is especially noteworthy, that a great deal of significant value of the land in FARM #1 may be in the near and long-term future excavation and mining of gravel and other aggregates available on this land with recent test results as completed by CORE Engineering and Consulting indicating a total of approximately 25 million tons of gravel/sand deposits are present on this property, excluding wetland areas which were not explored, with this report available for inspection by interested parties.**

**FARM #1 – +/-466.67 Acres – LEGAL DESC.:** The E½, Exc. the S. 690' of the E. 945', and the NW ¼ of Sec. 21, T. 111N., R. 56W. (DeSmet "North" Twp.), Kingsbury County, SD

**FARM #1 - +/-466.67 Acres - Will be offered as Tract #1A - +/-304.99 Acres – The E ½, except the +/-15 acre acreage site situated in the SE Corner of the SE ¼; Tract 1B – 161.68 Acres – The NW ¼ or Tracts #1A & 1B Combined the 466.67 Acre Unit.**

Farm #1 is a very good diversified crop/livestock farm, with significant deposits and potential for mining of gravel and aggregates. According to testing completed on this property by Core Engineering and Consulting, Inc. of Fort Thompson, SD and their report of Geotechnical Exploration and a subsequent summary letter estimated the following quantities assuming the necessary processing and or supplementation has been provided – a total of approx. 25 million tons of sand/gravel deposits are present on the property, excluding the wetland areas which were not explored – Copies of this report are available upon request; individual testing may be allowed with permission and assurance that disturbed areas be returned to pre-excavation condition and avoiding crop damage or harm to the property. Presently Farm #1 is being operated with a mixture of cropland and pasture and has previously been sectionalized into multiple pastures to accommodate a rotational grazing program as operated by the tenants – (although recently all of the temporary interior fence that was owned by the tenants has been removed). Water on the property is provided by a combination of a well & dugouts. The shallow well & electricity are located from the SW Corner of the SE¼ (Approx. 600' north of the Jct. of 206th Street & Prairie Ave.), from which an underground waterline runs northeasterly to two locations – 1 in the north central area of the SE¼ and a 2nd area in the south central area of the NE¼ - that fed large tire tanks which are owned by the tenants and will be removed. This property has very good exterior perimeter 4 barbed wire fencing.

According to FSA information Farm #1 as a unit has approx. 285.66 total acres considered as cropland - Tr. #1A (+/-300.28 Acres in the E½ of Sec. 21) is considered to contain a total of approx. 175.43 acres of cropland, with approx. 130.53 total base acres comprised of a 97.9 acre soybean base with a 33 bu. PLC yield and a 32.63 acre wheat base with a 61 bu. PLC yield; Tract 1B (+/-160 acres in the NE¼ of Sec. 21) is considered to contain a total of approx. 110.23 acres of cropland, with approx. 82 total base acres comprised of a 61.5 acre soybean base with a 33 bu. PLC yield and a 20.5 acre wheat base with a 61 bu. PLC yield; and is enrolled under the ARC County Election of the USDA farm program for soybeans and wheat. A noteworthy fact concerning this land is that there are No US Fish and Wildlife Easements on this land, thus a future buyer may operate the cropland acres and may graze and utilize the pasture & hayland without any limitations or restrictions on grazing or haying. According to information obtained from Surety Agri-Data, Inc. as a whole has a Soil Index of 42.8. According to Kingsbury County Treasurer 2020 RE Taxes payable in 2021 on the NW¼ are $1,620.96, on the NE ¼ are $1,189.34 and on the SE ¼ are $1,094.10, for a combined total tax amount on Farm #1 of $3,904.40.

**FARM #2 – +/-184.21 Acres - LEGAL DESC.:** The NE¼, exc. 2.51 Ac. Hwy. and Exc. the W. 342.42' of the E. 417.4' of the N. 417.42' of the NE¼ NE¼ (154.21 Acres); the N½ NW¼ SE ¼ (20 Acres) and the NW¼ NE¼ SE¼ (10 Acres); all in Sec. 16, T. 111N., R.56W., (DeSmet "North" Twp.), Kingsbury County, SD

Farm #2 is an excellent livestock farm as a summer grazing unit, which is comprised of native grass pasture. Water is provided by 2 dugouts and a seasonal creek. This property has very good 4 barbed wire perimeter fencing in place. According to information obtained from Surety Agri-Data this land has a soil rating of 45.4. One noteworthy fact concerning this land is that there are No US Fish and Wildlife Easements on this land, thus a future buyer may graze and utilize the property without any grazing or haying restrictions. According to Kingsbury County Treasurer the total combined amount on 183.21 taxable acres in Farm #2 for the of 2020 RE Taxes payable in 2021 for on this property were $1,727.04

**TERMS: Cash -** A 10% nonrefundable earnest money payment sale day & balance on or before Nov. 12, 2021, with full possession for the 2022 crop and grazing season. Marketable Title will be conveyed and an Owner's Title Insurance Policy will be provided with the cost divided 50-50 between the buyer & seller. Due to the fact that Farm #1 is being offered in multiple parcels it will be sold in accordance with the surveyed acres as determined by Midwest Land Surveying, Inc.; Farm #2 will be sold based on the acres as stated on the county tax records, with acres in either case being understood to be "more or less". All of the 2020 RE taxes payable in 2021 as well as all of the 2021 RE taxes due in 2022 will be paid by the sellers., The seller does not warranty or guarantee that existing fences lie on the true & correct boundary and new fencing, if any, will be the responsibility of the purchaser pursuant to SD law. FSA yields, bases, payments or other info. is estimated and subject to County Committee approval. This property is sold in "AS IS" condition with no contingencies whatsoever, and the merchantability or suitability of this property for any particular purpose is not guaranteed - Presently this property is zoned agricultural and any future changes in zoning or required mining permits are the responsibility of the purchaser and are subject to Kingsbury County Planning and Zoning and/or the State of South Dakota DENR Mining and Minerals regulations. This property is sold subject to existing easements, restrictions, reservations or highways of record, if any, an subject to any or all Kingsbury County Zoning Ordinances. Information contained herein is deemed to be correct but is not guaranteed. The RE Licensees in this transaction stipulate that they are acting as agents for the seller. Sold subject to confirmation of the Owners.

**CATTLE MAY BE PRESENT – SO IF YOU PLAN TO INSPECT THE PROPERTY, BE RESPECTFUL AND CLOSE THE GATES!! Please mark your calendars and plan to attend this auction, or if you are unable to attend and need to make arrangements to bid by phone, then contact the auctioneers prior to sale day to make arrangements. To View FSA Maps, Soils or additional information, see www.suttonauction.com or contact the auctioneers.**

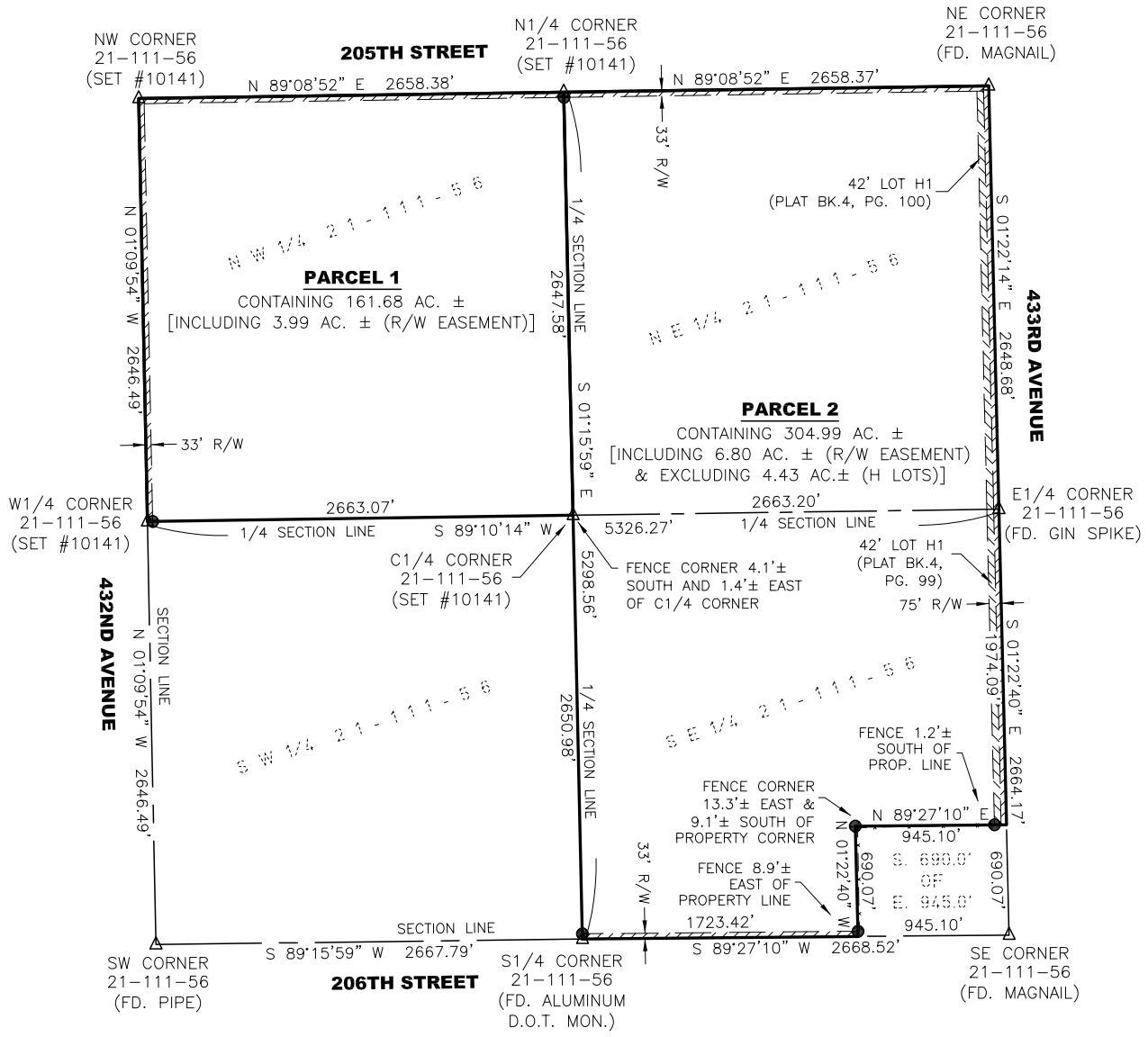
## DORIS CUMMINS ESTATE

**Maureen Droz – Personal Representative**

**CHUCK SUTTON - Auctioneer & Land Broker -**
**Sioux Falls, SD - ph. 605-336-6315 & Flandreau, SD - ph. 605-997-3777,**
**JARED SUTTON - Auctioneer & RE Broker Associate - Flandreau, SD - ph. 605-864-8527 &**
**BURLAGE-PETERSON AUCTIONEERS & REALTORS – Brookings, SD – ph. 605-692-7102**

# SALE DRAWING - PARCELS 1 AND 2

**IN SECTION 21, TOWNSHIP 111 NORTH, RANGE 56 WEST OF THE 5TH P.M., KINGSBURY COUNTY, SOUTH DAKOTA.**




**PARCEL 1 LEGAL DESCRIPTION:**
THE NORTHWEST QUARTER OF SECTION 21, TOWNSHIP 111 NORTH, RANGE 56 WEST OF THE 5TH P.M., KINGSBURY COUNTY, SOUTH DAKOTA.

**PARCEL 2 LEGAL DESCRIPTION:**
THE EAST HALF OF SECTION 21, TOWNSHIP 111 NORTH, RANGE 56 WEST OF THE 5TH P.M., KINGSBURY COUNTY, SOUTH DAKOTA; EXCEPT THE SOUTH 690.0' OF THE EAST 945.0' THEREOF; AND EXCEPT LOT H1 IN THE NE1/4 AND EXCEPT LOT H1 IN THE SE1/4 CONTAINED THEREIN.

**OWNERS: CUMMINS ESTATE**

**CLIENT: SUTTON AUCTION SERVICE**

**TOTAL ACRES FOR PARCEL 1**
161.68 ACRES±
[INCLUDING 3.99 AC.± OF R/W (EASEMENT)]

**TOTAL ACRES FOR PARCEL 2**
304.99 ACRES±
[INCLUDING 6.80 AC.± OF R/W (EASEMENT)
& EXCLUDING 4.43 AC.± (H LOTS)]

LEGEND:
- ● SET PROPERTY CORNER
- △ SECTION CORNER
- AC. ACRES
- R/W RIGHT-OF-WAY
- ——— PREVIOUSLY PLATTED LINE
- — — RIGHT OF WAY LINE

NOTES:
BASIS OF BEARINGS IS UTM-ZONE 14.
PROJECT #21-662
DRAWN BY: JEB


**PREPARED BY:**
Midwest Land Surveying, Inc.
**Land Surveying and GPS Consulting**
**211 E. 14th Street Suite 100**
**Sioux Falls, South Dakota 57104**
**Phone: (605) 339-8901 FAX:(605) 274-8951**


N

0 1000'

SCALE: 1"=1000'

# SALE DRAWING - PARCELS 1 AND 2

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N

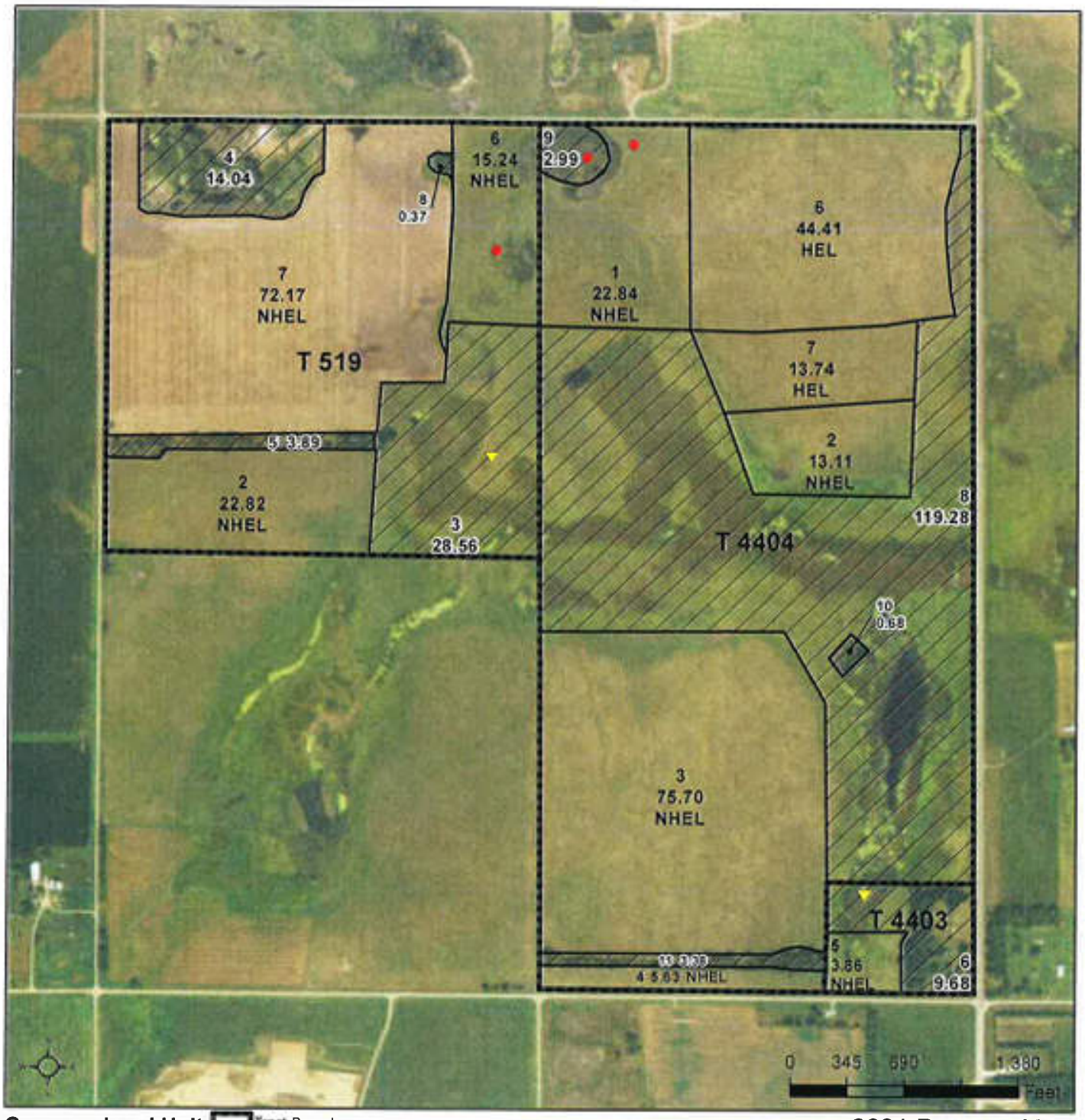
0 1000'

SCALE: 1"=1000'

USDA United States Department of Agriculture

# Kingsbury County, South Dakota

## Farm #1




**Common Land Unit**
- Non-Cropland
- Cropland

Tract Boundary
PLSS

**Wetland Determination**
- Restricted Use
- Limited Restrictions
- Exempt from Conservation Compliance Provisions

2021 Program Year

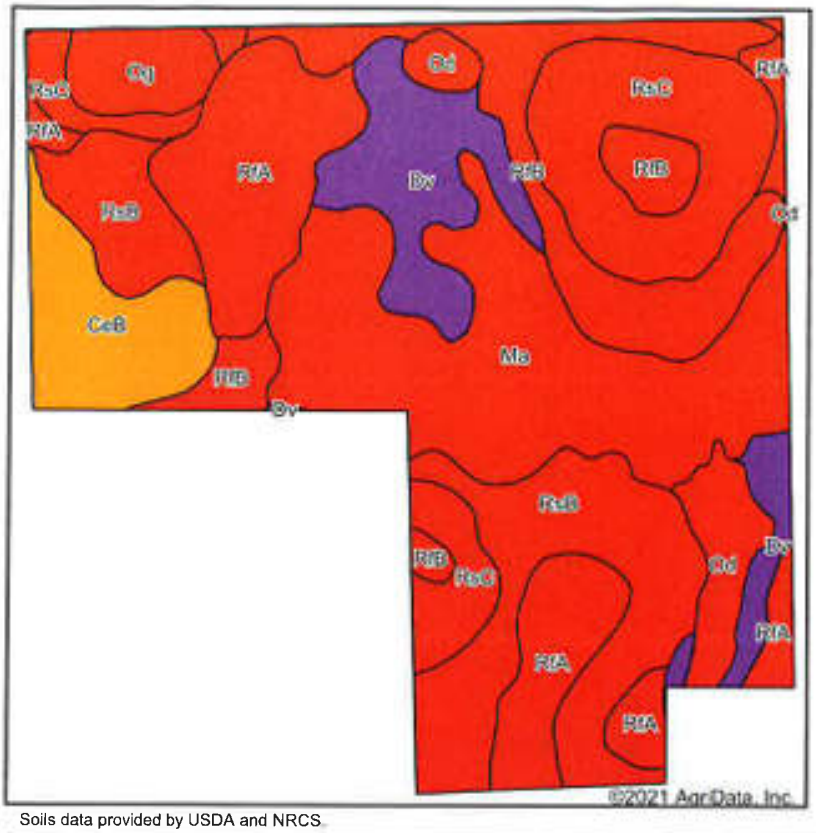
Map Created May 19, 2021

Farm **5110**

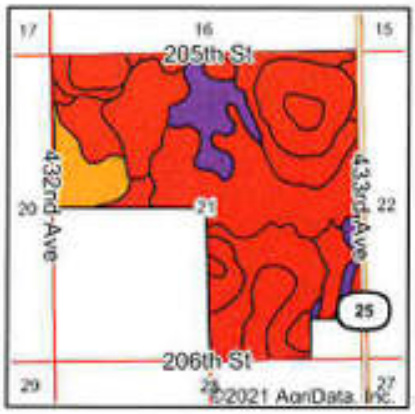
**21-111N-56W-Kingsbury**

United States Department of Agriculture (USDA) Farm Service Agency (FSA) maps are for FSA Program administration only. This map does not represent a legal survey or reflect actual ownership; rather it depicts the information provided directly from the producer and/or National Agricultural Imagery Program (NAIP) imagery. The producer accepts the data 'as is' and assumes all risks associated with its use. USDA-FSA assumes no responsibility for actual or consequential damage incurred as a result of any user's reliance on this data outside FSA Programs. Wetland identifiers do not represent the size, shape, or specific determination of the area. Refer to your original determination (CPA-026 and attached maps) for exact boundaries and determinations or contact USDA Natural Resources Conservation Service (NRCS).

# Soils Map




Soils data provided by USDA and NRCS.




State: **South Dakota**
County: **Kingsbury**
Location: **21-111N-56W**
Township: **De Smet**
Acres: **467.46**
Date: **8/3/2021**

CHUCK SUTTON
ENGINEER & LAND BROKER LLC

surety

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Area Symbol: SD077, Soil Area Version: 24

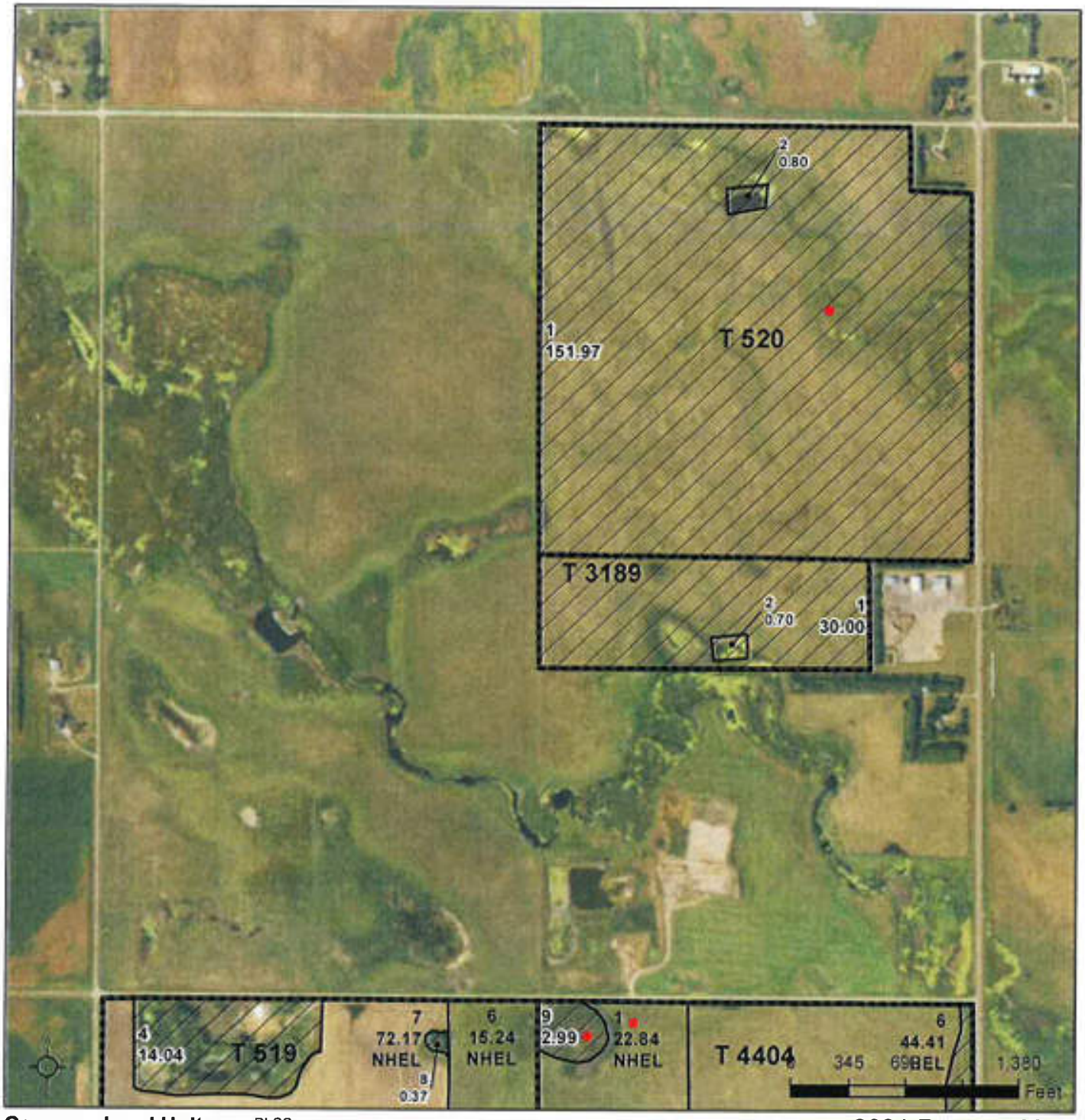
| Code | Soil Description | Acres | Percent of field | PI Legend | Non-Irr Class *c | Productivity Index |
|---|---|---|---|---|---|---|
| Ma | Marysland loam | 95.88 | 20.5% | | IVw | 48 |
| RsB | Renshaw-Sioux complex, coteau, 2 to 6 percent slopes | 74.00 | 15.8% | | IVs | 34 |
| RfA | Renshaw-Fordville loams, coteau, 0 to 2 percent slopes | 72.66 | 15.5% | | IIIs | 47 |
| RsC | Renshaw-Sioux complex, coteau, 6 to 9 percent slopes | 64.57 | 13.8% | | IVe | 28 |
| RfB | Renshaw-Fordville loams, coteau, 2 to 6 percent slopes | 57.23 | 12.2% | | IVs | 43 |
| Dv | Divide loam | 43.03 | 9.2% | | IIIs | 54 |
| CeB | Clarno-Ethan-Bonilla loams, 1 to 6 percent slopes | 28.81 | 6.2% | | IIe | 78 |
| Od | Oldham silty clay loam | 17.91 | 3.8% | | Vw | 34 |
| Og | Orthents, gravelly | 13.37 | 2.9% | | VIIIs | 3 |
| | | | | | **Weighted Average** | **42.8** |

*c: Using Capabilities Class Dominant Condition Aggregation Method
Soils data provided by USDA and NRCS.

USDA United States Department of Agriculture

# Kingsbury County, South Dakota

## Farm #2




**Common Land Unit**

Non-Cropland

Tract Boundary

PLSS

**Wetland Determination**

- Restricted Use
- Limited Restrictions
- Exempt from Conservation Compliance Provisions

2021 Program Year

Map Created May 19, 2021

Farm **5110**

**16-111N-56W-Kingsbury**

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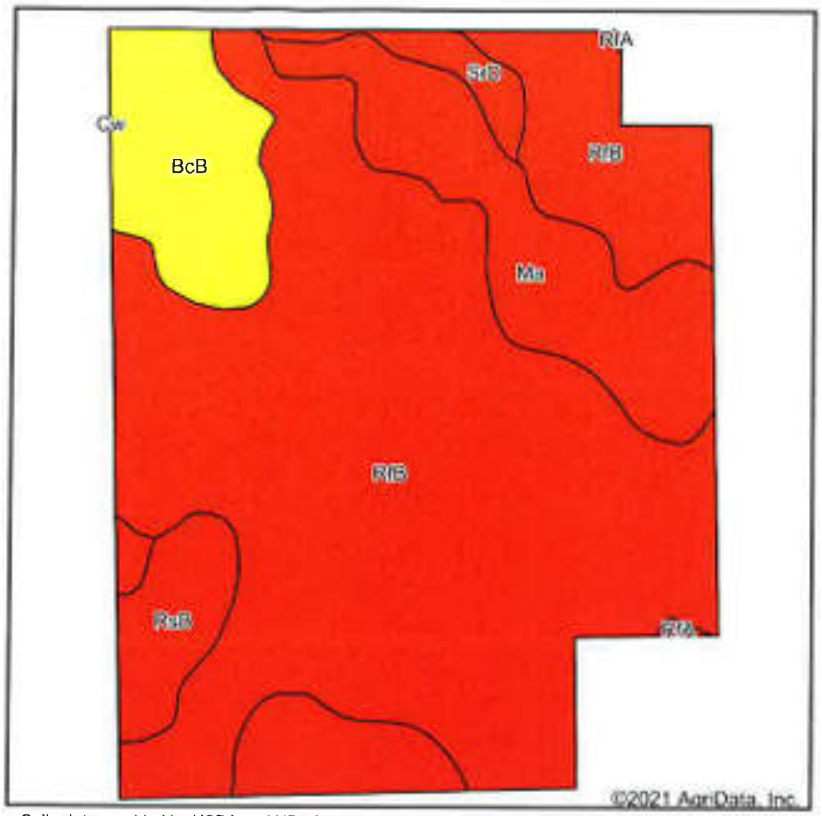
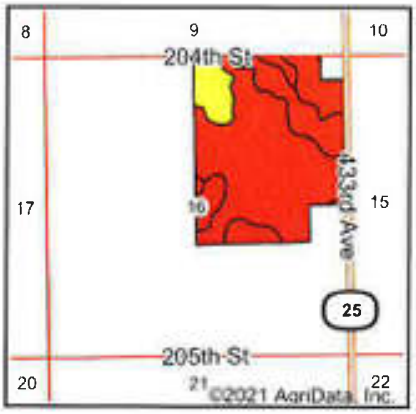
# Soils Map




Soils data provided by USDA and NRCS.




State: **South Dakota**
County: **Kingsbury**
Location: **16-111N-56W**
Township: **De Smet**
Acres: **184.95**
Date: **8/3/2021**

CHUCK SUTTON
REALTOR® & LAND BROKER LLC

Maps Provided By
surety®
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| Area Symbol: SD077, Soil Area Version: 24 | | | | | | |
|---|---|---|---|---|---|---|
| Code | Soil Description | Acres | Percent of field | PI Legend | Non-Irr Class *c | Productivity Index |
| RfB | Renshaw-Fordville loams, coteau, 2 to 6 percent slopes | 125.65 | 67.9% | | IVs | 43 |
| Ma | Marysland loam | 31.57 | 17.1% | | IVw | 48 |
| BcB | Barnes-Buse loams, 2 to 6 percent slopes | 16.01 | 8.7% | | IIe | 70 |
| RsB | Renshaw-Sioux complex, coteau, 2 to 6 percent slopes | 7.89 | 4.3% | | IVs | 34 |
| SrD | Sioux-Renshaw complex, coteau, 9 to 15 percent slopes | 3.52 | 1.9% | | VIs | 21 |
| RfA | Renshaw-Fordville loams, coteau, 0 to 2 percent slopes | 0.31 | 0.2% | | IIIs | 47 |
| | | | | | **Weighted Average** | **45.4** |

*c: Using Capabilities Class Dominant Condition Aggregation Method
Soils data provided by USDA and NRCS.

Geotechnical Engineering
Environmental Services
Materials Testing

January 21, 2021

Doug & Maureen Droz
232 Sunshine Loop
Pierre, SD 57501

RE: Report of Geotechnical Exploration and Review
The Dorris Cummins Estate Property Gravel Exploration
SD Highway 25 from 205th Street to 206th Street
Kingsbury County, South Dakota
CEC No. 01-20-064

Dear Mr. & Mrs. Droz,

As requested, we have performed calculations to determine the approximate quantities of aggregate materials present on the Dorris Cummins Estate property in rural Kingsbury County, South Dakota. The following values are based on the results of the five soil borings performed in October of 2020, topographic data provided by the United States Geologic Survey (USGS) and satellite imagery provided by Google. Understand that these are only approximations and that additional information necessary to refine these estimates can be obtained by means of additional exploration.

In our report from December 16, 2020, we indicate the areas around Boring #1 and Boring #4 have the potential to produce Gravel Surfacing while the areas around Boring #2 and Boring #5 are more conducive to producing Aggregate Base Course. None of these areas will produce these materials without some processing and/or supplementation. The following quantities assume the necessary processing and/or supplementation has been provided.

1. A total of approximately 25 million tons of sand/gravel deposits are present on the property, exclusive of the wetland areas which were not explored
2. The areas around Borings #2 & #5 have the potential to produce 10 million tons of Aggregate Base Course for use beneath pavements and slabs
3. The areas around Borings #1 & #4 have the potential to produce 4 million tons of Gravel Surfacing for use on gravel roads, driveways and yards
4. The balance of the sand/gravel deposits present are thought to be of a quality not conducive to producing a specified material and are likely useful only as fill soils

CEC appreciates the opportunity to provide these services to you. We trust this information will found useful in your planning process. If you have any questions, or if you require additional information, feel free to contact us.

Sincerely,

**Core Engineering & Consulting, Inc.**

Patrick J. Engels, PE
Principal Geotechnical Engineer

22700 Bad Nation Road • PO Box 654 • Fort Thompson, SD 57339
Phone: (605) 234-2673 • www.coresd.com

Geotechnical Engineering
Environmental Services
Materials Testing

December 16, 2019

Doug & Maureen Droz
232 Sunshine Loop
Pierre, SD 57501

RE: Report of Geotechnical Exploration and Review
The Dorris Cummins Estate Property Gravel Exploration
SD Highway 25 from 205th Street to 206th Street
Kingsbury County, South Dakota
CEC No. 01-20-064

Dear Mr. & Mrs. Droz,

This report presents the results of a subsurface exploration program and geotechnical engineering review for the gravel source exploration performed at your family property in rural Kingsbury County, South Dakota. This work was conducted in accordance with the verbal agreement between you and Core Engineering & Consulting, Inc. (CEC). We are submitting this report electronically; please advise us if hard/bound copies are required.

The opinions expressed in this report are based on information provided by you and the data obtained from our subsurface exploration. Should there be any changes as the project develops, we request that we be notified so that these new conditions can be reviewed and, if necessary, we can modify our recommendations.

The soil samples remaining after the laboratory testing is completed will be retained for a period of 1 month from the date of this report unless written request is made to retain them for a longer period of time.

CEC appreciates the opportunity to provide these services to you. As your project proceeds, we would be interested in providing additional geotechnical and construction materials engineering services. If you have any questions about this report, or if you require additional information, feel free to contact us.

Sincerely,

**Core Engineering & Consulting, Inc.**

Patrick J. Engels, PE
Principal Geotechnical Engineer

# REPORT OF GEOTECHNICAL EXPLORATION AND ENGINEERING REVIEW

## The Dorris Cummins Estate Property Gravel Explorations

SD Highway 25 from 205th Street to 206th Street
Kingsbury County, South Dakota

**CEC Job No.:** 01-20-064

**Report Date:** Wednesday December 16, 2020

**Prepared For:** Doug & Maureen Droz
232 Sunshine Loop
Pierre, South Dakota

# PROJECT SUMMARY

Core Engineering & Consulting, Inc. (CEC), under verbal agreement with Doug & Maureen Droz, mobilized to the site in rural Kingsbury County, South Dakota on October 14th, 2020 to perform a subsurface exploration program to explore for the quality and extent of potential aggregate sources on your family farm. The purpose of the work performed at this site is to provide you the necessary subsurface soil information to adequately plan, design and implement an aggregate mining program at the site.

The project consisted of gravel source exploration in an attempt to find adequate source materials for production of marketable aggregate materials. The field exploration consisted of five (5) flight-auger borings drilled and sampled to depths ranging from 14½' to 64½' below existing surface grade.

Results of the laboratory tests performed for the six samples taken indicate the following:

- Plasticity indices were found to be between 0% and 19%
- Total percent gravel (by weight) was determined to be between 4% and 39%
- Total percent sand (by weight) was determined to be between 40% and 80%
- Total percent silt/clay (by weight) was determined to be between 14.5% and 24.2%

Based on these test results, it is our opinion the gravel source is adequate to produce a range of different materials including gravel surfacing, aggregate base course and aggregate subbase materials meeting the requirements of the SD DOT, following some processing. Processing required to meet the SD DOT specifications will include:

- Crushing of the gravel materials to meet the requirements of 100% finer than the 1" (19.0 mm) sieve and at least 30% of coarse particles containing one or more fractured faces
- Careful selection of mining locations and methods to ensure the proper blend of materials
- Blending of the materials from different locations & depths to ensure the proper gradation and plasticity index

The following are generalized recommendations for aggregate production at each boring location:

Boring #1: The upper 21' of the subsurface will likely make good **Gravel Surfacing** with some crushing of larger rock and blending of higher/lower plasticity sands

Boring #2: The material from 9' to 53' could make good **Aggregate Base Course** if a source of rock can be found to supplement it, otherwise it is generally too fine and may only be useful for fill sand

Boring #3: No granular materials were found at the Boring #3 location

Boring #4: The material from 10' to 24' will likely make good **Gravel Surfacing** with some crushing of larger rock and either blending with cleaner sands or screening of fines

Boring #5: The upper 9' of the subsurface likely has too much fines to be useful for anything except fill sand while the materials below 9' can potentially make **Aggregate Base Course** if a source of rock can be found to supplement it

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UNIFIED SOIL CLASSIFICATION SYSTEM

# REPORT OF GEOTECHNICAL EXPLORATION AND ENGINEERING REVIEW DORRIS CUMMINS ESTATE GRAVEL EXPLORATION SD HIGHWAY 25 FROM 205TH STREET TO 206TH STREET KINGSBURY COUNTY, SOUTH DAKOTA

## CEC NO. 01-20-064

## INTRODUCTION

This report presents the results of the subsurface exploration program and geotechnical engineering review for the gravel source explorations performed at the Dorris Cummins Estate property in rural Kingsbury County, South Dakota. To protect you, Core Engineering & Consulting, Inc. (CEC), and the public, we authorize use of the opinions and recommendations in this report only by you and your project team for this specific project. Contact us if other uses are intended.

## BACKGROUND INFORMATION

### Previous Site Usage

The site proposed for mining of aggregate materials is currently a combination of undeveloped grassland and tillable agricultural land. No evidence of previous gravel exploration and/or mining is evident on the sites explored.

### Proposed Construction

Based on the information provided, the purpose of the subsurface exploration is to identify the location and extent of mineable aggregate materials which meet the requirements, or can be made to meet the requirements, for various marketable aggregate products, preferably in compliance with SD DOT specifications.

The above project information represents our understanding of the proposed project scope. This information is an integral part of our engineering review. It is important that you contact us if there are changes from that described so that we can evaluate whether changes in our recommendations are appropriate.

### Authorized Scope of Services

CEC's services for this project were performed in accordance with the verbal agreement between you and Core Engineering & Consulting, Inc. The authorized scope of services for this project consists of the following:

- Drill various locations throughout the property where you propose to mine for aggregate materials, using 5½" O.D. solid-stem flight augers, to define the lateral and vertical extents of any sand/gravel deposits
- Perform laboratory analyses on select soil samples to aid in classification and engineering review
- Perform a geotechnical engineering analysis based on the above and prepare this report

The contracted scope of services is intended for geotechnical purposes only and is not intended to explore for the presence or extent of environmental contamination at the site or provide opinions regarding the status of the site relative to "wetland" definitions.

# METHODOLOGIES

## Field Testing & Observations

The subsurface exploration program consisted of five (5) flight auger borings. The field exploration was performed on October 14th, 2020.

The approximate soil boring locations are shown on Figure 2 which can be found in the Appendix. The borings were spotted in the field based on an evaluation of the site geology and information provided by you.

### Drilling

The test borings were drilled using 5½" O.D. solid-stem augers. The boreholes were backfilled in compliance with State and local regulations.

### Sampling

#### *Bulk Samples*

Bulk samples taken for laboratory testing were obtained from drill cuttings which are brought to the ground surface. The depth of the sample is estimated based on the auger depth, the soil appearance and the action of the drill tooling. Due to the sampling method, some mixing of the soils can be expected as the cuttings are brought to the surface and subsequently shoveled into the sample container.

#### *Sampling Limitations*

Unless actually observed in a sample, contacts between soil layers are estimated based on the spacing of samples and the action of drilling tools. Cobbles, boulders and other large objects generally cannot be recovered from test borings. They may still be present in the ground even if they are not noted on the boring logs.

## Soil Classification

Included are the Subsurface Boring Logs, indicating the depth and identification of the various strata, the laboratory test data, water level information and pertinent information regarding the method of maintaining and advancing the boreholes. Soil classifications shown on the boring logs are based on the Unified Soil Classification (USC) system. The USC system is described in ASTM:D2487 and D2488. Where laboratory classification tests (i.e. particle size analyses and Atterberg Limits) have been performed, classifications per ASTM:D2487 are possible. We have attached charts illustrating the USC system, the descriptive terminology and the symbols used on the boring logs.

As the samples were obtained in the field, they were visually and manually classified in accordance with ASTM:D2488 by a geotechnical engineer. Representative portions of select samples were then collected and returned to the laboratory for further examination and for verification of the field classification. The boring logs also include judgments of the geological depositional origin. This judgment is primarily based on observation of the soil samples, which can be limited. Observations of the surrounding topography, vegetation and development can sometimes aid this judgment.

## Water Level Measurements

The ground water measurements are shown at the bottom of the boring log. The following information appears under "Water Level Measurements" on the log:

- Date and Time of measurement
- Sampled Depth: lowest depth of soil sampling at the time of measurement
- Casing Depth: depth to bottom of casing or hollow-stem auger at time of measurement
- Cave-in Depth: depth at which measuring tape stops in the borehole
- Water Level: depth in the borehole where free water is encountered
- Drilling Fluid Level: same as Water Level, except the liquid in the borehole is drilling fluid, if used

The true location of the water table at the boring location may be different than the water level measured in the borehole. This is possible because there are several factors which can affect the water level measurements in the borehole. Some of these factors include permeability of each soil layer in the profile, presence of perched water, amount of time between water level readings, presence of drilling fluid, weather conditions and the use of borehole casing.

## Laboratory Testing

Representative samples of the soils encountered were selected for laboratory testing to determine index properties. The tests included the determination of the particle size distribution and Atterberg Limits. The test results can be found on the Subsurface Boring Logs opposite the samples upon which they were performed and/or on the respective test reports included in Appendix A.

### Particle Size Analyses (ASTM:D422)

The particle size distribution was determined for samples recovered from the Boring #1, #2, #4 & #5 locations. The particle size distribution for the coarse fraction (gravel/sand) is determined by mechanical sieve analysis where the soil particles are agitated over a series of sieves and the weight retained on each recorded as a percent of the total. The particle size distribution for the fine fraction (silt/clay) is determined by colloidal analysis where the soil particles are forced into suspension and the rate of sedimentation is monitored by measuring the change in specific gravity of the solution through the use of a calibrated hydrometer. The particle size distribution is plotted on a logarithmic scale as a function of "percent finer by weight" and "effective particle size".

### Atterberg Limits Determinations (ASTM:D4318)

The Atterberg Limits were determined for samples recovered from the Boring #1, #2, #4 & #5 locations. The Atterberg Limits are those moisture contents at which a soil changes phases from a solid material to a plastic material (plastic limit) and from a plastic material to a liquid material (liquid limit). The plastic limit is determined by rolling a moist soil sample into a thread until it will no longer hold together at a diameter less than ⅛". The liquid limit is determined by adjusting the moisture content of a soil sample until dropping a brass cup against a solid surface a distance of ½" 25 times causes a standard groove cut through the soil sample to close upon itself. The Atterberg Limits can be used to evaluate the shrink/swell potential of soils and their relative stability under varying moisture conditions.

# FINDINGS

## Surface Observations

At the time of our exploration, the site was a combination of rolling grassland and tillable agricultural land.

## Subsurface Conditions

Logs of the test borings containing information concerning soil layering, soil classification, geologic description and moisture have been prepared. Relative density or consistency is also

noted, which is based on the standard penetration resistance (N-value). Please note the boring logs only indicate the subsurface conditions at the sampled locations. Variations often occur between and beyond borings. Logs of the test borings are included in Appendix A.

## Site Geology

The primary geologic origin of the soils encountered at this site consists of fine- and coarse-grained alluvium, referring to soils transported and deposited by water flow, overlying glacial till, referring to soils transported and deposited by glacial advance.

## Subsurface Soils

Based on our interpretation of the soil boring results, it is our judgment the borings encountered sand/gravel deposits within the depth range of 2′ to 63′ below existing surface grade. The sand/gravel deposits were found to be quite variable in nature, including silty sand, silty sand with gravel, gravelly silty sand, sand with silt, clayey sand, gravelly clayey sand, sand with clay, sand and sand with gravel.

The following table summarizes the depth of sand/gravel deposits in each borehole.

***Table 1: Sand Deposit Depths***

| Boring # | Sand Deposit Depths | Classification |
|---|---|---|
| 1 | 2′ – 8′ | Silty Sand with Gravel |
| | 8′ – 21′ | Sand with Silt, with Gravel |
| | 22′ – 28′ | Sand, a little Gravel |
| | 29′ – 45′ | Sand |
| | 45′ – 55′ | Sand with Silt |
| | 55′ – 63′ | Clayey Sand |
| 2 | 2′ – 9′ | Silty Sand with Gravel |
| | 9′ – 12′ | Sand with Gravel |
| | 12′ – 53′ | Sand, a little Gravel |
| 4 | 1′ – 7′ | Gravelly Silty Sand |
| | 10′ – 20′ | Gravelly Clayey Sand |
| | 20′ – 24′ | Sand with Clay, with Gravel |
| | 24′ – 54½′ | Clayey Sand |
| 5 | 0′ – 9′ | Silty Sand with Gravel |
| | 9′ – 33′ | Sand |
| | 33′ – 47′ | Sand, a little Gravel |

### Groundwater

The boreholes were probed for the presence of groundwater and water level measurements were taken. The measurements are recorded on the boring logs. Groundwater measurements were taken within four of the open boreholes immediately following completion of sampling, with no measurable groundwater surface at any of the four locations. Based on the soil profile encountered, the results of the groundwater monitoring at the site and our past experience in the area, it is our opinion the static groundwater table at the site is likely at a depth below the exploration. We do not anticipate that groundwater will affect mining operations.

Note that ground water levels usually fluctuate. Fluctuations occur due to varying seasonal and yearly rainfall and snow melt, as well as other factors, including river flow levels on the nearby Missouri River.

## Laboratory Testing

The results of the laboratory testing indicate the aggregate materials sampled at this site vary widely, both laterally and vertically. The following table summarizes the laboratory test results as compared to a range of material specifications.

***Table 2: Laboratory Test Results vs. SD DOT Specifications***

| Sieve Size | Percent Passing by Weight | | | | | | Specification | | |
|---|---|---|---|---|---|---|---|---|---|
| | B1-S1 | B1-S2 | B2-S2 | B4-S1 | B5-S1 | B5-S2 | Subbase | Base Course | Gravel Surfacing |
| 2 inch | 100 | 100 | 100 | 100 | 100 | 100 | 100 | --- | --- |
| 1 inch | 99 | 99 | 100 | 94 | 100 | 100 | 70 – 100 | 100 | --- |
| ¾ inch | 97 | 97 | 100 | 88 | 98 | 100 | --- | 80 – 100 | 100 |
| ½ inch | 93 | 94 | 99 | 82 | 95 | 99 | --- | 68 – 91 | --- |
| #4 | 74 | 81 | 94 | 61 | 83 | 96 | 30 – 70 | 46 – 70 | 50 – 78 |
| #8 | 65 | 72 | 90 | 53 | 77 | 85 | 22 – 62 | 34 – 58 | 37 – 67 |
| #40 | 41 | 42 | 60 | 35 | 48 | 48 | 10 – 35 | 13 – 35 | 13 – 35 |
| #200 | 21.5 | 14.5 | 14.5 | 21.0 | 24.2 | 16.5 | 0.0 – 15.0 | 3.0 – 12.0 | 4.0 – 15.0 |
| Liquid Limit | 38 | 18 | 0 | 26 | 26 | 0 | --- | 25 max | --- |
| PI | 19 | 0 | 0 | 8 | 9 | 0 | 0 – 6 | 0 – 6 | 4 – 12 |

## Conclusions

Based on the results of the field exploration and the subsequent laboratory testing, it is our opinion the proposed gravel source is adequate for production of subbase, base course or gravel

surfacing, with some processing. In general, the following are considered the most appropriate aggregate materials to produce from each location:

Boring #1: The upper 21' of the subsurface will likely make good **Gravel Surfacing** with some crushing of larger rock and blending of higher/lower plasticity sands

Boring #2: The material from 9' to 53' could make good **Aggregate Base Course** if a source of rock can be found to supplement it, otherwise it is generally too fine and may only be useful for fill sand

Boring #3: No granular materials were found at the Boring #3 location

Boring #4: The material from 10' to 24' will likely make good **Gravel Surfacing** with some crushing of larger rock and either blending with cleaner sands or screening of fines

Boring #5: The upper 9' of the subsurface likely has too much fines to be useful for anything except fill sand while the materials below 9' can potentially make **Aggregate Base Course** if a source of rock can be found to supplement

Because the aggregate materials are variable across the property, any plan to mine minerals should be accompanied with a detailed plan and additional exploration. Depending on the desired product, significant variations can be expected in the quantity and quality of the materials, which will directly affect the final value.

We would like to note the method of exploration and sampling employed as part of this study does not result in perfectly representative samples. In particular, some soil mixing occurs as the cuttings are brought to the ground surface and some of the larger aggregate materials may be forced to the side of the borehole and not brought to the surface. Because of this you can expect the materials to have less fines and more rock than is stated in test reports.

We highly recommend additional exploration prior to mining, including test pits where larger and less disturbed samples of the formation can be obtained. We also recommend laboratory evaluation of the processed materials be performed to verify the results of this exploration program and the processes employed to produce the required materials.

## LIMITATIONS

The data derived through this sampling and observation program has been used to develop our opinions about the subsurface conditions at your site. However, because no exploration program can reveal totally what is in the subsurface, conditions between samples and at other times may differ from conditions described in this report. The exploration we conducted identified subsurface conditions only at those points where we took samples or observed groundwater conditions. Depending on the sampling methods and sampling frequency, every soil layer may

not be observed, and some materials or layers which are present in the ground may not be noted on the boring log.

If conditions encountered during construction differ from those indicated by our borings, it may be necessary to alter our conclusions and recommendations, or to modify construction procedures, and the cost of construction may be affected.

The extent and detail of information about the subsurface condition is directly related to the scope of the exploration. It should be understood, therefore, that additional information can be obtained by means of additional exploration.

Our services for your project have been conducted to those standards considered normal for services of this type at this time and location. Other than this, no warranty, express or implied, is intended.

## SIGNATURES

Report Prepared by:

**Core Engineering & Consulting, Inc.**

Patrick J. Engels, PE
Principal Geotechnical Engineer
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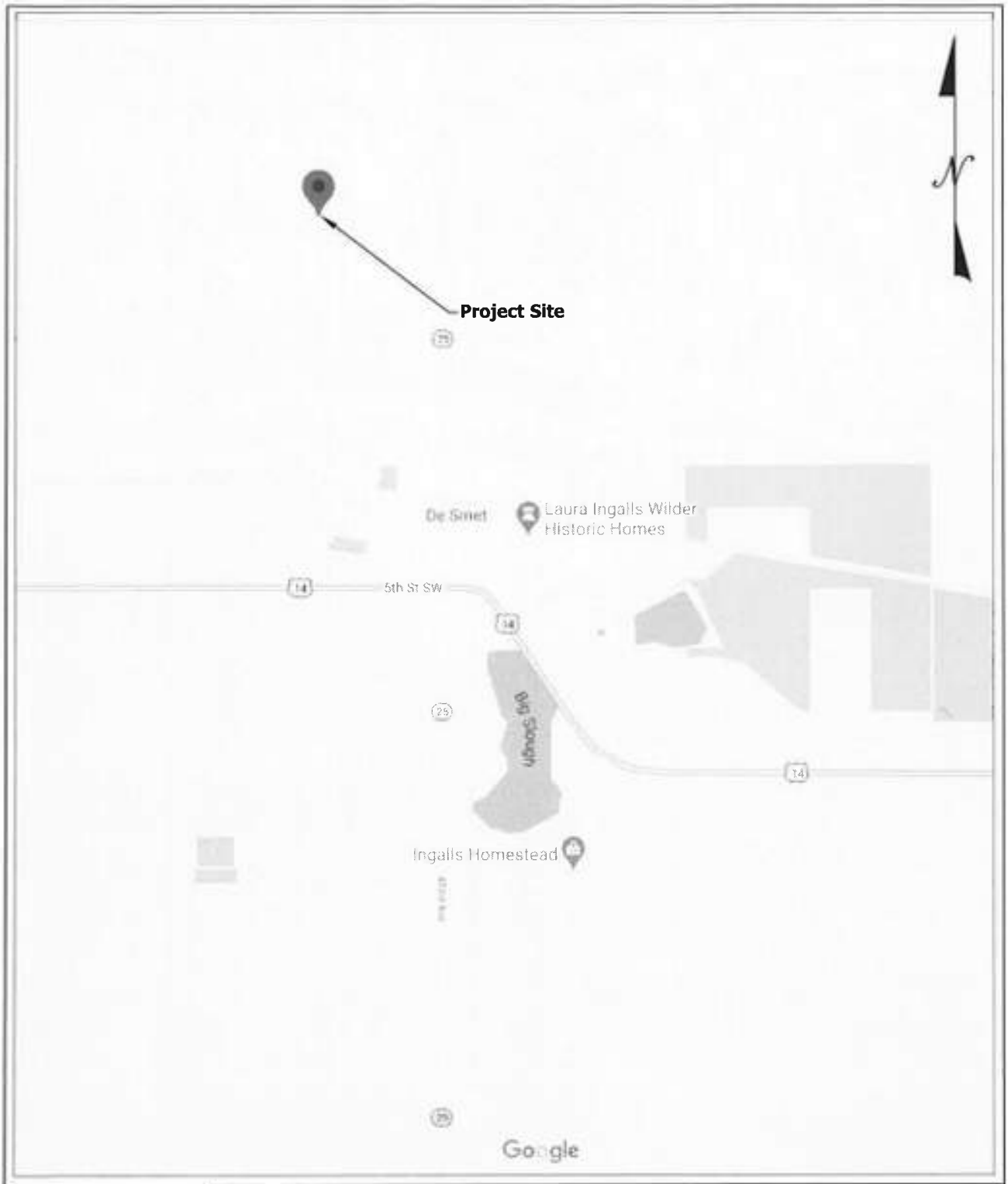
# APPENDIX A

FIGURE 1 – SITE LOCATION MAP
FIGURE 2 – BORING LAYOUT MAP
SUBSURFACE BORING LOG (5)
PARTICLE SIZE ANALYSIS (ASTM:D422) (6)
ATTERBERG LIMITS TEST RESULTS (ASTM:D4318)
BORING LOG NOTES
UNIFIED SOIL CLASSIFICATION SYSTEM




**Project:** Dorris Cummins Estate Property Gravel Exploration
SD Highway 25 from 205th Street to 206th Street; Kingsbury County, SD

**Core Engineering & Consulting, Inc.**
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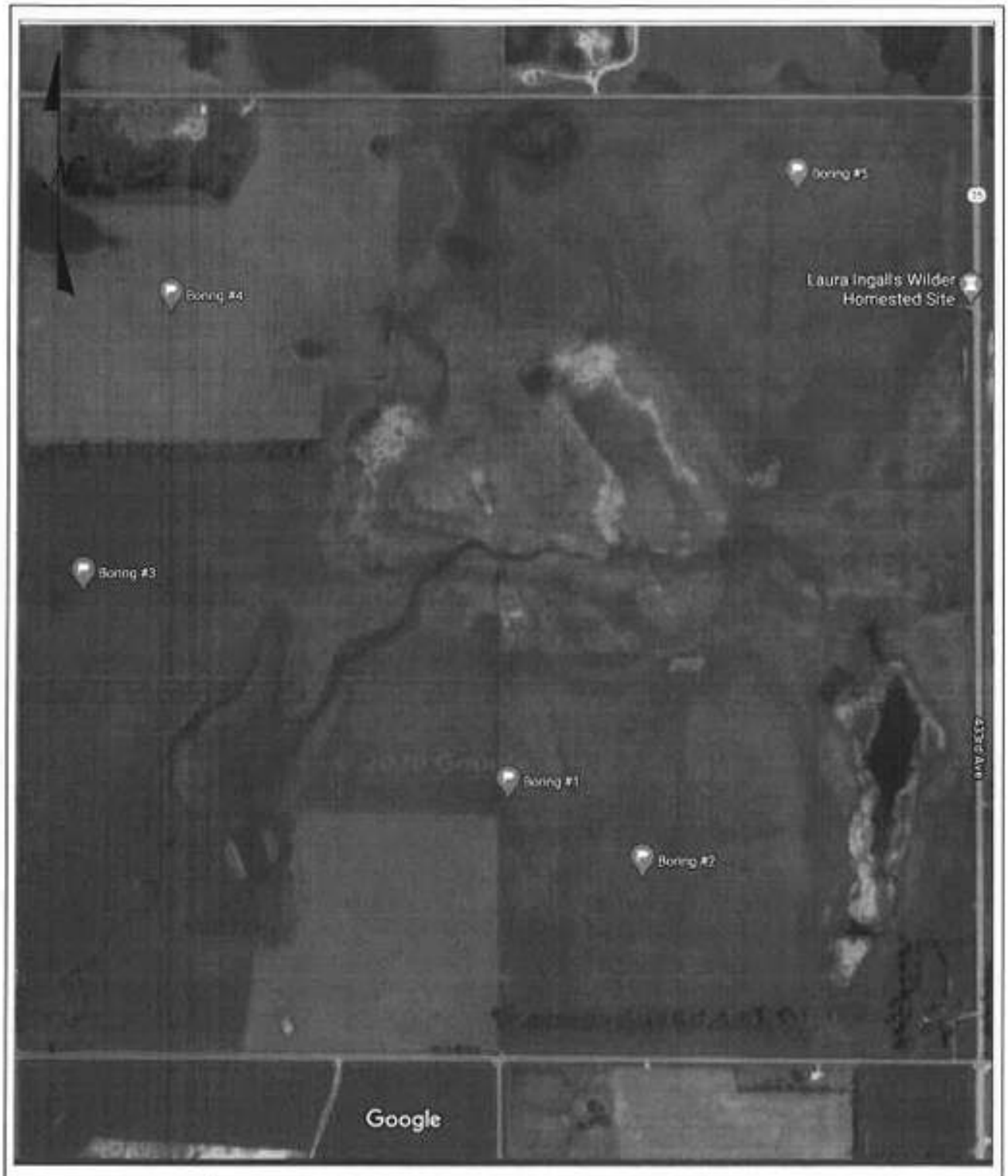
**Job No.:** 01-20-064
**Drawn By:** pje
**Checked By:** ---
**Date:** December 16, 2020

## Site Location Map

# Figure 1

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**Boring Layout Map**

**Figure 2**

# SUBSURFACE BORING LOG

Visual-Manual Classification Unless Verified by Laboratory Testing

CEC JOB NO: **01-20-064** LOG OF BORING NO. **1**

PROJECT: **Dorris Cummins Estate Property Gravel Exploration; SD Hwy 25 from 205th St to 206th St; Kingsbury County, SD**

| DEPTH IN FEET | SURFACE ELEVATION: _____ MATERIAL DESCRIPTION | GEOLOGY | N | GW | SAMPLE TYPE | REC. IN. | FIELD & LABORATORY TESTS | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Gravel | Sand | -#200 | LL | PI |
| 2 - | CLAYEY SILT, dark brown, dry (ML) | Eolian | | | | | | | | | |
| 4 - 6 - | CLAYEY SAND WITH GRAVEL, mostly fine-grained, brown, dry (SC) | | | | SU | | 26% | 52% | 22% | 38% | 19% |
| 8 - 10 - 12 - 14 - 16 - 18 - 20 - | SILTY SAND WITH GRAVEL, well-graded, brown, moist (SM) | Coarse Alluvium | | | SU | | 19% | 67% | 14% | 18% | 0% |
| 22 - | SILTY LEAN CLAY, brown, moist (CL) | Fine Alluvium | | | | | | | | | |
| 24 - 26 - | SAND, a little gravel, well-graded, brown, moist (SW) | Coarse Alluvium | | | | | | | | | |
| 28 - | CLAYEY SILT, brown, moist (ML) | Fine Alluvium | | | | | | | | | |
| 30 - 32 - 34 - 36 - 38 - 40 - 42 - 44 - | SAND, fine- to medium-grained, brown, moist (SP) | | | ▼ | | | | | | | |
| 46 - 48 - 50 - 52 - 54 - | SAND WITH SILT, trace gravels, well-graded, brown, wet (SW-SM) | Coarse Alluvium | | | | | | | | | |
| 56 - 58 - 60 - 62 - | CLAYEY SAND, well-graded, brown, wet (SC) | | | | | | | | | | |
| 64 - | SANDY LEAN CLAY, dark gray, moist (CL) | Glacial Till | | | | | | | | | |
| | END OF BORING | | | | | | | | | | |

| DEPTH | DRILLING METHOD |
|---|---|
| 0' - 64½' | 5½" O.D. FA |

WATER LEVEL MEASUREMENTS

| DATE | TIME | SAMPLED DEPTH | CASING DEPTH | CAVE-IN DEPTH | DRILLING FLUID LEVEL | WATER LEVEL |
|---|---|---|---|---|---|---|
| **10/14/20** | **11:55** | **14.0'** | **None** | **35.8'** | **n/a** | **None** |

BORING COMPLETED: **10/14/2020**

CC: **PJE** CA: **KDC** Rig: **4**

# SUBSURFACE BORING LOG

Visual-Manual Classification Unless Verified by Laboratory Testing

CEC JOB NO: **01-20-064** LOG OF BORING NO. **2**

PROJECT: **Dorris Cummins Estate Property Gravel Exploration; SD Hwy 25 from 205th St to 206th St; Kingsbury County, SD**

| DEPTH IN FEET | SURFACE ELEVATION: _____ MATERIAL DESCRIPTION | GEOLOGY | N | GW | SAMPLE TYPE | REC. IN. | FIELD & LABORATORY TESTS | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Gravel | Sand | -#200 | LL | PI |
| 2 - | SANDY SILT, dark brown, dry (ML) | Eolian | | | | | | | | | |
| 4 - 6 - 8 - | SILTY SAND WITH GRAVEL, well-graded, brown, dry (SM) | | | | SU | | | | | | |
| 10 - 12 - | SAND WITH GRAVEL, well-graded, brown, moist (SW) | | | | | | | | | | |
| 14 - 16 - 18 - 20 - 22 - 24 - 26 - 28 - 30 - 32 - 34 - 36 - 38 - 40 - 42 - 44 - 46 - 48 - 50 - 52 - | SAND, a little gravel, mostly medium-grained, brown, moist (SP)<br>(a lense of silty lean clay at 18')<br>(wet beginning at 35') | Coarse Alluvium | | ▼ | SU | | 6% | 79% | 15% | NP | NP |
| 54 - | SANDY LEAN CLAY, dark gray, moist (CL) | Glacial Till | | | | | | | | | |
| | End of Boring | | | | | | | | | | |

| DEPTH | DRILLING METHOD |
|---|---|
| 0' - 54½' | 5½" O.D. FA |

WATER LEVEL MEASUREMENTS

| DATE | TIME | SAMPLED DEPTH | CASING DEPTH | CAVE-IN DEPTH | DRILLING FLUID LEVEL | WATER LEVEL |
|---|---|---|---|---|---|---|
| **10/14/20** | **13:12** | **24.0'** | **None** | **25.0'** | **n/a** | **24.1'** |

BORING COMPLETED: **10/14/2020**

CC: **PJE** CA: **KDC** Rig: **4**

# SUBSURFACE BORING LOG

Visual-Manual Classification Unless Verified by Laboratory Testing

CEC JOB NO: **01-20-064** LOG OF BORING NO. **3**

PROJECT: **Dorris Cummins Estate Property Gravel Exploration; SD Hwy 25 from 205th St to 206th St; Kingsbury County, SD**

| DEPTH IN FEET | SURFACE ELEVATION: _____ MATERIAL DESCRIPTION | GEOLOGY | N | GW | SAMPLE TYPE | REC. IN. | FIELD & LABORATORY TESTS | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Gravel | Sand | -#200 | LL | PI |
| 2 - 4 - 6 - 8 - 10 - 12 - 14 - | SANDY LEAN CLAY, brown, moist (CL) | Glacial Till | | | | | | | | | |
| | End of Boring | | | | | | | | | | |

| DEPTH | DRILLING METHOD |
|---|---|
| 0' - 14½' | 5½" O.D. FA |

WATER LEVEL MEASUREMENTS

| DATE | TIME | SAMPLED DEPTH | CASING DEPTH | CAVE-IN DEPTH | DRILLING FLUID LEVEL | WATER LEVEL |
|---|---|---|---|---|---|---|
| **10/14/20** | **14:00** | **n/a** | **None** | **14.1'** | **n/a** | **None** |

BORING COMPLETED: **10/14/2020**

CC: **PJE** CA: **KDC** Rig: **4**

# SUBSURFACE BORING LOG

Visual-Manual Classification Unless Verified by Laboratory Testing

CEC JOB NO: **01-20-064** LOG OF BORING NO. **4**

PROJECT: **Dorris Cummins Estate Property Gravel Exploration; SD Hwy 25 from 205th St to 206th St; Kingsbury County, SD**

| DEPTH IN FEET | SURFACE ELEVATION: MATERIAL DESCRIPTION | GEOLOGY | N | GW | SAMPLE TYPE | REC. IN. | FIELD & LABORATORY TESTS | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Gravel | Sand | -#200 | LL | PI |
| | Silt, dark brown, dry (ML) | Eolian | | | | | | | | | |
| 2 - 4 - 6 - | GRAVELLY SILTY SAND, well-graded, brown, dry (SM) | Coarse Alluvium | | | | | | | | | |
| 8 - 10 - | SANDY LEAN CLAY WITH GRAVEL, brown, moist (CL) | Fine Alluvium | | | | | | | | | |
| 12 - 14 - 16 - 18 - | GRAVELLY CLAYEY SAND, well-graded, brown, moist (SC) | | | | SU | | 39% | 40% | 21% | 26% | 8% |
| 20 - 22 - 24 - | SAND WITH CLAY, with Gravel, well-graded, brown, moist (SW-SC) | | | | | | | | | | |
| 26 - 28 - 30 - 32 - 34 - 36 - 38 - 40 - 42 - 44 - 46 - 48 - 50 - 52 - 54 - | CLAYEY SAND, mostly fine- to medium-grained, brown, moist (SC) | Coarse Alluvium | | | | | | | | | |
| | End of Boring | | | | | | | | | | |

| DEPTH | DRILLING METHOD | WATER LEVEL MEASUREMENTS | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 0' - 54½' | 5½" O.D. FA | DATE | TIME | SAMPLED DEPTH | CASING DEPTH | CAVE-IN DEPTH | DRILLING FLUID LEVEL | WATER LEVEL |
| | | **10/14/20** | **15:15** | **19.0'** | **None** | **16.4'** | **n/a** | **None** |
| BORING COMPLETED: **10/14/2020** | | | | | | | | |
| CC: **PJE** CA: **KDC** Rig: **4** | | | | | | | | |

# SUBSURFACE BORING LOG

Visual-Manual Classification Unless Verified by Laboratory Testing

CEC JOB NO: **01-20-064** LOG OF BORING NO. **5**

PROJECT: **Dorris Cummins Estate Property Gravel Exploration; SD Hwy 25 from 205th St to 206th St; Kingsbury County, SD**

| DEPTH IN FEET | SURFACE ELEVATION: MATERIAL DESCRIPTION | GEOLOGY | N | GW | SAMPLE TYPE | REC. IN. | FIELD & LABORATORY TESTS | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Gravel | Sand | -#200 | LL | PI |
| 2 - 4 - 6 - 8 - | CLAYEY SAND WITH GRAVEL, well-graded, brown, dry (SC) | | | | SU | | 17% | 59% | 24% | 26% | 9% |
| 10 - 12 - 14 - 16 - 18 - 20 - 22 - 24 - 26 - 28 - 30 - 32 - | SAND, fine- to medium-grained, brown, moist (SP) | Coarse Alluvium | | | | | | | | | |
| 34 - 36 - 38 - 40 - 42 - 44 - 46 - | SAND, a little gravel, fine- to medium-grained, brown, moist (SP) | | | | SU | | 4% | 80% | 16% | NP | NP |
| 48 - | LEAN CLAY WITH SAND, slightly organic, dark gray, moist (CL/OL) | Swamp Deposits | | | | | | | | | |
| 50 - | End of Boring | | | | | | | | | | |

| DEPTH | DRILLING METHOD |
|---|---|
| 0' - 54½' | 5½" O.D. FA |

WATER LEVEL MEASUREMENTS

| DATE | TIME | SAMPLED DEPTH | CASING DEPTH | CAVE-IN DEPTH | DRILLING FLUID LEVEL | WATER LEVEL |
|---|---|---|---|---|---|---|
| **10/14/20** | **16:11** | **39.0'** | **None** | **41.0'** | **n/a** | **None** |

BORING COMPLETED: **10/14/2020**

CC: **PJE** CA: **KDC** Rig: **4**

**Geotechnical Engineering**
**Environmental Services**
**Materials Testing**

## Particle Size Analysis

| | | | |
|---|---|---|---|
| Project | Dorris Cummins Estate Property Gravel Exploration | Source | Boring #1 |
| Location | SD25 from 205th St to 206th St; Kingsbury Co., SD | Sample | #1 |
| Job No. | 01-20-064 | Depth | 4' - 8' |

**Original Dry Sample Weight** 5434.4

| Sieve Size mm | Sieve Size in / # | Wt. Ret. (0.1 g) | % of Total (0.1%) | Acc % Pass (0.1%) | Acc % Pass (rounded) | Specified % Pass |
|---|---|---|---|---|---|---|
| 50.0 | 2 | 0.0 | 0.0 | 100.0 | 100 | --- |
| 37.5 | 1½ | --- | --- | --- | --- | --- |
| 31.5 | 1¼ | --- | --- | --- | --- | --- |
| 25.0 | 1 | 75.8 | 1.4 | 98.6 | 99 | --- |
| 19.0 | ¾ | 107.7 | 2.0 | 96.6 | 97 | --- |
| 12.5 | ½ | 185.6 | 3.4 | 93.2 | 93 | --- |
| 9.5 | ⅜ | 268.6 | 4.9 | 88.3 | 88 | --- |
| 6.3 | ¼ | --- | --- | --- | --- | --- |
| 4.75 | #4 | 780.7 | 14.4 | 73.9 | 74 | --- |
| Pan | | 4010.6 | 73.8 | 0.1 | 0.1 | --- |
| Total | | 5429.0 | 99.9 | +#4 Gradation Check | | -0.10% |
| | | | | within 0.3% of the original dry wt. | | |

| Sieve Size mm | Sieve Size # | Wt. Ret. (0.1 g) | % of Total (0.1%) | Acc % Pass (0.1%) | Acc % Pass (rounded) | Specified % Pass |
|---|---|---|---|---|---|---|
| 2.360 | 8 | 458.2 | 8.4 | 65.5 | 65 | --- |
| 2.000 | 10 | 111.1 | 2.0 | 63.4 | 63 | --- |
| 1.180 | 16 | 316.1 | 5.8 | 57.6 | 58 | --- |
| 0.850 | 20 | 225.9 | 4.2 | 53.5 | 53 | --- |
| 0.600 | 30 | 284.3 | 5.2 | 48.2 | 48 | --- |
| 0.425 | 40 | 387.5 | 7.1 | 41.1 | 41 | --- |
| 0.300 | 50 | 427.9 | 7.9 | 33.2 | 33 | --- |
| 0.208 | 65 | 287.2 | 5.3 | 27.9 | 28 | --- |
| 0.180 | 80 | 100.3 | 1.8 | 26.1 | 26 | --- |
| 0.150 | 100 | 78.7 | 1.4 | 24.6 | 25 | --- |
| 0.075 | 200 | 171.0 | 3.1 | 21.5 | 21.5 | --- |
| Pan | | 70.0 | 1.3 | 0.3 | 0.3 | --- |
| Wash | | 1080.2 | 19.9 | | | |
| Total | | 3998.3 | 73.6 | -#4 Gradation Check | | -0.31% |
| | | | | within 0.3% of the original dry wt. | | |

**Geotechnical Engineering**
**Environmental Services**
**Materials Testing**

## Particle Size Analysis

| | | | |
|---|---|---|---|
| Project | Dorris Cummins Estate Property Gravel Exploration | Source | Boring #1 |
| Location | SD25 from 205th St to 206th St; Kingsbury Co., SD | Sample | #2 |
| Job No. | 01-20-064 | Depth | 8' - 14' |

**Original Dry Sample Weight** 5222

| Sieve Size mm | Sieve Size in / # | Wt. Ret. (0.1 g) | % of Total (0.1%) | Acc % Pass (0.1%) | Acc % Pass (rounded) | Specified % Pass |
|---|---|---|---|---|---|---|
| 50.0 | 2 | 0.0 | 0.0 | 1.0 | 100 | --- |
| 37.5 | 1½ | --- | --- | --- | --- | --- |
| 31.5 | 1¼ | --- | --- | --- | --- | --- |
| 25.0 | 1 | 48.5 | 0.9 | 99.1 | 99 | --- |
| 19.0 | ¾ | 107.5 | 2.1 | 97.0 | 97 | --- |
| 12.5 | ½ | 165.5 | 3.2 | 93.8 | 94 | --- |
| 9.5 | ⅜ | 189.8 | 3.6 | 90.2 | 90 | --- |
| 6.3 | ¼ | --- | --- | --- | --- | --- |
| 4.75 | #4 | 477.9 | 9.2 | 81.1 | 81 | --- |
| Pan | | 4232.0 | 81.0 | 0.0 | 0.0 | --- |
| Total | | 5221.2 | 100.0 | +#4 Gradation Check | | -0.02% |
| | | | | within 0.3% of the original dry wt. | | |

| Sieve Size mm | Sieve Size # | Wt. Ret. (0.1 g) | % of Total (0.1%) | Acc % Pass (0.1%) | Acc % Pass (rounded) | Specified % Pass |
|---|---|---|---|---|---|---|
| 2.360 | 8 | 462.7 | 8.9 | 72.2 | 72 | --- |
| 2.000 | 10 | 185.1 | 3.5 | 68.7 | 69 | --- |
| 1.180 | 16 | 438.0 | 8.4 | 60.3 | 60 | --- |
| 0.850 | 20 | 290.3 | 5.6 | 54.7 | 55 | --- |
| 0.600 | 30 | 326.9 | 6.3 | 48.4 | 48 | --- |
| 0.425 | 40 | 356.8 | 6.8 | 41.6 | 42 | --- |
| 0.300 | 50 | 386.8 | 7.4 | 34.2 | 34 | --- |
| 0.208 | 65 | 320.2 | 6.1 | 28.1 | 28 | --- |
| 0.180 | 80 | 203.0 | 3.9 | 24.2 | 24 | --- |
| 0.150 | 100 | 149.8 | 2.9 | 21.3 | 21 | --- |
| 0.075 | 200 | 354.8 | 6.8 | 14.5 | 14.5 | --- |
| Pan | | 6.7 | 0.1 | 0.1 | 0.1 | --- |
| Wash | | 744.3 | 14.3 | | | |
| Total | | 4225.3 | 80.9 | -#4 Gradation Check | | -0.16% |
| | | | | within 0.3% of the original dry wt. | | |

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**Environmental Services**
**Materials Testing**

## Particle Size Analysis

| | | | |
|---|---|---|---|
| Project | Dorris Cummins Estate Property Gravel Exploration | Source | Boring #2 |
| Location | SD25 from 205th St to 206th St; Kingsbury Co., SD | Sample | #2 |
| Job No. | 01-20-064 | Depth | 19' - 24' |

**Original Dry Sample Weight** 5697.2

| Sieve Size mm | Sieve Size in / # | Wt. Ret. (0.1 g) | % of Total (0.1%) | Acc % Pass (0.1%) | Acc % Pass (rounded) | Specified % Pass |
|---|---|---|---|---|---|---|
| 50.0 | 2 | 0.0 | 0.0 | 1.0 | 100 | --- |
| 37.5 | 1½ | --- | --- | --- | --- | --- |
| 31.5 | 1¼ | --- | --- | --- | --- | --- |
| 25.0 | 1 | 0.0 | 0.0 | 100.0 | 100 | --- |
| 19.0 | ¾ | 16.8 | 0.3 | 99.7 | 100 | --- |
| 12.5 | ½ | 55.4 | 1.0 | 98.7 | 99 | --- |
| 9.5 | ⅜ | 49.6 | 0.9 | 97.9 | 98 | --- |
| 6.3 | ¼ | --- | --- | --- | --- | --- |
| 4.75 | #4 | 225.8 | 4.0 | 93.9 | 94 | --- |
| Pan | | 5346.1 | 93.8 | 0.1 | 0.1 | --- |
| Total | | 5693.7 | 99.9 | +#4 Gradation Check | | -0.06% |
| | | | | within 0.3% of the original dry wt. | | |

| Sieve Size mm | Sieve Size # | Wt. Ret. (0.1 g) | % of Total (0.1%) | Acc % Pass (0.1%) | Acc % Pass (rounded) | Specified % Pass |
|---|---|---|---|---|---|---|
| 2.360 | 8 | 195.4 | 3.4 | 90.5 | 90 | --- |
| 2.000 | 10 | 103.6 | 1.8 | 88.7 | 89 | --- |
| 1.180 | 16 | 451.1 | 7.9 | 80.7 | 81 | --- |
| 0.850 | 20 | 296.3 | 5.2 | 75.5 | 76 | --- |
| 0.600 | 30 | 310.7 | 5.5 | 70.1 | 70 | --- |
| 0.425 | 40 | 602.4 | 10.6 | 59.5 | 60 | --- |
| 0.300 | 50 | 1062.6 | 18.7 | 40.9 | 41 | --- |
| 0.208 | 65 | 621.3 | 10.9 | 29.9 | 30 | --- |
| 0.180 | 80 | 261.1 | 4.6 | 25.4 | 25 | --- |
| 0.150 | 100 | 228.7 | 4.0 | 21.4 | 21 | --- |
| 0.075 | 200 | 390.8 | 6.9 | 14.5 | 14.5 | --- |
| Pan | | 9.9 | 0.2 | 0.1 | 0.1 | --- |
| Wash | | 808.6 | 14.2 | | | |
| Total | | 5342.5 | 93.8 | -#4 Gradation Check | | -0.07% |
| | | | | within 0.3% of the original dry wt. | | |

**Geotechnical Engineering**
**Environmental Services**
**Materials Testing**

## Particle Size Analysis

| | | | |
|---|---|---|---|
| Project | Dorris Cummins Estate Property Gravel Exploration | Source | Boring #4 |
| Location | SD25 from 205th St to 206th St; Kingsbury Co., SD | Sample | #1 |
| Job No. | 01-20-064 | Depth | 14' - 19' |

**Original Dry Sample Weight** 5707.9

| Sieve Size mm | Sieve Size in / # | Wt. Ret. (0.1 g) | % of Total (0.1%) | Acc % Pass (0.1%) | Acc % Pass (rounded) | Specified % Pass |
|---|---|---|---|---|---|---|
| 50.0 | 2 | 0.0 | 0.0 | 1.0 | 100 | --- |
| 37.5 | 1½ | --- | --- | --- | --- | --- |
| 31.5 | 1¼ | --- | --- | --- | --- | --- |
| 25.0 | 1 | 337.4 | 5.9 | 94.1 | 94 | --- |
| 19.0 | ¾ | 320.0 | 5.6 | 88.5 | 88 | --- |
| 12.5 | ½ | 394.6 | 6.9 | 81.6 | 82 | --- |
| 9.5 | ⅜ | 355.3 | 6.2 | 75.3 | 75 | --- |
| 6.3 | ¼ | --- | --- | --- | --- | --- |
| 4.75 | #4 | 814.3 | 14.3 | 61.1 | 61 | --- |
| Pan | | 3482.0 | 61.0 | 0.1 | 0.1 | --- |
| Total | | 5703.6 | 99.9 | +#4 Gradation Check | | -0.08% |
| | | | | within 0.3% of the original dry wt. | | |

| Sieve Size mm | Sieve Size # | Wt. Ret. (0.1 g) | % of Total (0.1%) | Acc % Pass (0.1%) | Acc % Pass (rounded) | Specified % Pass |
|---|---|---|---|---|---|---|
| 2.360 | 8 | 456.2 | 8.0 | 53.1 | 53 | --- |
| 2.000 | 10 | 90.5 | 1.6 | 51.5 | 51 | --- |
| 1.180 | 16 | 293.0 | 5.1 | 46.4 | 46 | --- |
| 0.850 | 20 | 201.9 | 3.5 | 42.8 | 43 | --- |
| 0.600 | 30 | 210.1 | 3.7 | 39.1 | 39 | --- |
| 0.425 | 40 | 237.5 | 4.2 | 35.0 | 35 | --- |
| 0.300 | 50 | 250.2 | 4.4 | 30.6 | 31 | --- |
| 0.208 | 65 | 211.1 | 3.7 | 26.9 | 27 | --- |
| 0.180 | 80 | 89.0 | 1.6 | 25.3 | 25 | --- |
| 0.150 | 100 | 77.8 | 1.4 | 24.0 | 24 | --- |
| 0.075 | 200 | 171.9 | 3.0 | 21.0 | 21.0 | --- |
| Pan | | 4.1 | 0.1 | 0.2 | 0.2 | --- |
| Wash | | 1181.0 | 20.7 | | | |
| Total | | 3474.4 | 60.9 | -#4 Gradation Check | | -0.22% |
| | | | | within 0.3% of the original dry wt. | | |

**Geotechnical Engineering**
**Environmental Services**
**Materials Testing**

## Particle Size Analysis

| | | | |
|---|---|---|---|
| Project | Dorris Cummins Estate Property Gravel Exploration | Source | Boring #5 |
| Location | SD25 from 205th St to 206th St; Kingsbury Co., SD | Sample | #1 |
| Job No. | 01-20-064 | Depth | 1' - 9' |

**Original Dry Sample Weight** 5533.4

| Sieve Size mm | Sieve Size in / # | Wt. Ret. (0.1 g) | % of Total (0.1%) | Acc % Pass (0.1%) | Acc % Pass (rounded) | Specified % Pass |
|---|---|---|---|---|---|---|
| 50.0 | 2 | 0.0 | 0.0 | 1.0 | 100 | --- |
| 37.5 | 1½ | --- | --- | --- | --- | --- |
| 31.5 | 1¼ | --- | --- | --- | --- | --- |
| 25.0 | 1 | 24.0 | 0.4 | 99.6 | 100 | --- |
| 19.0 | ¾ | 71.2 | 1.3 | 98.3 | 98 | --- |
| 12.5 | ½ | 198.0 | 3.6 | 94.7 | 95 | --- |
| 9.5 | ⅜ | 133.8 | 2.4 | 92.3 | 92 | --- |
| 6.3 | ¼ | --- | --- | --- | --- | --- |
| 4.75 | #4 | 494.1 | 8.9 | 83.4 | 83 | --- |
| Pan | | 4609.1 | 83.3 | 0.1 | 0.1 | --- |
| Total | | 5530.2 | 99.9 | +#4 Gradation Check | | -0.06% |
| | | | | within 0.3% of the original dry wt. | | |

| Sieve Size mm | Sieve Size # | Wt. Ret. (0.1 g) | % of Total (0.1%) | Acc % Pass (0.1%) | Acc % Pass (rounded) | Specified % Pass |
|---|---|---|---|---|---|---|
| 2.360 | 8 | 342.8 | 6.2 | 77.2 | 77 | --- |
| 2.000 | 10 | 116.7 | 2.1 | 75.0 | 75 | --- |
| 1.180 | 16 | 460.3 | 8.3 | 66.7 | 67 | --- |
| 0.850 | 20 | 317.1 | 5.7 | 61.0 | 61 | --- |
| 0.600 | 30 | 327.6 | 5.9 | 55.1 | 55 | --- |
| 0.425 | 40 | 397.6 | 7.2 | 47.9 | 48 | --- |
| 0.300 | 50 | 457.1 | 8.3 | 39.6 | 40 | --- |
| 0.208 | 65 | 414.5 | 7.5 | 32.1 | 32 | --- |
| 0.180 | 80 | 122.3 | 2.2 | 29.9 | 30 | --- |
| 0.150 | 100 | 109.5 | 2.0 | 28.0 | 28 | --- |
| 0.075 | 200 | 210.1 | 3.8 | 24.2 | 24.2 | --- |
| Pan | | 4.8 | 0.1 | 0.2 | 0.2 | --- |
| Wash | | 1322.3 | 23.9 | | | |
| Total | | 4602.7 | 83.2 | -#4 Gradation Check | | -0.14% |
| | | | | within 0.3% of the original dry wt. | | |

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**Environmental Services**
**Materials Testing**

## Particle Size Analysis

| | | | |
|---|---|---|---|
| Project | Dorris Cummins Estate Property Gravel Exploration | Source | Boring #5 |
| Location | SD25 from 205th St to 206th St; Kingsbury Co., SD | Sample | #2 |
| Job No. | 01-20-064 | Depth | 34' - 39' |

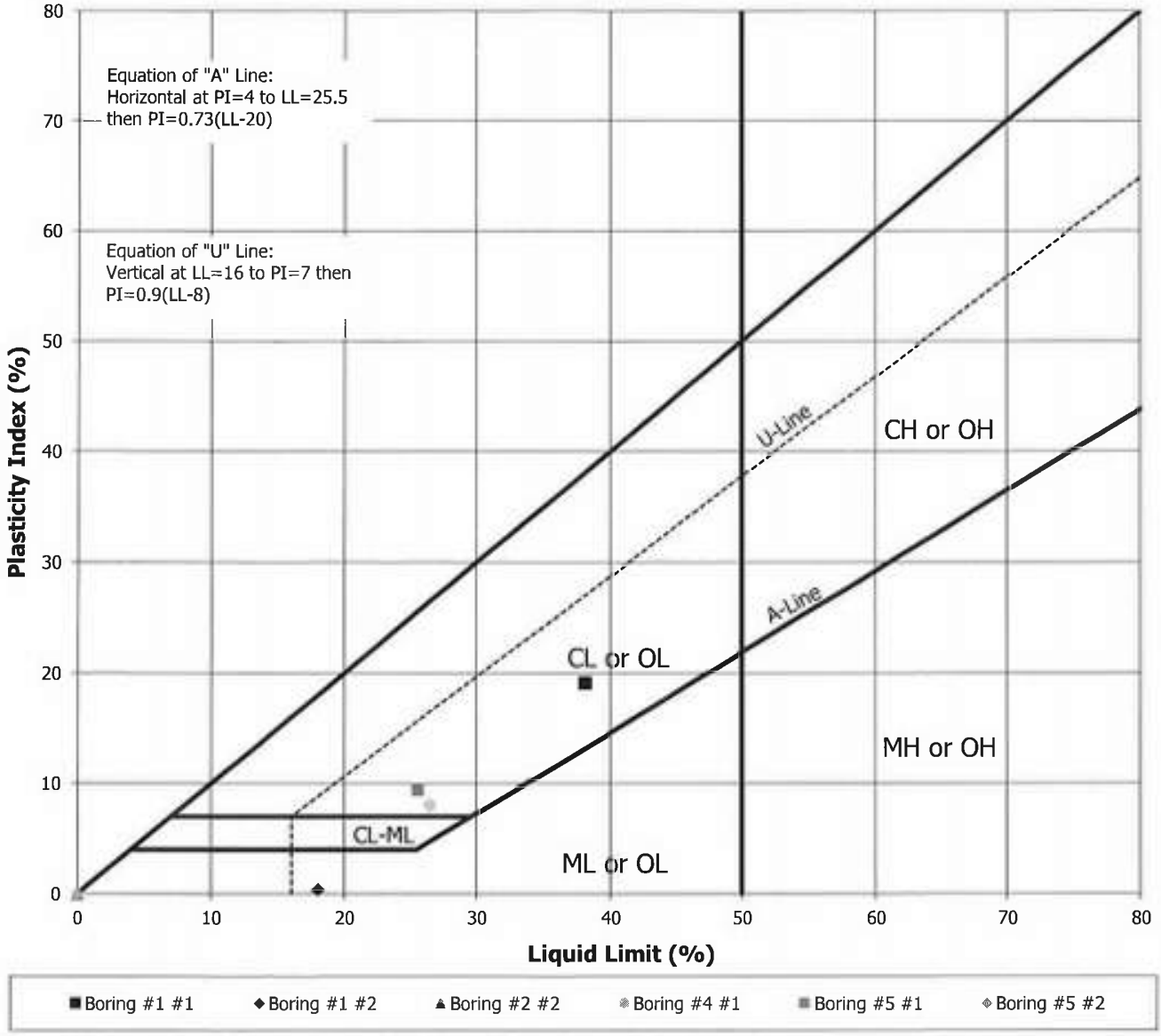
**Original Dry Sample Weight** 5611.7

| Sieve Size mm | Sieve Size in / # | Wt. Ret. (0.1 g) | % of Total (0.1%) | Acc % Pass (0.1%) | Acc % Pass (rounded) | Specified % Pass |
|---|---|---|---|---|---|---|
| 50.0 | 2 | 0.0 | 0.0 | 1.0 | 100 | --- |
| 37.5 | 1½ | --- | --- | --- | --- | --- |
| 31.5 | 1¼ | --- | --- | --- | --- | --- |
| 25.0 | 1 | 0.0 | 0.0 | 100.0 | 100 | --- |
| 19.0 | ¾ | 15.3 | 0.3 | 99.7 | 100 | --- |
| 12.5 | ½ | 28.1 | 0.5 | 99.2 | 99 | --- |
| 9.5 | ⅜ | 47.0 | 0.8 | 98.4 | 98 | --- |
| 6.3 | ¼ | --- | --- | --- | --- | --- |
| 4.75 | #4 | 120.5 | 2.1 | 96.2 | 96 | --- |
| Pan | | 5400.6 | 96.2 | 0.0 | 0.0 | --- |
| Total | | 5611.5 | 100.0 | +#4 Gradation Check | | 0.00% |
| | | | | within 0.3% of the original dry wt. | | |

| Sieve Size mm | Sieve Size # | Wt. Ret. (0.1 g) | % of Total (0.1%) | Acc % Pass (0.1%) | Acc % Pass (rounded) | Specified % Pass |
|---|---|---|---|---|---|---|
| 2.360 | 8 | 649.4 | 11.6 | 84.7 | 85 | --- |
| 2.000 | 10 | 176.9 | 3.2 | 81.5 | 82 | --- |
| 1.180 | 16 | 559.1 | 10.0 | 71.6 | 72 | --- |
| 0.850 | 20 | 394.0 | 7.0 | 64.5 | 65 | --- |
| 0.600 | 30 | 414.1 | 7.4 | 57.2 | 57 | --- |
| 0.425 | 40 | 519.0 | 9.2 | 47.9 | 48 | --- |
| 0.300 | 50 | 590.1 | 10.5 | 37.4 | 37 | --- |
| 0.208 | 65 | 540.0 | 9.6 | 27.8 | 28 | --- |
| 0.180 | 80 | 169.7 | 3.0 | 24.7 | 25 | --- |
| 0.150 | 100 | 168.7 | 3.0 | 21.7 | 22 | --- |
| 0.075 | 200 | 295.5 | 5.3 | 16.5 | 16.5 | --- |
| Pan | | 111.3 | 2.0 | 0.0 | 0.0 | --- |
| Wash | | 810.9 | 14.4 | | | |
| Total | | 5398.8 | 96.2 | -#4 Gradation Check | | -0.03% |
| | | | | within 0.3% of the original dry wt. | | |

## Soil Classification Chart

Unified Soil Classification System




**Test Results**

| Source | Sample | Depth | LL (%) | PL (%) | PI (%) | Classification |
|---|---|---|---|---|---|---|
| Boring #1 | #1 | 4' - 8' | 38 | 19 | 19 | CL |
| Boring #1 | #2 | 8' - 14' | 18 | 18 | 0 | ML |
| Boring #2 | #2 | 19' - 24' | 0 | 0 | 0 | ML |
| Boring #4 | #1 | 14' - 19' | 26 | 18 | 8 | CL |
| Boring #5 | #1 | 1' - 9' | 26 | 16 | 9 | CL |
| Boring #5 | #2 | 34' - 39' | 0 | 0 | 0 | ML |

**Project Information**

| | | | |
|---|---|---|---|
| **Project:** | Dorris Cummins Estate Property Gravel Exploration | **Job Number:** | 01-20-064 |
| **Location:** | SD Hwy 25 from 205th St to 206th St; Kingsbury County, SD | **Date:** | 11/3/2020 |

CORE engineering & Consulting, LLC

# ATTERBERG LIMITS TEST RESULTS
## (ASTM:D4318)

# BORING LOG NOTES

## DRILLING AND SAMPLING SYMBOLS

| Symbol | Definition |
|---|---|
| B,H,N: | Size of flush-joint casing |
| CA: | Crew Assistant (initials) |
| CAS: | Pipe casing, number indicates nominal diameter in inches |
| CC: | Crew Chief (initials) |
| COT: | Clean-out tube |
| DC: | Drive casing; number indicates diameter in inches |
| DM: | Drilling mud or bentonite slurry |
| DS: | Disturbed sample from auger flights |
| FA: | Solid-stem flight auger; number indicates outside diameter in inches |
| HA: | Hand auger; number indicates outside diameter |
| HSA: | Hollow stem auger; number indicates inside diameter in inches |
| MC: | Column used to describe moisture condition of samples and for the ground water level symbols |
| N (BPF): | Standard penetration resistance (N-value) in blows per foot (see notes) |
| NQ: | NQ wireline core barrel |
| PQ: | PQ wireline core barrel |
| RD: | Rotary drilling with fluid and roller or drag bit |
| 94mm: | 94 millimeter wireline core barrel |
| thin-walled tube sampling, the recovered length (in inches) | of sample. In rock coring, the length of core recovered (expressed as percent of the total core run). Zero indicates no sample recovered. |
| REV: | Revert drilling fluid |
| 2L: | California-spoon sampler (steel; 2" inside diameter with 4" long brass liners; 3" outside diameter) |
| SS: | Standard split-spoon sampler (steel; 1⅜" inside diameter; 2" outside diameter); unless indicated otherwise |
| SU: | Spin-up sample from hollow stem auger |
| TW: | Thin-walled tube; number indicates inside diameter in inches |
| WC: | Core sample of pavement materials cut using a diamond-tipped wet saw |
| WASH: | Sample of material obtained by screening returning rotary drilling fluid or by which has collected inside the borehole after "falling" through drilling fluid |
| WH: | Sampler advanced by static weight of drill rod and 140 lb hammer |
| WR: | Sampler advanced by static weight of drill rod |
| ▼ | Water level directly measured in boring |
| ▽ | Estimated water level based solely on sample appearance |

## TEST SYMBOLS

| Symbol | Definition |
|---|---|
| CONS: | One-dimensional consolidation test |
| DEN: | Dry density, pcf |
| DST: | Direct shear test |
| E: | Pressuremeter Modulus, tsf |
| HYD: | Hydrometer analysis |
| LL: | Liquid Limit, % |
| LP: | Pressuremeter Limit Pressure, tsf |
| OC: | Organic Content, % |
| PERM: | Coefficient of permeability (K) test; F – Field; L-Laboratory |
| PL: | Plastic Limit, % |
| $q_p$: | Pocket Penetrometer strength, tsf (approximate) |
| $q_c$: | Static cone bearing pressure, tsf |
| $q_u$: | Unconfined compressive strength, psf |
| R: | Electrical Resistivity, ohm-cms |
| RQD: | Rock Quality Designation of Rock Core, in percent (aggregate length of core pieces 4" or more in length as a percent of total core run) |
| SA: | Sieve analysis |
| TRX: | Triaxial compression test |
| VSR: | Vane shear strength, remolded (field), psf |
| VSU: | Vane shear strength, undisturbed (field), psf |
| WC: | Water content, as percent of dry weight |
| %-200: | Percent of material finer than #200 sieve |

## STANDARD PENETRATION TEST NOTES

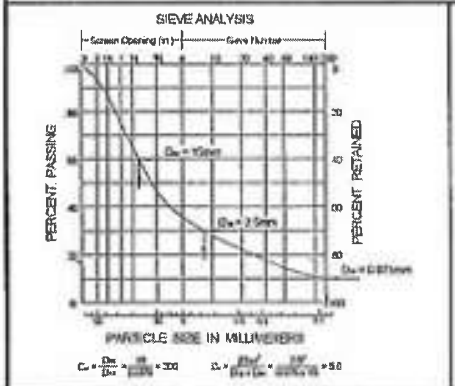
The standard penetration test consists of driving the sampler with a 140 pound hammer and counting the number of blows applied in each of three 6" increments of penetration. If the sampler is driven less than 18" (usually in highly resistant material), permitted in ASTM:D1586, the blows for each complete 6" increment and for each partial increment is on the boring log. For partial increments, the number of blows is shown to the nearest 0.1' below the slash. An "R" in the N-value column indicates refusal of the sampler prior to completing the initial 6" set.

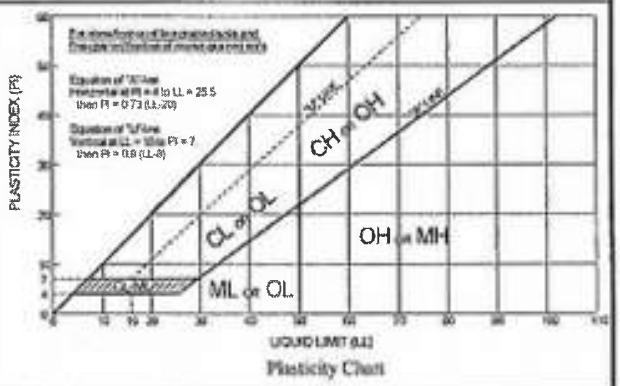
The length of sample recovered, as shown on the "REC" column, may be greater than the distance indicated in the N column. The disparity is because the N-value is recorded below the initial 6" set (unless partial penetration defined in ASTM:D1586 is encountered) whereas the length of sample recovered is for the entire sampler drive (which may even extend more than 18").

# UNIFIED SOIL CLASSIFICATION SYSTEM
## ASTM Designations: D 2487, D2488

Core Engineering & Consulting, Inc.
115 West Beebe Avenue
PO Box 456
Chamberlain, SD 57325

| Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A] | | | | Soil Classification: Group Symbol | Soil Classification: Group Name[B] |
|---|---|---|---|---|---|
| Coarse-Grained Soils More than 50% retained on No. 200 sieve | Gravels More than 50% coarse fraction retained on No. 4 sieve | Clean Gravels Less than 5% fines[C] | $C_u \geq 4$ and $1 \leq C_c \leq 3$[E] | GW | Well graded gravel[F] |
| | | | $C_u < 4$ and/or $1 > C_c > 3$[E] | GP | Poorly graded gravel[F] |
| | | Gravels with Fines more than 12% fines[C] | Fines classify as ML or MH | GM | Silty gravel[F,G,H] |
| | | | Fines classify as CL or CH | GC | Clayey gravel[F,G,H] |
| | Sands 50% or more of coarse fraction passes No. 4 sieve | Clean Sands Less than 5% fines[D] | $C_u \geq 6$ and $1 \leq C_c \leq 3$[E] | SW | Well-graded sand[I] |
| | | | $C_u < 6$ or $1 > C_c > 3$[E] | SP | Poorly-graded sand[I] |
| | | Sands with Fines more than 12% fines[D] | Fines classify as ML or MH | SM | Silty sand[G,H,I] |
| | | | Fines classify as CL or CH | SC | Clayey sand[G,H,I] |
| Fine-Grained Soils 50% or more passes the No. 200 sieve (see Plasticity Chart below) | Silts and Clays Liquid limit less than 50 | inorganic | PI>7 and plots on or above "A" line[J] | CL | Lean clay[K,L,M] |
| | | | PI<4 or plots below "A" line[J] | ML | Silt[K,L,M] |
| | | organic | Liquid limit–oven dried / Liquid limit – not dried < 0.75 | OL | Organic clay[K,L,M,N] / Organic silt[K,L,M,O] |
| | Silts and Clays Liquid limit 50 or more | inorganic | PI plots on or above "A" line | CH | Fat clay[K,L,M] |
| | | | PI plots below "A" line | MH | Elastic silt[K,L,M] |
| | | organic | Liquid limit–oven dried / Liquid limit – not dried < 0.75 | OH | Organic clay[K,L,M,P] / Organic silt[K,L,M,Q] |
| Highly organic soil | | | Primarily organic matter, dark in color, and organic in odor | PT | Peat[R] |



Plasticity Chart

### Notes

[A] Based on the material passing the 3-in (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay

[D] Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

[E] $C_u = D_{60} / D_{10}$, $C_c = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot is hatched area, soils is a CL-ML silty clay.

[K] If soil contains 15 to 29% plus No. 200 add "with sand" or "with gravel", whichever is predominant.

[L] If soil contains ≥30% plus No. 200, predominantly sand, add "sandy" to group name.

[M] If soil contains ≥30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI≥4 and plots on or above "A" line.

[O] PI<4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.

[R] Fiber Content description shown below.

## ADDITIONAL TERMINOLOGY NOTES USED BY CEC FOR SOIL IDENTIFICATION AND DESCRIPTION

### Grain Size

| Term | Particle Size |
|---|---|
| Boulders | Over 12" |
| Cobbles | 3" to 12" |
| Gravel | #4 sieve to 3" |
| Sand | #200 to #4 sieve |
| Fines (silt & clay) | Pass #200 sieve |

### Gravel Percentages

| Term | Percent |
|---|---|
| A Little Gravel | 3% - 14% |
| With Gravel | 15% - 29% |
| Gravelly | 30% - 50% |

### Consistency of Plastic Soils

| Term | N-Value, BPF |
|---|---|
| Very Soft | less than 2 |
| Soft | 2 - 4 |
| Firm | 5 - 8 |
| Stiff | 9 - 15 |
| Very Stiff | 16 - 30 |
| Hard | Greater than 30 |

### Relative Density of Non-Plastic Soils

| Term | N-Value, BPF |
|---|---|
| Very Loose | 0 - 4 |
| Loose | 5 - 10 |
| Medium Dense | 11 - 30 |
| Dense | 31 - 50 |
| Very Dense | Greater than 50 |

### Moisture/Frost Condition

(MC Column)

| | |
|---|---|
| D (Dry): | Absense of moisture, dusty, dry to touch. |
| M (Moist): | Damp, although free water not visible. Soil may still have a high water content (over "optimum"). |
| W (Wet/ Waterbearing): | Free water visible intended to describe non-plastic soils. Waterbearing usually relates to sands and sand with silt. |
| F (Frozen): | Soil frozen |

### Layering Notes

| | |
|---|---|
| Laminations: | Layers less than ½" thick of differing material or color. |
| Lenses: | Pockets or layers greater than ½" thick of differing material or color. |

### Fiber Content of Peat

| Term | Fiber Content (Visual Estimate) |
|---|---|
| Fibric Peat: | Greater than 67% |
| Hemic Peat: | 33 – 67% |
| Sapric Peat: | Less than 33% |

### Organic/Roots Description (if no lab tests)

Soils are described as organic, if soil is not peat and is judged to have sufficient organic fines content to influence the soil properties. *Slightly organic* used for borderline cases.

| | |
|---|---|
| With roots: | Judged to have sufficient quantity of roots to influence the soil properties. |
| Trace roots: | Small roots present, but not judged to be in sufficient quantity to significantly affect soil properties. |