

APPENDIX I

Water Resources

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Appendix I.1

Agency Correspondence

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From: Carroll, Daniel <Daniel.Carroll@rsandh.com>
Sent: Tuesday, March 4, 2025 12:54 PM
To: scott.wilson@dnr.iowa.gov; floodplain-help@dnr.iowa.gov
Cc: Gentile, Nicholas <Nicholas.Gentile@rsandh.com>; Barrow, Julie <Julie.Barrow@rsandh.com>; Christopher, Darren <Darren.Christopher@rsandh.com>
Subject: NEPA/EA Early Agency Coordination Letter - Sioux Gateway Airport Runway Program

Mr. Wilson,

As a part of the Environmental Assessment associated with the Runway Program at the Sioux Gateway Airport, the attached document is the agency scoping document that was sent to all agencies in April 2024 that had jurisdiction over environmental resources that could be affected by the proposed project. At the time of agency scoping, floodplains were not identified as an environmental resource that could be affected. However, since agency scoping, the FEMA FIRMs have been revised, and the proposed project could now affect floodplains. Please review the information for project background only, as some of the information in this document is out of date (i.e., schedule) and let us know if you have any questions.

Thanks and we appreciate your cooperation in advance.

Dan

Daniel Carroll, PE
Senior Engineer, Water Resources
436 S Main St, Plymouth, MI 48170
O 734-456-7063 | M 313-300-3868

From: Ron Kueny <rkueny@sioux-city.org>
Sent: Thursday, April 17, 2025 2:49 PM
To: Carroll, Daniel <Daniel.Carroll@rsandh.com>
Cc: Gentile, Nicholas <Nicholas.Gentile@rsandh.com>; Barrow, Julie <Julie.Barrow@rsandh.com>; Christopher, Darren <Darren.Christopher@rsandh.com>
Subject: [External] RE: SUX EA: City Coordination on Floodplains Impact

External Sender: Please use caution with links and attachments. Mr. Carroll,

I am in receipt of your request and apologize for the delayed response. I've been out of the office for some time due to an unexpected family matter. Please note that the City of Sioux City floodplain requirements do align with FEMA's and IDNR's so I would concur that meeting those floodplain requirements will also satisfactorily meet the City of Sioux City's floodplain requirements. A local floodplain development permit will be required. Documentation submitted to the IDNR is typically the same/similar to the information required to be submitted for this permit. Also, note there is no cost for this permit but we do need to have it on file before work begins.

Any questions please advise.

Thanks,
Ron

Ron Kueny
Zoning Enforcement Officer

City of Sioux City
405 6th Street
P.O. Box 447
Sioux City, IA 51102

Phone # 712-279-6226

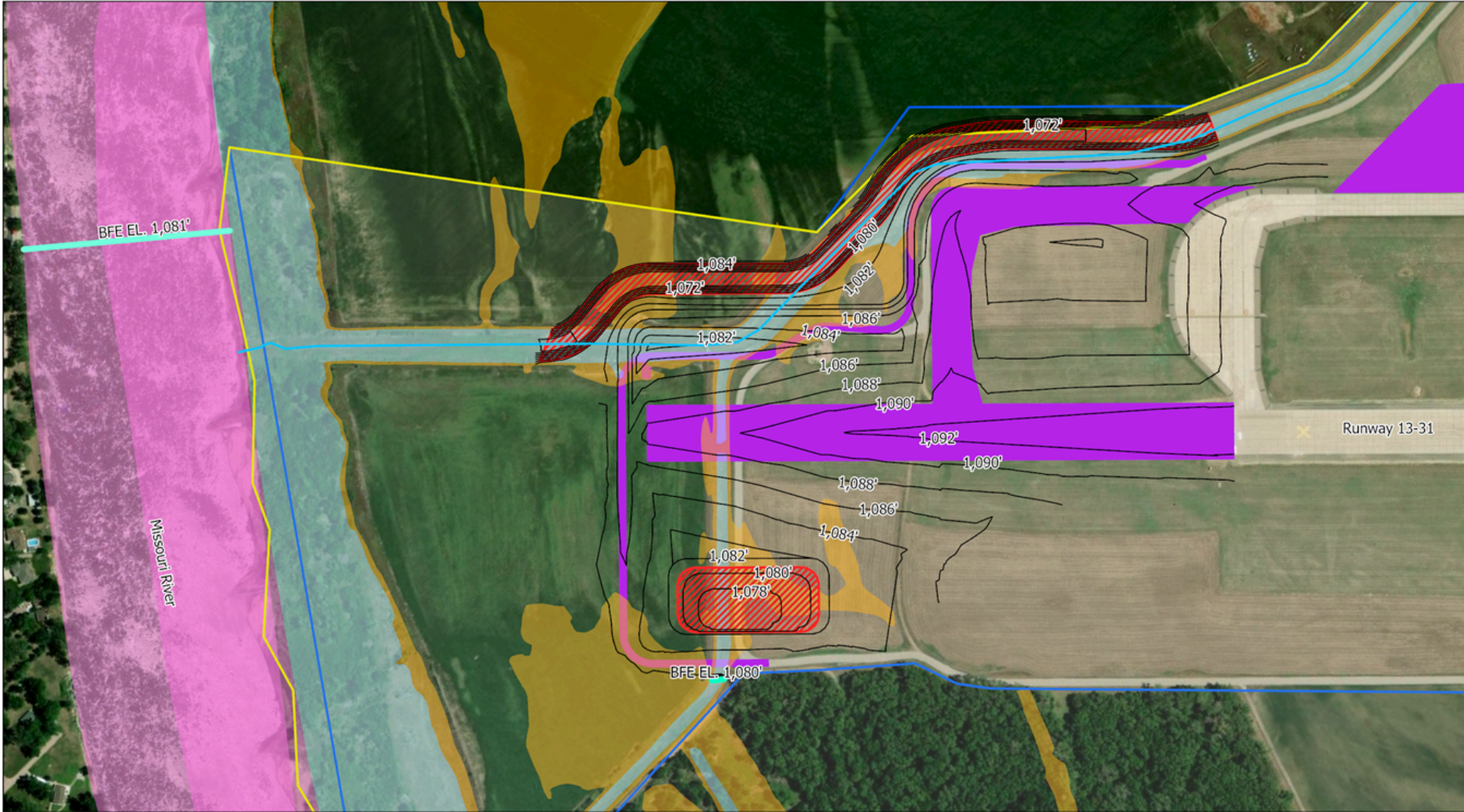
From: Carroll, Daniel <Daniel.Carroll@rsandh.com>
Sent: Wednesday, March 19, 2025 3:41 PM
To: Ron Kueny <rkueny@sioux-city.org>
Cc: Gentile, Nicholas <Nicholas.Gentile@rsandh.com>; Barrow, Julie <Julie.Barrow@rsandh.com>; Christopher, Darren <Darren.Christopher@rsandh.com>
Subject: SUX EA: City Coordination on Floodplains Impact

CAUTION: This email originated from **OUTSIDE** of the organization. Please verify the sender and use caution if the message contains any attachments, links, or requests for information as this person may NOT be who they claim. **If you are asked for your username and password, please call WCICC and DO NOT ENTER any data.**

Mr. Kueny,
As mentioned in previous correspondence, the SUX NEXUS project intends to impact the 100-year floodplain at the Sioux City Airport. The proposed improvements intend to comply with relevant FEMA and IDNR floodplain criteria. We are requesting concurrence that meeting the floodplain requirements of both FEMA and the IDNR would be satisfactory to meet City requirements.

The proposed improvements will result in encroachment into the FEMA-delineated 100-year floodplain in both the reshaping of the major drainageway at the along the northern boundary of the airfield and as a result of filling drainage ditch in the area of the north end runway extension. The proposed improvements will create compensatory flood storage areas below the 100-year BFE as part of the proposed improvements. This area will contain approximately 4,700 cubic yards of flood storage.

Prior to construction, the Airport will obtain relevant IDNR Floodplain Permits that would document floodplain impacts. The improvements will be categorized as a channel realignment which will demonstrate no change in the 100-year BFE through proving that the realigned channel will have at least the same capacity as those in existing conditions and that proposed channel velocities would not cause excessive erosion. Additionally, the improvements will demonstrate no adverse impacts on floodwater backwater affects and that sufficient freeboard is maintained above the 100-year BFE. IDNR may also require a Letter of Map Change (LOMC) and/or Letter of Map Revision (LOMR) to be submitted to FEMA Region 7.



Source: RS&H, 2024; ESRI, 2024; Iowa DNR, 2022; USGS, 2023

Legend

- | | | |
|-----------------------------|---|--------------------|
| Proposed Pavement | 100-year Floodplain | Airport Property |
| Existing Stormwater Channel | 500-year Floodplain | Project Study Area |
| Base Flood Elevation (BFE) | Preliminary Proposed Elevation Contour (2 foot) | |
| Floodway | Proposed Floodplain Compensatory Storage | |

0 500 1,000 Feet
Note: Proposed elevation contours shown are based on the North American Vertical Datum of 1988 (NAVD88).

If you could respond back to this e-mail with concurrence that the propose action detailed above will be satisfactory to meet City requirements we would greatly appreciate it.

Please let me know if you have any questions.

Thanks,
Dan

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From: Carroll, Daniel
Sent: Tuesday, March 4, 2025 1:02 PM
To: rkueny@sioux-city.org
Cc: Gentile, Nicholas <Nicholas.Gentile@rsandh.com>; Barrow, Julie <Julie.Barrow@rsandh.com>; Christopher, Darren <Darren.Christopher@rsandh.com>
Subject: NEPA/EA Early Agency Coordination Letter - Sioux Gateway Airport Runway Program

Mr. Keuny,

As a part of the Environmental Assessment associated with the Runway Program at the Sioux Gateway Airport, the attached document is the agency scoping document that was sent to all agencies in April 2024 that had jurisdiction over environmental resources that could be affected by the proposed project. At the time of agency scoping, floodplains were not identified as an environmental resource that could be affected. However, since agency scoping, the FEMA FIRMs have been revised, and the proposed project could now affect floodplains. Please review the information for project background only, as some of the information in this document is out of date (i.e., schedule) and let us know if you have any questions.

Thanks and we appreciate your cooperation in advance.

Dan

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Appendix I.2

Water Resources Report

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June 2025

Sioux Gateway Airport Runway Improvements Project EA: Water Resources Analysis





**Sioux Gateway Airport
Runway Improvements Project
EA: Water Resources Analysis**

June 2025
Woodbury County, Iowa
RS&H No.: 1014-4998-003

Prepared by RS&H Iowa, P.C. at the
direction of the City of Sioux City

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1 Introduction

The City of Sioux City (Airport Sponsor) owns and operates the Sioux Gateway Airport (Airport), a public and military shared-use airport located in Woodbury County, Iowa, approximately seven (7) miles south of downtown Sioux City, Iowa. The Airport Sponsor contracted RS&H Iowa, P.C. (RS&H) to perform an Environmental Assessment (EA) for the Proposed Action at the Airport, which includes Runway 13-31 reconstruction, strengthening, and extension, parallel taxiway expansion, land acquisition, and other associated development to support the Airport. IAANG's 185th Air Refueling Wing (185th ARW) is the primary operator of the runway. Additional details on the Proposed Action can be found in **Section 1.6** of the EA narrative.

This report evaluates the hydrologic impact of the Proposed Action under the EA. RS&H analyzed the changes in surface water quantity and quality, as well as impacts to quantity of groundwater recharge resulting from the Proposed Action. Drainage analysis within this report was performed in accordance with the Iowa Stormwater Management Manual (ISWMM), dated September 2009, revised December 31st, 2019 (Chapter 3.01 *Unified Sizing Criteria*) and June 24th, 2020 (Chapter 1.05 *Stormwater Management Plan*).

2 Regulatory Overview

2.1 Iowa Stormwater Management Manual (ISWMM)

The ISWMM provides guidance for design, construction, and post-construction stormwater requirements for development in municipalities regulated by MS4 and Phase 1 and Phase 2 National Pollutant Discharge Elimination System (NPDES) permits issued by the Iowa Department of Natural Resources (IDNR). ISWMM Chapter 1 – Section 4, *Stormwater Management Criteria*, establishes 11 minimum stormwater management guidelines recommended for applicable new development or redevelopment sites with land disturbing activity of one (1) acre or more. The Proposed Action is a redevelopment site per the ISWMM definition including but not limited to, “creation or addition of impervious surfaces, replacement of impervious surface not part of routine maintenance, and land disturbing activities associated with structural or impervious development.” Because the disturbed area of the Proposed Action is greater than one (1) acre, it is subject to these guidelines.

The ISWMM minimum stormwater management guidelines are as follows:

1. Use of Enhanced Design Practices for Stormwater Management
2. Stormwater Runoff Quality
3. Stream Channel Protection
4. Overbank Flood Protection
5. Extreme Flood Protection
6. Downstream Analysis
7. Groundwater Recharge
8. Construction Erosion and Sediment Control[^]
9. Stormwater Management System Operation and Maintenance (O&M)^{*}
10. Pollution Prevention^{*^}
11. Stormwater Management Plan^{*^}

^{*}To be completed in final design

[^]To be completed by contractor prior to construction

This analysis focuses on Guidelines 1 through 7 as they impact the proposed stormwater improvements at this stage of design. Guideline 11 is also discussed as it will be inclusive of the final design of the Proposed Action. Guidelines marked to be completed in final design and to be completed by the contractor prior to construction were not analyzed.

2.1.1 Guideline 1: Use of Enhanced Design Practices for Stormwater Management

Guideline 1 encourages preservation of natural drainage patterns on development sites by utilizing low impact development (LID) practices. LID identified in ISWMM Chapter 3 – Section 8, *Low-Impact Development (LID) Hydrology*, applicable for airport use include, but are not limited to, flatter slopes in pervious areas, minimal soil disturbance, infiltration swales, vegetative filter strips, disconnected impervious areas (DCIAs), and bioretention. LID can be incorporated alongside other Best Management Practices (BMPs) as described in ISWMM Chapter 4, *BMP Types and Applications*, to meet Guidelines 2, 3, and 7 below.

The Proposed Action would meet Guideline 1 by incorporating LID practices into final design, including but not limited to utilizing permanent stormwater BMPs that incorporate LID techniques. The Proposed Action would incorporate LID techniques, including disconnected impervious areas for airfield pavement that drains to vegetated areas and flattened slopes based on FAA grading criteria. Taxiway and runway safety areas could also act as vegetated filter strips and promoted runoff infiltration along the edges of taxiway and runway pavement, due to grading requirements and minimum distances from the edge of pavement based on FAA criteria.

2.1.2 Guideline 2: Stormwater Runoff Quality

Guideline 2 establishes guidance for managing future conditions water quality via a stormwater management system to remove at least 80% of the calculated average total suspended solids (TSS) from the site. This treatment level can be reached by treating the water quality volume (WQv) for the site, which is determined by multiplying the 90th percentile annual rainfall event of 1.25 inches by the volumetric runoff coefficient (Rv) and the area of the site. A minimum WQv value of 0.2 inches per acre should be treated for individual drainage areas with less than 15% impervious cover.

The Proposed Action would meet Guideline 2 via permanent stormwater BMPs by treating runoff from the 90th percentile storm from all Redeveloped areas prior to its discharge off Airport property. Treatment infrastructure may include, but is not limited to, vegetative practices, infiltration facilities, bioretention facilities, and LID. Stormwater runoff quality analysis is in **Section 5** of this document.

2.1.3 Guideline 3: Stream Channel Protection

Guideline 3 is accomplished through the following three criteria:

1. Extended detention of the 1-year, 24-hour storm for a minimum 24-hour period;
2. Implementation of energy dissipation, streambank stabilization, and erosion prevention practices and structures to prevent downstream erosion and streambank damage; and,
3. Establishment of 100-foot riparian stream buffers, where feasible, on the development site. The following are recommended for different levels of development:
 - a. New Development: Establish an appropriate stream buffer by requiring a development setback from the stream centerline.
 - b. Redevelopment: Structural controls for bank stabilization where bank material erosion is of concern

The Proposed Action would meet all criteria for Guideline 3. The Proposed Action would include permanent stormwater BMPs to detain the volume of the 1-year, 24-hour storm for a period of 24 hours. Peak discharge from the Proposed Action for the 1-year, 24-hour storm are found in **Table 8** of this document. The Proposed Action would provide energy dissipation within permanent stormwater BMPs in final design, such as riprap, to limit downstream erosion and streambank damage. The Proposed Action would not impact the existing riparian stream buffers and is further than 100 feet from any stream bank.

2.1.4 Guideline 4: Overbank Flood Protection

Guideline 4 establishes guidance for flooding of downstream channels and from surcharging of downstream piped conveyances. This guideline requires that the future conditions 5-year, 24-

hour peak discharge rate does not exceed the existing conditions discharge rate. Guideline 4 works in conjunction with Guidelines 3 and 5 to provide effective peak flow control per the ISWMM.

The Proposed Action would meet Guideline 4 by utilizing permanent stormwater BMPs to meet existing conditions discharge rates for the 5-year, 24-hour storm in future conditions. Comparison of peak discharge rates from existing to future are found in **Table 9** of this document.

2.1.5 Guideline 5: Extreme Flood Protection

Guideline 5 establishes guidance for prevention of flooding due to major storm events. This guideline requires that the 100-year, 24-hour storm is controlled via one of the following measures:

1. Structural stormwater controls that maintain the 100-year floodplain; or
2. Providing conveyance sized to discharge the 100-year, 24-hour storm to a receiving water whose floodplain is not damaged by the increase in flow.

The Proposed Action would meet Guideline 5 by utilizing permanent stormwater BMPs to detain the 100-year, 24-hour storm such that future conditions flow rates are less than or equal to existing conditions and that the 100-year floodplain is maintained. Comparison of peak discharge rates from existing to future conditions are found in **Table 12** of this document.

2.1.6 Guideline 6: Downstream Analysis

Guideline 6 establishes guidance for limiting additional downstream impacts regarding peak flows and flooding. This guideline follows the 10 percent rule, which is based on the drainage area to an individual permanent stormwater BMP being 10% of a total corresponding downstream drainage area that the discharge from the permanent stormwater BMP has influence on. The analysis of the 10 percent rule is based on hydrologically modeling the drainage area to an individual permanent stormwater BMP and its downstream influence area for existing and future conditions, then designing the permanent stormwater BMP as to not increase peak flows from the 25-year, 24-hour storm at both the outlet from the BMP, as well as at downstream junctions to the end of its influence.

The Proposed Action would meet Guideline 6 by designing outlet controls in permanent stormwater BMPs to meet existing peak flow rates at site outlets and downstream design junctions in final design. Comparison of the 25-year, 24-hour storm peak discharge rates from existing to future conditions are found in **Table 11** of this document.

2.1.7 Guideline 7: Groundwater Recharge

Guideline 7 establishes guidance for site design to allow for stormwater runoff to infiltrate into the ground. This guideline requires that annual recharge from the future site conditions should approximate the annual recharge from existing conditions. Stormwater runoff from hotspots requires pretreatment before infiltration.

The Proposed Action would meet Guideline 7 by utilizing permanent stormwater BMPs to ensure future groundwater recharge volumes are met. Groundwater recharge is analyzed further in **Section 6** of this document.

2.1.8 Guideline 11: Stormwater Management Plan

Guideline 11 establishes guidance for developing a stormwater management plan for all new and redeveloped sites. The plan includes a narrative, technical information and analysis, and indication for how the proposed development meets Guidelines 1 through 10, as well as other local jurisdictional stormwater criteria. Analysis includes, but is not limited to, pre- and post-development hydrologic and hydraulic conditions of the site, impacts on water quality in post-development conditions, and sizing and location of stormwater infrastructure required to meet all ISWMM Guidelines and local jurisdictional requirements in post-development conditions. The stormwater management plan will be completed in final design.

3 Water Quantity Analysis

3.1 Drainage Basins

RS&H delineated the eight (8) existing drainage basins using existing Light Detection and Ranging (LiDAR) data from the United States Geological Survey (USGS). RS&H determined existing land cover for drainage basins utilizing Airport base file drawing information based on prior surveys. The future basins are assumed to not be modified as a result of the Proposed Action, with the exception of Basin A, which would include acquired land in the Proposed Action. Future land cover includes the modifications from the Proposed Action. **Table 1** and **Table 2** summarize the existing and future drainage basins. **Table 3** summarizes the comparison between existing and future drainage basin impervious land cover. **Figure 1** and **Figure 2** show the existing and future hydrologic conditions on site.

Table 1: Existing Drainage Basin Impervious Cover Summary

Basin	Area (acres)	Impervious Area (acres)	Percent Impervious
A	242.20	33.20	13.7%
B	43.56	1.41	3.2%
C	34.01	3.69	10.8%
D	40.13	4.63	11.5%
E	15.92	3.42	21.5%
F	17.83	3.91	21.9%
G	154.17	50.39	32.7%
H	358.45	72.46	20.2%

Note: gravel land use assumed 100% impervious in table above for simplicity of land use change.

Table 2: Future Drainage Basin Impervious Cover Summary

Basin	Area (acres)	Impervious Area (acres)	Percent Impervious
A	243.67	44.99	18.5%
B	43.56	3.71	8.5%
C	34.01	4.08	12.0%
D	40.13	4.69	11.7%
E	15.92	3.42	21.5%
F	17.83	3.91	21.9%
G	154.17	51.68	33.5%
H	358.45	82.30	23.0%

Note: gravel land use assumed 100% impervious in table above for simplicity of land use change.

Table 3: Comparison of Existing and Future Drainage Basin Impervious Cover

Basin	Existing Impervious Area (acres)	Future Impervious Area (acres)	Change in Area (acres)
A	33.20	44.99	+11.78
B	1.41	3.71	+2.30
C	3.69	4.08	+0.39
D	4.63	4.69	+0.06
E	3.42	3.42	-
F	3.91	3.91	-
G	50.39	51.68	+1.29
H	72.46	82.30	+9.84

Note: gravel land use assumed 100% impervious in table above for simplicity of land use change.

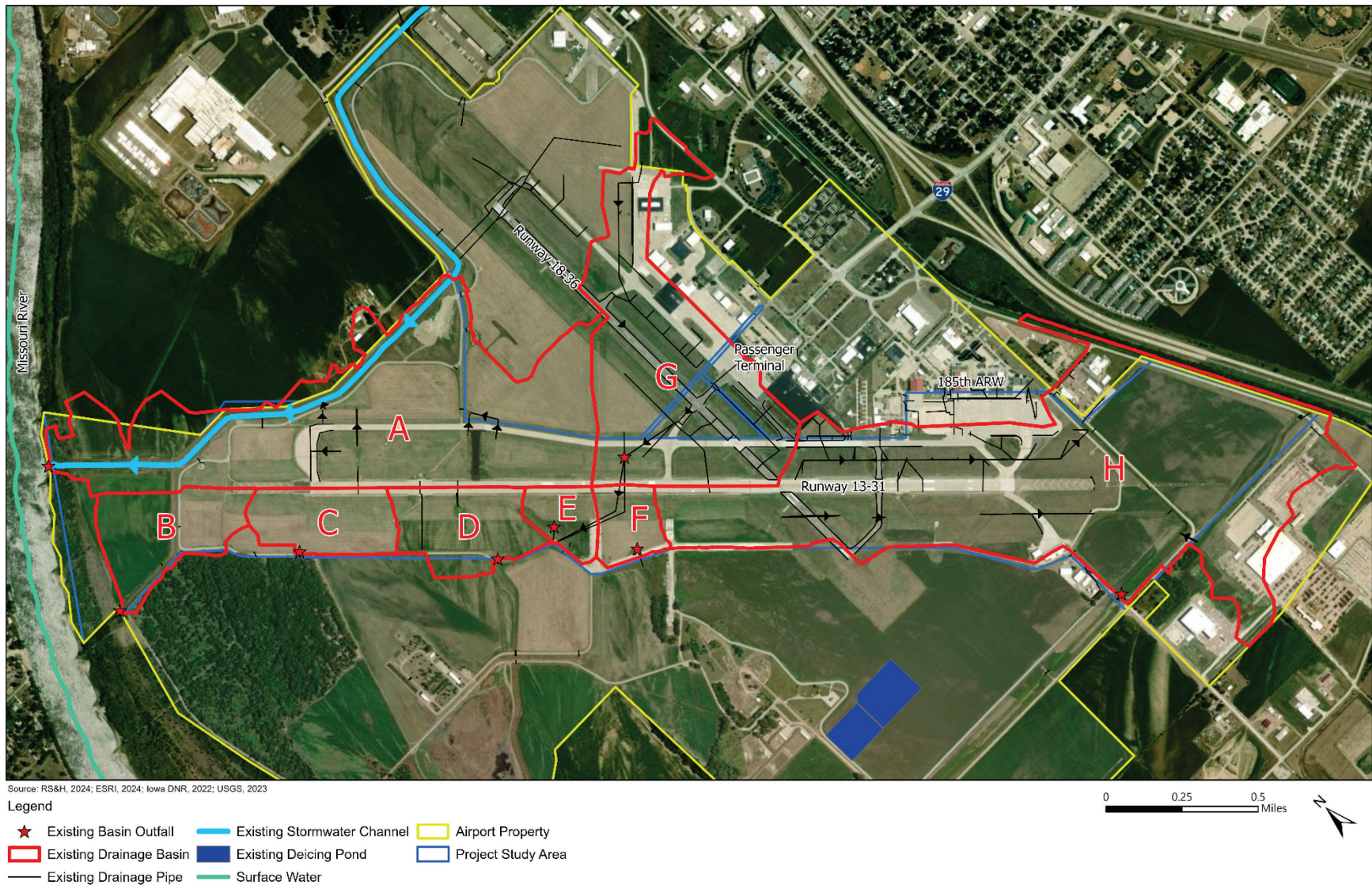


Figure 1: Existing Hydrologic Conditions

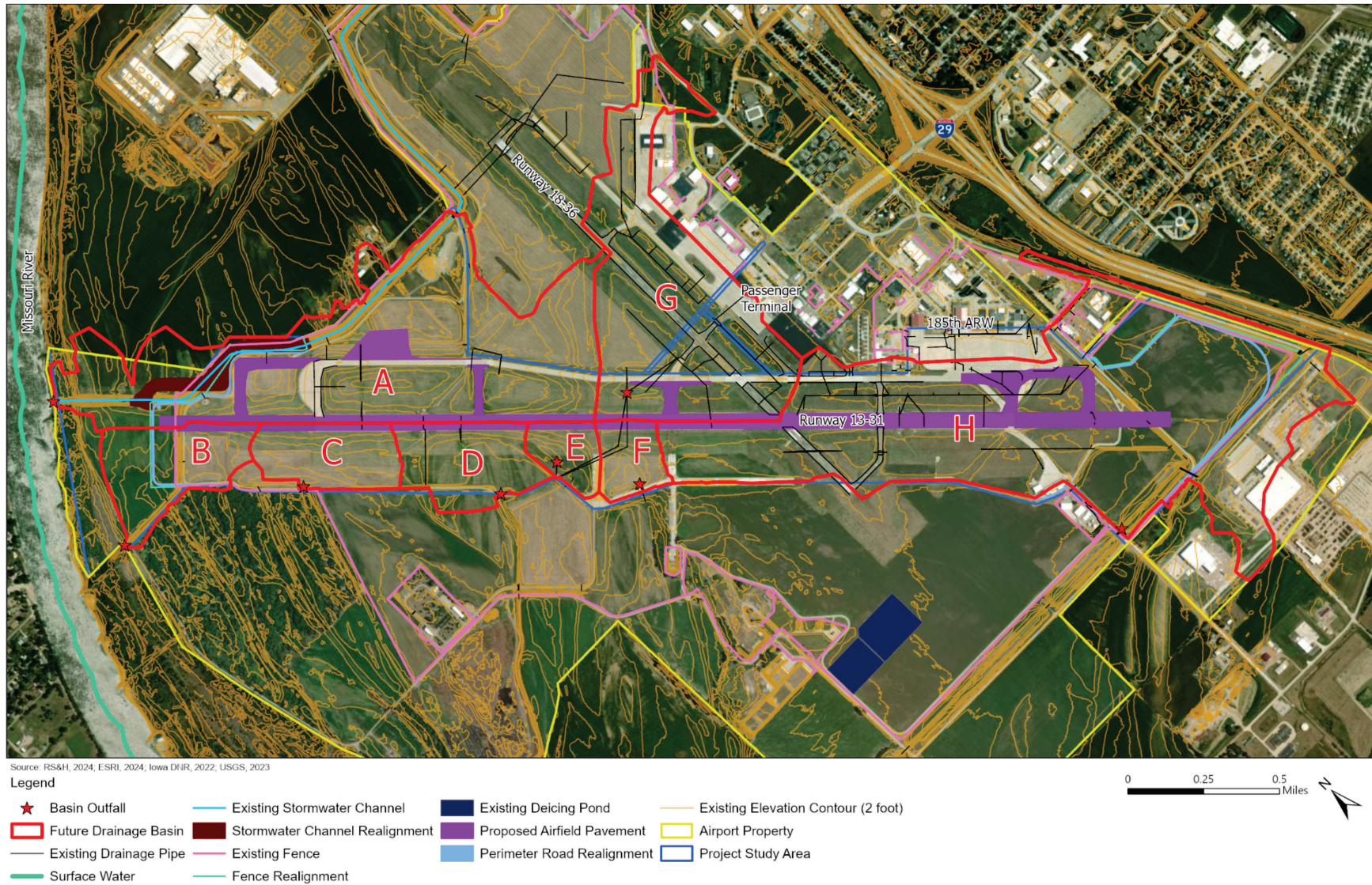


Figure 2: Future Hydrologic Conditions

3.2 Time of Concentration (T_c)

T_c is the time it takes runoff to travel from the hydraulically most distant point of the basin to the point of interest and is used in calculating the peak runoff rate. RS&H calculated the T_c for each existing and future drainage basin utilizing the Natural Resources Conservation Service (NRCS) Runoff Method. T_c flow paths for existing basins were determined using existing LiDAR elevation data, stormwater infrastructure data provided by Airport personnel, and survey of site topography and stormwater infrastructure performed in April 2024. T_c flow paths for future basins were determined based on the existing basin flow paths with changes in land cover as a result of the Proposed Action. The rainfall depth used in T_c calculations is shown in **Table 6**. The Manning’s roughness coefficients (n) used in T_c calculations are shown in **Table 4**. See **Attachment I-1** for T_c calculations.

Table 4: Manning's Roughness Coefficient Values

Material	Manning’s Roughness Coefficient (n)
Smooth Surfaces*	0.011
Dense Grasses^	0.240
Reinforced Concrete Pipe (RCP)	0.013
Corrugated Metal Pipe (CMP)	0.024

*Used for sheet flow calculations in impervious areas

^Used for sheet flow calculations in pervious areas

3.3 Soils and Land Cover

Soil type and land cover within the Study Area impact the amount of runoff produced by rainfall. These site characteristics can be used to determine runoff curve numbers (CN) for the site, which indicate the site’s runoff potential. RS&H utilized NRCS resources to determine the types of soil found on site at the Airport, as shown in **Figure 3** below. Dual Hydrologic Soil Group (HSG) classification C/D found on site was assumed to be HSG D in hydrologic calculations as a conservative approach. Udorthents, Loamy soil does not have an HSG classification (listed as N/A) and was assumed to be HSG D in hydrologic calculations as a conservative approach due to the unknown makeup of the soil. **Table 5** below presents the soil types, land covers, and CN values for the site. See **Attachment I-2** for the NRCS Soils Report.

Table 5: Land Cover and Curve Number Values

Soil Type	Land Cover Description	Curve Number
Hydrologic Soil Group (HSG) A	Good Condition (grass cover >75%)	39
HSG B	Good Condition (grass cover >75%)	61
HSG C	Good Condition (grass cover >75%)	74
HSG D	Good Condition (grass cover >75%)	80
HSG A	Gravel Road	76
HSG B	Gravel Road	85
HSG C	Gravel Road	89
HSG D	Gravel Road	91
Impervious	Paved Area, Roofs	98

Source: ISWMM, Table C3-S5-2

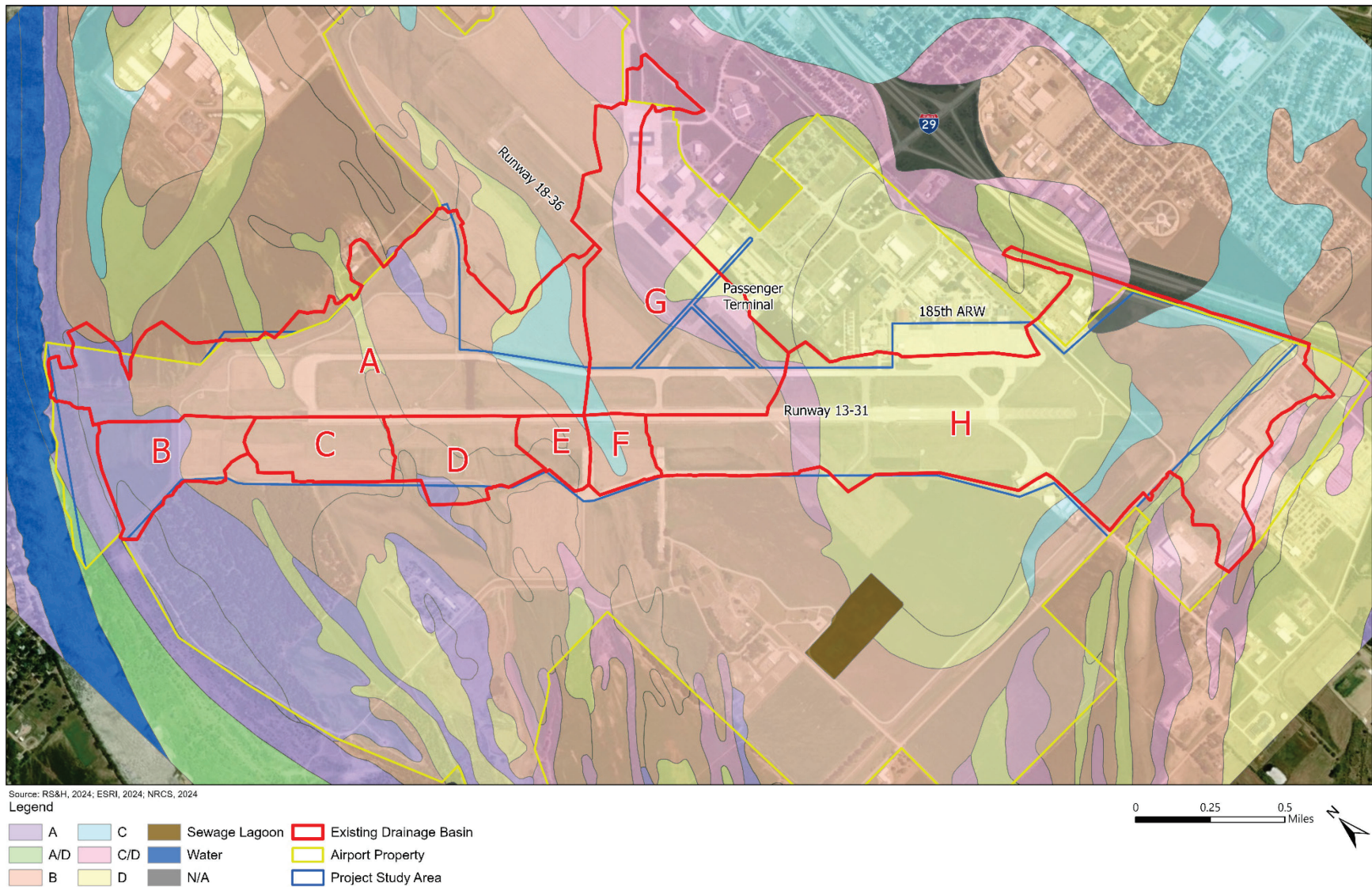


Figure 3: Site Soils by HSG

3.4 Rainfall Depths

RS&H utilized local rainfall depths from ISWMM Chapter 3 – Section 2, *Rainfall and Runoff Analysis*, Figure C3-S2-1 and Table C3-S2-3. The ISWMM requires analysis for runoff rates from the 1-year, 5-year, 25-year, and 100-year, 24-hour storm events. The ISWMM also requires water quality treatment of the 90th percentile cumulative frequency rainfall depth (1.25 inches). Rainfall depths for these design storms are provided in **Table 6**.

Table 6: Rainfall Depth

Design Storm	Rainfall Depth (inches)
Groundwater Recharge	1.00
90 th Percentile	1.25
1-Year, 24-hour	2.63
2-year, 24-hour*	3.01
5-Year, 24-hour	3.74
25-year, 24-hour	5.59
100-Year, 24-hour	7.67

*Used in calculations for T_c

3.5 Peak Discharge

RS&H used the above variables and NRCS TR-55 methodology to determine peak discharge rates from existing and future drainage basins for the 1-, 5-, 25- and 100-year, 24-hour design storms required for analysis by Guidelines 3, 4, 5, and 6 of the ISWMM. **Table 7** and **Table 8** summarize the peak discharge rates in existing and future drainage basins. **Table 9**, **Table 10**, **Table 11**, and **Table 12** summarize the comparisons between existing and future drainage basin peak flow rates for the 1-year, 5-year, 25-year, and 100-year, 24-hour design storms. See **Attachment I-3** for existing and future CN and Peak Discharge calculations.

Table 7: Existing Basin Peak Discharge Summary

Basin	Area (acres)	Time of Concentration (minutes)	Curve Number	1-Year, 24- hour Peak Discharge (cubic feet per second [cfs])	5-Year, 24-hour Peak Discharge (cfs)	25-Year, 24-hour Peak Discharge (cfs)	100-Year, 24-hour Peak Discharge (cfs)
A	242.20	112.0	65	20.46	65.79	169.74	312.80
B	43.56	34.8	47	0.20	2.63	17.23	49.81
C	34.01	30.8	65	6.11	20.63	52.13	96.89
D	40.13	54.3	63	4.06	15.04	41.14	77.72
E	15.92	26.5	69	5.29	13.72	31.64	56.26
F	17.83	39.2	72	6.56	15.10	33.13	57.46
G	154.17	84.7	78	53.17	109.45	223.63	354.45
H	358.45	152.0	77	81.20	168.01	343.53	545.23

Table 8: Future Basin Peak Discharge Summary

Basin	Area (acres)	Time of Concentration (minutes)	Curve Number	1-Year, 24- hour Peak Discharge (cubic feet per second [cfs])	5-Year, 24-hour Peak Discharge (cfs)	25-Year, 24-hour Peak Discharge (cfs)	100-Year, 24-hour Peak Discharge (cfs)
A	243.67	107.4	67	26.59	79.30	192.39	350.66
B	43.56	34.8	49	0.46	3.50	21.68	57.21
C	34.01	30.8	65	6.55	21.12	53.61	99.16
D	40.13	55.3	63	4.07	15.00	41.12	77.86
E	15.92	26.5	69	5.29	13.72	31.63	56.25
F	17.83	39.2	72	6.56	15.10	33.13	57.45
G	154.17	84.7	78	53.89	111.65	226.38	358.04
H	358.45	152.0	78	83.78	172.08	349.79	553.41

Table 9: Comparison of Basin Peak Discharge Rates – 1-year, 24-hour Design Storm

Basin	Rainfall Event	Existing Peak Discharge (cubic feet per second [cfs])	Future Peak Discharge (cfs)	Change in Peak Discharge (cfs)
A	1-year, 24-hour	20.46	26.59	+6.13
B	1-year, 24-hour	0.20	0.46	+0.26
C	1-year, 24-hour	6.11	6.55	+0.44
D	1-year, 24-hour	4.06	4.07	+0.01
E	1-year, 24-hour	5.29	5.29	-
F	1-year, 24-hour	6.56	6.56	-
G	1-year, 24-hour	53.17	53.89	+0.72
H	1-year, 24-hour	81.20	83.78	+2.58

Table 10: Comparison of Basin Peak Discharge Rates – 5-year, 24-hour Design Storm

Basin	Rainfall Event	Existing Peak Discharge (cubic feet per second [cfs])	Future Peak Discharge (cfs)	Change in Peak Discharge (cfs)
A	5-year, 24-hour	65.79	79.30	+13.51
B	5-year, 24-hour	2.63	3.50	+0.87
C	5-year, 24-hour	20.63	21.12	+0.49
D	5-year, 24-hour	15.04	15.00	-0.04
E	5-year, 24-hour	13.72	13.72	-
F	5-year, 24-hour	15.10	15.10	-
G	5-year, 24-hour	109.45	111.65	+2.20
H	5-year, 24-hour	168.01	172.08	+4.07

Table 11: Comparison of Basin Peak Discharge Rates – 25-year, 24-hour Design Storm

Basin	Rainfall Event	Existing Peak Discharge (cubic feet per second [cfs])	Future Peak Discharge (cfs)	Change in Peak Discharge (cfs)
A	25-year, 24-hour	169.74	192.39	+22.65
B	25-year, 24-hour	17.23	21.68	+4.45
C	25-year, 24-hour	52.13	53.61	+1.48
D	25-year, 24-hour	41.14	41.12	-0.02
E	25-year, 24-hour	31.64	31.63	-0.01
F	25-year, 24-hour	33.13	33.13	-
G	25-year, 24-hour	223.63	226.38	+2.75
H	25-year, 24-hour	343.53	349.79	+6.26

Table 12: Comparison of Basin Peak Discharge Rates – 100-year, 24-hour Design Storm

Basin	Rainfall Event	Existing Peak Discharge (cubic feet per second [cfs])	Future Peak Discharge (cfs)	Change in Peak Discharge (cfs)
A	100-year, 24-hour	312.80	350.66	+37.86
B	100-year, 24-hour	49.81	57.21	+7.40
C	100-year, 24-hour	96.89	99.16	+2.27
D	100-year, 24-hour	77.72	77.86	+0.14
E	100-year, 24-hour	56.28	56.25	-0.03
F	100-year, 24-hour	57.46	57.45	-0.01
G	100-year, 24-hour	354.45	358.04	+3.59
H	100-year, 24-hour	545.23	553.41	+8.18

3.6 Future Design Considerations

ISWMM Chapter 4 – Section 3, *Structural Controls*, identifies the general design for stormwater facilities and may be used in final design to manage peak flows as required in ISWMM Chapter 1 – Section 4, *Stormwater Management Criteria*. Proposed permanent stormwater facilities should be designed to discharge at rates less than or equal to the existing conditions flow rates discussed in **Section 3.5** of this document. Proposed permanent stormwater facilities may also be designed to provide water quality treatment, thus contributing to the necessary water quality volumes discussed in **Section 5.1** of this document. The increases in peak flow rates and required water quality volumes as a result of the Proposed Action will require new permanent stormwater facilities and/or major modifications to existing stormwater collection and conveyance system to mitigate impacts. If new permanent stormwater facilities are necessary to be required in final design, the following permanent stormwater facilities are discussed in ISWMM Chapter 4 – Section 3, *Structural Controls*, to meet peak flow requirements:

- Infiltration Facilities
 - o Infiltration Trench
 - o Infiltration Basin
- Extended Detention Basins (EDBs)

These permanent stormwater facilities should be designed to not interfere with known groundwater elevations and to limit standing water requirements to those outlined in the Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5200-33C, *Hazardous Wildlife Attractants on or Near Airports*.

4 Channel Realignment

The Proposed Action would realign the existing drainage channel at the northeast corner of the Study Area due to the realignment of the vehicle service road (VSR) and proposed taxiway pavement. The existing channel is a man-made, non-jurisdictional water feature. RS&H estimated the existing peak flow in the channel from existing upstream infrastructure, including a triple 84" RCP culvert and a single 24" RCP culvert, maximum flow rates added to the 100-year, 24-hour peak runoff flow from existing Basin A, which directly contributes to the channel. RS&H estimated the future peak flow in the channel with the same components used in the existing calculation, with the addition of impacts by the Proposed Action on the 100-year, 24-hour peak runoff flow for Basin A. Preliminary proposed grading has been developed which has a similar hydraulic capacity of the existing channel. **Table 13** below shows the channel capacity and peak discharge in existing and future conditions. See **Attachment I-4** for existing and future channel modeling and calculations.

Table 13: Channel Peak Flow Rate Summary

Condition	100-year Peak Discharge Rate (cubic feet per second)
Existing	1,715.41
Future	1,753.27
Change	+37.86

5 Water Quality Analysis

5.1 Calculations

ISWMM Chapter 1 – Section 4, *Stormwater Management Criteria*, Guideline 2 identifies the 90th percentile design storm to be used for volume-based treatment facility sizing. RS&H used the calculation methodology as described in the ISWMM Chapter 3 – Section 6, *Small Storm Hydrology*, to determine the WQv for each basin under the future conditions. The WQv is calculated based on impervious land cover and total area for each drainage basin. **Table 14** below summarizes the WQv required for each basin due to the Proposed Action. See **Attachment I-5** for water quality volume calculations.

Table 14: Proposed Action Water Quality Volume Summary

Basin	Future Conditions Required Water Quality Volume (acre-feet)	Future Conditions Required Water Quality Volume Peak Flow Rate (cubic feet per second)
A	5.49	20.06
B	0.57	3.23
C	0.56	3.75
D	0.65	3.16
E	0.40	3.65
F	0.46	3.36
G	5.65	27.85
H	9.58	30.54

5.2 Future Design Considerations

ISWMM Chapter 4, *BMP Types and Applications*, identifies the general requirements for stormwater quality facilities and may be used in final design to treat the WQv provided in **Section 5.1** of this document. ISWMM Chapter 3 – Section 8, *Low-Impact Development (LID) Hydrology*, also identifies LID and their applications in treating the WQv.

- Vegetative Practices
 - o Vegetated Filter Strip
 - o Grass Channel
- Infiltration Facilities
 - o Infiltration Trench
 - o Infiltration Basin
- Bioretention Facilities
- LID

6 Groundwater Analysis

6.1 Regulatory Overview

Relevant local, state, and federal regulations and statutes pertaining to groundwater include:

- Safe Water Drinking Act (SDWA)
- ISWMM Chapter 1 – Section 4, *Stormwater Management Criteria*

As discussed in **Section 2.1.7** above, the ISWMM Chapter 1 – Section 4, *Stormwater Management Criteria*, Guideline 7 establishes guidance for groundwater recharge on new development and redevelopment sites.

6.2 Groundwater Recharge

The groundwater recharge guidance is attained by infiltrating the recharge volume (Rev). The Rev is considered part of the total WQv, therefore meeting the requirements of the Rev can be achieved by treating the WQv via structural or nonstructural BMPs. **Table 15** below summarizes the Rev required for each basin due to the Proposed Action. As stated in **Section 2.1.7**, annual recharge from future conditions should approximate that of existing conditions. To meet this, in final design the existing and future Rev values will be calculated, and the difference between the values will be used to size the required treatment for the increased impervious area. See **Attachment I-6** for groundwater recharge volume calculations.

Table 15: Proposed Action Groundwater Recharge Volume Requirements

Basin	Future Conditions Required Groundwater Recharge Volume (acre-inches)
A	42.74
B	3.52
C	3.88
D	4.46
E	3.25
F	3.71
G	49.10
H	78.19

6.3 Future Design Considerations

ISWMM Chapter 4, *BMP Types and Applications*, identifies the general requirements for stormwater quality facilities and may be used in final design to ensure required groundwater recharge volumes in **Section 6.2** of this document are met. ISWMM Chapter 3 – Section 8, *Low-Impact Development (LID) Hydrology*, also identifies LID and their applications in promoting groundwater infiltration.

- Infiltration Facilities
 - o Infiltration Trench
 - o Infiltration Basin
- Bioretention Facilities
- LID

7 Floodplain Analysis

7.1 Existing Floodplain Conditions

The Missouri River is located approximately 60 feet northwest of the Project Study Area at its nearest point. The Proposed Action is located in Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) numbers 19193C0192E and 19193C0194E, dated July 17, 2024, as well as 19193C0213E, dated September 29th, 2011. The majority of the floodplain in the Study area is designated as Zone AE, which is defined as the 100-year (1-percent-annual-chance) floodplain where base flood elevations (BFEs) are established. The 100-year (1-percent-annual-chance) BFE of the Missouri River southwest of the Proposed Action is 1080.0 feet with respect to the North American Vertical Datum of 1988 (NAVD88). The 100-year (1-percent-annual-chance) floodplain extends into and through the Project Study Area via two floodplain reaches, one being the existing channel described in **Section 4** of this document. The 100-year floodplain BFE of this channel upstream of the Proposed Action is also 1081.0 feet NAVD88. The nearest 100-year floodplain cross section to both floodplain reaches nearest the Proposed Action is 1080.6 feet NAVD88. See **Figure 4** below for the FEMA-delineated floodplains and Proposed Action. See **Attachment I-7** for FEMA FIRMs.

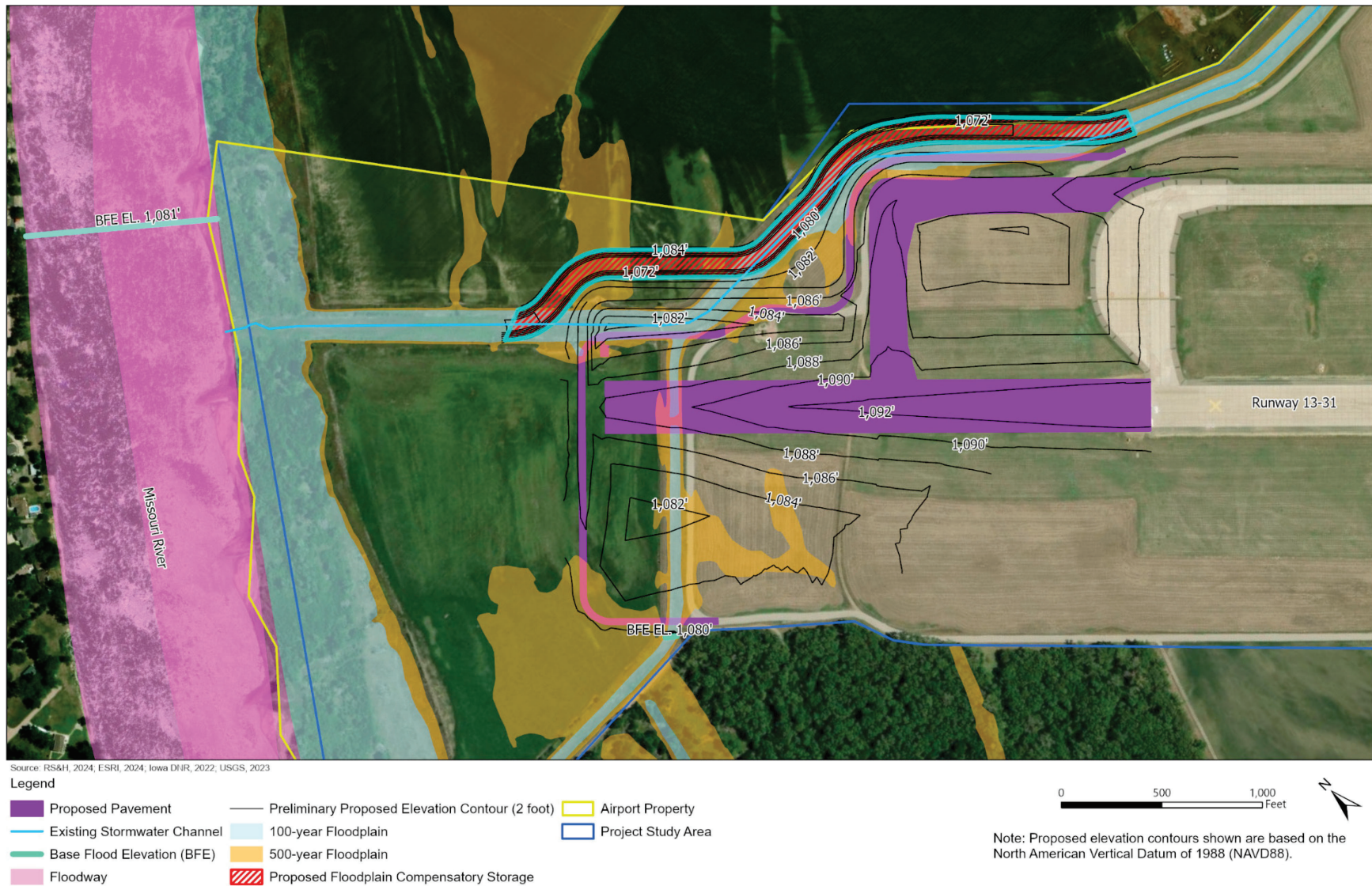


Figure 4: Study Area Floodplains and Proposed Action

7.2 Future Floodplain Conditions

The Proposed Action would place fill into the 100-year (1-percent-annual-chance) floodplain in two locations: the major channel realignment as discussed in Section 4, and along a ditch due to the runway extension. RS&H utilized preliminary proposed grading associated with the Proposed Action to determine the compensatory floodplain storage that would be implemented to offset fill placed negating adverse impacts to the floodplain. In final design, floodplain hydraulic modeling would verify that the Proposed Action would not result in an increase in the 100-year (1-percent-annual-chance) BFE.

7.2.1 Compensatory Storage Methodology

RS&H compared the available floodplain storage in existing and proposed conditions to verify that the Proposed Action would not result in a net decrease in floodplain storage volume. RS&H analyzed volume surfaces between the existing topographic data, proposed grading, and the 100-year (1-percent-annual-chance) BFE at 1080.6 feet NAVD88. Using these volume surfaces, RS&H determined the volume of compensatory storage by taking the storage volume below the 100-year floodplain BFE relative to the existing topography for existing conditions and the volume below 100-year floodplain BFE relative to the preliminary proposed grading for the Proposed Action. The storage volume in each condition was equal to the “fill volume” as determined in AutoCAD Civil 3D, which represents the amount of volume above existing and proposed surfaces to reach the floodplain elevation. This calculation ensures that any storage or fill above the floodplain elevation is not counted in the compensatory storage volume calculation as floodwater from the 100-year event would not stage high enough to be impacted by those factors. RS&H also only analyzed the volume within the defined 100-year floodplain in existing conditions. In proposed conditions, areas hydraulically connected to the 100-year floodplain were analyzed to ensure that additional low-lying areas were also not counted.

Preliminary proposed grading, shown in **Figure 4**, would include compensatory floodplain storage such that the Proposed Action would result in an additional 1,934 cubic yards of floodplain storage below the 100-year (1-percent-annual-chance) BFE. Therefore, the Proposed Action would not adversely affect the 100-year (1-percent-annual-chance) floodplain BFE. Floodplain compensatory storage calculations can be seen in **Attachment I-8**.

8 Conclusion

The Proposed Action would not exceed established significance thresholds, as defined in **Section 3.15** of the EA narrative. Impacts to surface waters, groundwater, and floodplains as a result of the Proposed Action would be considered minimal and would not impact overall water quantity and quality standards set by local, state, or federal jurisdictions. The Proposed Action will implement permanent stormwater BMPs to control future peak flows in accordance with ISWMM Guidelines 3, 4, 5, and 6. The Proposed Action will implement permanent stormwater

BMPs and LID to meet water quality treatment targets in accordance with ISWMM Guidelines 1 and 2. The Proposed Action will also implement permanent stormwater BMPs and LID to meet groundwater recharge requirements in accordance with ISWMM Guideline 7. In final design, future stormwater infrastructure will need verification to ensure all ISWMM and FAA requirements are met.

9 References

Federal Aviation Administration. (2020, February 21). *Advisory Circular 150/5200-33C – Hazardous Wildlife Attractants on or near Airports*.

Federal Emergency Management Agency. (2011, September 29). *Flood Insurance Rate Map: Woodbury County, Iowa and Incorporated Areas, Map Number 19193C0213E*.

Federal Emergency Management Agency. (2024, July 17). *Flood Insurance Rate Map: Woodbury County, Iowa and Incorporated Areas, Map Numbers 19193C0192E and 19193C0194E*.

Iowa Department of Natural Resources. (2009, September). *Iowa Storm Water Management Manual*.

Natural Resources Conservation Service. (2023, June). *Web Soil Survey*.

United States Geological Survey. (2024). *National Elevation Dataset*.

Attachment I-1: Time of Concentration Calculations

Sioux Gateway Airport Runway Program EA	Comp. By:	JKK
	Date:	5/12/2025
	Chk. By:	LMM
	Job No:	10144998.003

Sioux Gateway Airport Runway Program EA	Comp. By:	JKK
	Date:	5/12/2025
	Chk. By:	LMM
	Job No:	10144998.003

Time of Concentration Calculations

Sub-Basin Name: **Basin A**
Condition: **Existing**

Sheet Flow [TR-55 equation 3-3]

	AB		BC		
Surface Description	Smooth surfaces		Dense grasses		
Manning's Roughness coeff., n	0.011		0.24		
Flow Length, L should be < 100 ft	47 ft		53 ft		
Two-yr, 24-hr rainfall, P ₂	3.01 in		3.01 in		
Elevation 1, E ₁	1098.00 ft		1097.81 ft		
Elevation 2, E ₂	1097.81 ft		1097.29 ft		
Land Slope, s = (E ₁ - E ₂) / L	0.00 ft/ft		0.01 ft/ft		
Tt 0.007 n L ^{0.8} / (P ₂ ^{0.5} * s ^{0.4})	0.02 hr		0.20 hr		
	1.3 +		11.8 +		
					13.1 min

Shallow Concentrated Flow [TR-55 figure 3-1]

	CD		EF		GH			
Surface Description	Unpaved		Unpaved		Unpaved			
Flow Length, L	1911	ft	107	ft	1727	ft		ft
Elevation 1, E ₁	1097.29	ft	1082.19	ft	1081.71	ft		ft
Elevation 2, E ₂	1082.73	ft	1082.13	ft	1080.19	ft		ft
Watercourse Slope, s = (E ₁ - E ₂) / L	0.008		0.001	ft/ft	0.001	ft/ft		ft/ft
Velocity, V	1.41		0.38	ft/s	0.48	ft/s		ft/s
T _t = L / (3600 V)	0.38		0.08	hr	1.00	hr		hr
	22.6	+	4.7	+	60.1	+		= 87.4 min

Open Channel Flow [TR-55 equation 3-4]

		DE		FG		HI		IJ	
	Pipe			Pipe		Pipe		Channel	
Open Channel	Front Slope, s ₁		:1		:1		:1	4.50	:1
	Bottom width, B		ft		ft		ft	40.00	ft
	Back Slope, s ₂		:1		:1		:1	4.50	:1
	Depth, H		ft		ft		ft	12.00	ft
Pipe	Diameter, D	24	in	30	in	42	in		in
Cross Sectional Flow Area, a		3.14	sq ft	4.91	sq ft	9.62	sq ft	1128.00	sq ft
Wetted Perimeter, P _w		6.28	ft	7.85	ft	11.00	ft	150.63	ft
Hydraulic radius, r = a / P _w		0.50	ft	0.63	ft	0.88	ft	7.49	ft
Flow Length, L		361	ft	43	ft	84	ft	3809	ft
Elevation 1, E ₁		1082.73	ft	1082.13	ft	1080.19	ft	1072.86	ft
Elevation 2, E ₂		1082.19	ft	1081.71	ft	1072.86	ft	1066.00	ft
Channel Slope, s = (E ₁ - E ₂) / L		0.001	ft/ft	0.010	ft/ft	0.087	ft/ft	0.002	ft/ft
Manning's Roughness coeff., n		0.013		0.013		0.024		0.035	
Velocity, V = 1.49 r ^{2/3} * s ^{1/2} / n		2.79	ft/s	8.28	ft/s	16.78	ft/s	6.92	ft/s
T _t = L / (3600 V)		0.04	ft/s	0.00	ft/s	0.00	ft/s	0.15	ft/s
		2.2	+	0.1	+	0.1	+	9.2	= 11.5 min

Total Time of Concentration

Sub-Basin Tc = 112.0 min

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	Chk. By:	LMM
	Job No:	10144998.003

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5/12/2025

LMM

10144998.003

Time of Concentration Calculations

Sub-Basin Name: **Basin B**

Condition: Existing

Sheet Flow [TR-55 equation 3-3]

	AB				
Surface Description	Dense grasses				
Manning's Roughness coeff., n	0.24				
Flow Length, L should be < 100 ft	100	ft			
Two-yr, 24-hr rainfall, P ₂	3.01	in			
Elevation 1, E ₁	1090.00	ft			
Elevation 2, E ₂	1088.98	ft			
Land Slope, s = (E ₁ - E ₂) / L	0.01	ft/ft			
Tt = 0.007 * (n * L ^{0.8} / (P ₂ ^{0.5} * s ^{0.4}))	0.32	hr			
	19.3	+		+	
					= 19.3 min

Shallow Concentrated Flow [TR-55 figure 3-1]

	BC				
Surface Description	Unpaved				
Flow Length, L	900	ft			
Elevation 1, E ₁	1088.98	ft			
Elevation 2, E ₂	1079.77	ft			
Watercourse Slope, s = (E ₁ - E ₂) / L	0.010		ft/ft	ft/ft	ft/ft
Velocity, V	1.63		ft/s	ft/s	ft/s
T _t = L / (3600 V)	0.15		hr	hr	hr
	9.2	+		+	
					= 9.2 min

Open Channel Flow [TR-55 equation 3-4]

[illegible]

Total Time of Concentration

Sub-Basin Tc = 34.8 min

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	Chk. By:	LMM
	Job No:	10144998.003

Time of Concentration Calculations

Sub-Basin Name: **Basin C**
Condition: **Existing**

Sheet Flow [TR-55 equation 3-3]

	AB		BC			
Surface Description	Smooth surfaces		Dense grasses			
Manning's Roughness coeff., n	0.011		0.24			
Flow Length, L should be < 100 ft	92	ft	8	ft		
Two-yr, 24-hr rainfall, P ₂	3.01	in	3.01	in		
Elevation 1, E ₁	1092.00	ft	1090.79	ft		
Elevation 2, E ₂	1090.79	ft	1090.66	ft		
Land Slope, s = (E ₁ - E ₂) / L	0.01	ft/ft	0.02	ft/ft		
Tt = 0.007 * (n * L ^{0.8} / (P ₂ ^{0.5} * s ^{0.4}))	0.02	hr	0.04	hr		
	1.4	+	2.1	+		= 3.5 min

Shallow Concentrated Flow [TR-55 figure 3-1]

	CD					
Surface Description	Unpaved					
Flow Length, L	1678	ft				
Elevation 1, E ₁	1090.66	ft				
Elevation 2, E ₂	1083.90	ft				
Watercourse Slope, s = (E ₁ - E ₂) / L	0.004		ft/ft		ft/ft	ft/ft
Velocity, V	1.02		ft/s		ft/s	ft/s
T _t = L / (3600 V)	0.46		hr		hr	hr
	27.3	+		+		= 27.3 min

Open Channel Flow [TR-55 equation 3-4]

Open Channel	Front Slope, s_1	:	:	:	:
	Bottom width, B	ft	ft	ft	ft
	Back Slope, s_2	:	:	:	:
	Depth, H	ft	ft	ft	ft
Pipe	Diameter, D	in	in	in	in
Cross Sectional Flow Area, a		sq ft	sq ft	sq ft	sq ft
Wetted Perimeter, P_w		ft	ft	ft	ft
Hydraulic radius, $r = a / P_w$		ft	ft	ft	ft
Flow Length, L		ft	ft	ft	ft
Elevation 1, E_1		ft	ft	ft	ft
Elevation 2, E_2		ft	ft	ft	ft
Channel Slope, $s = (E_1 - E_2) / L$		ft/ft	ft/ft	ft/ft	ft/ft
Manning's Roughness coeff., n					
Velocity, $V = 1.49 r^{2/3} s^{1/2} / n$		ft/s	ft/s	ft/s	ft/s
$T_t = L / (3600 V)$		ft/s	ft/s	ft/s	ft/s
		+	+	+	=
					0.0 min

Total Time of Concentration

Sub-Basin Tc = 30.8 min

Sioux Gateway Airport Runway Program EA

Comp. By:

JKK

Date:

5/12/2025

Chk. By:

LMM

Job No:

10144998.003

Time of Concentration Calculations

Sub-Basin Name: Basin D
Condition: Existing

Sheet Flow [TR-55 equation 3-3]

	AB					
	Smooth surfaces					
Surface Description						
Manning's Roughness coeff., n	0.011					
Flow Length, L should be < 100 ft	100	ft		ft		ft
Two-yr, 24-hr rainfall, P ₂	3.01	in		in		in
Elevation 1, E ₁	1092.00	ft		ft		ft
Elevation 2, E ₂	1090.59	ft		ft		ft
Land Slope, s = (E ₁ - E ₂) / L	0.01	ft/ft		ft/ft		ft/ft
Tt = 0.007 * (n * L ^{0.8} / (P ₂ ^{0.5} * s ^{0.4}))	0.02	hr		hr		hr
	1.4		+		+	
						= 1.4 min

Shallow Concentrated Flow [TR-55 figure 3-1]

	BC		CD		DE		
	Unpaved		Paved		Unpaved		
Surface Description							
Flow Length, L	299	ft	13	ft	1711	ft	
Elevation 1, E ₁	1090.59	ft	1086.26	ft	1086.12	ft	
Elevation 2, E ₂	1086.26	ft	1086.12	ft	1084.00	ft	
Watercourse Slope, s = (E ₁ - E ₂) / L	0.014		0.011	ft/ft	0.001	ft/ft	
Velocity, V	1.94		2.11	ft/s	0.57	ft/s	
T _t = L / (3600 V)	0.04		0.00	hr	0.84	hr	
	2.6		0.1		50.2		
		+		+		+	
							= 52.9 min

Open Channel Flow [TR-55 equation 3-4]

Open Channel	Front Slope, s ₁	:1	:1	:1	:1	
	Bottom width, B	ft	ft	ft	ft	
	Back Slope, s ₂	:1	:1	:1	:1	
	Depth, H	ft	ft	ft	ft	
Pipe	Diameter, D	in	in	in	in	
Cross Sectional Flow Area, a		sq ft	sq ft	sq ft	sq ft	
Wetted Perimeter, P _w		ft	ft	ft	ft	
Hydraulic radius, r = a / P _w		ft	ft	ft	ft	
Flow Length, L		ft	ft	ft	ft	
Elevation 1, E ₁		ft	ft	ft	ft	
Elevation 2, E ₂		ft	ft	ft	ft	
Channel Slope, s = (E ₁ - E ₂) / L		ft/ft	ft/ft	ft/ft	ft/ft	
Manning's Roughness coeff., n						
Velocity, V = 1.49 r ^{2/3} * s ^{1/2} / n		ft/s	ft/s	ft/s	ft/s	
T _t = L / (3600 V)		ft/s	ft/s	ft/s	ft/s	
		+	+	+		
						= 0.0 min

Total Time of Concentration

Sub-Basin Tc = 54.3 min

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	Chk. By:	LMM
	Job No:	10144998.003

Time of Concentration Calculations

Sub-Basin Name: Basin E
Condition: Existing

Sheet Flow [TR-55 equation 3-3]

	AB				
	Dense grasses				
Surface Description					
Manning's Roughness coeff., n	0.24				
Flow Length, L should be < 100 ft	100	ft	ft	ft	ft
Two-yr, 24-hr rainfall, P ₂	3.01	in	in	in	in
Elevation 1, E ₁	1096.00	ft	ft	ft	ft
Elevation 2, E ₂	1095.23	ft	ft	ft	ft
Land Slope, s = (E ₁ - E ₂) / L	0.01	ft/ft	ft/ft	ft/ft	ft/ft
Tt = 0.007 * (n * L ^{0.8} / (P ₂ ^{0.5} * s ^{0.4}))	0.36	hr	hr	hr	hr
	21.6	+	+	+	= 21.6 min

Shallow Concentrated Flow [TR-55 figure 3-1]

	BC				
	Unpaved				
Surface Description					
Flow Length, L	608	ft	ft	ft	ft
Elevation 1, E ₁	1095.23	ft	ft	ft	ft
Elevation 2, E ₂	1085.34	ft	ft	ft	ft
Watercourse Slope, s = (E ₁ - E ₂) / L	0.016	ft/ft	ft/ft	ft/ft	ft/ft
Velocity, V	2.06	ft/s	ft/s	ft/s	ft/s
T _t = L / (3600 V)	0.08	hr	hr	hr	hr
	4.9	+	+	+	= 4.9 min

Open Channel Flow [TR-55 equation 3-4]

Open Channel	Front Slope, s ₁	:1	:1	:1	:1
	Bottom width, B	ft	ft	ft	ft
	Back Slope, s ₂	:1	:1	:1	:1
	Depth, H	ft	ft	ft	ft
Pipe	Diameter, D	in	in	in	in
Cross Sectional Flow Area, a		sq ft	sq ft	sq ft	sq ft
Wetted Perimeter, P _w		ft	ft	ft	ft
Hydraulic radius, r = a / P _w		ft	ft	ft	ft
Flow Length, L		ft	ft	ft	ft
Elevation 1, E ₁		ft	ft	ft	ft
Elevation 2, E ₂		ft	ft	ft	ft
Channel Slope, s = (E ₁ - E ₂) / L		ft/ft	ft/ft	ft/ft	ft/ft
Manning's Roughness coeff., n					
Velocity, V = 1.49 r ^{2/3} * s ^{1/2} / n		ft/s	ft/s	ft/s	ft/s
T _t = L / (3600 V)		ft/s	ft/s	ft/s	ft/s
		+	+	+	= 0.0 min

Total Time of Concentration

Sub-Basin Tc = 26.5 min

Sioux Gateway Airport Runway Program EA	Comp. By:	JKK
	Date:	5/12/2025
	Chk. By:	LMM
	Job No:	10144998.003

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5/12/2025

LMM

10144998.003

Time of Concentration Calculations

Sub-Basin Name: **Basin F**

Condition: Existing

Sheet Flow [TR-55 equation 3-3]

	AB				
Surface Description	Dense grasses				
Manning's Roughness coeff., n	0.24				
Flow Length, L should be < 100 ft	100	ft	ft	ft	ft
Two-yr, 24-hr rainfall, P ₂	3.01	in	in	in	in
Elevation 1, E ₁	1096.00	ft	ft	ft	ft
Elevation 2, E ₂	1095.67	ft	ft	ft	ft
Land Slope, s = (E ₁ - E ₂) / L	0.00	ft/ft	ft/ft	ft/ft	ft/ft
Tt = 0.007 * (n * L ^{0.8} / (P ₂ ^{0.5} * s ^{0.4}))	0.50	hr	hr	hr	hr
	30.3	+	+	+	= 30.3 min

Shallow Concentrated Flow [TR-55 figure 3-1]

	BC				
Surface Description	Unpaved				
Flow Length, L	890	ft			
Elevation 1, E ₁	1095.67	ft			
Elevation 2, E ₂	1086.34	ft			
Watercourse Slope, s = (E ₁ - E ₂) / L	0.010		ft/ft	ft/ft	ft/ft
Velocity, V	1.65		ft/s	ft/s	ft/s
T _t = L / (3600 V)	0.15		hr	hr	hr
	9.0	+		+	
					= 9.0 min

Open Channel Flow [TR-55 equation 3-4]

Open Channel	Front Slope, s_1	:	:	:	:
	Bottom width, B	ft	ft	ft	ft
	Back Slope, s_2	:	:	:	:
	Depth, H	ft	ft	ft	ft
Pipe	Diameter, D	in	in	in	in
Cross Sectional Flow Area, a		sq ft	sq ft	sq ft	sq ft
Wetted Perimeter, P_w		ft	ft	ft	ft
Hydraulic radius, $r = a / P_w$		ft	ft	ft	ft
Flow Length, L		ft	ft	ft	ft
Elevation 1, E_1		ft	ft	ft	ft
Elevation 2, E_2		ft	ft	ft	ft
Channel Slope, $s = (E_1 - E_2) / L$		ft/ft	ft/ft	ft/ft	ft/ft
Manning's Roughness coeff., n					
Velocity, $V = 1.49 r^{2/3} * s^{1/2} / n$		ft/s	ft/s	ft/s	ft/s
$T_t = L / (3600 V)$		ft/s	ft/s	ft/s	ft/s
		+	+	+	=
					0.0 min

Total Time of Concentration

Sub-Basin Tc = 39.2 min

Sioux Gateway Airport Runway Program EA	Comp. By:	JKK
	Date:	5/12/2025
	Chk. By:	LMM
	Job No:	10144998.003

Sioux Gateway Airport Runway Program EA	Comp. By:	JKK
	Date:	5/12/2025
	Chk. By:	LMM
	Job No:	10144998.003

Time of Concentration Calculations

Sub-Basin Name: **Basin G (Page 1 of 2)**
Condition: **Existing**

Sheet Flow [TR-55 equation 3-3]

	AB				
Surface Description	Dense grasses				
Manning's Roughness coeff., n	0.24				
Flow Length, L should be < 100 ft	100	ft	ft	ft	ft
Two-yr, 24-hr rainfall, P ₂	3.01	in	in	in	in
Elevation 1, E ₁	1096.50	ft	ft	ft	ft
Elevation 2, E ₂	1096.33	ft	ft	ft	ft
Land Slope, s = (E ₁ - E ₂) / L	0.00	ft/ft	ft/ft	ft/ft	ft/ft
Tt = 0.007 * (n * L ^{0.8} / (P ₂ ^{0.5} * s ^{0.4}))	0.66	hr	hr	hr	hr
	39.4	+	+	+	= 39.4 min

Shallow Concentrated Flow [TR-55 figure 3-1]

	BC				
Surface Description	Unpaved				
Flow Length, L	587	ft			
Elevation 1, E ₁	1096.33	ft			
Elevation 2, E ₂	1095.34	ft			
Watercourse Slope, s = (E ₁ - E ₂) / L	0.002		ft/ft	ft/ft	ft/ft
Velocity, V	0.66		ft/s	ft/s	ft/s
T _t = L / (3600 V)	0.25		hr	hr	hr
	14.8	+		+	
					= 14.8 min

Open Channel Flow [TR-55 equation 3-4]

		CD		DE		EF		FG		
		Pipe		Pipe		Pipe		Pipe		
Open Channel	Front Slope, s_1		:1		:1		:1		:1	
	Bottom width, B		ft		ft		ft		ft	
	Back Slope, s_2		:1		:1		:1		:1	
	Depth, H		ft		ft		ft		ft	
Pipe	Diameter, D	12	in	15	in	18	in	21	in	
Cross Sectional Flow Area, a		0.79	sq ft	1.23	sq ft	1.77	sq ft	2.41	sq ft	
Wetted Perimeter, P_w		3.14	ft	3.93	ft	4.71	ft	5.50	ft	
Hydraulic radius, $r = a / P_w$		0.25	ft	0.31	ft	0.38	ft	0.44	ft	
Flow Length, L		931	ft	800	ft	347	ft	599	ft	
Elevation 1, E_1		1093.01	ft	1088.80	ft	1087.50	ft	1086.75	ft	
Elevation 2, E_2		1088.80	ft	1087.60	ft	1086.75	ft	1085.93	ft	
Channel Slope, $s = (E_1 - E_2) / L$		0.005	ft/ft	0.002	ft/ft	0.002	ft/ft	0.001	ft/ft	
Manning's Roughness coeff., n		0.013		0.013		0.013		0.013		
Velocity, $V = 1.49 r^{2/3} s^{1/2} / n$		3.06	ft/s	2.04	ft/s	2.77	ft/s	2.44	ft/s	
$T_t = L / (3600 V)$		0.08	ft/s	0.11	ft/s	0.03	ft/s	0.07	ft/s	
		5.1	+	6.5	+	2.1	+	4.1	=	17.8 min

Total Time of Concentration

Sub-Basin Tc = min

Sioux Gateway Airport Runway Program EA	Comp. By: JKK Date: 5/12/2025 Chk. By: LMM Job No: 10144998.003
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Time of Concentration Calculations

Sub-Basin Name: Basin G (Page 2 of 2)
Condition: Existing

Sheet Flow [TR-55 equation 3-3]

Surface Description					
Manning's Roughness coeff., n					
Flow Length, L should be < 100 ft	ft	ft	ft	ft	
Two-yr, 24-hr rainfall, P ₂	in	in	in	in	
Elevation 1, E ₁	ft	ft	ft	ft	
Elevation 2, E ₂	ft	ft	ft	ft	
Land Slope, s = (E ₁ - E ₂) / L	ft/ft	ft/ft	ft/ft	ft/ft	
Tt = 0.007 * (n * L ^{0.8} / (P ₂ ^{0.5} * s ^{0.4}))	hr	hr	hr	hr	
	+	+	+	=	0.0 min

Shallow Concentrated Flow [TR-55 figure 3-1]

Surface Description					
Flow Length, L	ft	ft	ft	ft	
Elevation 1, E ₁	ft	ft	ft	ft	
Elevation 2, E ₂	ft	ft	ft	ft	
Watercourse Slope, s = (E ₁ - E ₂) / L		ft/ft	ft/ft	ft/ft	
Velocity, V		ft/s	ft/s	ft/s	
T _t = L / (3600 V)		hr	hr	hr	
	+	+	+	=	0.0 min

Open Channel Flow [TR-55 equation 3-4]

		GH		HI		IJ		
		Pipe		Pipe		Pipe		
Open Channel	Front Slope, s ₁	:1	:1	:1	:1	:1	:1	
	Bottom width, B	ft	ft	ft	ft	ft	ft	
	Back Slope, s ₂	:1	:1	:1	:1	:1	:1	
	Depth, H	ft	ft	ft	ft	ft	ft	
Pipe	Diameter, D	24 in	30 in	48 in				
Cross Sectional Flow Area, a		3.14 sq ft	4.91 sq ft	12.57 sq ft				
Wetted Perimeter, P _w		6.28 ft	7.85 ft	12.57 ft				
Hydraulic radius, r = a / P _w		0.50 ft	0.63 ft	1.00 ft				
Flow Length, L		301 ft	1299 ft	776 ft				
Elevation 1, E ₁		1085.93 ft	1085.46 ft	1083.44 ft				
Elevation 2, E ₂		1085.46 ft	1083.54 ft	1082.89 ft				
Channel Slope, s = (E ₁ - E ₂) / L		0.002 ft/ft	0.001 ft/ft	0.001 ft/ft				
Manning's Roughness coeff., n		0.013	0.013	0.013				
Velocity, V = 1.49 r ^{2/3} * s ^{1/2} / n		2.85 ft/s	3.22 ft/s	3.05 ft/s				
T _t = L / (3600 V)		0.03 ft/s	0.11 ft/s	0.07 ft/s				
		1.8	6.7	4.2	+	=	12.7	min

Total Time of Concentration

Sub-Basin Tc = 84.7 min

Sioux Gateway Airport Runway Program EA	Comp. By: JKK Date: 5/12/2025 Chk. By: LMM Job No: 10144998.003
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Time of Concentration Calculations

Sub-Basin Name: Basin H (Page 1 of 2)
Condition: Existing

Sheet Flow [TR-55 equation 3-3]

	AB		BC			
	Smooth surfaces		Dense grasses			
Surface Description	0.011		0.24			
Manning's Roughness coeff., n	97	ft	3	ft		
Flow Length, L should be < 100 ft	3.01	in	3.01	in		
Two-yr, 24-hr rainfall, P ₂	1096.00	ft	1095.84	ft		
Elevation 1, E ₁	1095.84	ft	1095.81	ft		
Elevation 2, E ₂	0.00	ft/ft	0.01	ft/ft		
Land Slope, s = (E ₁ - E ₂) / L	0.06	hr	0.02	hr		
Tt = 0.007 * (n * L ^{0.8} / (P ₂ ^{0.5} * s ^{0.4}))	3.3		1.2			
		+		+		
						4.5 min

Shallow Concentrated Flow [TR-55 figure 3-1]

	CD		EF		GH	
	Unpaved		Unpaved		Unpaved	
Surface Description	1783	ft	418	ft	1235	ft
Flow Length, L	1095.81	ft	1090.19	ft	1090.10	ft
Elevation 1, E ₁	1091.43	ft	1090.11	ft	1088.09	ft
Elevation 2, E ₂	0.002		0.000	ft/ft	0.002	ft/ft
Watercourse Slope, s = (E ₁ - E ₂) / L	0.80		0.22	ft/s	0.65	ft/s
Velocity, V	0.62		0.52	hr	0.53	hr
T _t = L / (3600 V)	37.2		31.2		31.6	
		+		+		
						100.0 min

Open Channel Flow [TR-55 equation 3-4]

		DE		FG		HI		IJ	
		Pipe		Pipe		Pipe		Channel	
Open Channel	Front Slope, s ₁		:1		:1		:1	4.00	:1
	Bottom width, B		ft		ft		ft	0.00	ft
	Back Slope, s ₂		:1		:1		:1	4.00	:1
	Depth, H		ft		ft		ft	4.00	ft
Pipe	Diameter, D	15	in	15	in	18	in		in
Cross Sectional Flow Area, a		1.23	sq ft	1.23	sq ft	1.77	sq ft	64.00	sq ft
Wetted Perimeter, P _w		3.93	ft	3.93	ft	4.71	ft	32.98	ft
Hydraulic radius, r = a / P _w		0.31	ft	0.31	ft	0.38	ft	1.94	ft
Flow Length, L		742	ft	170	ft	1438	ft	958	ft
Elevation 1, E ₁		1091.43	ft	1090.11	ft	1088.09	ft	1084.91	ft
Elevation 2, E ₂		1090.19	ft	1090.10	ft	1084.91	ft	1084.75	ft
Channel Slope, s = (E ₁ - E ₂) / L		0.002	ft/ft	0.000	ft/ft	0.002	ft/ft	0.000	ft/ft
Manning's Roughness coeff., n		0.013		0.013		0.013		0.035	
Velocity, V = 1.49 r ^{2/3} * s ^{1/2} / n		2.16	ft/s	0.40	ft/s	2.80	ft/s	0.86	ft/s
T _t = L / (3600 V)		0.10	ft/s	0.12	ft/s	0.14	ft/s	0.31	ft/s
		5.7		7.0		8.6		18.7	
			+		+		+		
									39.9 min

Total Time of Concentration

Sub-Basin Tc = 144.4 min

Sioux Gateway Airport Runway Program EA	Comp. By: JKK Date: 5/12/2025 Chk. By: LMM Job No: 10144998.003
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Time of Concentration Calculations

Sub-Basin Name: Basin H (Page 2 of 2)
Condition: Existing

Sheet Flow [TR-55 equation 3-3]

Surface Description					
Manning's Roughness coeff., n					
Flow Length, L should be < 100 ft		ft	ft	ft	
Two-yr, 24-hr rainfall, P ₂		in	in	in	
Elevation 1, E ₁		ft	ft	ft	
Elevation 2, E ₂		ft	ft	ft	
Land Slope, s = (E ₁ - E ₂) / L		ft/ft	ft/ft	ft/ft	
T _t = 0.007 * (n * L ^{0.8} / (P ₂ ^{0.5} * s ^{0.4}))		hr	hr	hr	
		+	+	=	0.0 min

Shallow Concentrated Flow [TR-55 figure 3-1]

Surface Description					
Flow Length, L	ft			ft	
Elevation 1, E ₁	ft			ft	
Elevation 2, E ₂	ft			ft	
Watercourse Slope, s = (E ₁ - E ₂) / L		ft/ft		ft/ft	
Velocity, V		ft/s		ft/s	
T _t = L / (3600 V)		hr		hr	
	+	+		=	0.0 min

Open Channel Flow [TR-55 equation 3-4]

		JK		KL		LM		MN	
		Pipe		Channel		Pipe		Channel	
Open Channel	Front Slope, s ₁	:1	:1	:1	:1	:1	:1	:1	:1
	Bottom width, B	ft	ft	ft	ft	ft	ft	ft	ft
	Back Slope, s ₂	:1	:1	:1	:1	:1	:1	:1	:1
	Depth, H	ft	ft	ft	ft	ft	ft	ft	ft
Pipe	Diameter, D	24 in			84 in				
Cross Sectional Flow Area, a		3.14 sq ft	216.00 sq ft	38.48 sq ft	100.00 sq ft				
Wetted Perimeter, P _w		6.28 ft	43.40 ft	21.99 ft	41.31 ft				
Hydraulic radius, r = a / P _w		0.50 ft	4.98 ft	1.75 ft	2.42 ft				
Flow Length, L		56 ft	207 ft	60 ft	1235 ft				
Elevation 1, E ₁		1084.75 ft	1082.05 ft	1078.82 ft	1078.81 ft				
Elevation 2, E ₂		1082.05 ft	1078.82 ft	1078.81 ft	1076.68 ft				
Channel Slope, s = (E ₁ - E ₂) / L		0.048 ft/ft	0.016 ft/ft	0.000 ft/ft	0.002 ft/ft				
Manning's Roughness coeff., n		0.013	0.035	0.024	0.035				
Velocity, V = 1.49 r ^{2/3} * s ^{1/2} / n		15.85 ft/s	15.50 ft/s	1.16 ft/s	3.19 ft/s				
T _t = L / (3600 V)		0.00 ft/s	0.00 ft/s	0.01 ft/s	0.11 ft/s				
		0.1	0.2	0.9	6.5				7.6 min

Total Time of Concentration

Sub-Basin Tc = 152.0 min

Sioux Gateway Airport Runway Program EA

Comp. By:

JKK

Date:

5/12/2025

Chk. By:

LMM

Job No:

10144998.003

Time of Concentration Calculations

Sub-Basin Name: Basin A (Page 1 of 2)
Condition: Future

Sheet Flow [TR-55 equation 3-3]

	AB		BC			
	Smooth surfaces		Dense grasses			
Surface Description	0.011		0.24			
Manning's Roughness coeff., n	0.011		0.24			
Flow Length, L (should be <= 100 ft)	47ft		53ft			
Two-yr, 24-hr rainfall, P ₂	3.01in		3.01in			
Elevation 1, E ₁	1098.00ft		1097.81ft			
Elevation 2, E ₂	1097.81ft		1097.29ft			
Land Slope, s = (E ₁ - E ₂) / L	0.00ft/ft		0.01ft/ft			
Tt = 0.007 * (n * L) ^{0.8} / (P ₂ ^{0.5} * s ^{0.4})	0.02hr		0.20hr			
	1.3	+	11.8	+		= 13.1 min

Shallow Concentrated Flow [TR-55 figure 3-1]

	CD		EF		GH		HI	
	Unpaved		Unpaved		Unpaved		Paved	
Surface Description	1911ft		107ft		702ft		637ft	
Flow Length, L	1911ft		107ft		702ft		637ft	
Elevation 1, E ₁	1097.29ft		1082.19ft		1081.71ft		1081.09ft	
Elevation 2, E ₂	1082.73ft		1082.13ft		1081.09ft		1080.53ft	
Watercourse Slope, s = (E ₁ - E ₂) / L	0.008ft/ft		0.001ft/ft		0.001ft/ft		0.001ft/ft	
Velocity, V	1.41ft/s		0.38ft/s		0.48ft/s		0.60ft/s	
T _t = L / (3600 * V)	0.38hr		0.08hr		0.41hr		0.29hr	
	22.6	+	4.7	+	24.4	+	17.6	= 69.3 min

Open Channel Flow [TR-55 equation 3-4]

	DE		FG			
	Pipe		Pipe			
Open Channel	Front Slope, s ₁	:1	:1	:1	:1	
	Bottom width, B	ft	ft	ft	ft	
	Back Slope, s ₂	:1	:1	:1	:1	
	Depth, H	ft	ft	ft	ft	
Pipe	Diameter, D	24in	30in	in	in	
Cross Sectional Flow Area, a	3.14sq ft		4.91sq ft			
Wetted Perimeter, P _w	6.28ft		7.85ft			
Hydraulic radius, r = a / P _w	0.50ft		0.63ft			
Flow Length, L	361ft		43ft			
Elevation 1, E ₁	1082.73ft		1082.13ft			
Elevation 2, E ₂	1082.19ft		1081.71ft			
Channel Slope, s = (E ₁ - E ₂) / L	0.001ft/ft		0.010ft/ft			
Manning's Roughness coeff., n	0.013		0.013			
Velocity, V = 1.49 * r ^{2/3} * s ^{1/2} / n	2.79ft/s		8.28ft/s			
T _t = L / (3600 * V)	0.04ft/s		0.00ft/s			
	2.2	+	0.1	+		= 2.2 min

Total Time of Concentration

Sub-Basin Tc = 84.6 min

Sioux Gateway Airport Runway Program EA	Comp. By: JKK Date: 5/12/2025 Chk. By: LMM Job No: 10144998.003
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Time of Concentration Calculations

Sub-Basin Name: Basin A (Page 2 of 2)
Condition: Future

Sheet Flow [TR-55 equation 3-3]

Surface Description					
Manning's Roughness coeff., n					
Flow Length, L (should be <= 100 ft)	ft	ft	ft	ft	
Two-yr, 24-hr rainfall, P ₂	in	in	in	in	
Elevation 1, E ₁	ft	ft	ft	ft	
Elevation 2, E ₂	ft	ft	ft	ft	
Land Slope, s = (E ₁ - E ₂) / L	ft/ft	ft/ft	ft/ft	ft/ft	
Tt = 0.007 * (n * L) ^{0.8} / (P ₂ ^{0.5} * s ^{0.4})	hr	hr	hr	hr	
	+	+	+	=	0.0 min

Shallow Concentrated Flow [TR-55 figure 3-1]

	IJ				
Surface Description	Unpaved				
Flow Length, L	388	ft	ft	ft	ft
Elevation 1, E ₁	1080.53	ft	ft	ft	ft
Elevation 2, E ₂	1080.19	ft	ft	ft	ft
Watercourse Slope, s = (E ₁ - E ₂) / L	0.001	ft/ft	ft/ft	ft/ft	ft/ft
Velocity, V	0.48	ft/s	ft/s	ft/s	ft/s
T _t = L / (3600 * V)	0.23	hr	hr	hr	
	13.5	+	+	+	13.5 min

Open Channel Flow [TR-55 equation 3-4]

		JK		KL			
		Pipe		Channel			
Open Channel	Front Slope, s ₁	:1	:1	:1	:1		
	Bottom width, B	ft	ft	ft	ft		
	Back Slope, s ₂	:1	:1	:1	:1		
	Depth, H	ft	ft	ft	ft		
Pipe	Diameter, D	42	in		in		
Cross Sectional Flow Area, a		9.62	sq ft	1128.00	sq ft		
Wetted Perimeter, P _w		11.00	ft	150.63	ft		
Hydraulic radius, r = a / P _w		0.88	ft	7.49	ft		
Flow Length, L		84	ft	3809	ft		
Elevation 1, E ₁		1080.19	ft	1072.86	ft		
Elevation 2, E ₂		1072.86	ft	1066.00	ft		
Channel Slope, s = (E ₁ - E ₂) / L		0.087	ft/ft	0.002	ft/ft		
Manning's Roughness coeff., n		0.024		0.035			
Velocity, V = 1.49 * r ^{2/3} * s ^{1/2} / n		16.78	ft/s	6.92	ft/s		
T _t = L / (3600 * V)		0.00	ft/s	0.15	ft/s		
		0.1	+	9.2	+		9.3 min

Total Time of Concentration

Sub-Basin Tc = 107.4 min

Sioux Gateway Airport Runway Program EA

Comp. By:

JKK

Date:

5/12/2025

Chk. By:

LMM

Job No:

10144998.003

Time of Concentration Calculations

Sub-Basin Name: Basin B
Condition: Future

Sheet Flow [TR-55 equation 3-3]

	AB						
	Dense grasses						
Surface Description							
Manning's Roughness coeff., n	0.24						
Flow Length, L (should be <= 100 ft)	100ft						
Two-yr, 24-hr rainfall, P ₂	3.01in						
Elevation 1, E ₁	1090.00ft						
Elevation 2, E ₂	1088.98ft						
Land Slope, s = (E ₁ - E ₂) / L	0.01ft/ft						
T _t = 0.007 * (n * L) ^{0.8} / (P ₂ ^{0.5} * s ^{0.4})	0.32hr						
	19.3	+		+		=	19.3 min

Shallow Concentrated Flow [TR-55 figure 3-1]

	BC						
	Unpaved						
Surface Description							
Flow Length, L	906ft						
Elevation 1, E ₁	1088.98ft						
Elevation 2, E ₂	1079.77ft						
Watercourse Slope, s = (E ₁ - E ₂) / L	0.010ft/ft						
Velocity, V	1.63ft/s						
T _t = L / (3600 * V)	0.15hr						
	9.3	+		+		=	9.3 min

Open Channel Flow [TR-55 equation 3-4]

	CD						
	Channel						
Open Channel	Front Slope, s ₁	4.00:1					
	Bottom width, B	15.00ft					
	Back Slope, s ₂	6.00:1					
	Depth, H	6.00ft					
Pipe	Diameter, D						
Cross Sectional Flow Area, a	270.00sq ft						
Wetted Perimeter, P _w	76.24ft						
Hydraulic radius, r = a / P _w	3.54ft						
Flow Length, L	1731ft						
Elevation 1, E ₁	1079.77ft						
Elevation 2, E ₂	1076.00ft						
Channel Slope, s = (E ₁ - E ₂) / L	0.002ft/ft						
Manning's Roughness coeff., n	0.035						
Velocity, V = 1.49 * r ^{2/3} * s ^{1/2} / n	4.62ft/s						
T _t = L / (3600 * V)	0.10ft/s						
	6.2	+		+		=	6.2 min

Total Time of Concentration

Sub-Basin Tc = 34.8 min

Sioux Gateway Airport Runway Program EA

Comp. By:

Date:

Chk. By:

Job No:

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Time of Concentration Calculations

Sub-Basin Name: Basin C
Condition: Future

Sheet Flow [TR-55 equation 3-3]

	AB		BC			
Surface Description	Smooth surfaces		Dense grasses			
Manning's Roughness coeff., n	0.011		0.24			
Flow Length, L (should be <= 100 ft)	92ft		8ft			
Two-yr, 24-hr rainfall, P ₂	3.01in		3.01in			
Elevation 1, E ₁	1092.00ft		1090.79ft			
Elevation 2, E ₂	1090.79ft		1090.66ft			
Land Slope, s = (E ₁ - E ₂) / L	0.01ft/ft		0.02ft/ft			
Tt = 0.007 * (n * L) ^{0.8} / (P ₂ ^{0.5} * s ^{0.4})	0.02hr		0.04hr			
	1.4	+	2.1	+		= 3.5 min

Shallow Concentrated Flow [TR-55 figure 3-1]

	CD					
Surface Description	Unpaved					
Flow Length, L	1678ft					
Elevation 1, E ₁	1090.66ft					
Elevation 2, E ₂	1083.90ft					
Watercourse Slope, s = (E ₁ - E ₂) / L	0.004ft/ft					
Velocity, V	1.02ft/s					
T _t = L / (3600 * V)	0.46hr					
	27.3	+		+		= 27.3 min

Open Channel Flow [TR-55 equation 3-4]

Open Channel	Front Slope, s ₁	:1	:1	:1	:1	
	Bottom width, B	ft	ft	ft	ft	
	Back Slope, s ₂	:1	:1	:1	:1	
	Depth, H	ft	ft	ft	ft	
Pipe	Diameter, D	in	in	in	in	
Cross Sectional Flow Area, a		sq ft	sq ft	sq ft	sq ft	
Wetted Perimeter, P _w		ft	ft	ft	ft	
Hydraulic radius, r = a / P _w		ft	ft	ft	ft	
Flow Length, L		ft	ft	ft	ft	
Elevation 1, E ₁		ft	ft	ft	ft	
Elevation 2, E ₂		ft	ft	ft	ft	
Channel Slope, s = (E ₁ - E ₂) / L		ft/ft	ft/ft	ft/ft	ft/ft	
Manning's Roughness coeff., n						
Velocity, V = 1.49 * r ^{2/3} * s ^{1/2} / n		ft/s	ft/s	ft/s	ft/s	
T _t = L / (3600 * V)		ft/s	ft/s	ft/s	ft/s	
		+	+	+		= 0.0 min

Total Time of Concentration

Sub-Basin Tc = 30.8 min

Sioux Gateway Airport Runway Program EA	Comp. By: JKK Date: 5/12/2025 Chk. By: LMM Job No: 10144998.003
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Time of Concentration Calculations

Sub-Basin Name: Basin D
Condition: Future

Sheet Flow [TR-55 equation 3-3]

	AB					
	Smooth surfaces					
Surface Description						
Manning's Roughness coeff., n	0.011					
Flow Length, L (should be <= 100 ft)	100	ft		ft		ft
Two-yr, 24-hr rainfall, P ₂	3.01	in		in		in
Elevation 1, E ₁	1092.00	ft		ft		ft
Elevation 2, E ₂	1090.59	ft		ft		ft
Land Slope, s = (E ₁ - E ₂) / L	0.01	ft/ft		ft/ft		ft/ft
T _t = 0.007 * (n * L) ^{0.8} / (P ₂ ^{0.5} * s ^{0.4})	0.02	hr		hr		hr
	1.4		+		+	
						= 1.4 min

Shallow Concentrated Flow [TR-55 figure 3-1]

	BC		CD		DE		
	Unpaved		Paved		Unpaved		
Surface Description							
Flow Length, L	298	ft	32	ft	1693	ft	
Elevation 1, E ₁	1090.59	ft	1086.27	ft	1085.99	ft	
Elevation 2, E ₂	1086.27	ft	1085.99	ft	1084.00	ft	
Watercourse Slope, s = (E ₁ - E ₂) / L	0.014		0.009	ft/ft	0.001	ft/ft	
Velocity, V	1.94		1.90	ft/s	0.55	ft/s	
T _t = L / (3600 * V)	0.04		0.00	hr	0.85	hr	
	2.6		0.3		51.0		= 53.8 min

Open Channel Flow [TR-55 equation 3-4]

Open Channel	Front Slope, s ₁	:1	:1	:1	:1	
	Bottom width, B	ft	ft	ft	ft	
	Back Slope, s ₂	:1	:1	:1	:1	
	Depth, H	ft	ft	ft	ft	
Pipe	Diameter, D	in	in	in	in	
Cross Sectional Flow Area, a		sq ft	sq ft	sq ft	sq ft	
Wetted Perimeter, P _w		ft	ft	ft	ft	
Hydraulic radius, r = a / P _w		ft	ft	ft	ft	
Flow Length, L		ft	ft	ft	ft	
Elevation 1, E ₁		ft	ft	ft	ft	
Elevation 2, E ₂		ft	ft	ft	ft	
Channel Slope, s = (E ₁ - E ₂) / L		ft/ft	ft/ft	ft/ft	ft/ft	
Manning's Roughness coeff., n						
Velocity, V = 1.49 * r ^{2/3} * s ^{1/2} / n		ft/s	ft/s	ft/s	ft/s	
T _t = L / (3600 * V)		ft/s	ft/s	ft/s	ft/s	
						= 0.0 min

Total Time of Concentration

Sub-Basin Tc = 55.3 min

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	Job No:	10144998.003

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Time of Concentration Calculations

Sub-Basin Name: **Basin E**

Condition: Future

Sheet Flow [TR-55 equation 3-3]

	AB				
Surface Description	Dense grasses				
Manning's Roughness coeff., n	0.24				
Flow Length, L (should be <= 100 ft)	100	ft	ft	ft	ft
Two-yr, 24-hr rainfall, P ₂	3.01	in	in	in	in
Elevation 1, E ₁	1096.00	ft	ft	ft	ft
Elevation 2, E ₂	1095.23	ft	ft	ft	ft
Land Slope, s = (E ₁ - E ₂) / L	0.01	ft/ft	ft/ft	ft/ft	ft/ft
Tt = 0.007 * (n * L) ^{0.8} / (P ₂ ^{0.5} * s ^{0.4})	0.36	hr	hr	hr	hr
	21.6	+	+	+	= 21.6 min

Shallow Concentrated Flow [TR-55 figure 3-1]

	BC				
Surface Description	Unpaved				
Flow Length, L	608	ft			
Elevation 1, E ₁	1095.23	ft			
Elevation 2, E ₂	1085.34	ft			
Watercourse Slope, s = (E ₁ - E ₂) / L	0.016		ft/ft		ft/ft
Velocity, V	2.06		ft/s		ft/s
T _t = L / (3600 * V)	0.08		hr		hr
	4.9	+		+	
					= 4.9 min

Open Channel Flow [TR-55 equation 3-4]

Open Channel	Front Slope, s_1	:	:	:	:
	Bottom width, B	ft	ft	ft	ft
	Back Slope, s_2	:	:	:	:
	Depth, H	ft	ft	ft	ft
Pipe	Diameter, D	in	in	in	in
Cross Sectional Flow Area, a		sq ft	sq ft	sq ft	sq ft
Wetted Perimeter, P_w		ft	ft	ft	ft
Hydraulic radius, $r = a / P_w$		ft	ft	ft	ft
Flow Length, L		ft	ft	ft	ft
Elevation 1, E_1		ft	ft	ft	ft
Elevation 2, E_2		ft	ft	ft	ft
Channel Slope, $s = (E_1 - E_2) / L$		ft/ft	ft/ft	ft/ft	ft/ft
Manning's Roughness coeff., n					
Velocity, $V = 1.49 * r^{2/3} * s^{1/2} / n$		ft/s	ft/s	ft/s	ft/s
$T_t = L / (3600 * V)$		ft/s	ft/s	ft/s	ft/s
		+	+	+	=
					0.0 min

Total Time of Concentration

Sub-Basin Tc = min

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	Chk. By:	LMM
	Job No:	10144998.003

Time of Concentration Calculations

Sub-Basin Name: **Basin F**
Condition: **Future**

Sheet Flow [TR-55 equation 3-3]

	AB					
Surface Description	Dense grasses					
Manning's Roughness coeff., n	0.24					
Flow Length, L (should be <= 100 ft)	100	ft				
Two-yr, 24-hr rainfall, P ₂	3.01	in				
Elevation 1, E ₁	1096.00	ft				
Elevation 2, E ₂	1095.67	ft				
Land Slope, s = (E ₁ - E ₂) / L	0.00	ft/ft				
Tt = 0.007 * (n * L) ^{0.8} / (P ₂ ^{0.5} * s ^{0.4})	0.50	hr				
	30.3	+		+		= 30.3 min

Shallow Concentrated Flow [TR-55 figure 3-1]

Surface Description	BC					
Flow Length, L	890	ft		ft		ft
Elevation 1, E ₁	1095.67	ft		ft		ft
Elevation 2, E ₂	1086.34	ft		ft		ft
Watercourse Slope, s = (E ₁ - E ₂) / L	0.010		ft/ft	ft/ft		ft/ft
Velocity, V	1.65		ft/s	ft/s		ft/s
T _t = L / (3600 * V)	0.15		hr	hr		hr
	9.0	+		+		= 9.0 min

Open Channel Flow [TR-55 equation 3-4]

Open Channel	Front Slope, s ₁	:1	:1	:1	:1
	Bottom width, B	ft	ft	ft	ft
	Back Slope, s ₂	:1	:1	:1	:1
	Depth, H	ft	ft	ft	ft
Pipe	Diameter, D	in	in	in	in
Cross Sectional Flow Area, a		sq ft	sq ft	sq ft	sq ft
Wetted Perimeter, P _w		ft	ft	ft	ft
Hydraulic radius, r = a / P _w		ft	ft	ft	ft
Flow Length, L		ft	ft	ft	ft
Elevation 1, E ₁		ft	ft	ft	ft
Elevation 2, E ₂		ft	ft	ft	ft
Channel Slope, s = (E ₁ - E ₂) / L		ft/ft	ft/ft	ft/ft	ft/ft
Manning's Roughness coeff., n					
Velocity, V = 1.49 * r ^{2/3} * s ^{1/2} / n		ft/s	ft/s	ft/s	ft/s
T _t = L / (3600 * V)		ft/s	ft/s	ft/s	ft/s
		+	+	+	=
					0.0 min

Total Time of Concentration

Sub-Basin Tc = 39.2 min

Sioux Gateway Airport Runway Program EA	Comp. By: JKK Date: 5/12/2025 Chk. By: LMM Job No: 10144998.003
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Time of Concentration Calculations

Sub-Basin Name: Basin G (Page 1 of 2)
Condition: Future

Sheet Flow [TR-55 equation 3-3]

	AB					
	Dense grasses					
Surface Description						
Manning's Roughness coeff., n	0.24					
Flow Length, L (should be <= 100 ft)	100ft					
Two-yr, 24-hr rainfall, P ₂	3.01in					
Elevation 1, E ₁	1096.50ft					
Elevation 2, E ₂	1096.33ft					
Land Slope, s = (E ₁ - E ₂) / L	0.00ft/ft					
T _t = 0.007 * (n * L) ^{0.8} / (P ₂ ^{0.5} * s ^{0.4})	0.66hr					
	39.4	+		+		= 39.4 min

Shallow Concentrated Flow [TR-55 figure 3-1]

	BC					
	Unpaved					
Surface Description						
Flow Length, L	587ft					
Elevation 1, E ₁	1096.33ft					
Elevation 2, E ₂	1095.34ft					
Watercourse Slope, s = (E ₁ - E ₂) / L	0.002ft/ft					
Velocity, V	0.66ft/s					
T _t = L / (3600 * V)	0.25hr					
	14.8	+		+		= 14.8 min

Open Channel Flow [TR-55 equation 3-4]

	CD		DE		EF		FG	
	Pipe		Pipe		Pipe		Pipe	
Open Channel	Front Slope, s ₁	:1		:1		:1		:1
	Bottom width, B	ft		ft		ft		ft
	Back Slope, s ₂	:1		:1		:1		:1
	Depth, H	ft		ft		ft		ft
Pipe	Diameter, D	12in		15in		18in		21in
Cross Sectional Flow Area, a	0.79sq ft			1.23sq ft				2.41sq ft
Wetted Perimeter, P _w	3.14ft			3.93ft				5.50ft
Hydraulic radius, r = a / P _w	0.25ft			0.31ft				0.44ft
Flow Length, L	931ft			800ft				599ft
Elevation 1, E ₁	1093.01ft			1088.80ft				1086.75ft
Elevation 2, E ₂	1088.80ft			1087.60ft				1085.93ft
Channel Slope, s = (E ₁ - E ₂) / L	0.005ft/ft			0.002ft/ft				0.001ft/ft
Manning's Roughness coeff., n	0.013			0.013				0.013
Velocity, V = 1.49 * r ^{2/3} * s ^{1/2} / n	3.06ft/s			2.04ft/s				2.44ft/s
T _t = L / (3600 * V)	0.08ft/s			0.11ft/s				0.07ft/s
	5.1	+		6.5	+			4.1 = 17.8 min

Total Time of Concentration

Sub-Basin Tc = 72.0 min

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	Chk. By:	LMM
	Job No:	10144998.003

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Time of Concentration Calculations

Sub-Basin Name: **Basin G (Page 2 of 2)**

Condition: Future

Sheet Flow [TR-55 equation 3-3]

Surface Description						
Manning's Roughness coeff., n						
Flow Length, L (should be <= 100 ft)	ft	ft	ft	ft	ft	ft
Two-yr, 24-hr rainfall, P ₂	in	in	in	in	in	in
Elevation 1, E ₁	ft	ft	ft	ft	ft	ft
Elevation 2, E ₂	ft	ft	ft	ft	ft	ft
Land Slope, s = (E ₁ - E ₂) / L	ft/ft	ft/ft	ft/ft	ft/ft	ft/ft	ft/ft
Tt = 0.007 * (n * L) ^{0.8} / (P ₂ ^{0.5} * s ^{0.4})	hr	hr	hr	hr	hr	hr
	+	+	+	=		
					0.0	min

Shallow Concentrated Flow [TR-55 figure 3-1]

Surface Description						
Flow Length, L		ft		ft		ft
Elevation 1, E ₁		ft		ft		ft
Elevation 2, E ₂		ft		ft		ft
Watercourse Slope, s = (E ₁ - E ₂) / L		ft/ft		ft/ft		ft/ft
Velocity, V		ft/s		ft/s		ft/s
T _t = L / (3600 * V)		hr		hr		hr
	+		+		+	= 0.0 min

Open Channel Flow [TR-55 equation 3-4]

[illegible]

Total Time of Concentration	
1	1
2	2
3	3
4	4
5	5
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92	92
93	93
94	94
95	95
96	96
97	97
98	98
99	99
100	100

Sub-Basin Tc = 84.7 min

Sioux Gateway Airport Runway Program EA

Comp. By:

JKK

Date:

5/12/2025

Chk. By:

LMM

Job No:

10144998.003

Time of Concentration Calculations

Sub-Basin Name: Basin H (Page 1 of 2)
Condition: Future

Sheet Flow [TR-55 equation 3-3]

	AB		BC			
	Smooth surfaces		Dense grasses			
Surface Description	0.011		0.24			
Manning's Roughness coeff., n	0.011		0.24			
Flow Length, L (should be <= 100 ft)	97ft		3ft			
Two-yr, 24-hr rainfall, P ₂	3.01in		3.01in			
Elevation 1, E ₁	1096.00ft		1095.84ft			
Elevation 2, E ₂	1095.84ft		1095.81ft			
Land Slope, s = (E ₁ - E ₂) / L	0.00ft/ft		0.01ft/ft			
Tt = 0.007 * (n * L) ^{0.8} / (P ₂ ^{0.5} * s ^{0.4})	0.06hr		0.02hr			
	3.3	+	1.2	+		= 4.5 min

Shallow Concentrated Flow [TR-55 figure 3-1]

	CD		EF		GH	
	Unpaved		Unpaved		Unpaved	
Surface Description	1783ft		418ft		1235ft	
Flow Length, L	1783ft		418ft		1235ft	
Elevation 1, E ₁	1095.81ft		1090.19ft		1090.10ft	
Elevation 2, E ₂	1091.43ft		1090.11ft		1088.09ft	
Watercourse Slope, s = (E ₁ - E ₂) / L	0.002ft/ft		0.000ft/ft		0.002ft/ft	
Velocity, V	0.80ft/s		0.22ft/s		0.65ft/s	
T _t = L / (3600 * V)	0.62hr		0.52hr		0.53hr	
	37.2	+	31.2	+	31.6	= 100.0 min

Open Channel Flow [TR-55 equation 3-4]

		DE		FG		HI		IJ	
		Pipe		Pipe		Pipe		Channel	
Open Channel	Front Slope, s ₁		:1		:1		:1	4.00	:1
	Bottom width, B		ft		ft		ft	0.00	ft
	Back Slope, s ₂		:1		:1		:1	4.00	:1
	Depth, H		ft		ft		ft	4.00	ft
Pipe	Diameter, D	15	in	15	in	18	in		in
Cross Sectional Flow Area, a		1.23	sq ft	1.23	sq ft	1.77	sq ft	64.00	sq ft
Wetted Perimeter, P _w		3.93	ft	3.93	ft	4.71	ft	32.98	ft
Hydraulic radius, r = a / P _w		0.31	ft	0.31	ft	0.38	ft	1.94	ft
Flow Length, L		742	ft	170	ft	1438	ft	958	ft
Elevation 1, E ₁		1091.43	ft	1090.11	ft	1088.09	ft	1084.91	ft
Elevation 2, E ₂		1090.19	ft	1090.10	ft	1084.91	ft	1084.75	ft
Channel Slope, s = (E ₁ - E ₂) / L		0.002	ft/ft	0.000	ft/ft	0.002	ft/ft	0.000	ft/ft
Manning's Roughness coeff., n		0.013		0.013		0.013		0.035	
Velocity, V = 1.49 * r ^{2/3} * s ^{1/2} / n		2.16	ft/s	0.40	ft/s	2.80	ft/s	0.86	ft/s
T _t = L / (3600 * V)		0.10	ft/s	0.12	ft/s	0.14	ft/s	0.31	ft/s
		5.7	+	7.0	+	8.6	+	18.7	= 39.9 min

Total Time of Concentration

Sub-Basin Tc = 144.4 min

Sioux Gateway Airport Runway Program EA	Comp. By: JKK Date: 5/12/2025 Chk. By: LMM Job No: 10144998.003
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Time of Concentration Calculations

Sub-Basin Name: Basin H (Page 2 of 2)
Condition: Future

Sheet Flow [TR-55 equation 3-3]

Surface Description					
Manning's Roughness coeff., n					
Flow Length, L (should be <= 100 ft)		ft	ft	ft	
Two-yr, 24-hr rainfall, P ₂		in	in	in	
Elevation 1, E ₁		ft	ft	ft	
Elevation 2, E ₂		ft	ft	ft	
Land Slope, s = (E ₁ - E ₂) / L		ft/ft	ft/ft	ft/ft	
T _t = 0.007 * (n * L) ^{0.8} / (P ₂ ^{0.5} * s ^{0.4})		hr	hr	hr	
		+	+	=	0.0 min

Shallow Concentrated Flow [TR-55 figure 3-1]

Surface Description					
Flow Length, L	ft			ft	
Elevation 1, E ₁	ft			ft	
Elevation 2, E ₂	ft			ft	
Watercourse Slope, s = (E ₁ - E ₂) / L		ft/ft		ft/ft	
Velocity, V		ft/s		ft/s	
T _t = L / (3600 * V)		hr		hr	
	+	+		=	0.0 min

Open Channel Flow [TR-55 equation 3-4]

		JK		KL		LM		MN	
		Pipe		Channel		Pipe		Channel	
Open Channel	Front Slope, s ₁	:1	1.25				:1	5.00	
	Bottom width, B	ft	0.00				ft	0.00	
	Back Slope, s ₂	:1	1.75				:1	3.00	
	Depth, H	ft	12.00				ft	5.00	
Pipe	Diameter, D	in				84	in		
Cross Sectional Flow Area, a		sq ft	3.14	216.00		38.48	sq ft	100.00	
Wetted Perimeter, P _w		ft	6.28	43.40		21.99	ft	41.31	
Hydraulic radius, r = a / P _w		ft	0.50	4.98		1.75	ft	2.42	
Flow Length, L		ft	56	207		60	ft	1235	
Elevation 1, E ₁		ft	1084.75	1082.05		1078.82	ft	1078.81	
Elevation 2, E ₂		ft	1082.05	1078.82		1078.81	ft	1076.68	
Channel Slope, s = (E ₁ - E ₂) / L		ft/ft	0.048	0.016		0.000	ft/ft	0.002	
Manning's Roughness coeff., n			0.013	0.035		0.024		0.035	
Velocity, V = 1.49 * r ^{2/3} * s ^{1/2} / n		ft/s	15.85	15.50		1.16	ft/s	3.19	
T _t = L / (3600 * V)		ft/s	0.00	0.00		0.01	ft/s	0.11	
		+	0.1	0.2		0.9	=	6.5	7.6 min

Total Time of Concentration

Sub-Basin Tc = 152.0 min

Attachment I-2: NRCS Soil Survey



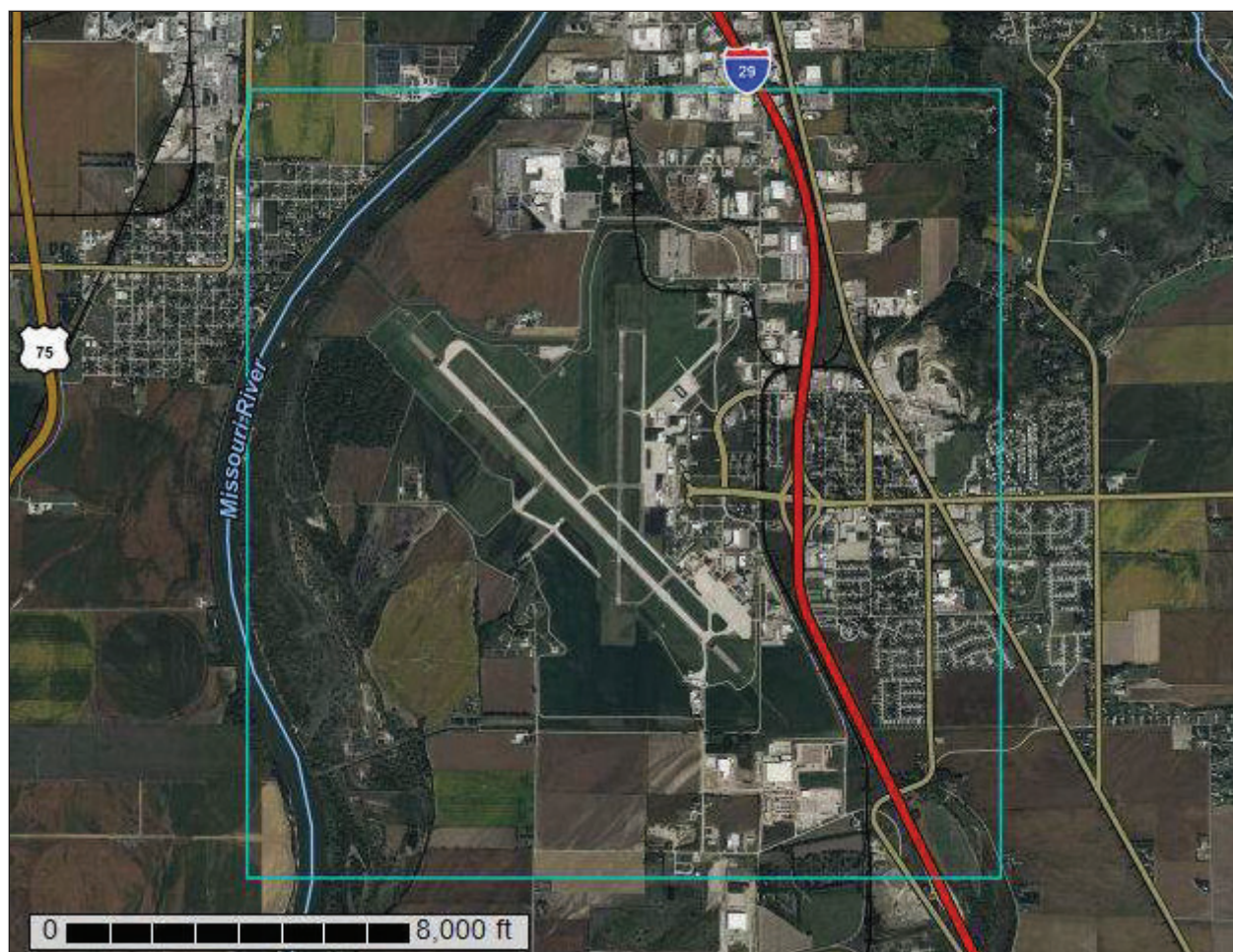
United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for Dakota County, Nebraska, and Woodbury County, Iowa



Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

96° 20' 33" W



N

10

Custom Soil Resource Report

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

 Blowout

 Borrow Pit

 Clay Spot

 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water

 Perennial Water

 Rock Outcrop

 Saline Spot

 Sandy Spot

 Severely Eroded Spot

 Sinkhole

 Slide or Slip

 Sodic Spot

 Spoil Area

 Stony Spot

 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

Water Features

 Streams and Canals

Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at scales ranging from 1:12,000 to 1:20,000.

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

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Dakota County, Nebraska

Survey Area Data: Version 21, Sep 6, 2023

Soil Survey Area: Woodbury County, Iowa

Survey Area Data: Version 33, Sep 12, 2023

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Date(s) aerial images were photographed: Sep 19, 2022—Sep 20, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
6308	Barney fine sandy loam, occasionally flooded	241.3	3.2%
7083	Sarpy loamy fine sand, occasionally flooded	43.7	0.6%
7710	Albaton silty clay, 0 to 2 percent slopes, occasionally flooded	106.2	1.4%
7713	Albaton silty clay loam, 0 to 2 percent slopes, occasionally flooded	14.8	0.2%
7722	Blake silty clay loam, occasionally flooded	38.1	0.5%
7741	Haynie silt loam, 0 to 2 percent slopes, occasionally flooded	101.2	1.4%
7758	Modale silt loam, occasionally flooded	17.2	0.2%
7800	Owego silty clay, occasionally flooded	59.0	0.8%
7850	Sarpy fine sand, 3 to 11 percent slopes	55.3	0.7%
7880	Onawa silty clay, occasionally flooded	13.5	0.2%
9986	Miscellaneous water, sewage lagoon	2.0	0.0%
9999	Water	220.7	3.0%
Subtotals for Soil Survey Area		913.0	12.3%
Totals for Area of Interest		7,429.8	100.0%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1F3	Ida silt loam, 20 to 30 percent slopes, severely eroded	16.1	0.2%
1G	Ida silt loam, 30 to 40 percent slopes	0.0	0.0%
2G	Hamburg silt loam, 40 to 75 percent slopes	116.4	1.6%
3E	Castana silt loam, 14 to 20 percent slopes	79.8	1.1%
12C	Napier silt loam, 5 to 9 percent slopes	28.4	0.4%
	Haynie silt loam, deep loess, 0 to 2 percent slopes, rarely flooded	1,751.1	23.6%
	Blake silty clay loam, 0 to 2 percent slopes, rarely flooded	593.9	8.0%

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Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
156	Albaton silty clay, 0 to 2 percent slopes, rarely flooded	1,040.2	14.0%
170E	Napier-Castana silt loams, 9 to 20 percent slopes	12.2	0.2%
237	Sarpy loamy fine sand, 0 to 2 percent slopes, rarely flooded	152.4	2.1%
237B	Sarpy loamy fine sand, 2 to 5 percent slopes, rarely flooded	118.0	1.6%
515	Percival silty clay, 0 to 2 percent slopes, rarely flooded	153.4	2.1%
518	Morconick fine sandy loam, 0 to 2 percent slopes, rarely flooded	479.9	6.5%
549	Modale complex, 0 to 2 percent slopes, occasionally flooded	35.0	0.5%
552	Owego silty clay, 0 to 2 percent slopes, rarely flooded	7.1	0.1%
945	Albaton silty clay, depressional, drained, 0 to 1 percent slopes, frequently flooded	49.5	0.7%
1137	Haynie silt loam, 0 to 2 percent slopes, occasionally flooded	21.8	0.3%
1144	Blake silty clay loam, 0 to 2 percent slopes, occasionally flooded	24.2	0.3%
1146	Onawa silty clay, 0 to 2 percent slopes, occasionally flooded	86.9	1.2%
1237B	Sarpy loamy fine sand, 2 to 5 percent slopes, occasionally flooded	37.2	0.5%
1238	Sarpy-Morconick complex, 0 to 2 percent slopes, occasionally flooded	147.7	2.0%
1513	Grable-Morconick complex, 0 to 2 percent slopes, occasionally flooded	44.2	0.6%
1524	Morconick fine sandy loam, 0 to 2 percent slopes, occasionally flooded	68.5	0.9%
1525	Scroll silty clay, 0 to 2 percent slopes, occasionally flooded	34.8	0.5%
2515	Percival-Albaton complex, 0 to 2 percent slopes, occasionally flooded	67.6	0.9%
3146	Onawa-Albaton complex, 0 to 2 percent slopes, rarely flooded	358.0	4.8%
3275	Moville-Holly Springs, overwash complex, 0 to 2 percent slopes, rarely flooded	37.3	0.5%

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Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
	Grable-Morconick complex, 0 to 2 percent slopes, rarely flooded	107.7	1.5%
	Modale complex, 0 to 2 percent slopes, rarely flooded	607.7	8.2%
5010	Pits, sand and gravel	32.8	0.4%
	Udorthents, loamy	86.9	1.2%
5044	Fluvaquents, 0 to 2 percent slopes, frequently flooded	30.7	0.4%
5060	Pits, clay	22.9	0.3%
SL	Sewage lagoon	17.9	0.2%
W	Water	48.0	0.6%
Subtotals for Soil Survey Area		6,516.3	87.7%
Totals for Area of Interest		7,429.8	100.0%

Map Unit Descriptions

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

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

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

Custom Soil Resource Report

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

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

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

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

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

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

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

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

Dakota County, Nebraska

6308—Barney fine sandy loam, occasionally flooded

Map Unit Setting

National map unit symbol: gb0z
Elevation: 1,000 to 1,500 feet
Mean annual precipitation: 26 to 28 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 140 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Barney

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium over sandy and gravelly alluvium

Typical profile

A - 0 to 6 inches: fine sandy loam
2Cg - 6 to 60 inches: fine sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 0 to 18 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: R102CY044NE - WET LAND
Forage suitability group: Not suited (G102CY000NE)
Other vegetative classification: Not suited (G102CY000NE)
Hydric soil rating: Yes

7083—Sarpy loamy fine sand, occasionally flooded

Map Unit Setting

National map unit symbol: gb2r
Elevation: 1,000 to 1,500 feet
Mean annual precipitation: 26 to 28 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 140 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Sarpy

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous sandy alluvium

Typical profile

A - 0 to 7 inches: loamy fine sand
C - 7 to 60 inches: fine sand

Properties and qualities

Slope: 0 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F107XB015MO - Sandy/Loamy Floodplain Forest
Forage suitability group: Not suited (G102CY000NE)
Other vegetative classification: Not suited (G102CY000NE)
Hydric soil rating: No

7710—Albaton silty clay, 0 to 2 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: 2xbkt
Elevation: 770 to 1,210 feet
Mean annual precipitation: 27 to 37 inches
Mean annual air temperature: 49 to 54 degrees F
Frost-free period: 145 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Albaton, Occasionally Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous clayey alluvium

Typical profile

Ap - 0 to 7 inches: silty clay
Cg - 7 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.01 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: D
Ecological site: F107XB017MO - Clayey Floodplain Forest
Hydric soil rating: Yes

Minor Components

Onawa, occasionally flooded

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB017MO - Clayey Floodplain Forest
Hydric soil rating: No

Blake, occasionally flooded

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

7713—Albaton silty clay loam, 0 to 2 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: 2xbkw
Elevation: 1,030 to 1,200 feet
Mean annual precipitation: 28 to 30 inches
Mean annual air temperature: 49 to 50 degrees F
Frost-free period: 155 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Albaton, occasionally flooded, and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Albaton, Occasionally Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous clayey alluvium

Typical profile

Ap - 0 to 15 inches: silty clay loam
Cg - 15 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.01 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: D
Ecological site: F107XB017MO - Clayey Floodplain Forest
Hydric soil rating: Yes

7722—Blake silty clay loam, occasionally flooded

Map Unit Setting

National map unit symbol: gb10
Elevation: 1,000 to 1,500 feet
Mean annual precipitation: 26 to 28 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 140 to 160 days
Farmland classification: Prime farmland if drained

Map Unit Composition

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

Description of Blake

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous silty alluvium

Typical profile

A - 0 to 7 inches: silty clay loam
Cg1 - 7 to 16 inches: silty clay loam
Cg2 - 16 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Low

Custom Soil Resource Report

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)

Depth to water table: About 18 to 36 inches

Frequency of flooding: Occasional

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: High (about 11.5 inches)

Interpretive groups

Land capability classification (irrigated): 1

Land capability classification (nonirrigated): 1

Hydrologic Soil Group: C

Ecological site: F107XB016MO - Loamy Floodplain Forest

Forage suitability group: Not suited (G102CY000NE)

Other vegetative classification: Not suited (G102CY000NE)

Hydric soil rating: No

7741—Haynie silt loam, 0 to 2 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: 2xbkn

Elevation: 840 to 1,140 feet

Mean annual precipitation: 28 to 35 inches

Mean annual air temperature: 49 to 53 degrees F

Frost-free period: 145 to 180 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Haynie, occasionally flooded, and similar soils: 80 percent

Minor components: 20 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Haynie, Occasionally Flooded

Setting

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Calcareous silty alluvium

Typical profile

Ap - 0 to 7 inches: silt loam

C - 7 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Moderately well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 1.42 in/hr)

Custom Soil Resource Report

Depth to water table: About 48 to 79 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very high (about 12.7 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

Minor Components

Grable, occasionally flooded

Percent of map unit: 10 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

Lossing, occasionally flooded

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

Albaton, occasionally flooded

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB017MO - Clayey Floodplain Forest
Hydric soil rating: Yes

7758—Modale silt loam, occasionally flooded

Map Unit Setting

National map unit symbol: gb1z
Elevation: 1,000 to 1,500 feet

Custom Soil Resource Report

Mean annual precipitation: 26 to 28 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 140 to 160 days
Farmland classification: Prime farmland if drained

Map Unit Composition

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

Description of Modale

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous silty alluvium over clayey alluvium

Typical profile

C - 0 to 25 inches: silt loam
2Cg - 25 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low
0.01 to 0.06 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: High (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: C
Ecological site: F107XB016MO - Loamy Floodplain Forest
Forage suitability group: Not suited (G102CY000NE)
Other vegetative classification: Not suited (G102CY000NE)
Hydric soil rating: No

7800—Owego silty clay, occasionally flooded

Map Unit Setting

National map unit symbol: gb2m
Elevation: 1,000 to 1,500 feet
Mean annual precipitation: 26 to 28 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 140 to 160 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Owego and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Owego

Setting

Landform: Flood plains

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Calcareous clayey alluvium

Typical profile

A - 0 to 11 inches: silty clay

2Cg - 11 to 22 inches: silt loam

3Cg - 22 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained

Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)

Depth to water table: About 0 to 18 inches

Frequency of flooding: Occasional

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 7.7 inches)

Interpretive groups

Land capability classification (irrigated): 3w

Land capability classification (nonirrigated): 3w

Hydrologic Soil Group: D

Ecological site: F107XB017MO - Clayey Floodplain Forest

Forage suitability group: Not suited (G102CY000NE)

Other vegetative classification: Not suited (G102CY000NE)

Hydric soil rating: Yes

7850—Sarpy fine sand, 3 to 11 percent slopes

Map Unit Setting

National map unit symbol: gb2q

Elevation: 1,000 to 1,500 feet

Mean annual precipitation: 26 to 28 inches

Mean annual air temperature: 46 to 50 degrees F

Frost-free period: 140 to 160 days

Farmland classification: Not prime farmland

Map Unit Composition

Sarpy and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sarpy

Setting

Landform: Dunes on flood plains
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Sandy alluvium

Typical profile

A - 0 to 7 inches: fine sand
C - 7 to 60 inches: loamy fine sand

Properties and qualities

Slope: 2 to 11 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: Low (about 5.8 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F107XB015MO - Sandy/Loamy Floodplain Forest
Forage suitability group: Not suited (G102CY000NE)
Other vegetative classification: Not suited (G102CY000NE)
Hydric soil rating: No

7880—Onawa silty clay, occasionally flooded

Map Unit Setting

National map unit symbol: gb2l
Elevation: 1,000 to 1,500 feet
Mean annual precipitation: 26 to 28 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 140 to 160 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Onawa and similar soils: 98 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Onawa

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous clayey alluvium over loamy alluvium

Typical profile

Ap - 0 to 7 inches: silty clay
Cg - 7 to 18 inches: silty clay
2Cg - 18 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low
0.01 to 0.06 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: D
Ecological site: F107XB017MO - Clayey Floodplain Forest
Forage suitability group: Not suited (G102CY000NE)
Other vegetative classification: Not suited (G102CY000NE)
Hydric soil rating: No

Minor Components

Albaton

Percent of map unit: 2 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB017MO - Clayey Floodplain Forest
Other vegetative classification: Not suited (G102CY000NE)
Hydric soil rating: Yes

9986—Miscellaneous water, sewage lagoon

Map Unit Setting

National map unit symbol: gj3s

Custom Soil Resource Report

Elevation: 1,200 to 1,800 feet
Mean annual precipitation: 28 to 30 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 150 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Miscellaneous Water

Interpretive groups

Land capability classification (irrigated): None specified
Forage suitability group: Not suited (G102CY000NE)
Other vegetative classification: Not suited (G102CY000NE)

9999—Water

Map Unit Setting

National map unit symbol: gj3w
Elevation: 3,500 to 5,250 feet
Mean annual precipitation: 22 to 24 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 120 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Water

Interpretive groups

Land capability classification (irrigated): None specified
Forage suitability group: Unnamed (G065XY0NENE)
Other vegetative classification: Unnamed (G065XY0NENE)
Hydric soil rating: Unranked

Woodbury County, Iowa

1F3—Ida silt loam, 20 to 30 percent slopes, severely eroded

Map Unit Setting

National map unit symbol: 2sqr7
Elevation: 920 to 1,520 feet
Mean annual precipitation: 28 to 34 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 145 to 180 days
Farmland classification: Farmland of local importance

Map Unit Composition

Ida, severely eroded, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ida, Severely Eroded

Setting

Landform: Loess hills
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Calcareous loess

Typical profile

Ap - 0 to 4 inches: silt loam
C - 4 to 79 inches: silt loam

Properties and qualities

Slope: 20 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 14 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very high (about 12.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R107XB013MO - Calcareous Loess Protected Backslope
Savanna, R107XB006MO - Calcareous Loess Exposed Backslope Prairie
Hydric soil rating: No

Minor Components

Monona, eroded

Percent of map unit: 10 percent

Custom Soil Resource Report

Landform: Loess hills

Landform position (two-dimensional): Shoulder, backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Convex

Across-slope shape: Convex

Ecological site: R107XB003MO - Deep Loess Exposed Backslope Savanna

Hydric soil rating: No

Burchard, eroded

Percent of map unit: 5 percent

Landform: Hillslopes

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Convex

Across-slope shape: Convex

Ecological site: R107XB027IA - Calcareous Till Upland Prairie

Hydric soil rating: No

1G—Ida silt loam, 30 to 40 percent slopes

Map Unit Setting

National map unit symbol: 2sqr9

Elevation: 910 to 1,470 feet

Mean annual precipitation: 28 to 34 inches

Mean annual air temperature: 47 to 52 degrees F

Frost-free period: 145 to 180 days

Farmland classification: Farmland of local importance

Map Unit Composition

Ida and similar soils: 90 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ida

Setting

Landform: Loess hills

Landform position (two-dimensional): Backslope, shoulder

Landform position (three-dimensional): Side slope

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Calcareous loess

Typical profile

Ap - 0 to 9 inches: silt loam

C - 9 to 79 inches: silt loam

Properties and qualities

Slope: 30 to 40 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Custom Soil Resource Report

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 1.42 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 14 percent

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water supply, 0 to 60 inches: Very high (about 12.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: B

Ecological site: R107XB013MO - Calcareous Loess Protected Backslope

Savanna, R107XB006MO - Calcareous Loess Exposed Backslope Prairie

Hydric soil rating: No

Minor Components

Monona

Percent of map unit: 5 percent

Landform: Loess hills

Landform position (two-dimensional): Backslope, shoulder

Landform position (three-dimensional): Side slope

Down-slope shape: Convex

Across-slope shape: Convex

Ecological site: R107XB003MO - Deep Loess Exposed Backslope Savanna

Hydric soil rating: No

Steinauer

Percent of map unit: 5 percent

Landform: Loess hills

Landform position (two-dimensional): Shoulder, backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Convex

Across-slope shape: Convex

Ecological site: R107XB027IA - Calcareous Till Upland Prairie

Hydric soil rating: No

2G—Hamburg silt loam, 40 to 75 percent slopes

Map Unit Setting

National map unit symbol: 2y69l

Elevation: 920 to 1,480 feet

Mean annual precipitation: 28 to 33 inches

Mean annual air temperature: 48 to 52 degrees F

Frost-free period: 145 to 180 days

Farmland classification: Farmland of local importance

Map Unit Composition

Hamburg and similar soils: 95 percent

Minor components: 5 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hamburg

Setting

Landform: Loess hills

Landform position (two-dimensional): Backslope, shoulder

Landform position (three-dimensional): Side slope

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Calcareous loess

Typical profile

A - 0 to 4 inches: silt loam

AC - 4 to 14 inches: silt loam

C - 14 to 79 inches: silt loam

Properties and qualities

Slope: 40 to 75 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 1.42 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 20 percent

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water supply, 0 to 60 inches: Very high (about 12.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: B

Ecological site: R107XB006MO - Calcareous Loess Exposed Backslope Prairie

Hydric soil rating: No

Minor Components

Liston

Percent of map unit: 5 percent

Landform: Hillslopes

Landform position (two-dimensional): Backslope, shoulder

Landform position (three-dimensional): Side slope

Down-slope shape: Convex

Across-slope shape: Convex

Ecological site: R107XB027IA - Calcareous Till Upland Prairie

Hydric soil rating: No

3E—Castana silt loam, 14 to 20 percent slopes

Map Unit Setting

National map unit symbol: fh6r

Elevation: 900 to 1,500 feet

Mean annual precipitation: 26 to 36 inches

Mean annual air temperature: 46 to 48 degrees F

Frost-free period: 155 to 200 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Castana and similar soils: 75 percent

Minor components: 25 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Castana

Setting

Landform: Alluvial fans

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Base slope

Down-slope shape: Concave

Across-slope shape: Linear

Parent material: Silty local alluvium and colluvium

Typical profile

Ap - 0 to 8 inches: silt loam

A - 8 to 18 inches: silt loam

AC - 18 to 30 inches: silt loam

C1,C3 - 30 to 60 inches: silt loam

Properties and qualities

Slope: 14 to 20 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 1.42 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Very high (about 12.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: B

Ecological site: R107XB008MO - Loamy Footslope Savanna

Hydric soil rating: No

Minor Components

Napier

Percent of map unit: 10 percent
Landform: Alluvial fans
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: R107XB008MO - Loamy Footslope Savanna
Hydric soil rating: No

Dow, severely eroded

Percent of map unit: 10 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: R107XB013MO - Calcareous Loess Protected Backslope
Savanna, R107XB006MO - Calcareous Loess Exposed Backslope Prairie
Hydric soil rating: No

Monona

Percent of map unit: 5 percent
Landform: Loess hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: R107XB003MO - Deep Loess Exposed Backslope Savanna
Hydric soil rating: No

12C—Napier silt loam, 5 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2sy78
Elevation: 910 to 1,470 feet
Mean annual precipitation: 28 to 35 inches
Mean annual air temperature: 47 to 52 degrees F
Frost-free period: 145 to 180 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Napier and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Napier

Setting

Landform: Loess hills
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Local silty colluvium

Typical profile

Ap - 0 to 8 inches: silt loam
A - 8 to 29 inches: silt loam
Bw - 29 to 48 inches: silt loam
C - 48 to 79 inches: silt loam

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very high (about 13.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R107XB008MO - Loamy Footslope Savanna
Hydric soil rating: No

Minor Components

Rawles, occasionally flooded

Percent of map unit: 3 percent
Landform: Drainageways
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: R107XB024IA - Wet Upland Drainageway Prairie
Hydric soil rating: No

Monona

Percent of map unit: 2 percent
Landform: Loess hills
Landform position (two-dimensional): Backslope, shoulder
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: R107XB002MO - Deep Loess Upland Prairie

Hydric soil rating: No

137—Haynie silt loam, deep loess, 0 to 2 percent slopes, rarely flooded

Map Unit Setting

National map unit symbol: 2xbkp
Elevation: 780 to 1,150 feet
Mean annual precipitation: 28 to 37 inches
Mean annual air temperature: 49 to 54 degrees F
Frost-free period: 155 to 180 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Haynie, Rarely Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous silty alluvium

Typical profile

Ap - 0 to 7 inches: silt loam
C - 7 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 1.42 in/hr)
Depth to water table: About 48 to 79 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very high (about 12.7 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

Minor Components

Percival, rarely flooded

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB017MO - Clayey Floodplain Forest
Hydric soil rating: No

Sarpy, rarely flooded

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: F107XB015MO - Sandy/Loamy Floodplain Forest
Hydric soil rating: No

144—Blake silty clay loam, 0 to 2 percent slopes, rarely flooded

Map Unit Setting

National map unit symbol: fh4n
Elevation: 800 to 1,200 feet
Mean annual precipitation: 26 to 36 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 155 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Blake, rarely flooded, and similar soils: 70 percent
Minor components: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blake, Rarely Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty alluvium

Typical profile

Ap - 0 to 7 inches: silty clay loam
C1 - 7 to 24 inches: silty clay loam

Custom Soil Resource Report

C2 - 24 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat poorly drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 1.42 in/hr)

Depth to water table: About 12 to 42 inches

Frequency of flooding: Rare

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Very high (about 12.6 inches)

Interpretive groups

Land capability classification (irrigated): 1

Land capability classification (nonirrigated): 1

Hydrologic Soil Group: C/D

Ecological site: F107XB016MO - Loamy Floodplain Forest

Hydric soil rating: No

Minor Components

Onawa, rarely flooded

Percent of map unit: 15 percent

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F107XB017MO - Clayey Floodplain Forest

Hydric soil rating: No

Haynie, rarely flooded

Percent of map unit: 5 percent

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F107XB016MO - Loamy Floodplain Forest

Hydric soil rating: No

Albaton, rarely flooded

Percent of map unit: 5 percent

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F107XB017MO - Clayey Floodplain Forest

Hydric soil rating: Yes

Owego, rarely flooded

Percent of map unit: 3 percent

Landform: Flood plains

Custom Soil Resource Report

Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB017MO - Clayey Floodplain Forest
Hydric soil rating: Yes

Lakeport, rarely flooded

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R107XB019MO - Wet Floodplain Prairie
Hydric soil rating: No

156—Albaton silty clay, 0 to 2 percent slopes, rarely flooded

Map Unit Setting

National map unit symbol: 2xbkv
Elevation: 780 to 1,180 feet
Mean annual precipitation: 28 to 37 inches
Mean annual air temperature: 49 to 54 degrees F
Frost-free period: 150 to 170 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Albaton, Rarely Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous clayey alluvium

Typical profile

Ap - 0 to 7 inches: silty clay
Cg - 7 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained

Custom Soil Resource Report

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.01 in/hr)

Depth to water table: About 0 to 12 inches

Frequency of flooding: Rare

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3w

Hydrologic Soil Group: D

Ecological site: F107XB017MO - Clayey Floodplain Forest

Hydric soil rating: Yes

Minor Components

Onawa, rarely flooded

Percent of map unit: 5 percent

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F107XB017MO - Clayey Floodplain Forest

Hydric soil rating: No

Modale, rarely flooded

Percent of map unit: 5 percent

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F107XB026MO - Wet Floodplain Woodland

Hydric soil rating: No

170E—Napier-Castana silt loams, 9 to 20 percent slopes

Map Unit Setting

National map unit symbol: 2xblp

Elevation: 1,070 to 1,410 feet

Mean annual precipitation: 28 to 31 inches

Mean annual air temperature: 48 to 49 degrees F

Frost-free period: 155 to 165 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Napier and similar soils: 70 percent

Custom Soil Resource Report

Castana and similar soils: 25 percent

Minor components: 5 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Napier

Setting

Landform: Loess hills

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Base slope

Down-slope shape: Linear

Across-slope shape: Convex

Parent material: Local silty colluvium

Typical profile

Ap - 0 to 8 inches: silt loam

A - 8 to 29 inches: silt loam

Bw - 29 to 48 inches: silt loam

C - 48 to 79 inches: silt loam

Properties and qualities

Slope: 9 to 14 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 1.42 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 10 percent

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water supply, 0 to 60 inches: Very high (about 13.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: B

Ecological site: R107XB008MO - Loamy Footslope Savanna

Hydric soil rating: No

Description of Castana

Setting

Landform: Loess hills

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Base slope

Down-slope shape: Linear

Across-slope shape: Convex

Parent material: Local silty colluvium

Typical profile

Ap - 0 to 8 inches: silt loam

A - 8 to 18 inches: silt loam

AC - 18 to 30 inches: silt loam

C - 30 to 60 inches: silt loam

Properties and qualities

Slope: 14 to 20 percent

Custom Soil Resource Report

Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very high (about 12.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R107XB008MO - Loamy Footslope Savanna
Hydric soil rating: No

Minor Components

Monona

Percent of map unit: 5 percent
Landform: Loess hills
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: R107XB002MO - Deep Loess Upland Prairie
Hydric soil rating: No

237—Sarpy loamy fine sand, 0 to 2 percent slopes, rarely flooded

Map Unit Setting

National map unit symbol: fh5r
Elevation: 700 to 1,200 feet
Mean annual precipitation: 26 to 36 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 155 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Sarpy, rarely flooded, and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sarpy, Rarely Flooded

Setting

Landform: Flood plains

Custom Soil Resource Report

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Rise

Down-slope shape: Convex

Across-slope shape: Linear

Parent material: Sandy alluvium

Typical profile

Ap - 0 to 6 inches: loamy fine sand

C - 6 to 60 inches: fine sand

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Excessively drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 14.17 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: Rare

Frequency of ponding: None

Calcium carbonate, maximum content: 15 percent

Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): 3s

Land capability classification (nonirrigated): 4s

Hydrologic Soil Group: A

Ecological site: F107XB015MO - Sandy/Loamy Floodplain Forest

Hydric soil rating: No

Minor Components

Haynie, rarely flooded

Percent of map unit: 5 percent

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F107XB015MO - Sandy/Loamy Floodplain Forest

Hydric soil rating: No

237B—Sarpy loamy fine sand, 2 to 5 percent slopes, rarely flooded

Map Unit Setting

National map unit symbol: fh5s

Elevation: 700 to 1,650 feet

Mean annual precipitation: 26 to 36 inches

Mean annual air temperature: 46 to 48 degrees F

Frost-free period: 155 to 200 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Sarpy, rarely flooded, and similar soils: 80 percent

Minor components: 20 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sarpy, Rarely Flooded

Setting

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Rise

Down-slope shape: Convex

Across-slope shape: Linear

Parent material: Sandy alluvium

Typical profile

Ap - 0 to 6 inches: loamy fine sand

C - 6 to 60 inches: fine sand

Properties and qualities

Slope: 2 to 5 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Excessively drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 14.17 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: Rare

Frequency of ponding: None

Calcium carbonate, maximum content: 15 percent

Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): 3s

Land capability classification (nonirrigated): 4s

Hydrologic Soil Group: A

Ecological site: F107XB015MO - Sandy/Loamy Floodplain Forest

Hydric soil rating: No

Minor Components

Ticonic, rarely flooded

Percent of map unit: 10 percent

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F107XB016MO - Loamy Floodplain Forest

Hydric soil rating: No

Onawa, rarely flooded

Percent of map unit: 10 percent

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB017MO - Clayey Floodplain Forest
Hydric soil rating: No

515—Percival silty clay, 0 to 2 percent slopes, rarely flooded

Map Unit Setting

National map unit symbol: fh7s
Elevation: 700 to 1,200 feet
Mean annual precipitation: 26 to 36 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 155 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Percival, rarely flooded, and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Percival, Rarely Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey alluvium over sandy alluvium

Typical profile

Ap - 0 to 8 inches: silty clay
Cg - 8 to 24 inches: silty clay
2Cg - 24 to 60 inches: stratified fine sand to loamy fine sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.01 in/hr)
Depth to water table: About 12 to 42 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Low (about 3.7 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w

Custom Soil Resource Report

Hydrologic Soil Group: D

Ecological site: F107XB017MO - Clayey Floodplain Forest

Hydric soil rating: No

Minor Components

Morconick, rarely flooded

Percent of map unit: 10 percent

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Convex

Across-slope shape: Linear

Ecological site: F107XB016MO - Loamy Floodplain Forest

Hydric soil rating: No

Sarpy, rarely flooded

Percent of map unit: 10 percent

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Rise

Down-slope shape: Convex

Across-slope shape: Linear

Ecological site: F107XB015MO - Sandy/Loamy Floodplain Forest

Hydric soil rating: No

Albaton, rarely flooded

Percent of map unit: 5 percent

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F107XB017MO - Clayey Floodplain Forest

Hydric soil rating: Yes

518—Morconick fine sandy loam, 0 to 2 percent slopes, rarely flooded

Map Unit Setting

National map unit symbol: fhfc

Elevation: 700 to 1,200 feet

Mean annual precipitation: 26 to 36 inches

Mean annual air temperature: 46 to 48 degrees F

Frost-free period: 155 to 200 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Morconick, rarely flooded, and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Morconick, Rarely Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy alluvium over sandy alluvium

Typical profile

Ap - 0 to 7 inches: fine sandy loam
C1 - 7 to 13 inches: loam
2C2,2C8 - 13 to 80 inches: fine sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: B
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

549—Modale complex, 0 to 2 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: swq6
Elevation: 950 to 1,150 feet
Mean annual precipitation: 26 to 36 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 155 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Modale, silt loam, occasionally flooded, and similar soils: 70 percent
Modale, silty clay loam, occasionally flooded, and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Modale, Silt Loam, Occasionally Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty alluvium over clayey alluvium

Typical profile

Ap - 0 to 7 inches: silt loam
C1,C3 - 7 to 24 inches: silt loam
2Cg,3Cg3 - 24 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.01 in/hr)
Depth to water table: About 12 to 42 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: C
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

Description of Modale, Silty Clay Loam, Occasionally Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty alluvium over clayey alluvium

Typical profile

Ap - 0 to 7 inches: silty clay loam
Cg - 7 to 24 inches: silt loam
2Cg - 24 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.01 in/hr)

Custom Soil Resource Report

Depth to water table: About 12 to 42 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: C
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

552—Owego silty clay, 0 to 2 percent slopes, rarely flooded

Map Unit Setting

National map unit symbol: fh81
Elevation: 700 to 1,200 feet
Mean annual precipitation: 26 to 36 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 155 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Owego, rarely flooded, and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Owego, Rarely Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey and silty alluvium

Typical profile

Ap - 0 to 8 inches: silty clay
Bg - 8 to 14 inches: silty clay
2Cg - 14 to 23 inches: silt loam
3Ab - 23 to 32 inches: silty clay
3Bgb1,3Bssgk - 32 to 55 inches: silty clay
3Cssg,3Cg - 55 to 80 inches: clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high

Custom Soil Resource Report

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.01 in/hr)

Depth to water table: About 0 to 12 inches

Frequency of flooding: Rare

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): 3w

Land capability classification (nonirrigated): 3w

Hydrologic Soil Group: D

Ecological site: F107XB017MO - Clayey Floodplain Forest

Hydric soil rating: Yes

Minor Components

Cooper, rarely flooded

Percent of map unit: 3 percent

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: R107XB019MO - Wet Floodplain Prairie

Hydric soil rating: No

Percival, rarely flooded

Percent of map unit: 2 percent

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F107XB017MO - Clayey Floodplain Forest

Hydric soil rating: No

945—Albaton silty clay, depressional, drained, 0 to 1 percent slopes, frequently flooded

Map Unit Setting

National map unit symbol: 2xbky

Elevation: 1,030 to 1,100 feet

Mean annual precipitation: 28 to 31 inches

Mean annual air temperature: 49 to 50 degrees F

Frost-free period: 155 to 160 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Albaton, frequently flooded, drained, and similar soils: 90 percent

Custom Soil Resource Report

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Albaton, Frequently Flooded, Drained

Setting

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Dip

Down-slope shape: Concave

Across-slope shape: Concave

Parent material: Calcareous clayey alluvium

Typical profile

Ap - 0 to 7 inches: silty clay

Cg - 7 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 1 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Very poorly drained

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.01 in/hr)

Depth to water table: About 0 to 12 inches

Frequency of flooding: Frequent

Frequency of ponding: Occasional

Calcium carbonate, maximum content: 30 percent

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4w

Hydrologic Soil Group: D

Ecological site: F107XB017MO - Clayey Floodplain Forest

Hydric soil rating: Yes

Minor Components

Percival, frequently flooded

Percent of map unit: 10 percent

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F107XB017MO - Clayey Floodplain Forest

Hydric soil rating: Yes

1137—Haynie silt loam, 0 to 2 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: 2xbkn
Elevation: 840 to 1,140 feet
Mean annual precipitation: 28 to 35 inches
Mean annual air temperature: 49 to 53 degrees F
Frost-free period: 145 to 180 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Haynie, occasionally flooded, and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Haynie, Occasionally Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous silty alluvium

Typical profile

Ap - 0 to 7 inches: silt loam
C - 7 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 1.42 in/hr)
Depth to water table: About 48 to 79 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very high (about 12.7 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

Minor Components

Grable, occasionally flooded

Percent of map unit: 10 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

Lossing, occasionally flooded

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

Albaton, occasionally flooded

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB017MO - Clayey Floodplain Forest
Hydric soil rating: Yes

1144—Blake silty clay loam, 0 to 2 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: fh43
Elevation: 700 to 1,200 feet
Mean annual precipitation: 26 to 36 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 155 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Blake, Occasionally Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty alluvium

Typical profile

Ap - 0 to 7 inches: silty clay loam
C1 - 7 to 24 inches: silty clay loam
C2 - 24 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 1.42 in/hr)
Depth to water table: About 12 to 42 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Very high (about 12.6 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

Minor Components

Onawa, occasionally flooded

Percent of map unit: 10 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB017MO - Clayey Floodplain Forest
Hydric soil rating: No

1146—Onawa silty clay, 0 to 2 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: fh45

Elevation: 700 to 1,200 feet

Mean annual precipitation: 26 to 36 inches

Mean annual air temperature: 46 to 48 degrees F

Frost-free period: 155 to 200 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Onawa, occasionally flooded, and similar soils: 75 percent

Minor components: 25 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Onawa, Occasionally Flooded

Setting

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Clayey alluvium over silty alluvium

Typical profile

Ap1, Ap2 - 0 to 9 inches: silty clay

Cg1, Cg4 - 9 to 36 inches: silty clay

2Cg5, 2Cg8 - 36 to 80 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat poorly drained

Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.01 in/hr)

Depth to water table: About 12 to 42 inches

Frequency of flooding: Occasional

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): 2w

Land capability classification (nonirrigated): 2w

Hydrologic Soil Group: D

Ecological site: F107XB017MO - Clayey Floodplain Forest

Hydric soil rating: No

Minor Components

Onawa, silt loam, occasionally flooded

Percent of map unit: 10 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB017MO - Clayey Floodplain Forest
Hydric soil rating: No

Grable, occasionally flooded

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

Owego, rarely flooded

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB017MO - Clayey Floodplain Forest
Hydric soil rating: Yes

Morconick, occasionally flooded

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

1237B—Sarpy loamy fine sand, 2 to 5 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: fh4f
Elevation: 450 to 1,000 feet
Mean annual precipitation: 26 to 36 inches
Mean annual air temperature: 46 to 48 degrees F

Custom Soil Resource Report

Frost-free period: 155 to 200 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Sarpy, occasionally flooded, and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sarpy, Occasionally Flooded

Setting

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Rise

Down-slope shape: Convex

Across-slope shape: Linear

Parent material: Sandy alluvium

Typical profile

Ap - 0 to 6 inches: loamy fine sand

C - 6 to 60 inches: fine sand

Properties and qualities

Slope: 2 to 5 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Excessively drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 14.17 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: Occasional

Frequency of ponding: None

Calcium carbonate, maximum content: 15 percent

Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): 3s

Land capability classification (nonirrigated): 4s

Hydrologic Soil Group: A

Ecological site: F107XB015MO - Sandy/Loamy Floodplain Forest

Hydric soil rating: No

1238—Sarpy-Morconick complex, 0 to 2 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: swqh

Elevation: 450 to 1,200 feet

Mean annual precipitation: 26 to 36 inches

Mean annual air temperature: 46 to 48 degrees F

Frost-free period: 155 to 200 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Sarpy, occasionally flooded, and similar soils: 60 percent

Morconick, occasionally flooded, and similar soils: 20 percent

Minor components: 20 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sarpy, Occasionally Flooded

Setting

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Rise

Down-slope shape: Convex

Across-slope shape: Linear

Parent material: Sandy alluvium

Typical profile

Ap - 0 to 6 inches: loamy fine sand

C - 6 to 60 inches: fine sand

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Excessively drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 14.17 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: Occasional

Frequency of ponding: None

Calcium carbonate, maximum content: 2 percent

Available water supply, 0 to 60 inches: Low (about 4.2 inches)

Interpretive groups

Land capability classification (irrigated): 3s

Land capability classification (nonirrigated): 4s

Hydrologic Soil Group: A

Ecological site: F107XB015MO - Sandy/Loamy Floodplain Forest

Hydric soil rating: No

Description of Morconick, Occasionally Flooded

Setting

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Convex

Across-slope shape: Linear

Parent material: Loamy alluvium over sandy alluvium

Typical profile

Ap - 0 to 7 inches: fine sandy loam

C1 - 7 to 13 inches: loam

2C2,2C8 - 13 to 80 inches: fine sand

Properties and qualities

Slope: 0 to 2 percent

Custom Soil Resource Report

Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: B
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

Minor Components

Percival, occasionally flooded

Percent of map unit: 12 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB017MO - Clayey Floodplain Forest
Hydric soil rating: No

Modale, occasionally flooded

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

Haynie, occasionally flooded

Percent of map unit: 3 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

1513—Grable-Morconick complex, 0 to 2 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: swq0
Elevation: 700 to 1,200 feet
Mean annual precipitation: 26 to 36 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 155 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Grable, occasionally flooded, and similar soils: 70 percent
Morconick, occasionally flooded, and similar soils: 20 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Grable, Occasionally Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty alluvium over sandy alluvium

Typical profile

Ap - 0 to 6 inches: silt loam
C1 - 6 to 23 inches: silt loam
2C2 - 23 to 60 inches: fine sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s

Custom Soil Resource Report

Hydrologic Soil Group: B

Ecological site: F107XB016MO - Loamy Floodplain Forest

Hydric soil rating: No

Description of Morconick, Occasionally Flooded

Setting

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Convex

Across-slope shape: Linear

Parent material: Loamy alluvium over sandy alluvium

Typical profile

Ap - 0 to 7 inches: fine sandy loam

C1 - 7 to 13 inches: loam

2C2,2C8 - 13 to 80 inches: fine sand

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 1.42 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: Occasional

Frequency of ponding: None

Calcium carbonate, maximum content: 5 percent

Available water supply, 0 to 60 inches: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3s

Hydrologic Soil Group: B

Ecological site: F107XB016MO - Loamy Floodplain Forest

Hydric soil rating: No

Minor Components

Percival, occasionally flooded

Percent of map unit: 10 percent

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F107XB017MO - Clayey Floodplain Forest

Hydric soil rating: No

1524—Morconick fine sandy loam, 0 to 2 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: fh4w

Elevation: 700 to 1,200 feet

Mean annual precipitation: 26 to 36 inches

Mean annual air temperature: 46 to 48 degrees F

Frost-free period: 155 to 200 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Morconick, occasionally flooded, and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Morconick, Occasionally Flooded

Setting

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Convex

Across-slope shape: Linear

Parent material: Loamy alluvium over sandy alluvium

Typical profile

Ap - 0 to 7 inches: fine sandy loam

C1 - 7 to 13 inches: loam

2C2,2C8 - 13 to 80 inches: fine sand

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 1.42 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: Occasional

Frequency of ponding: None

Calcium carbonate, maximum content: 5 percent

Available water supply, 0 to 60 inches: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3s

Hydrologic Soil Group: B

Custom Soil Resource Report

Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

Minor Components

Percival, occasionally flooded

Percent of map unit: 10 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB017MO - Clayey Floodplain Forest
Hydric soil rating: No

Albaton, undrained, occasionally flooded

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB017MO - Clayey Floodplain Forest
Hydric soil rating: Yes

1525—Scroll silty clay, 0 to 2 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: fh4x
Elevation: 700 to 1,200 feet
Mean annual precipitation: 26 to 36 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 155 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Scroll, occasionally flooded, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scroll, Occasionally Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey or silty alluvium over sandy alluvium

Custom Soil Resource Report

Typical profile

Ap - 0 to 7 inches: silty clay
Cg1 - 7 to 11 inches: silt loam
2Cg2,2Cg3 - 11 to 60 inches: loamy fine sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.01 in/hr)
Depth to water table: About 12 to 42 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: D
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

Minor Components

Scroll, clay loam, occasionally flooded

Percent of map unit: 10 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

Grable, occasionally flooded

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

2515—Percival-Albaton complex, 0 to 2 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: swqg
Elevation: 700 to 1,200 feet
Mean annual precipitation: 26 to 36 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 155 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Percival, occasionally flooded, and similar soils: 55 percent
Albaton, occasionally flooded, and similar soils: 30 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Percival, Occasionally Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey alluvium over sandy alluvium

Typical profile

Ap - 0 to 7 inches: clay
Cg - 7 to 24 inches: silty clay
2Cg - 24 to 60 inches: stratified fine sand to loamy fine sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.01 in/hr)
Depth to water table: About 12 to 42 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Available water supply, 0 to 60 inches: Low (about 3.7 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: D
Ecological site: F107XB017MO - Clayey Floodplain Forest

Hydric soil rating: No

Description of Albaton, Occasionally Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey alluvium

Typical profile

Ap - 0 to 7 inches: silty clay
Cg - 7 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.01 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: D
Ecological site: F107XB017MO - Clayey Floodplain Forest
Hydric soil rating: Yes

Minor Components

Morconick, occasionally flooded

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

Modale, silty clay loam, occasionally flooded

Percent of map unit: 3 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

Modale, silt loam, occasionally flooded

Percent of map unit: 3 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

Grable, occasionally flooded

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

Albaton, silt loam, occasionally flooded

Percent of map unit: 2 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB017MO - Clayey Floodplain Forest
Hydric soil rating: Yes

3146—Onawa-Albaton complex, 0 to 2 percent slopes, rarely flooded

Map Unit Setting

National map unit symbol: swqf
Elevation: 700 to 1,200 feet
Mean annual precipitation: 26 to 36 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 155 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Onawa, rarely flooded, and similar soils: 55 percent
Albaton, rarely flooded, and similar soils: 25 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Onawa, Rarely Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey alluvium over silty alluvium

Typical profile

Ap1, Ap2 - 0 to 9 inches: silty clay
Cg1, Cg4 - 9 to 36 inches: silty clay
2Cg5, 2Cg8 - 36 to 80 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.01 in/hr)
Depth to water table: About 12 to 42 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: D
Ecological site: F107XB017MO - Clayey Floodplain Forest
Hydric soil rating: No

Description of Albaton, Rarely Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey alluvium

Typical profile

Ap - 0 to 7 inches: silty clay
Cg - 7 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.01 in/hr)
Depth to water table: About 0 to 12 inches

Custom Soil Resource Report

Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: D
Ecological site: F107XB017MO - Clayey Floodplain Forest
Hydric soil rating: Yes

Minor Components

Modale, rarely flooded

Percent of map unit: 10 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

Grable, rarely flooded

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

Onawa, silt loam, rarely flooded

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB017MO - Clayey Floodplain Forest
Hydric soil rating: No

3275—Menville-Holly Springs, overwash complex, 0 to 2 percent slopes, rarely flooded

Map Unit Setting

National map unit symbol: swqb

Custom Soil Resource Report

Elevation: 600 to 1,300 feet

Mean annual precipitation: 26 to 36 inches

Mean annual air temperature: 46 to 48 degrees F

Frost-free period: 155 to 200 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Moville, rarely flooded, and similar soils: 70 percent

Holly springs, overwash, rarely flooded, and similar soils: 25 percent

Minor components: 5 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Moville, Rarely Flooded

Setting

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Silty alluvium over clayey alluvium

Typical profile

Ap - 0 to 6 inches: silt loam

C1,C2 - 6 to 28 inches: silt loam

2AB1,2Bsskgb - 28 to 80 inches: clay

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat poorly drained

Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.01 in/hr)

Depth to water table: About 12 to 42 inches

Frequency of flooding: Rare

Frequency of ponding: None

Available water supply, 0 to 60 inches: High (about 10.0 inches)

Interpretive groups

Land capability classification (irrigated): 2w

Land capability classification (nonirrigated): 2w

Hydrologic Soil Group: D

Ecological site: F107XB016MO - Loamy Floodplain Forest

Hydric soil rating: No

Description of Holly Springs, Overwash, Rarely Flooded

Setting

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Clayey alluvium

Typical profile

Ap - 0 to 6 inches: silty clay loam
A1 - 6 to 12 inches: silty clay loam
A2,A4 - 12 to 44 inches: silty clay
Bg1,Bg2 - 44 to 70 inches: silty clay
Cg - 70 to 80 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.01 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: D
Ecological site: R107XB019MO - Wet Floodplain Prairie
Hydric soil rating: Yes

Minor Components

Wilsey, rarely flooded

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R107XB025IA - Loamy Floodplain Prairie
Hydric soil rating: No

3513—Grable-Morconick complex, 0 to 2 percent slopes, rarely flooded

Map Unit Setting

National map unit symbol: swq2
Elevation: 700 to 1,200 feet
Mean annual precipitation: 26 to 36 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 155 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Grable, rarely flooded, and similar soils: 65 percent

Morconick, rarely flooded, and similar soils: 20 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Grable, Rarely Flooded

Setting

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Silty alluvium over sandy alluvium

Typical profile

Ap - 0 to 6 inches: silt loam

C1 - 6 to 23 inches: silt loam

2C2 - 23 to 60 inches: fine sand

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 1.42 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: Rare

Frequency of ponding: None

Calcium carbonate, maximum content: 30 percent

Available water supply, 0 to 60 inches: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2s

Hydrologic Soil Group: B

Ecological site: F107XB016MO - Loamy Floodplain Forest

Hydric soil rating: No

Description of Morconick, Rarely Flooded

Setting

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Convex

Across-slope shape: Linear

Parent material: Loamy alluvium over sandy alluvium

Typical profile

Ap - 0 to 7 inches: fine sandy loam

C1 - 7 to 13 inches: loam

2C2,2C8 - 13 to 80 inches: fine sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 1.42 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 5.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: B
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

Minor Components

Percival, rarely flooded

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB017MO - Clayey Floodplain Forest
Hydric soil rating: No

Blake, rarely flooded

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

Modale, loam, rarely flooded

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

3549—Modale complex, 0 to 2 percent slopes, rarely flooded

Map Unit Setting

National map unit symbol: swq7
Elevation: 700 to 1,200 feet
Mean annual precipitation: 26 to 36 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 155 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Modale, silty clay loam, rarely flooded, and similar soils: 35 percent
Modale, silt loam, rarely flooded, and similar soils: 30 percent
Minor components: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Modale, Silty Clay Loam, Rarely Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty alluvium over clayey alluvium

Typical profile

Ap - 0 to 7 inches: silty clay loam
Cg - 7 to 24 inches: silt loam
2Cg,3Cg3 - 24 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.01 in/hr)
Depth to water table: About 12 to 42 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: C
Ecological site: F107XB016MO - Loamy Floodplain Forest

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Hydric soil rating: No

Description of Modale, Silt Loam, Rarely Flooded

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty alluvium over clayey alluvium

Typical profile

Ap - 0 to 7 inches: silt loam
C1,C3 - 7 to 24 inches: silt loam
2Cg,3Cg3 - 24 to 60 inches: clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.01 in/hr)
Depth to water table: About 12 to 42 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: D
Ecological site: F107XB016MO - Loamy Floodplain Forest
Hydric soil rating: No

Minor Components

Onawa, rarely flooded

Percent of map unit: 15 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB017MO - Clayey Floodplain Forest
Hydric soil rating: No

Owego, rarely flooded

Percent of map unit: 10 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB017MO - Clayey Floodplain Forest

Custom Soil Resource Report

Hydric soil rating: Yes

Blake, rarely flooded

Percent of map unit: 5 percent

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F107XB016MO - Loamy Floodplain Forest

Hydric soil rating: No

Haynie, rarely flooded

Percent of map unit: 2 percent

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: F107XB016MO - Loamy Floodplain Forest

Hydric soil rating: No

Cooper, rarely flooded

Percent of map unit: 2 percent

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Linear

Across-slope shape: Linear

Ecological site: R107XB019MO - Wet Floodplain Prairie

Hydric soil rating: No

Morconick, rarely flooded

Percent of map unit: 1 percent

Landform: Flood plains

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Convex

Across-slope shape: Linear

Ecological site: F107XB016MO - Loamy Floodplain Forest

Hydric soil rating: No

5010—Pits, sand and gravel

Map Unit Setting

National map unit symbol: 2zv8y

Elevation: 750 to 1,600 feet

Mean annual precipitation: 27 to 37 inches

Mean annual air temperature: 45 to 51 degrees F

Frost-free period: 140 to 180 days

Farmland classification: Not prime farmland

Map Unit Composition

Pits, sand and gravel: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

5040—Udorthents, loamy

Map Unit Setting

National map unit symbol: fh7c

Elevation: 660 to 980 feet

Mean annual precipitation: 34 to 41 inches

Mean annual air temperature: 48 to 54 degrees F

Frost-free period: 175 to 210 days

Farmland classification: Not prime farmland

Map Unit Composition

Udorthents, loamy and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Loamy

Setting

Parent material: Loamy manipulated materials

Properties and qualities

Depth to restrictive feature: More than 80 inches

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Interpretive groups

Land capability classification (irrigated): None specified

Ecological site: F105XY013WI - Loamy-Silty Upland

Hydric soil rating: Unranked

5044—Fluvaquents, 0 to 2 percent slopes, frequently flooded

Map Unit Setting

National map unit symbol: fh7d

Elevation: 1,050 to 1,250 feet

Mean annual precipitation: 26 to 36 inches

Mean annual air temperature: 46 to 48 degrees F

Frost-free period: 155 to 200 days

Farmland classification: Not prime farmland

Map Unit Composition

Fluvaquents, frequently flooded, ponded, and similar soils: 75 percent

Minor components: 25 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fluvaquents, Frequently Flooded, Ponded

Setting

Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Alluvium

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very low
Depth to water table: About 0 to 12 inches
Frequency of flooding: Frequent
Frequency of ponding: Frequent

Interpretive groups

Land capability classification (irrigated): None specified
Ecological site: R107XB019MO - Wet Floodplain Prairie
Hydric soil rating: Yes

Minor Components

Udifluvents, frequently flooded

Percent of map unit: 25 percent
Landform: Flood plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F107XB016MO - Loamy Floodplain Forest

5060—Pits, clay

Map Unit Setting

National map unit symbol: 2zv8w
Elevation: 770 to 1,340 feet
Mean annual precipitation: 28 to 35 inches
Mean annual air temperature: 49 to 49 degrees F
Frost-free period: 150 to 165 days
Farmland classification: Not prime farmland

Map Unit Composition

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

SL—Sewage lagoon

Map Unit Setting

National map unit symbol: rt93

Elevation: 660 to 980 feet

Mean annual precipitation: 34 to 41 inches

Mean annual air temperature: 48 to 54 degrees F

Frost-free period: 175 to 210 days

Farmland classification: Not prime farmland

Map Unit Composition

Sewage lagoon: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

W—Water

Map Unit Setting

National map unit symbol: fh9b

Mean annual precipitation: 33 to 38 inches

Mean annual air temperature: 46 to 52 degrees F

Frost-free period: 170 to 200 days

Farmland classification: Not prime farmland

Map Unit Composition

Water: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

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Attachment I-3: Curve Number and Peak Flow Calculations

TR-55 Worksheet 2: Curve Number and Runoff

Subbasin Name: Basin A
Condition: Existing

Curve Number (TR-55 Table 2-2)

Total Area:	10,550,294	sf	242.20	ac	0.38	mi ²
Pervious Area:	9,097,237	sf	208.84	ac		
Gravel Area:	452,511	sf	10.39	ac		
Impervious Area:	1,000,546	sf	22.97	ac		

HSG	Description	CN	Area	CN*A
A	Good Condition (grass cover >75%)	39	26.78	1044.3
B	Good Condition (grass cover >75%)	61	148.34	9048.5
C	Good Condition (grass cover >75%)	74	23.56	1743.1
D	Good Condition (grass cover >75%)	80	10.17	813.9
A	Gravel Road	76	1.70	129.2
B	Gravel Road	85	8.49	721.5
D	Gravel Road	91	0.20	18.2
				0.0
Impervious	Paved Area, Roofs	98	22.97	2251.0
Totals:			242.20	15769.8
Composite Curve Number:				65.11

Runoff

Frequency		yr	Recurrence Interval (yr)			
Rainfall (ISWMM Table C3-S2-3, 24-hour)	P	in	1	5	25	100
Potential Maximum Retention (Use TR-55 Equation 2-4)	S	in	2.63	3.74	5.59	7.67
Runoff (Use TR-55 Equation 2-3)	Q	in	5.36	5.36	5.36	5.36
			0.351	0.887	2.067	3.641

TR-55 Worksheet 2: Curve Number and Runoff

Subbasin Name: Basin B
Condition: Existing

Curve Number (TR-55 Table 2-2)

Total Area:	1,897,555	sf	43.56	ac	0.07	mi ²
Pervious Area:	1,828,915	sf	41.99	ac		
Gravel Area:	48,023	sf	1.10	ac		
Impervious Area:	20,617	sf	0.47	ac		

HSG	Description	CN	Area	CN*A
A	Good Condition (grass cover >75%)	39	28.91	1127.5
B	Good Condition (grass cover >75%)	61	13.08	797.7
A	Gravel Road	76	0.57	43.5
B	Gravel Road	85	0.53	45.1
				0.0
Impervious	Paved Area, Roofs	98	0.47	46.4
Totals:			43.56	2060.1
Composite Curve Number:				47.29

Runoff

Frequency		yr	Recurrence Interval (yr)			
Rainfall (ISWMM Table C3-S2-3, 24-hour)	P	in	1	5	25	100
Potential Maximum Retention (Use TR-55 Equation 2-4)	S	in	2.63	3.74	5.59	7.67
Runoff (Use TR-55 Equation 2-3)	Q	in	11.15	11.15	11.15	11.15
			0.014	0.180	0.779	1.785

TR-55 Worksheet 2: Curve Number and Runoff

Subbasin Name: Basin C
Condition: Existing

Curve Number (TR-55 Table 2-2)

Total Area:	1,481,656	sf	34.01	ac	0.05	mi ²
Pervious Area:	1,320,148	sf	30.31	ac		
Gravel Area:	23,778	sf	0.55	ac		
Impervious Area:	137,730	sf	3.16	ac		

HSG	Description	CN	Area	CN*A
B	Good Condition (grass cover >75%)	61	30.31	1848.7
B	Gravel Road	85	0.55	46.4
				0.0
Impervious	Paved Area, Roofs	98	3.16	309.9
Totals:			34.01	2205.0
Composite Curve Number:				64.82

Runoff

Frequency		yr	Recurrence Interval (yr)			
Rainfall (ISWMM Table C3-S2-3, 24-hour)	P	in	1	5	25	100
Potential Maximum Retention (Use TR-55 Equation 2-4)	S	in	2.63	3.74	5.59	7.67
Runoff (Use TR-55 Equation 2-3)	Q	in	5.43	5.43	5.43	5.43
			0.342	0.872	2.043	3.610

TR-55 Worksheet 2: Curve Number and Runoff

Subbasin Name: Basin D
Condition: Existing

Curve Number (TR-55 Table 2-2)

Total Area:	1,748,174	sf	40.13	ac	0.06	mi ²
Pervious Area:	1,546,005	sf	35.49	ac		
Gravel Area:	27,649	sf	0.63	ac		
Impervious Area:	174,487	sf	4.01	ac		

HSG	Description	CN	Area	CN*A
A	Good Condition (grass cover >75%)	39	3.17	123.7
B	Good Condition (grass cover >75%)	61	32.32	1971.4
A	Gravel Road	76	0.19	14.6
B	Gravel Road	85	0.44	37.6
				0.0
Impervious	Paved Area, Roofs	98	4.01	392.6
Totals:			40.13	2539.9
Composite Curve Number:				63.29

Runoff

Frequency		yr	Recurrence Interval (yr)			
Rainfall (ISWMM Table C3-S2-3, 24-hour)	P	in	1	5	25	100
Potential Maximum Retention (Use TR-55 Equation 2-4)	S	in	2.63	3.74	5.59	7.67
Runoff (Use TR-55 Equation 2-3)	Q	in	5.80	5.80	5.80	5.80
			0.297	0.794	1.918	3.443

TR-55 Worksheet 2: Curve Number and Runoff

Subbasin Name: Basin E
Condition: Existing

Curve Number (TR-55 Table 2-2)

Total Area:	693,468	sf	15.92	ac	0.02	mi ²
Pervious Area:	544,287	sf	12.50	ac		
Gravel Area:	526	sf	0.01	ac		
Impervious Area:	148,273	sf	3.40	ac		

HSG	Description	CN	Area	CN*A
B	Good Condition (grass cover >75%)	61	12.37	754.3
C	Good Condition (grass cover >75%)	74	0.13	9.5
B	Gravel Road	85	0.01	1.0
				0.0
Impervious	Paved Area, Roofs	98	3.40	333.6
Totals:			15.91	1098.5
Composite Curve Number:				69.04

Runoff

Frequency		yr	Recurrence Interval (yr)			
Rainfall (ISWMM Table C3-S2-3, 24-hour)	P	in	1	5	25	100
Potential Maximum Retention (Use TR-55 Equation 2-4)	S	in	2.63	3.74	5.59	7.67
Runoff (Use TR-55 Equation 2-3)	Q	in	4.48	4.48	4.48	4.48
			0.483	1.103	2.400	4.075

TR-55 Worksheet 2: Curve Number and Runoff

Subbasin Name: Basin F
Condition: Existing

Curve Number (TR-55 Table 2-2)

Total Area:	776,689	sf	17.83	ac	0.03	mi ²
Pervious Area:	606,453	sf	13.92	ac		
Gravel Area:	0	sf	0.00	ac		
Impervious Area:	170,236	sf	3.91	ac		

HSG	Description	CN	Area	CN*A
B	Good Condition (grass cover >75%)	61	9.61	585.9
C	Good Condition (grass cover >75%)	74	4.32	319.5
				0.0
Impervious	Paved Area, Roofs	98	3.91	383.0
Totals:			17.83	1288.4
Composite Curve Number:				72.26

Runoff

Frequency		yr	Recurrence Interval (yr)			
Rainfall (ISWMM Table C3-S2-3, 24-hour)	P	in	1	5	25	100
Potential Maximum Retention (Use TR-55 Equation 2-4)	S	in	2.63	3.74	5.59	7.67
Runoff (Use TR-55 Equation 2-3)	Q	in	3.84	3.84	3.84	3.84
			0.608	1.297	2.685	4.435

TR-55 Worksheet 2: Curve Number and Runoff

Subbasin Name: Basin G
Condition: Existing

Curve Number (TR-55 Table 2-2)

Total Area:	6,715,860	sf	154.17	ac	0.24	mi ²
Pervious Area:	4,517,728	sf	103.71	ac		
Gravel Area:	9,561	sf	0.22	ac		
Impervious Area:	2,188,571	sf	50.24	ac		

HSG	Description	CN	Area	CN*A
B	Good Condition (grass cover >75%)	61	66.92	4082.3
C	Good Condition (grass cover >75%)	74	1.35	99.9
D	Good Condition (grass cover >75%)	80	35.44	2835.2
D	Gravel Road	91	0.22	20.0
				0.0
Impervious	Paved Area, Roofs	98	50.24	4923.8
Totals:			154.17	11961.1
Composite Curve Number:				77.58

Runoff

Frequency		yr	Recurrence Interval (yr)			
Rainfall (ISWMM Table C3-S2-3, 24-hour)	P	in	1	5	25	100
Potential Maximum Retention (Use TR-55 Equation 2-4)	S	in	2.89	2.89	2.89	2.89
Runoff (Use TR-55 Equation 2-3)	Q	in	0.852	1.652	3.179	5.039

TR-55 Worksheet 2: Curve Number and Runoff

Subbasin Name: Basin H
Condition: Existing

Curve Number (TR-55 Table 2-2)

Total Area:	15,614,065	sf	358.45	ac	0.56	mi ²
Pervious Area:	12,311,307	sf	282.63	ac		
Gravel Area:	256,141	sf	5.88	ac		
Impervious Area:	3,046,617	sf	69.94	ac		

HSG	Description	CN	Area	CN*A
B	Good Condition (grass cover >75%)	61	112.71	6875.4
C	Good Condition (grass cover >75%)	74	18.74	1386.8
D	Good Condition (grass cover >75%)	80	151.18	12094.1
B	Gravel Road	85	0.26	22.5
C	Gravel Road	89	0.29	26.0
D	Gravel Road	91	5.32	484.4
				0.0
Impervious	Paved Area, Roofs	98	69.94	6854.2
Totals:			358.45	27743.4
Composite Curve Number:				77.40

Runoff

Frequency		yr	Recurrence Interval (yr)			
Rainfall (ISWMM Table C3-S2-3, 24-hour)	P	in	1	5	25	100
Potential Maximum Retention (Use TR-55 Equation 2-4)	S	in	2.92	2.92	2.92	2.92
Runoff (Use TR-55 Equation 2-3)	Q	in	0.843	1.639	3.162	5.018

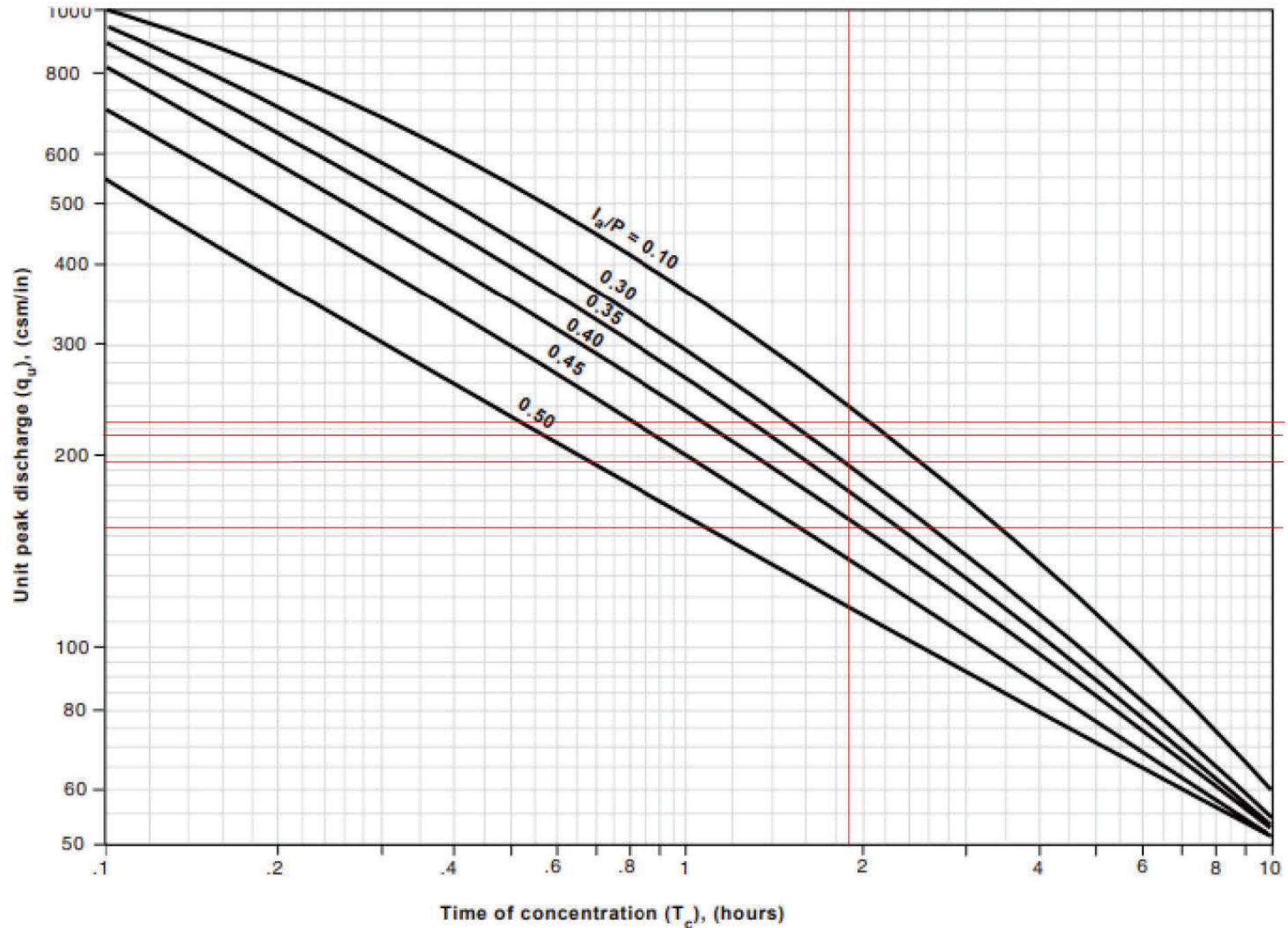
Exhibit 4-II Unit peak discharge (q_u) for NRCS (SCS) type II rainfall distribution

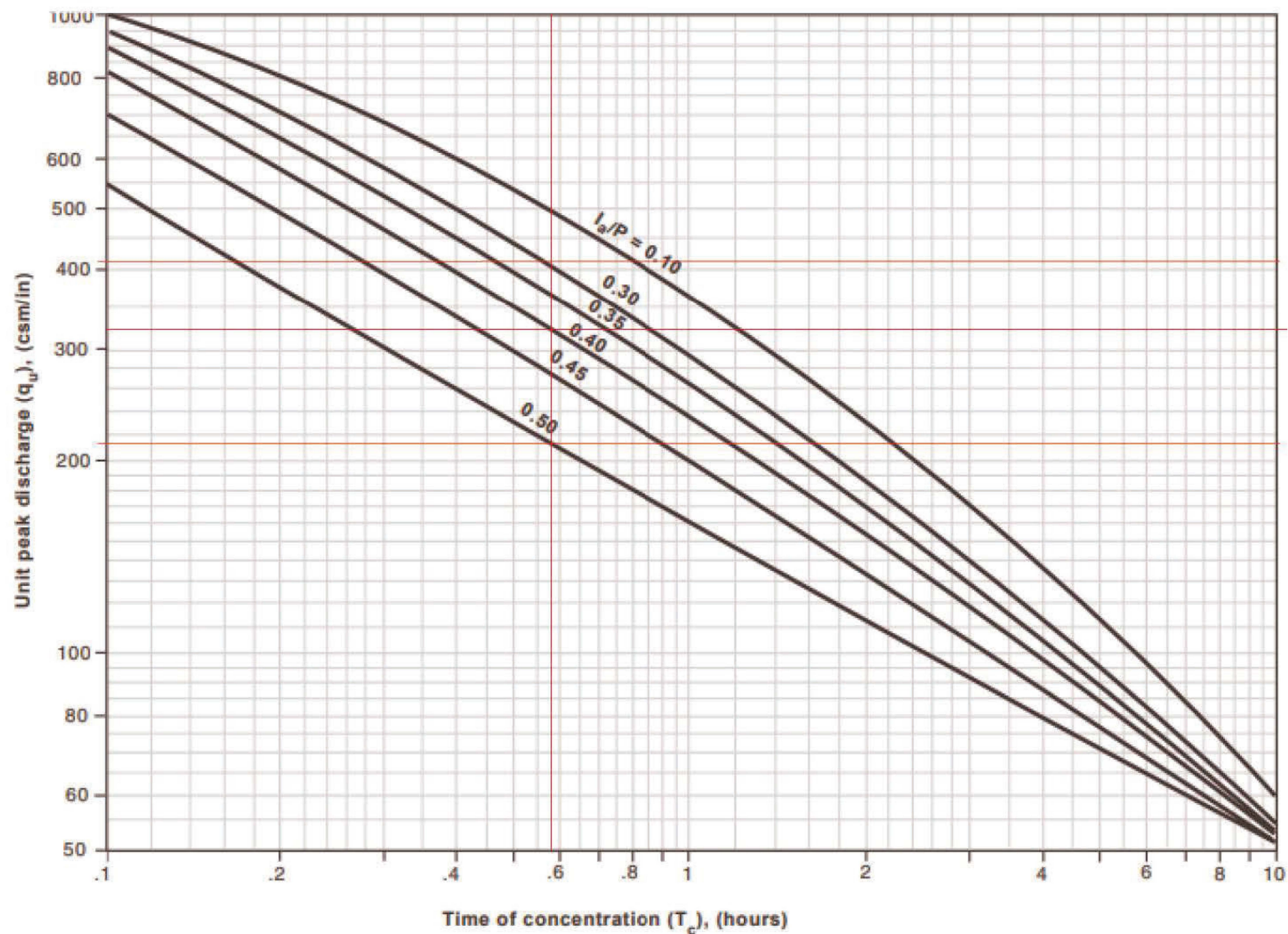
Exhibit 4-II Unit peak discharge (q_u) for NRCS (SCS) type II rainfall distribution

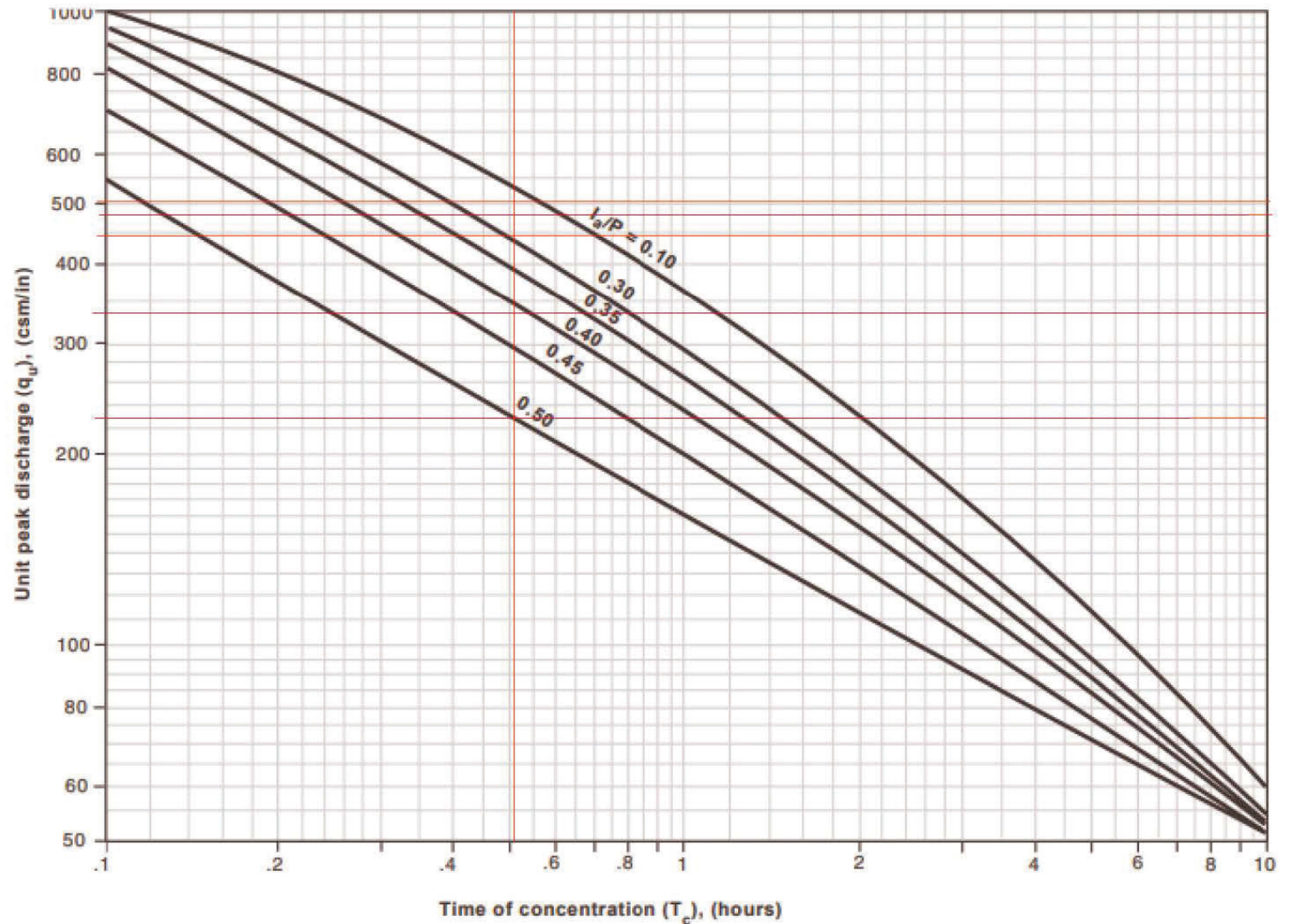
Exhibit 4-II Unit peak discharge (q_u) for NRCS (SCS) type II rainfall distribution

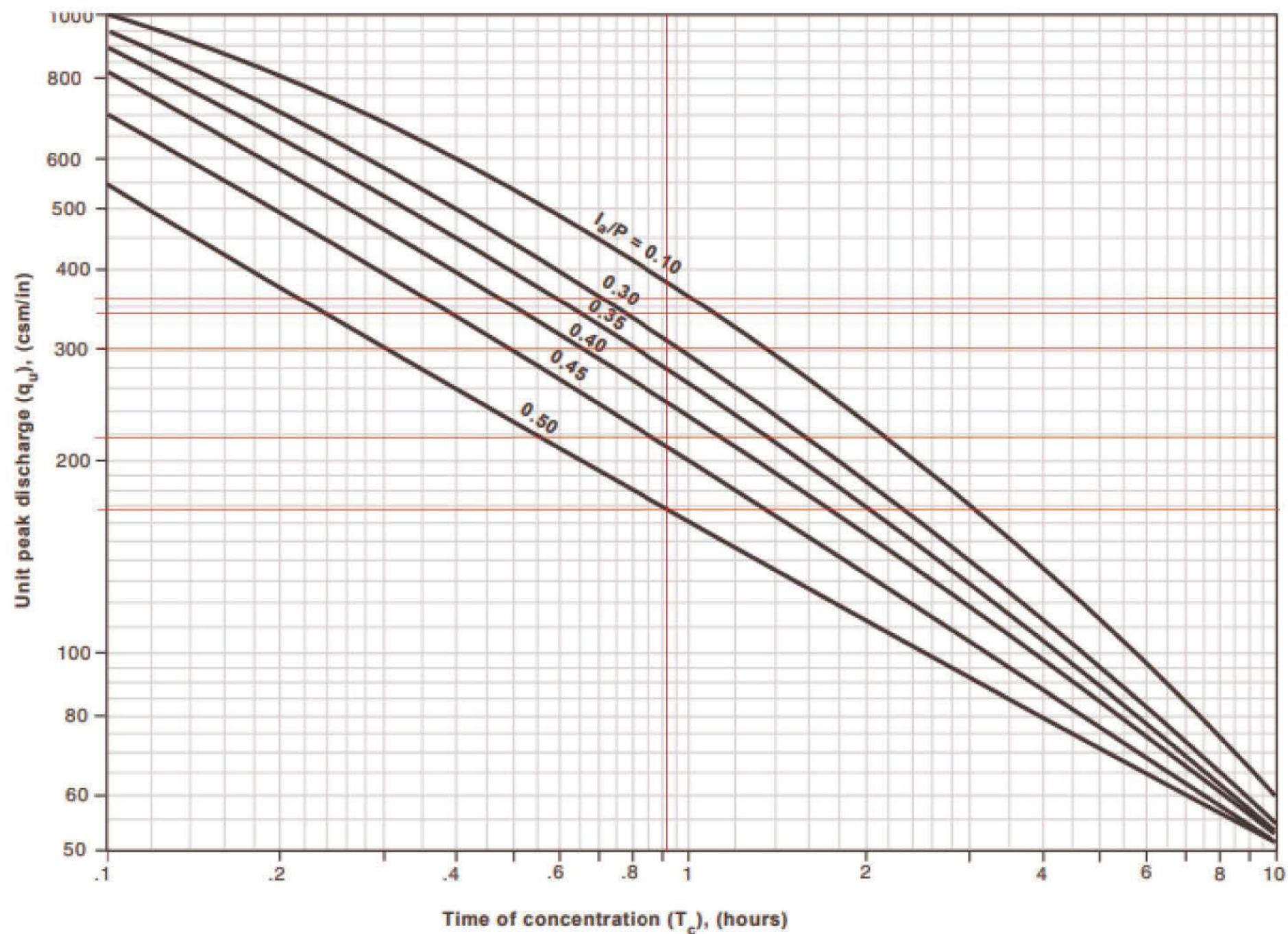
Exhibit 4-II Unit peak discharge (q_u) for NRCS (SCS) type II rainfall distribution

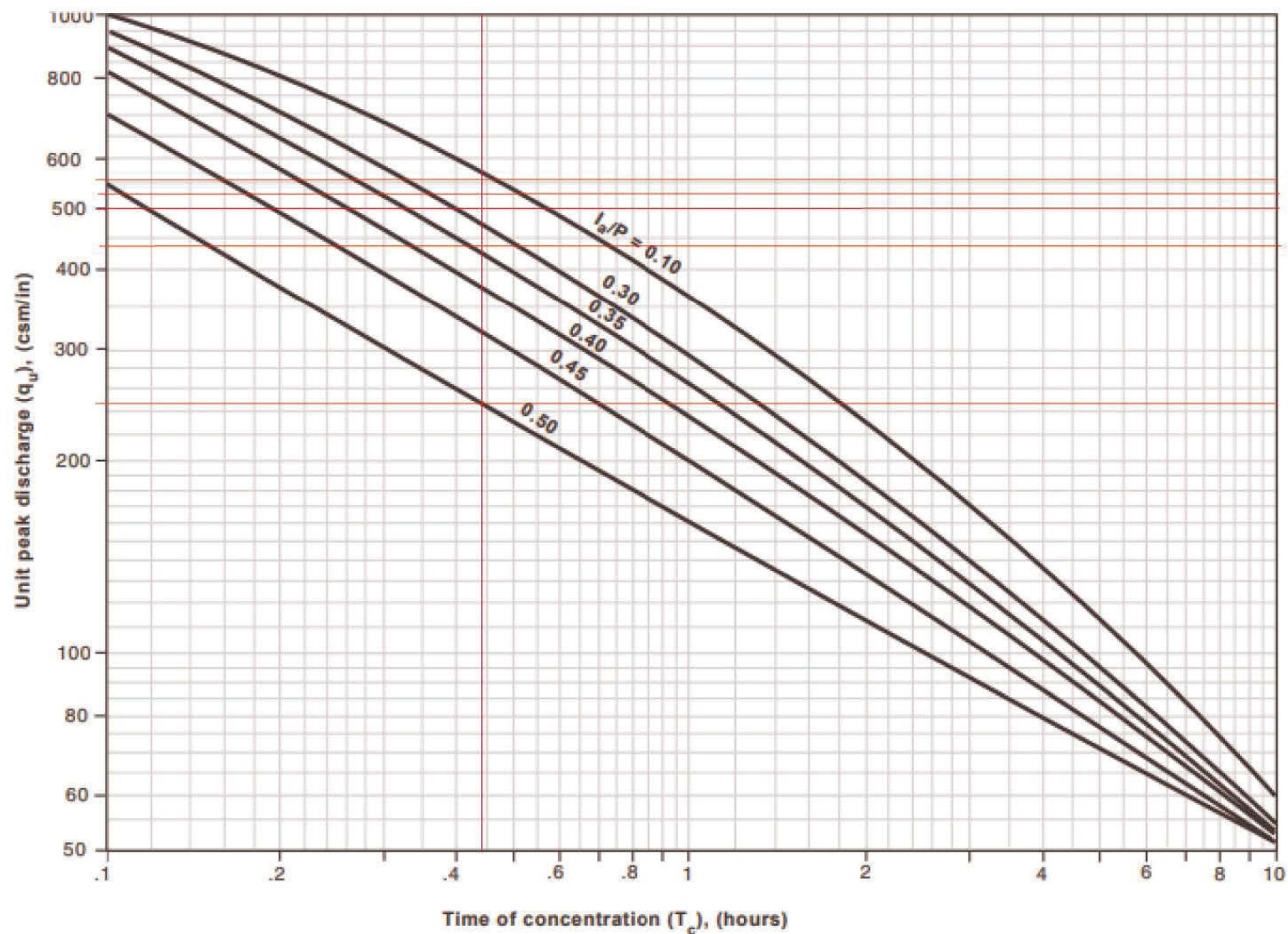
Exhibit 4-II Unit peak discharge (q_u) for NRCS (SCS) type II rainfall distribution

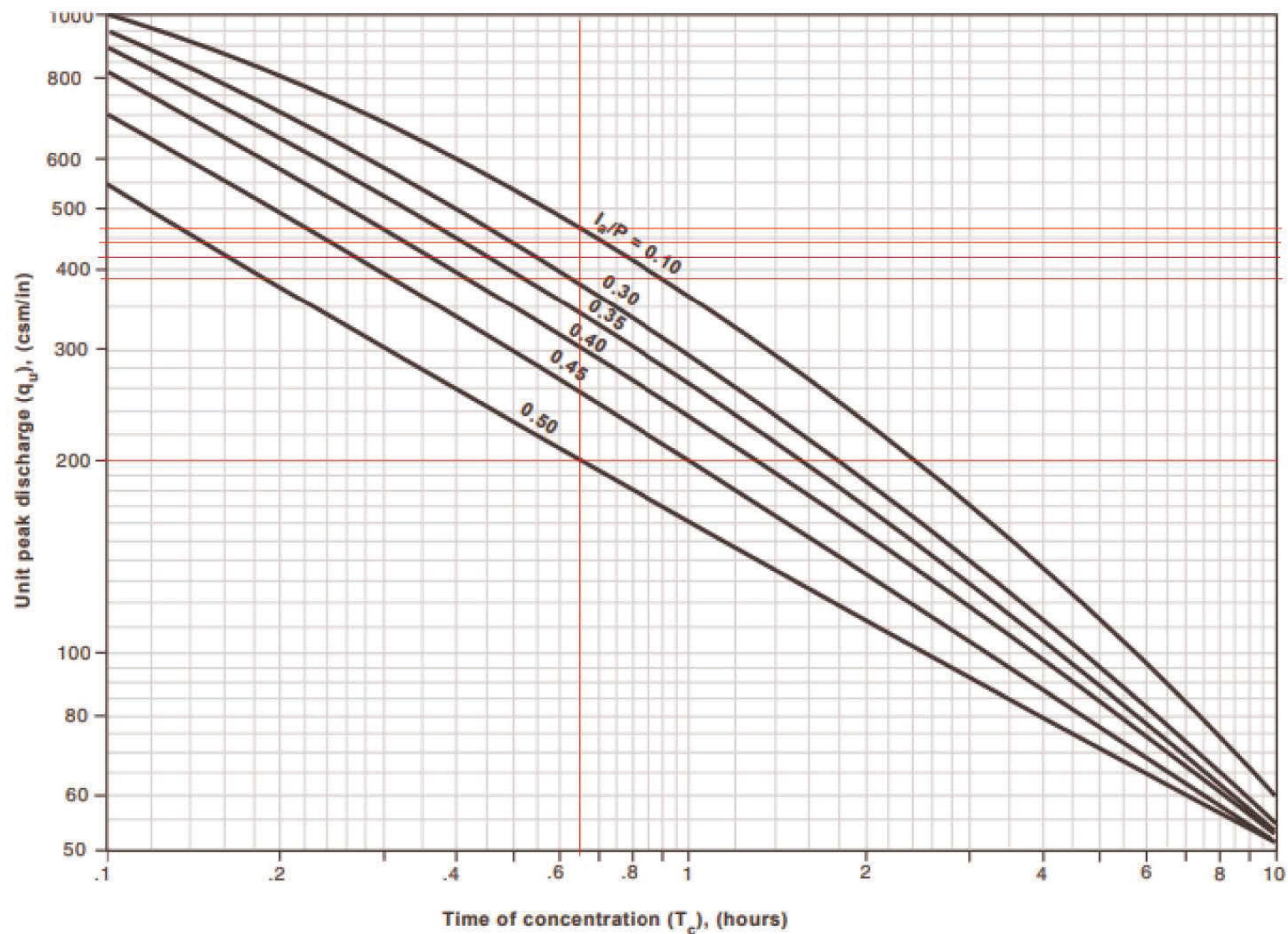
Exhibit 4-II Unit peak discharge (q_u) for NRCS (SCS) type II rainfall distribution

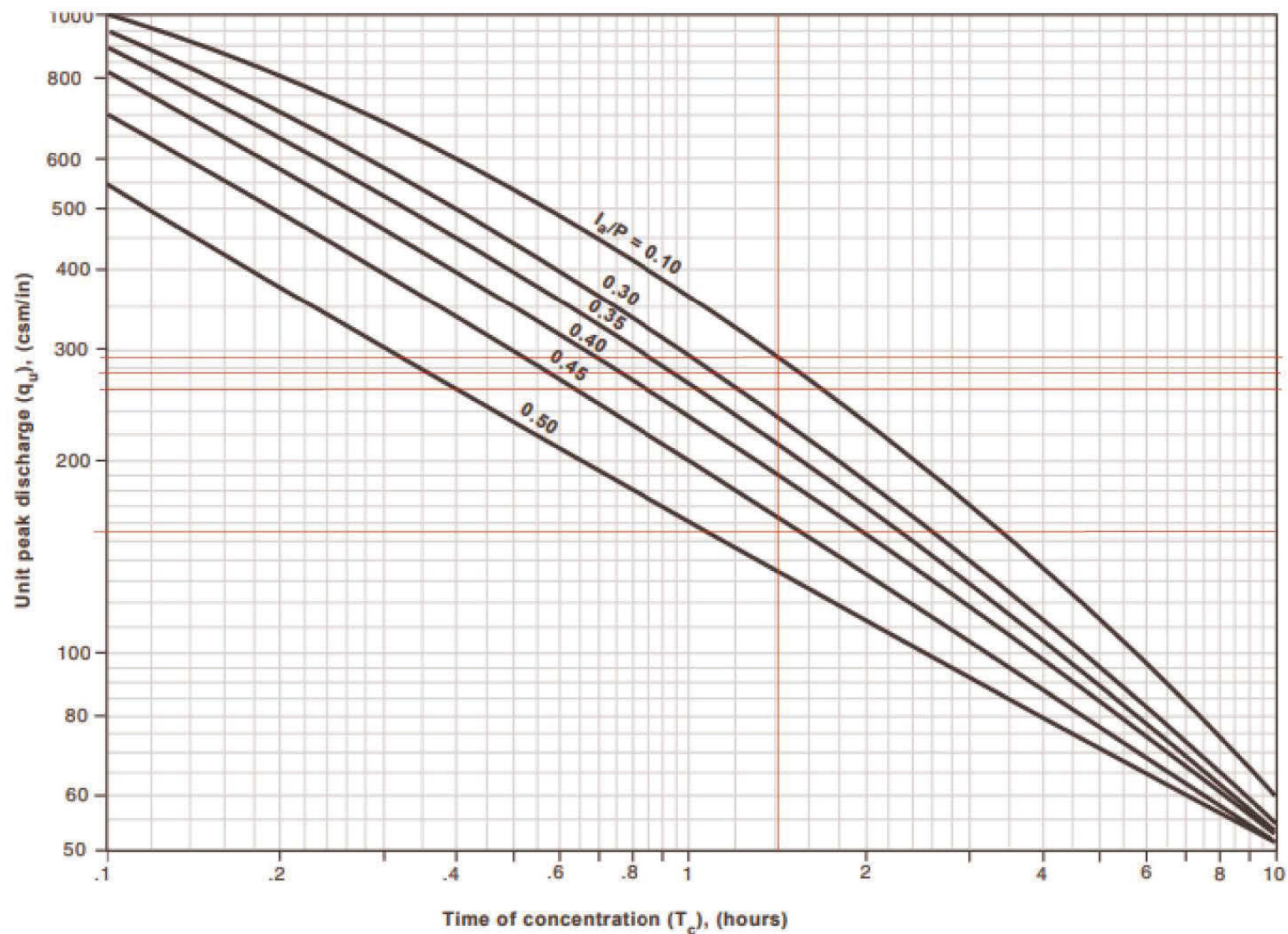
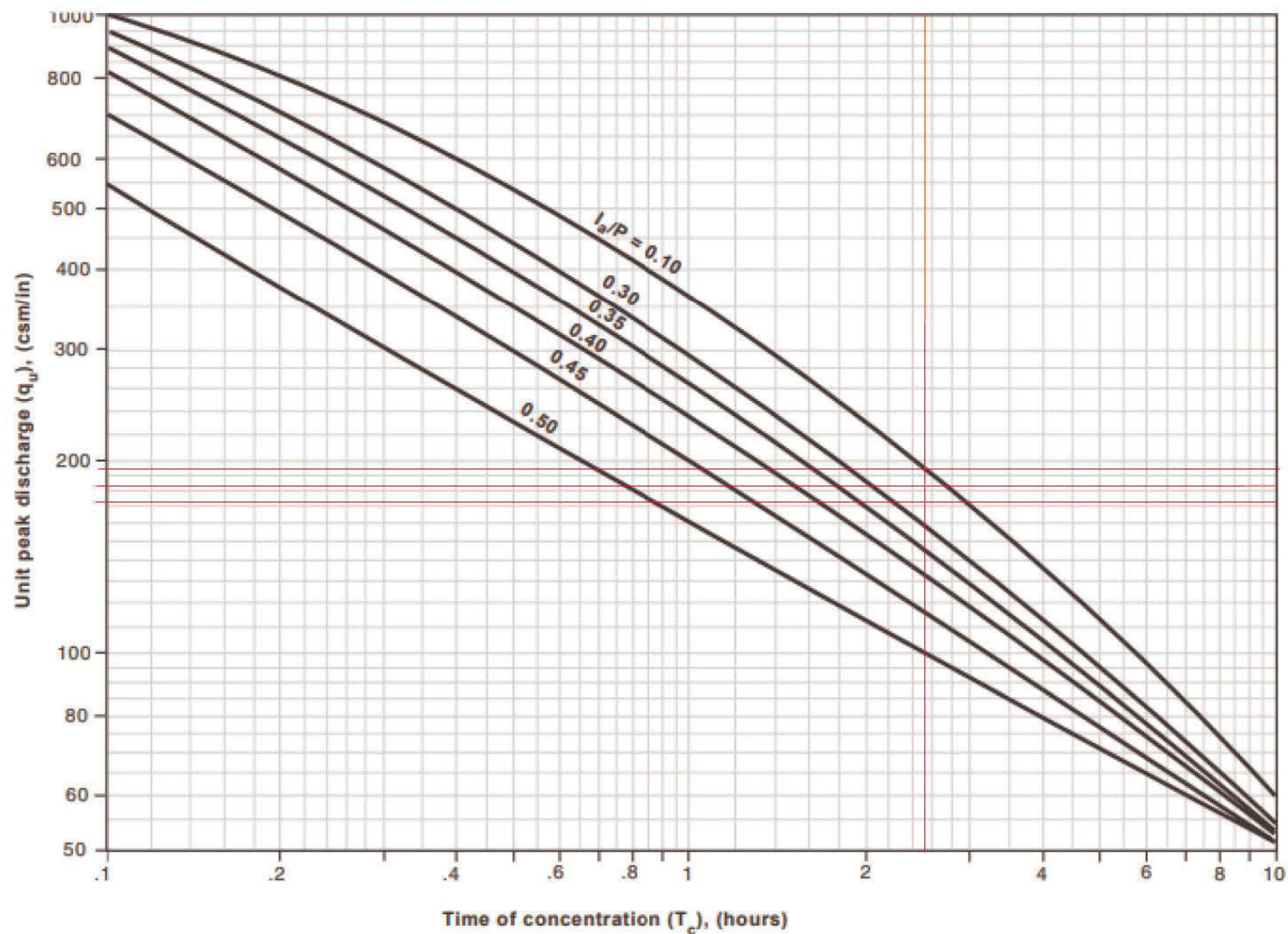
Exhibit 4-II Unit peak discharge (q_u) for NRCS (SCS) type II rainfall distribution

Exhibit 4-II Unit peak discharge (q_u) for NRCS (SCS) type II rainfall distribution

Sioux Gateway Airport Runway Program EA

Comp. By:

JKK

Date:

5/13/2025

Chk. By:

LMM

Job No:

10144998.003**TR-55 Worksheet 3: Graphical Peak Discharge**Sub-Basin Name: **Basin A**Condition: **Existing****Data**

Drainage Area	A_m	=	0.38	mi ²
Runoff Curve Number (From TR-55 Worksheet 2)	CN	=	65.11	
Potential Maximum Retention (From TR-55 Worksheet 2)	S	=	5.36	
Time of Concentration (From TR-55 Worksheet 3)	T_c	=	1.87	hr
Rainfall Distribution		=	II	
Pond and Swamp Area		=	--	% of A _m

Calculations

Frequency	P	yr	Recurrence Interval			
Rainfall (IDF 24-hour)		in	1	5	25	100
Initial Abstraction (Use TR-55 Table 4-1)	I_a	in	2.63	3.74	5.59	7.67
Compute	I_a/P		1.072	1.072	1.072	1.072
Unit Peak Discharge (Use TR-55 Exhibit 4-II)	q_u	csm/in	0.41	0.29	0.19	0.14
Runoff (From TR-55 Worksheet 2)	Q	in	154	196	217	227
Pond and Swamp Adjustment Factor (Use TR-55 Table 4-2)	F_p		0.351	0.887	2.067	3.641
Peak Discharge (Where Q _p = q _u A _m QF _p)	Q_p	cfs	1.0	1.0	1.0	1.0
			20.46	65.79	169.74	312.80

Sioux Gateway Airport Runway Program EA

Comp. By: **JKK**
 Date: **5/13/2025**
 Chk. By: **LMM**
 Job No: **10144998.003**

TR-55 Worksheet 3: Graphical Peak Discharge

Sub-Basin Name: **Basin B**
 Condition: **Existing**

Data

Drainage Area **A_m** = **0.07** mi²
 Runoff Curve Number (From TR-55 Worksheet 2) **CN** = **47.29**
 Potential Maximum Retention (From TR-55 Worksheet 2) **S** = **11.15**
 Time of Concentration (From TR-55 Worksheet 3) **T_c** = **0.58** hr
 Rainfall Distribution = **II**
 Pond and Swamp Area = **--** % of A_m

Calculations

Frequency **P** yr
 Rainfall (IDF 24-hour) **I_a** in
 Initial Abstraction (Use TR-55 Table 4-1) **I_a/P**
 Compute **q_u** csm/in
 Unit Peak Discharge (Use TR-55 Exhibit 4-II) **Q** in
 Runoff (From TR-55 Worksheet 2) **F_p**
 Pond and Swamp Adjustment Factor (Use TR-55 Table 4-2) **Q_p** cfs
 Peak Discharge (Where Q_p = q_uA_mQF_p)

Recurrence Interval			
1	5	25	100
2.63	3.74	5.59	7.67
2.229	2.229	2.229	2.229
0.85	0.60	0.40	0.29
214	214	325	410
0.014	0.180	0.779	1.785
1.0	1.0	1.0	1.0
0.20	2.63	17.23	49.81

Sioux Gateway Airport Runway Program EA

Comp. By: **JKK**
 Date: **5/13/2025**
 Chk. By: **LMM**
 Job No: **10144998.003**

TR-55 Worksheet 3: Graphical Peak Discharge

Sub-Basin Name: **Basin C**
 Condition: **Existing**

Data

Drainage Area **A_m** = **0.05** mi²
 Runoff Curve Number (From TR-55 Worksheet 2) **CN** = **64.82**
 Potential Maximum Retention (From TR-55 Worksheet 2) **S** = **5.43**
 Time of Concentration (From TR-55 Worksheet 3) **T_c** = **0.51** hr
 Rainfall Distribution = **II**
 Pond and Swamp Area = **--** % of A_m

Calculations

Frequency **P** yr
 Rainfall (IDF 24-hour) **I_a** in
 Initial Abstraction (Use TR-55 Table 4-1) **I_a/P** in
 Compute **q_u** csm/in
 Unit Peak Discharge (Use TR-55 Exhibit 4-II) **Q** in
 Runoff (From TR-55 Worksheet 2) **F_p**
 Pond and Swamp Adjustment Factor (Use TR-55 Table 4-2) **Q_p** cfs
 Peak Discharge (Where Q_p = q_uA_mQF_p)

Recurrence Interval			
1	5	25	100
2.63	3.74	5.59	7.67
1.085	1.085	1.085	1.085
0.41	0.29	0.19	0.14
336	445	480	505
0.342	0.872	2.043	3.610
1.0	1.0	1.0	1.0
6.11	20.63	52.13	96.89

Sioux Gateway Airport Runway Program EA

Comp. By:

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Date:

5/13/2025

Chk. By:

LMM

Job No:

10144998.003**TR-55 Worksheet 3: Graphical Peak Discharge**Sub-Basin Name: **Basin D**Condition: **Existing****Data**

Drainage Area	A_m	=	0.06	mi ²
Runoff Curve Number (From TR-55 Worksheet 2)	CN	=	63.29	
Potential Maximum Retention (From TR-55 Worksheet 2)	S	=	5.80	
Time of Concentration (From TR-55 Worksheet 3)	T_c	=	0.91	hr
Rainfall Distribution		=	II	
Pond and Swamp Area		=	--	% of A_m

Calculations

Frequency	P	yr
Rainfall (IDF 24-hour)	I_a	in
Initial Abstraction (Use TR-55 Table 4-1)	I_a/P	
Compute	q_u	csm/in
Unit Peak Discharge (Use TR-55 Exhibit 4-II)	Q	in
Runoff (From TR-55 Worksheet 2)	F_p	
Pond and Swamp Adjustment Factor (Use TR-55 Table 4-2)	Q_p	cfs
Peak Discharge (Where $Q_p = q_u A_m Q F_p$)		

Recurrence Interval			
1	5	25	100
2.63	3.74	5.59	7.67
1.160	1.160	1.160	1.160
0.44	0.31	0.21	0.15
218	302	342	360
0.297	0.794	1.918	3.443
1.0	1.0	1.0	1.0
4.06	15.04	41.14	77.72

Sioux Gateway Airport Runway Program EA

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Date:

5/13/2025

Chk. By:

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Job No:

10144998.003**TR-55 Worksheet 3: Graphical Peak Discharge**Sub-Basin Name: **Basin E**Condition: **Existing****Data**

Drainage Area	A_m	=	0.02	mi ²
Runoff Curve Number (From TR-55 Worksheet 2)	CN	=	69.04	
Potential Maximum Retention (From TR-55 Worksheet 2)	S	=	4.48	
Time of Concentration (From TR-55 Worksheet 3)	T_c	=	0.44	hr
Rainfall Distribution		=	II	
Pond and Swamp Area		=	--	% of A _m

Calculations

Frequency	P	yr
Rainfall (IDF 24-hour)	I_a	in
Initial Abstraction (Use TR-55 Table 4-1)	I_a/P	
Compute	q_u	csm/in
Unit Peak Discharge (Use TR-55 Exhibit 4-II)	Q	in
Runoff (From TR-55 Worksheet 2)	F_p	
Pond and Swamp Adjustment Factor (Use TR-55 Table 4-2)	Q_p	cfs
Peak Discharge (Where Q _p = q _u A _m QF _p)		

Recurrence Interval			
1	5	25	100
2.63	3.74	5.59	7.67
0.897	0.897	0.897	0.897
0.34	0.24	0.16	0.12
440	500	530	555
0.483	1.103	2.400	4.075
1.0	1.0	1.0	1.0
5.29	13.72	31.64	56.26

Sioux Gateway Airport Runway Program EA

Comp. By:

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Date:

5/13/2025

Chk. By:

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Job No:

10144998.003**TR-55 Worksheet 3: Graphical Peak Discharge**Sub-Basin Name: **Basin F**Condition: **Existing****Data**

Drainage Area	A_m	=	0.03	mi ²
Runoff Curve Number (From TR-55 Worksheet 2)	CN	=	72.26	
Potential Maximum Retention (From TR-55 Worksheet 2)	S	=	3.84	
Time of Concentration (From TR-55 Worksheet 3)	T_c	=	0.65	hr
Rainfall Distribution		=	II	
Pond and Swamp Area		=	--	% of A_m

Calculations

Frequency	P	yr	Recurrence Interval			
Rainfall (IDF 24-hour)	I_a	in	1	5	25	100
Initial Abstraction (Use TR-55 Table 4-1)	I_a/P	in	2.63	3.74	5.59	7.67
Compute	q_u	in	0.768	0.768	0.768	0.768
Unit Peak Discharge (Use TR-55 Exhibit 4-II)	Q	csm/in	0.29	0.21	0.14	0.10
Runoff (From TR-55 Worksheet 2)	F_p	in	387	418	443	465
Pond and Swamp Adjustment Factor (Use TR-55 Table 4-2)	Q_p	cfs	0.608	1.297	2.685	4.435
Peak Discharge (Where $Q_p = q_u A_m Q F_p$)			1.0	1.0	1.0	1.0
			6.56	15.10	33.13	57.46

Sioux Gateway Airport Runway Program EA

Comp. By: JKK
 Date: 5/13/2025
 Chk. By: LMM
 Job No: 10144998.003

TR-55 Worksheet 3: Graphical Peak Discharge

Sub-Basin Name: Basin G
 Condition: Existing

Data

Drainage Area A_m = 0.24 mi^2
 Runoff Curve Number (From TR-55 Worksheet 2) CN = 77.58
 Potential Maximum Retention (From TR-55 Worksheet 2) S = 2.89
 Time of Concentration (From TR-55 Worksheet 3) T_c = 1.41 hr
 Rainfall Distribution = II
 Pond and Swamp Area = -- % of A_m

Calculations

Frequency P yr
 Rainfall (IDF 24-hour) I_a in
 Initial Abstraction (Use TR-55 Table 4-1) I_a/P in
 Compute q_u csm/in
 Unit Peak Discharge (Use TR-55 Exhibit 4-II) Q in
 Runoff (From TR-55 Worksheet 2) F_p
 Pond and Swamp Adjustment Factor (Use TR-55 Table 4-2) Q_p cfs
 Peak Discharge (Where $Q_p = q_u A_m Q F_p$)

Recurrence Interval			
1	5	25	100
2.63	3.74	5.59	7.67
0.578	0.578	0.578	0.578
0.22	0.15	0.10	0.08
259	275	292	292
0.852	1.652	3.179	5.039
1.0	1.0	1.0	1.0
53.17	109.45	223.63	354.45

Sioux Gateway Airport Runway Program EA

Comp. By:

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Date:

5/13/2025

Chk. By:

LMM

Job No:

10144998.003**TR-55 Worksheet 3: Graphical Peak Discharge**Sub-Basin Name: **Basin H**Condition: **Existing****Data**

Drainage Area	A_m	=	0.56	mi ²
Runoff Curve Number (From TR-55 Worksheet 2)	CN	=	77.40	
Potential Maximum Retention (From TR-55 Worksheet 2)	S	=	2.92	
Time of Concentration (From TR-55 Worksheet 3)	T_c	=	2.53	hr
Rainfall Distribution		=	II	
Pond and Swamp Area		=	--	% of A _m

Calculations

Frequency	P	yr	Recurrence Interval			
Rainfall (IDF 24-hour)	I_a	in	1	5	25	100
Initial Abstraction (Use TR-55 Table 4-1)	I_a/P	in	2.63	3.74	5.59	7.67
Compute	q_u	in	0.584	0.584	0.584	0.584
Unit Peak Discharge (Use TR-55 Exhibit 4-II)	Q	csm/in	0.22	0.16	0.10	0.08
Runoff (From TR-55 Worksheet 2)	F_p	in	172	183	194	194
Pond and Swamp Adjustment Factor (Use TR-55 Table 4-2)	Q_p	cfs	0.843	1.639	3.162	5.018
Peak Discharge (Where Q _p = q _u A _m QF _p)			1.0	1.0	1.0	1.0
			81.20	168.01	343.53	545.23

TR-55 Worksheet 2: Curve Number and Runoff

Subbasin Name: Basin A
Condition: Future

Curve Number (TR-55 Table 2-2)

Total Area:	10,550,294	sf	242.20	ac	0.38	mi ²
Pervious Area:	8,595,069	sf	197.32	ac		
Gravel Area:	464,533	sf	10.66	ac		
Impervious Area:	1,490,693	sf	34.22	ac		

HSG	Description	CN	Area	CN*A
A	Good Condition (grass cover >75%)	39	26.43	1030.9
B	Good Condition (grass cover >75%)	61	139.13	8486.8
C	Good Condition (grass cover >75%)	74	23.57	1744.3
D	Good Condition (grass cover >75%)	80	8.18	654.6
A	Gravel Road	76	1.73	131.4
B	Gravel Road	85	8.73	741.8
D	Gravel Road	91	0.21	18.8
				0.0
Impervious	Paved Area, Roofs	98	34.22	3353.7
Totals:			242.20	16162.5
Composite Curve Number:				66.73

Runoff

Frequency		yr	Recurrence Interval (yr)			
Rainfall (ISWMM Table C3-S2-3, 24-hour)	P	in	1	5	25	100
Potential Maximum Retention (Use TR-55 Equation 2-4)	S	in	2.63	3.74	5.59	7.67
Runoff (Use TR-55 Equation 2-3)	Q	in	4.99	4.99	4.99	4.99
			0.403	0.974	2.202	3.819

TR-55 Worksheet 2: Curve Number and Runoff

Subbasin Name: Basin B
Condition: Future

Curve Number (TR-55 Table 2-2)

Total Area:	1,897,555	sf	43.56	ac	0.07	mi ²
Pervious Area:	1,736,144	sf	39.86	ac		
Gravel Area:	51,965	sf	1.19	ac		
Impervious Area:	109,445	sf	2.51	ac		

HSG	Description	CN	Area	CN*A
A	Good Condition (grass cover >75%)	39	28.18	1098.8
B	Good Condition (grass cover >75%)	61	11.68	712.5
A	Gravel Road	76	0.86	65.0
B	Gravel Road	85	0.34	28.7
				0.0
Impervious	Paved Area, Roofs	98	2.51	246.2
Totals:			43.56	2151.3
Composite Curve Number:				49.39

Runoff

Frequency		yr	Recurrence Interval (yr)			
Rainfall (ISWMM Table C3-S2-3, 24-hour)	P	in	1	5	25	100
Potential Maximum Retention (Use TR-55 Equation 2-4)	S	in	2.63	3.74	5.59	7.67
Runoff (Use TR-55 Equation 2-3)	Q	in	10.25	10.25	10.25	10.25
			0.031	0.239	0.909	1.990

TR-55 Worksheet 2: Curve Number and Runoff

Subbasin Name: Basin C
Condition: Future

Curve Number (TR-55 Table 2-2)

Total Area:	1,481,656	sf	34.01	ac	0.05	mi ²
Pervious Area:	1,303,661	sf	29.93	ac		
Gravel Area:	20,244	sf	0.46	ac		
Impervious Area:	157,751	sf	3.62	ac		

HSG	Description	CN	Area	CN*A
B	Good Condition (grass cover >75%)	61	29.93	1825.6
B	Gravel Road	85	0.46	39.5
				0.0
Impervious	Paved Area, Roofs	98	3.62	354.9
Totals:			34.01	2220.0
Composite Curve Number:				65.27

Runoff

Frequency		yr	Recurrence Interval (yr)			
Rainfall (ISWMM Table C3-S2-3, 24-hour)	P	in	1	5	25	100
Potential Maximum Retention (Use TR-55 Equation 2-4)	S	in	2.63	3.74	5.59	7.67
Runoff (Use TR-55 Equation 2-3)	Q	in	5.32	5.32	5.32	5.32
			0.356	0.895	2.080	3.658

TR-55 Worksheet 2: Curve Number and Runoff

Subbasin Name: Basin D
Condition: Future

Curve Number (TR-55 Table 2-2)

Total Area:	1,748,174	sf	40.13	ac	0.06	mi ²
Pervious Area:	1,543,948	sf	35.44	ac		
Gravel Area:	26,029	sf	0.60	ac		
Impervious Area:	178,197	sf	4.09	ac		

HSG	Description	CN	Area	CN*A
A	Good Condition (grass cover >75%)	39	3.17	123.5
B	Good Condition (grass cover >75%)	61	32.28	1968.9
A	Gravel Road	76	0.19	14.5
B	Gravel Road	85	0.41	34.5
				0.0
Impervious	Paved Area, Roofs	98	4.09	400.9
Totals:			40.13	2542.4
Composite Curve Number:				63.35

Runoff

Frequency		yr	Recurrence Interval (yr)			
			1	5	25	100
Rainfall (ISWMM Table C3-S2-3, 24-hour)	P	in	2.63	3.74	5.59	7.67
Potential Maximum Retention (Use TR-55 Equation 2-4)	S	in	5.79	5.79	5.79	5.79
Runoff (Use TR-55 Equation 2-3)	Q	in	0.299	0.797	1.923	3.449

Sioux Gateway Airport Runway Program EA		Comp. By: JKK
		Date: 5/13/2025
		Chk. By: LMM
		Job No: 10144998.003

TR-55 Worksheet 2: Curve Number and Runoff

Subbasin Name: Basin E
Condition: Future

Curve Number (TR-55 Table 2-2)

Total Area:	693,468	sf	15.92	ac	0.02	mi ²
Pervious Area:	544,677	sf	12.50	ac		
Gravel Area:	518	sf	0.01	ac		
Impervious Area:	148,273	sf	3.40	ac		

HSG	Description	CN	Area	CN*A
B	Good Condition (grass cover >75%)	61	12.37	754.9
C	Good Condition (grass cover >75%)	74	0.13	9.6
B	Gravel Road	85	0.01	1.0
				0.0
Impervious	Paved Area, Roofs	98	3.40	333.6
Totals:			15.92	1099.0
Composite Curve Number:				69.03

Runoff

Frequency		yr	Recurrence Interval (yr)			
Rainfall (ISWMM Table C3-S2-3, 24-hour)	P	in	1	5	25	100
Potential Maximum Retention (Use TR-55 Equation 2-4)	S	in	2.63	3.74	5.59	7.67
Runoff (Use TR-55 Equation 2-3)	Q	in	4.49	4.49	4.49	4.49
			0.483	1.103	2.399	4.074

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		Date: 5/13/2025
		Chk. By: LMM
		Job No: 10144998.003

TR-55 Worksheet 2: Curve Number and Runoff

Subbasin Name: Basin F
Condition: Future

Curve Number (TR-55 Table 2-2)

Total Area:	776,689	sf	17.83	ac	0.03	mi ²
Pervious Area:	606,453	sf	13.92	ac		
Gravel Area:	0	sf	0.00	ac		
Impervious Area:	170,236	sf	3.91	ac		

HSG	Description	CN	Area	CN*A
B	Good Condition (grass cover >75%)	61	9.61	585.9
C	Good Condition (grass cover >75%)	74	4.32	319.4
				0.0
Impervious	Paved Area, Roofs	98	3.91	383.0
Totals:			17.83	1288.4
Composite Curve Number:				72.26

Runoff

Frequency		yr	Recurrence Interval (yr)			
Rainfall (ISWMM Table C3-S2-3, 24-hour)	P	in	1	5	25	100
Potential Maximum Retention (Use TR-55 Equation 2-4)	S	in	2.63	3.74	5.59	7.67
Runoff (Use TR-55 Equation 2-3)	Q	in	3.84	3.84	3.84	3.84
			0.608	1.297	2.685	4.435

TR-55 Worksheet 2: Curve Number and Runoff

Subbasin Name: Basin G
Condition: Future

Curve Number (TR-55 Table 2-2)

Total Area:	6,715,860	sf	154.17	ac	0.24	mi ²
Pervious Area:	4,464,687	sf	102.50	ac		
Gravel Area:	9,567	sf	0.22	ac		
Impervious Area:	2,241,606	sf	51.46	ac		

HSG	Description	CN	Area	CN*A
B	Good Condition (grass cover >75%)	61	65.69	4007.0
C	Good Condition (grass cover >75%)	74	1.35	100.1
D	Good Condition (grass cover >75%)	80	35.45	2836.4
D	Gravel Road	91	0.22	20.0
				0.0
Impervious	Paved Area, Roofs	98	51.46	5043.1
Totals:			154.17	12006.5
Composite Curve Number:				77.88

Runoff

Frequency		yr	Recurrence Interval (yr)			
Rainfall (ISWMM Table C3-S2-3, 24-hour)	P	in	1	5	25	100
Potential Maximum Retention (Use TR-55 Equation 2-4)	S	in	2.84	2.84	2.84	2.84
Runoff (Use TR-55 Equation 2-3)	Q	in	0.867	1.673	3.207	5.073

TR-55 Worksheet 2: Curve Number and Runoff

Subbasin Name: Basin H
Condition: Future

Curve Number (TR-55 Table 2-2)

Total Area:	15,614,065	sf	358.45	ac	0.56	mi ²
Pervious Area:	12,006,667	sf	275.64	ac		
Gravel Area:	195,389	sf	4.49	ac		
Impervious Area:	3,412,010	sf	78.33	ac		

HSG	Description	CN	Area	CN*A
B	Good Condition (grass cover >75%)	61	113.00	6893.0
C	Good Condition (grass cover >75%)	74	17.37	1285.4
D	Good Condition (grass cover >75%)	80	145.26	11621.1
B	Gravel Road	85	0.05	4.3
D	Gravel Road	91	4.44	403.6
				0.0
Impervious	Paved Area, Roofs	98	78.33	7676.2
Totals:			358.45	27883.7
Composite Curve Number:				77.79

Runoff

Frequency		yr	Recurrence Interval (yr)			
Rainfall (ISWMM Table C3-S2-3, 24-hour)	P	in	1	5	25	100
Potential Maximum Retention (Use TR-55 Equation 2-4)	S	in	2.86	2.86	2.86	2.86
Runoff (Use TR-55 Equation 2-3)	Q	in	0.863	1.667	3.199	5.063

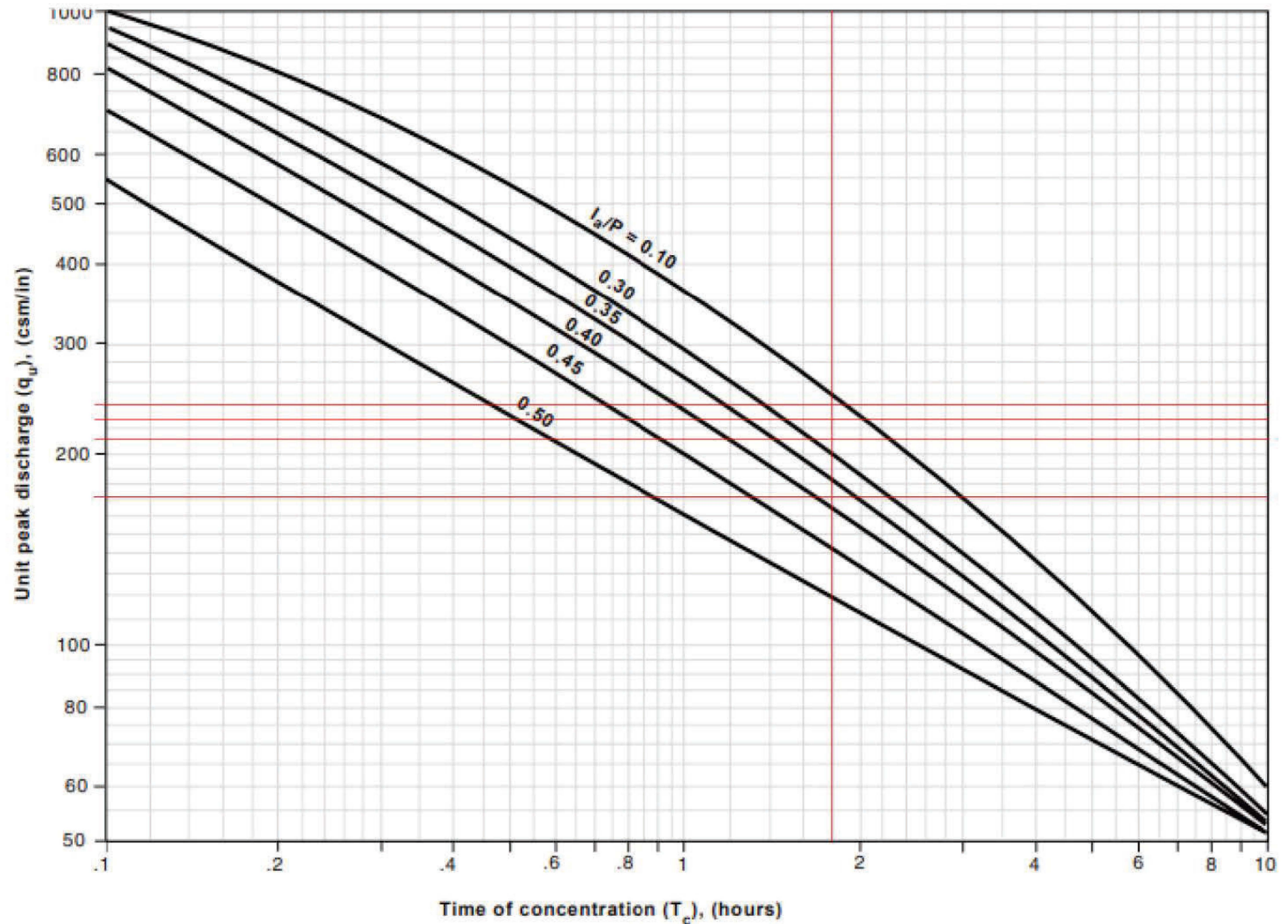
Exhibit 4-II Unit peak discharge (q_u) for NRCS (SCS) type II rainfall distribution

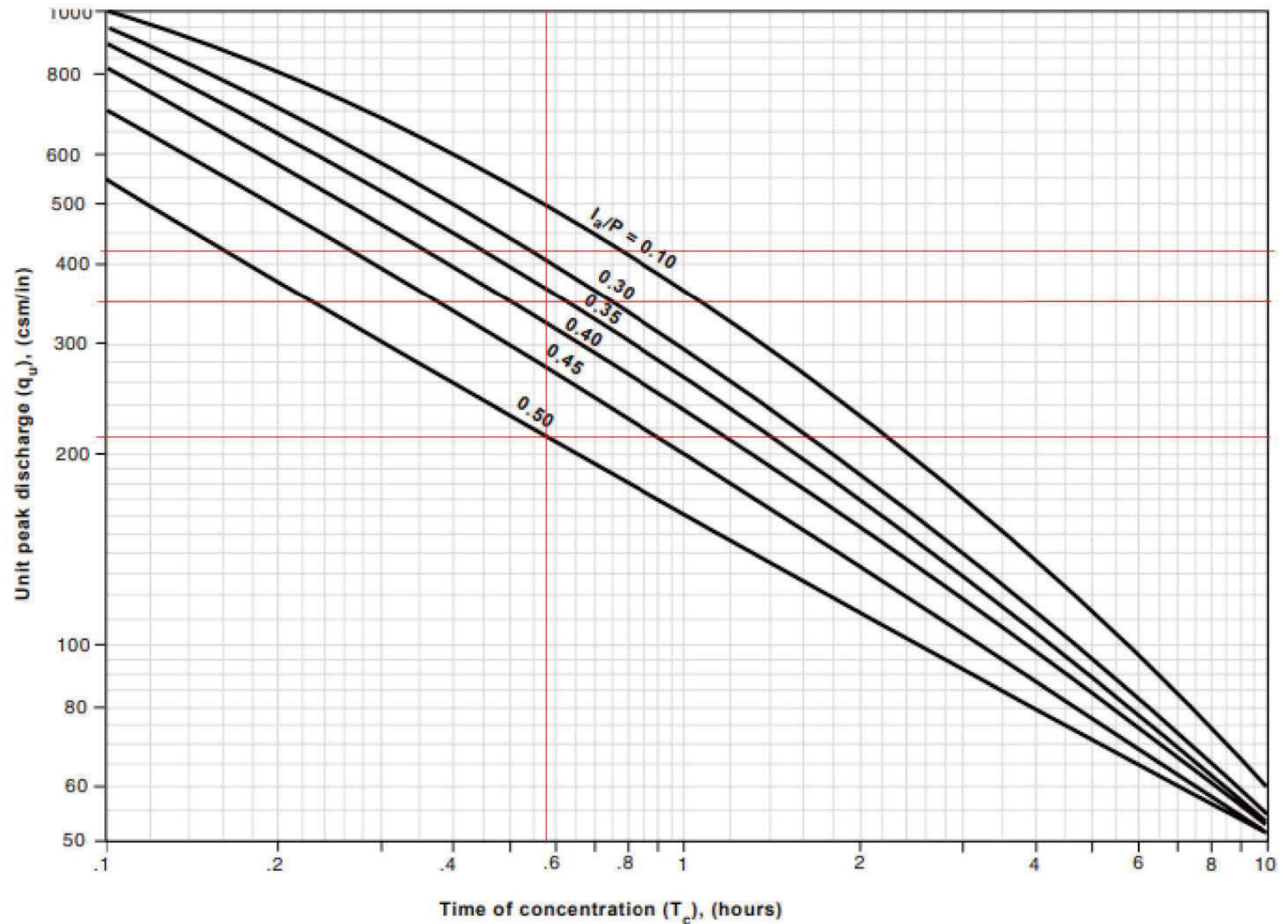
Exhibit 4-II Unit peak discharge (q_u) for NRCS (SCS) type II rainfall distribution

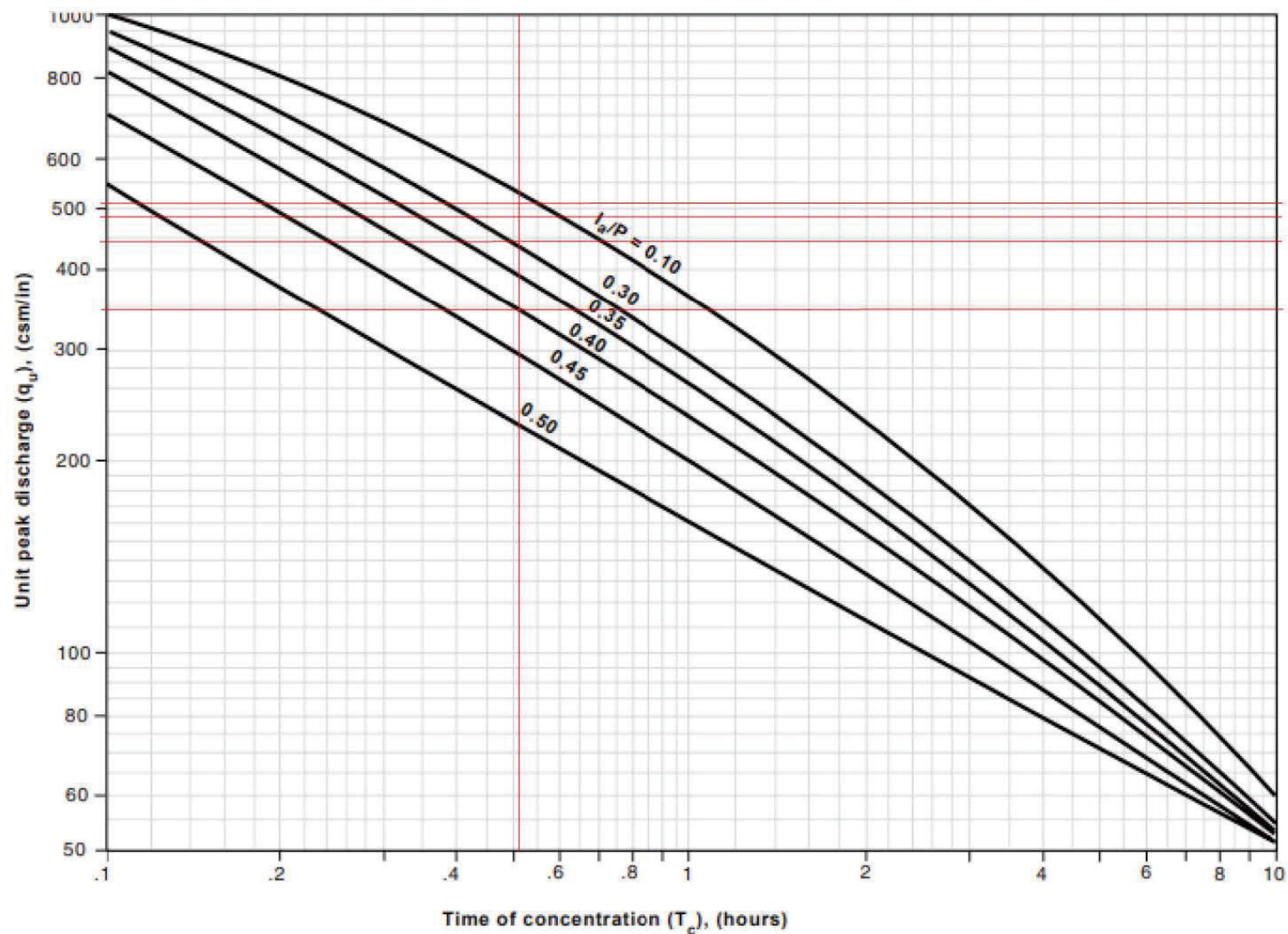
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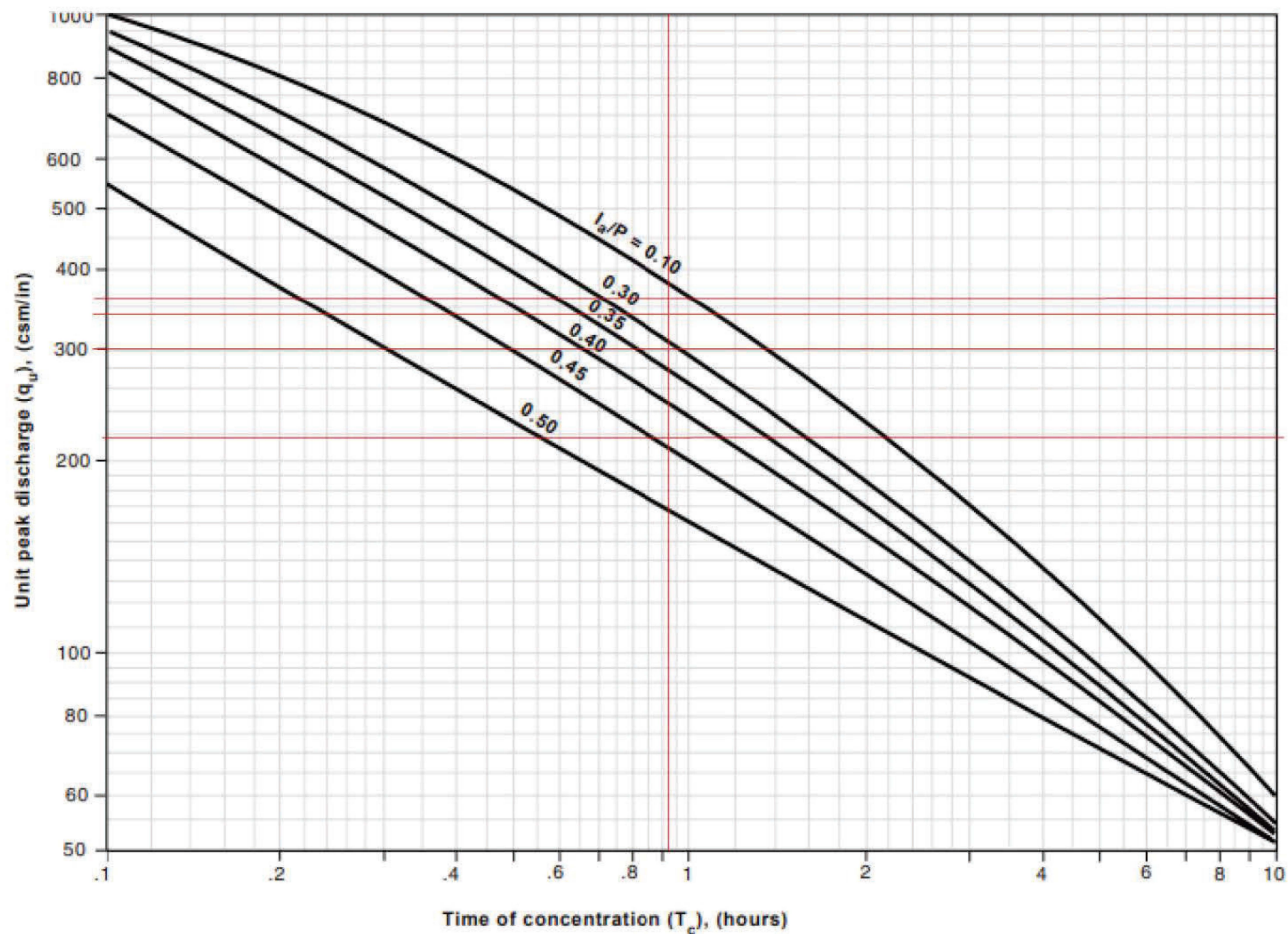
Exhibit 4-II Unit peak discharge (q_u) for NRCS (SCS) type II rainfall distribution

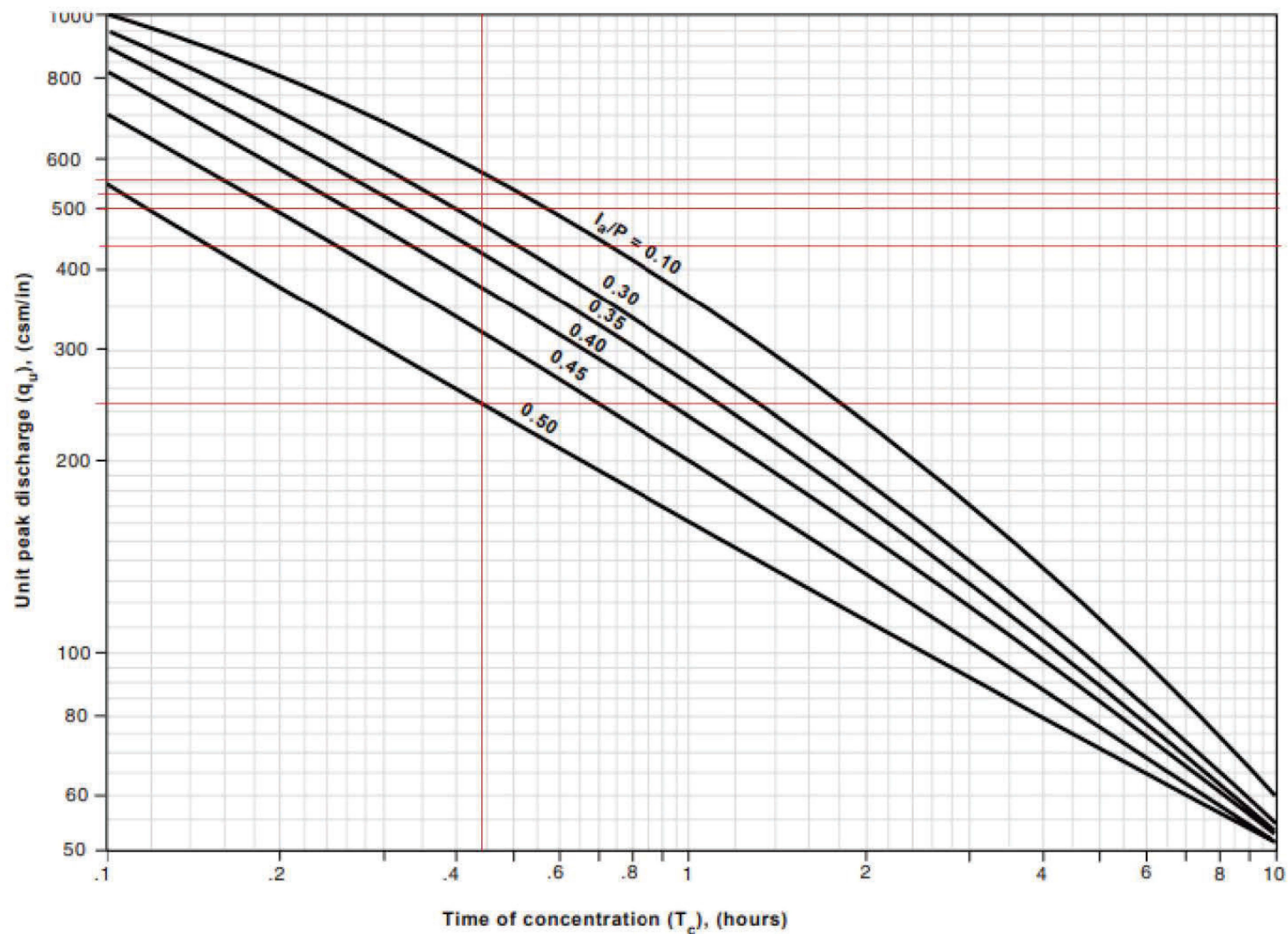
Exhibit 4-II Unit peak discharge (q_u) for NRCS (SCS) type II rainfall distribution

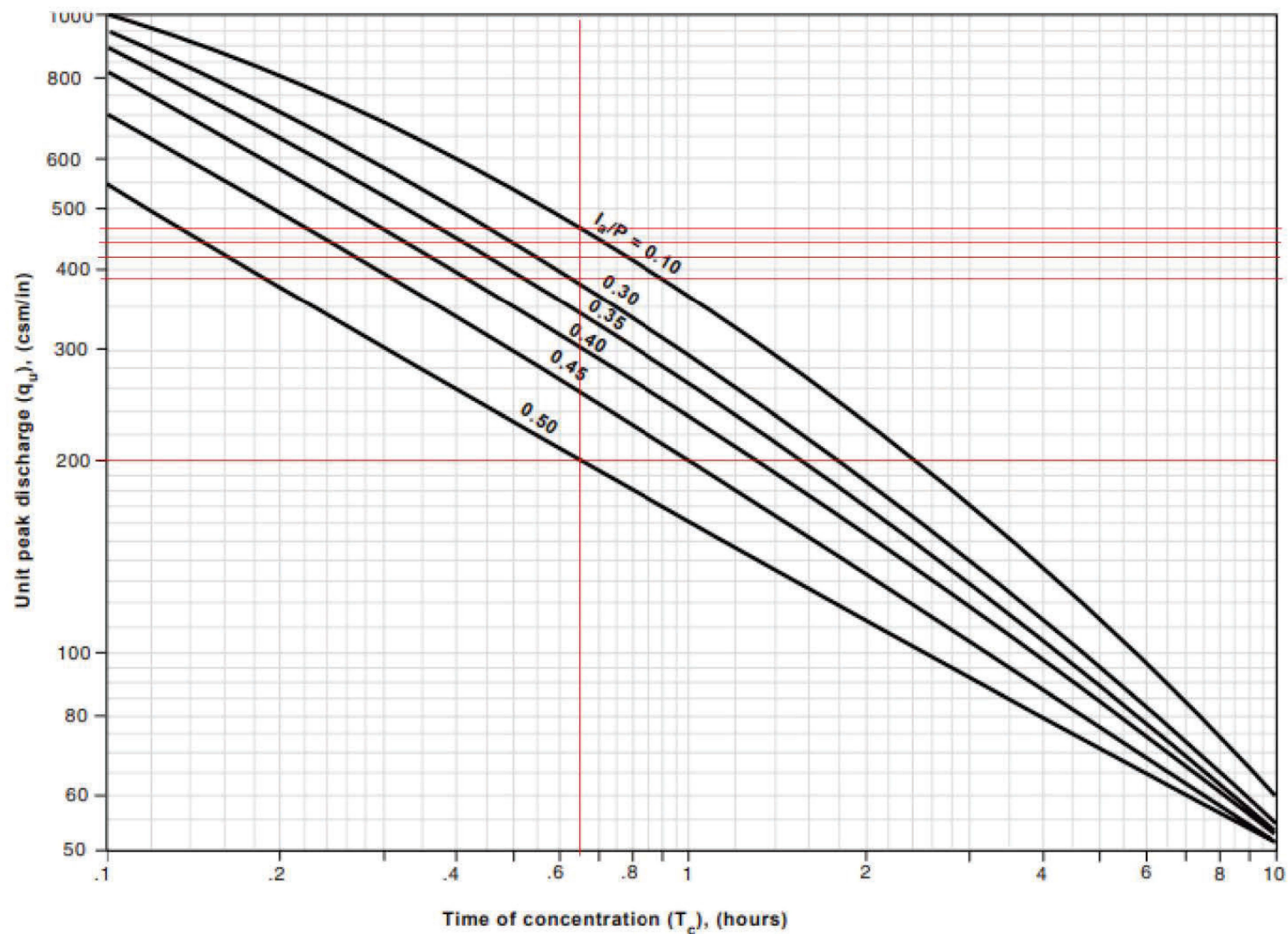
Exhibit 4-II Unit peak discharge (q_u) for NRCS (SCS) type II rainfall distribution

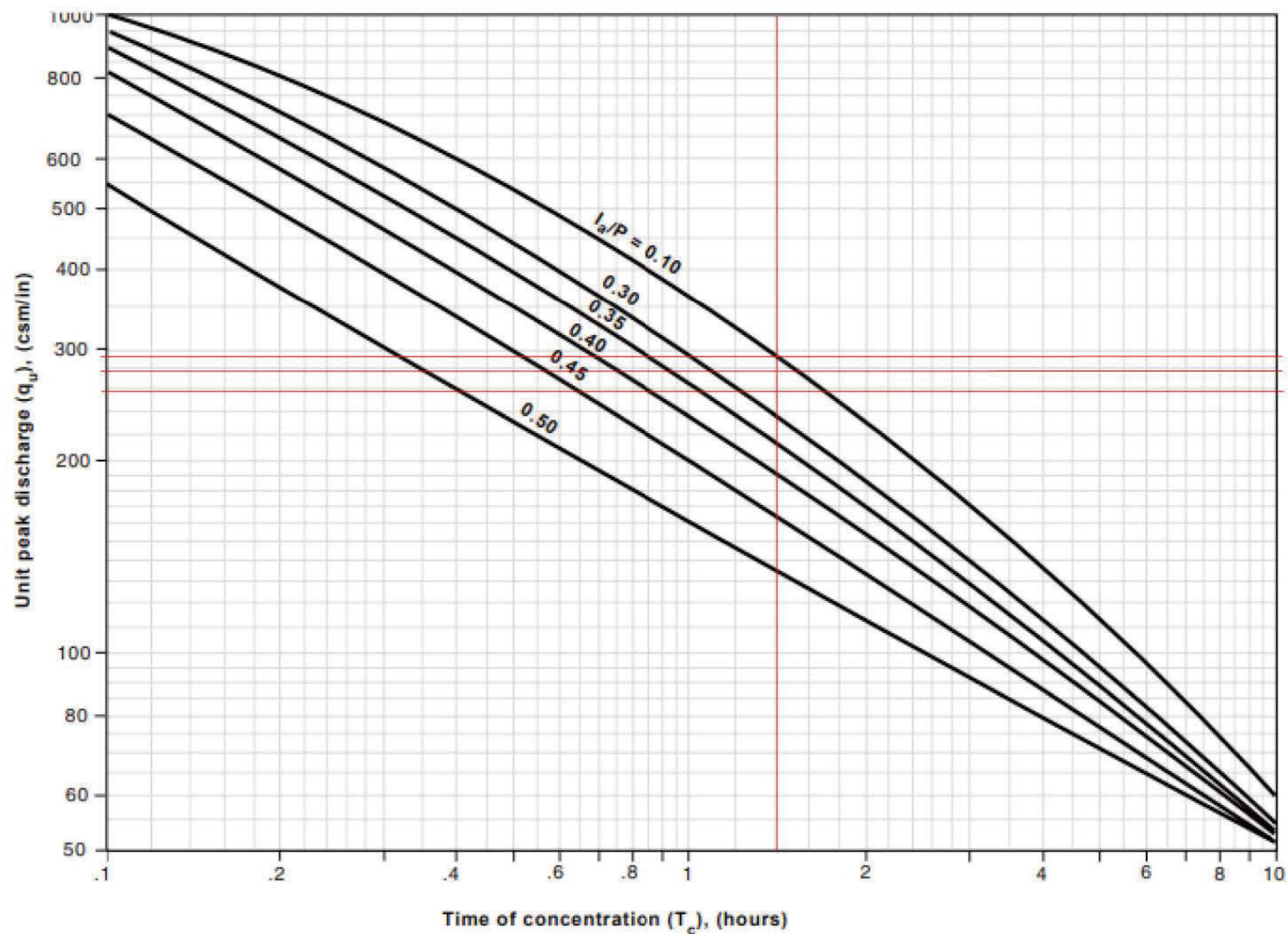
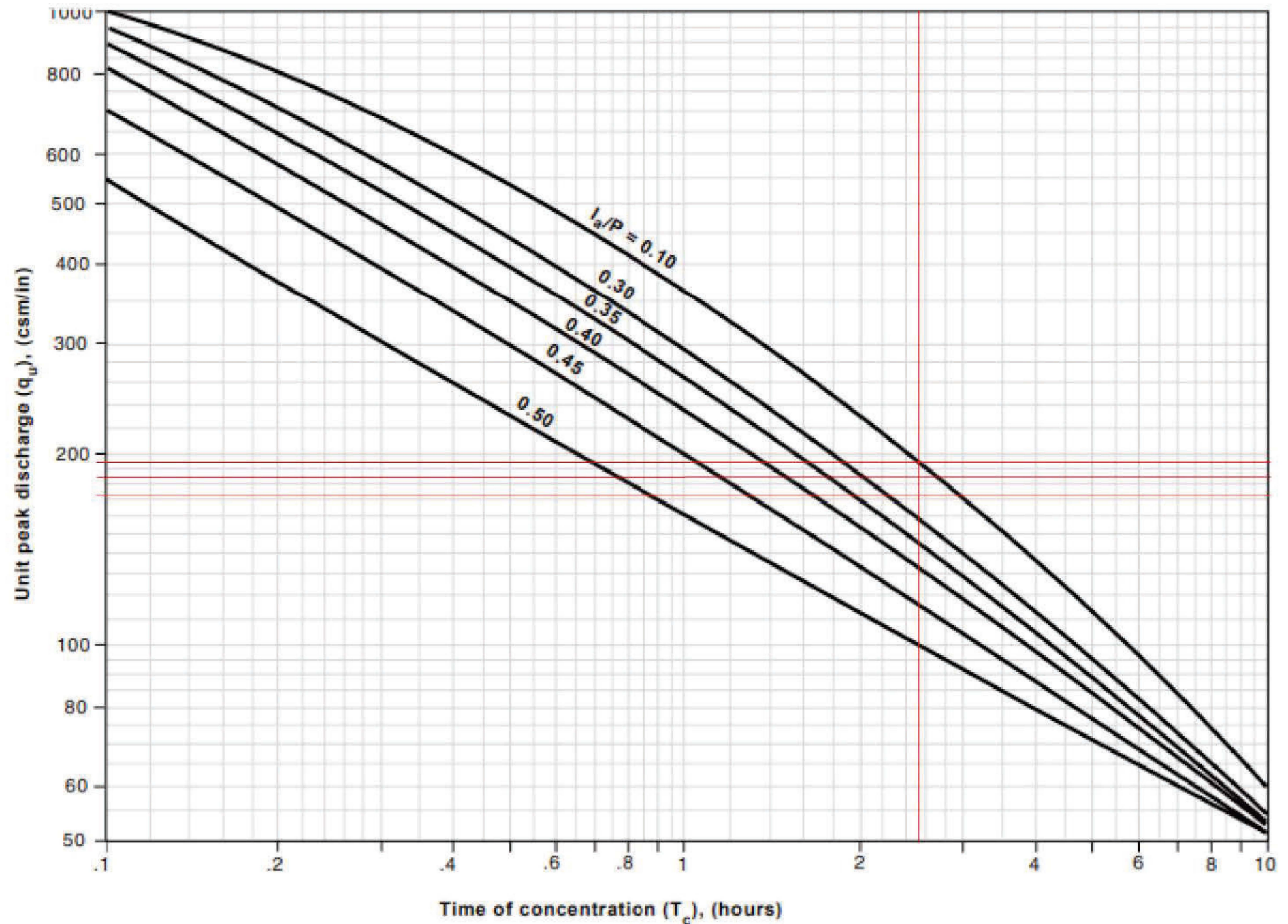
Exhibit 4-II Unit peak discharge (q_u) for NRCS (SCS) type II rainfall distribution

Exhibit 4-II Unit peak discharge (q_u) for NRCS (SCS) type II rainfall distribution

Sioux Gateway Airport Runway Program EA

Comp. By:

JKK

Date:

5/13/2025

Chk. By:

LMM

Job No:

10144998.003**TR-55 Worksheet 3: Graphical Peak Discharge**Sub-Basin Name: **Basin A**Condition: **Future****Data**

Drainage Area	A_m	=	0.38	mi ²
Runoff Curve Number (From TR-55 Worksheet 2)	CN	=	66.73	
Potential Maximum Retention (From TR-55 Worksheet 2)	S	=	4.99	
Time of Concentration (From TR-55 Worksheet 3)	T_c	=	1.79	hr
Rainfall Distribution		=	II	
Pond and Swamp Area		=	--	% of A_m

Calculations

Frequency	P	yr	Recurrence Interval			
Rainfall (IDF 24-hour)	I_a	in	1	5	25	100
Initial Abstraction (Use TR-55 Table 4-1)	I_a/P	in	2.63	3.74	5.59	7.67
Compute	q_u	in	0.998	0.998	0.998	0.998
Unit Peak Discharge (Use TR-55 Exhibit 4-II)	Q	csm/in	0.38	0.27	0.18	0.13
Runoff (From TR-55 Worksheet 2)	F_p	in	171	212	228	240
Pond and Swamp Adjustment Factor (Use TR-55 Table 4-2)	Q_p	cfs	0.408	0.983	2.216	3.838
Peak Discharge (Where $Q_p = q_u A_m Q F_p$)			1.0	1.0	1.0	1.0
			26.59	79.30	192.39	350.66

Sioux Gateway Airport Runway Program EA

Comp. By: **JKK**
 Date: **5/13/2025**
 Chk. By: **LMM**
 Job No: **10144998.003**

TR-55 Worksheet 3: Graphical Peak Discharge

Sub-Basin Name: **Basin B**
 Condition: **Future**

Data

Drainage Area **A_m** = **0.07** mi²
 Runoff Curve Number (From TR-55 Worksheet 2) **CN** = **49.39**
 Potential Maximum Retention (From TR-55 Worksheet 2) **S** = **10.25**
 Time of Concentration (From TR-55 Worksheet 3) **T_c** = **0.58** hr
 Rainfall Distribution = **II**
 Pond and Swamp Area = **--** % of A_m

Calculations

Frequency **P** yr
 Rainfall (IDF 24-hour) **I_a** in
 Initial Abstraction (Use TR-55 Table 4-1) **I_a/P** in
 Compute **q_u** csm/in
 Unit Peak Discharge (Use TR-55 Exhibit 4-II) **Q** in
 Runoff (From TR-55 Worksheet 2) **F_p**
 Pond and Swamp Adjustment Factor (Use TR-55 Table 4-2) **Q_p** cfs
 Peak Discharge (Where Q_p = q_uA_mQF_p)

Recurrence Interval			
1	5	25	100
2.63	3.74	5.59	7.67
2.050	2.050	2.050	2.050
0.78	0.55	0.37	0.27
213	213	349	421
0.032	0.241	0.913	1.996
1.0	1.0	1.0	1.0
0.46	3.50	21.68	57.21

Sioux Gateway Airport Runway Program EA

Comp. By:

JKK

Date:

5/13/2025

Chk. By:

LMM

Job No:

10144998.003**TR-55 Worksheet 3: Graphical Peak Discharge**Sub-Basin Name: **Basin C**Condition: **Future****Data**

Drainage Area	A_m	=	0.05	mi ²
Runoff Curve Number (From TR-55 Worksheet 2)	CN	=	65.27	
Potential Maximum Retention (From TR-55 Worksheet 2)	S	=	5.32	
Time of Concentration (From TR-55 Worksheet 3)	T_c	=	0.51	hr
Rainfall Distribution		=	II	
Pond and Swamp Area		=	--	% of A_m

Calculations

Frequency	P	yr
Rainfall (IDF 24-hour)	I_a	in
Initial Abstraction (Use TR-55 Table 4-1)	I_a/P	
Compute	q_u	csm/in
Unit Peak Discharge (Use TR-55 Exhibit 4-II)	Q	in
Runoff (From TR-55 Worksheet 2)	F_p	
Pond and Swamp Adjustment Factor (Use TR-55 Table 4-2)	Q_p	cfs
Peak Discharge (Where $Q_p = q_u A_m Q F_p$)		

Recurrence Interval			
1	5	25	100
2.63	3.74	5.59	7.67
1.064	1.064	1.064	1.064
0.40	0.28	0.19	0.14
346	444	485	510
0.356	0.895	2.080	3.658
1.0	1.0	1.0	1.0
6.55	21.12	53.61	99.16

Sioux Gateway Airport Runway Program EA

Comp. By: JKK
 Date: 5/13/2025
 Chk. By: LMM
 Job No: 10144998.003

TR-55 Worksheet 3: Graphical Peak Discharge

Sub-Basin Name: Basin D
 Condition: Future

Data

Drainage Area A_m = 0.06 mi^2
 Runoff Curve Number (From TR-55 Worksheet 2) CN = 63.35
 Potential Maximum Retention (From TR-55 Worksheet 2) S = 5.79
 Time of Concentration (From TR-55 Worksheet 3) T_c = 0.92 hr
 Rainfall Distribution = II
 Pond and Swamp Area = -- % of A_m

Calculations

Frequency P yr
 Rainfall (IDF 24-hour) I_a in
 Initial Abstraction (Use TR-55 Table 4-1) I_a/P in
 Compute q_u csm/in
 Unit Peak Discharge (Use TR-55 Exhibit 4-II) Q in
 Runoff (From TR-55 Worksheet 2) F_p
 Pond and Swamp Adjustment Factor (Use TR-55 Table 4-2) Q_p cfs
 Peak Discharge (Where $Q_p = q_u A_m Q F_p$)

Recurrence Interval			
1	5	25	100
2.63	3.74	5.59	7.67
1.157	1.157	1.157	1.157
0.44	0.31	0.21	0.15
217	300	341	360
0.299	0.797	1.923	3.449
1.0	1.0	1.0	1.0
4.07	15.00	41.12	77.86

Sioux Gateway Airport Runway Program EA

Comp. By:

JKK

Date:

5/13/2025

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LMM

Job No:

10144998.003**TR-55 Worksheet 3: Graphical Peak Discharge**Sub-Basin Name: **Basin E**Condition: **Future****Data**

Drainage Area	A_m	=	0.02	mi ²
Runoff Curve Number (From TR-55 Worksheet 2)	CN	=	69.03	
Potential Maximum Retention (From TR-55 Worksheet 2)	S	=	4.49	
Time of Concentration (From TR-55 Worksheet 3)	T_c	=	0.44	hr
Rainfall Distribution		=	II	
Pond and Swamp Area		=	--	% of A _m

Calculations

Frequency	P	yr
Rainfall (IDF 24-hour)	I_a	in
Initial Abstraction (Use TR-55 Table 4-1)	I_a/P	
Compute	q_u	csm/in
Unit Peak Discharge (Use TR-55 Exhibit 4-II)	Q	in
Runoff (From TR-55 Worksheet 2)	F_p	
Pond and Swamp Adjustment Factor (Use TR-55 Table 4-2)	Q_p	cfs
Peak Discharge (Where Q _p = q _u A _m QF _p)		

Recurrence Interval			
1	5	25	100
2.63	3.74	5.59	7.67
0.897	0.897	0.897	0.897
0.34	0.24	0.16	0.12
440	500	530	555
0.483	1.103	2.399	4.074
1.0	1.0	1.0	1.0
5.29	13.72	31.63	56.25

Sioux Gateway Airport Runway Program EA

Comp. By:

JKK

Date:

5/13/2025

Chk. By:

LMM

Job No:

10144998.003**TR-55 Worksheet 3: Graphical Peak Discharge**Sub-Basin Name: **Basin F**Condition: **Future****Data**

Drainage Area	A_m	=	0.03	mi ²
Runoff Curve Number (From TR-55 Worksheet 2)	CN	=	72.26	
Potential Maximum Retention (From TR-55 Worksheet 2)	S	=	3.84	
Time of Concentration (From TR-55 Worksheet 3)	T_c	=	0.65	hr
Rainfall Distribution		=	II	
Pond and Swamp Area		=	--	% of A_m

Calculations

Frequency	P	yr	Recurrence Interval			
Rainfall (IDF 24-hour)	I_a	in	1	5	25	100
Initial Abstraction (Use TR-55 Table 4-1)	I_a/P	in	2.63	3.74	5.59	7.67
Compute	q_u	in	0.768	0.768	0.768	0.768
Unit Peak Discharge (Use TR-55 Exhibit 4-II)	Q	csm/in	0.29	0.21	0.14	0.10
Runoff (From TR-55 Worksheet 2)	F_p	in	387	418	443	465
Pond and Swamp Adjustment Factor (Use TR-55 Table 4-2)	Q_p	cfs	0.608	1.297	2.685	4.435
Peak Discharge (Where $Q_p = q_u A_m Q F_p$)			1.0	1.0	1.0	1.0
			6.56	15.10	33.13	57.45

Sioux Gateway Airport Runway Program EA

Comp. By:

JKK

Date:

5/13/2025

Chk. By:

LMM

Job No:

10144998.003**TR-55 Worksheet 3: Graphical Peak Discharge**Sub-Basin Name: **Basin G**Condition: **Future****Data**

Drainage Area	A_m	=	0.24	mi ²
Runoff Curve Number (From TR-55 Worksheet 2)	CN	=	77.88	
Potential Maximum Retention (From TR-55 Worksheet 2)	S	=	2.84	
Time of Concentration (From TR-55 Worksheet 3)	T_c	=	1.41	hr
Rainfall Distribution		=	II	
Pond and Swamp Area		=	--	% of A _m

Calculations

Frequency	P	yr	Recurrence Interval			
Rainfall (IDF 24-hour)		in	1	5	25	100
Initial Abstraction (Use TR-55 Table 4-1)	I_a	in	2.63	3.74	5.59	7.67
Compute	I_a/P		0.568	0.568	0.568	0.568
Unit Peak Discharge (Use TR-55 Exhibit 4-II)	q_u	csm/in	0.22	0.15	0.10	0.07
Runoff (From TR-55 Worksheet 2)	Q	in	258	277	293	293
Pond and Swamp Adjustment Factor (Use TR-55 Table 4-2)	F_p		0.867	1.673	3.207	5.073
Peak Discharge (Where Q _p = q _u A _m QF _p)	Q_p	cfs	1.0	1.0	1.0	1.0
			53.89	111.65	226.38	358.04

Sioux Gateway Airport Runway Program EA

Comp. By:

JKK

Date:

5/13/2025

Chk. By:

LMM

Job No:

10144998.003**TR-55 Worksheet 3: Graphical Peak Discharge**Sub-Basin Name: **Basin H**Condition: **Future****Data**

Drainage Area	A_m	=	0.56	mi ²
Runoff Curve Number (From TR-55 Worksheet 2)	CN	=	77.79	
Potential Maximum Retention (From TR-55 Worksheet 2)	S	=	2.86	
Time of Concentration (From TR-55 Worksheet 3)	T_c	=	2.53	hr
Rainfall Distribution		=	II	
Pond and Swamp Area		=	--	% of A _m

Calculations

Frequency	P	yr	Recurrence Interval			
Rainfall (IDF 24-hour)	I_a	in	1	5	25	100
Initial Abstraction (Use TR-55 Table 4-1)	I_a/P	in	2.63	3.74	5.59	7.67
Compute	q_u	in	0.572	0.572	0.572	0.572
Unit Peak Discharge (Use TR-55 Exhibit 4-II)	Q	csm/in	0.22	0.15	0.10	0.07
Runoff (From TR-55 Worksheet 2)	F_p	in	173	184	195	195
Pond and Swamp Adjustment Factor (Use TR-55 Table 4-2)	Q_p	cfs	0.865	1.670	3.203	5.067
Peak Discharge (Where Q _p = q _u A _m QF _p)			1.0	1.0	1.0	1.0
			83.78	172.08	349.79	553.41

Attachment I-4: Channel Realignment Capacity Calculations

Crossing Properties

Name: Existing Triple 84" Culvert

Parameter	Value	Units
DISCHARGE DATA		
Discharge Method	Minimum, Design, and Maximum	
Minimum Flow	1000.000	cfs
Design Flow	1300.000	cfs
Maximum Flow	2000.000	cfs
TAILWATER DATA		
Channel Type	Trapezoidal Channel	
Bottom Width	30.000	ft
Side Slope (H:V)	4.000	_:1
Channel Slope	0.0020	ft/ft
Manning's n (channel)	0.035	
Channel Invert Elevation	1075.510	ft
Rating Curve	View...	
ROADWAY DATA		
Roadway Profile Shape	Constant Roadway Elevation	
First Roadway Station	0.000	ft
Crest Length	50.000	ft
Crest Elevation	1086.000	ft
Roadway Surface	Paved	
Top Width	50.000	ft

Culvert Properties

SUX Triple 84

Add Culvert

Duplicate Culvert

Delete Culvert

Parameter	Value	Units
CULVERT DATA		
Name	SUX Triple 84	
Shape	Circular	
Material	Concrete	
Diameter	7.000	ft
Embedment Depth	0.000	in
Manning's n	0.013	
Culvert Type	Straight	
Inlet Configuration	Square Edge with Headwall (Ke=0.5)	
Inlet Depression?	No	
SITE DATA		
Site Data Input Option	Culvert Invert Data	
Inlet Station	0.000	ft
Inlet Elevation	1075.730	ft
Outlet Station	82.000	ft
Outlet Elevation	1075.510	ft
Number of Barrels	3	
Computed Culvert Slope	0.002683	ft/ft

Help

Click on any ? icon for help on a specific topic

Low Flow

AOP

Energy Dissipation

Analyze Crossing

OK

Cancel

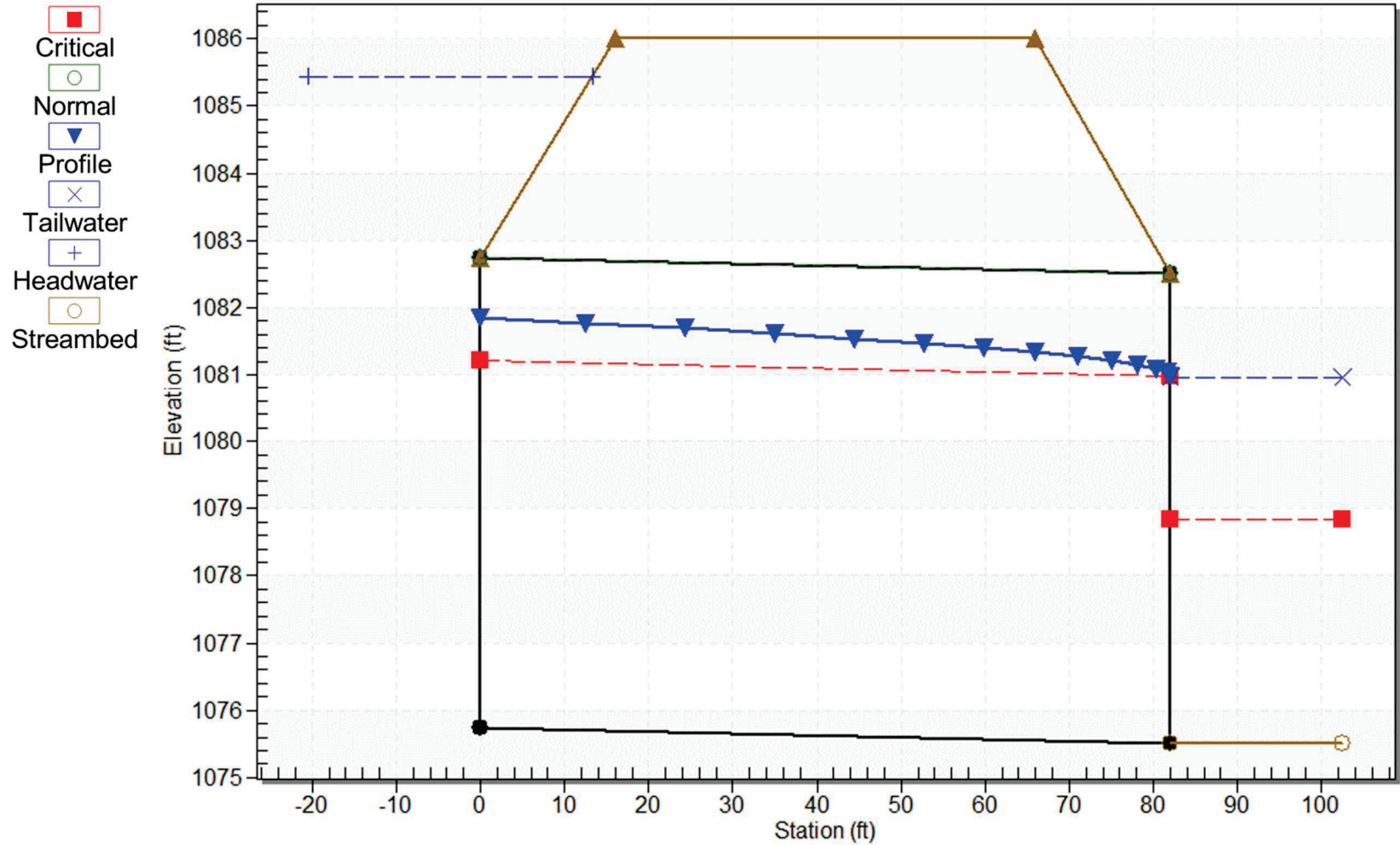
Headwater Elevation (ft)	Total Discharge (cfs)	SUX Triple 84 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
1083.68	1000.00	1000.00	0.00	1
1084.21	1100.00	1100.00	0.00	1
1084.74	1200.00	1200.00	0.00	1
1085.44	1300.00	1300.00	0.00	1
1086.15	1400.00	1391.19	8.80	6
1086.55	1500.00	1438.97	61.01	5
1086.87	1600.00	1477.05	122.94	5
1087.16	1700.00	1510.35	189.64	5
1087.43	1800.00	1540.46	259.50	4
1087.68	1900.00	1568.26	331.71	4
1087.93	2000.00	1594.21	405.77	4
1086.00	1372.14	1372.14	0.00	Overtopping

Peak Culvert
Discharge Rate

Water Surface Profile Plot for Culvert: Triple 84" RCP

Crossing - SUX Triple 84, Design Discharge - 1300.0 cfs

Culvert - SUX Triple 84, Culvert Discharge - 1300.0 cfs



Crossing Properties

Name: Existing Single 24" Culvert

Parameter	Value	Units
? DISCHARGE DATA		
Discharge Method	Minimum, Design, and Maximum	
Minimum Flow	10.000	cfs
Design Flow	25.000	cfs
Maximum Flow	50.000	cfs
? TAILWATER DATA		
Channel Type	Trapezoidal Channel	
Bottom Width	15.000	ft
Side Slope (H:V)	4.000	_:1
Channel Slope	0.0020	ft/ft
Manning's n (channel)	0.035	
Channel Invert Elevation	1074.000	ft
Rating Curve	View...	
? ROADWAY DATA		
Roadway Profile Shape	Constant Roadway Elevation	
First Roadway Station	0.000	ft
Crest Length	3.000	ft
Crest Elevation	1087.670	ft
Roadway Surface	Paved	
Top Width	3.000	ft

Culvert Properties

Single 24 RCP

Add Culvert

Duplicate Culvert

Delete Culvert

Parameter	Value	Units
? CULVERT DATA		
Name	Single 24 RCP	
Shape	Circular	
? Material	Concrete	
Diameter	2.000	ft
? Embedment Depth	0.000	in
Manning's n	0.013	
? Culvert Type	Straight	
? Inlet Configuration	Square Edge with Headwall (Ke=0.5)	
? Inlet Depression?	No	
? SITE DATA		
Site Data Input Option	Culvert Invert Data	
Inlet Station	0.000	ft
Inlet Elevation	1082.750	ft
Outlet Station	62.210	ft
Outlet Elevation	1073.410	ft
Number of Barrels	1	
Computed Culvert Slope	0.150137	ft/ft

Help

Click on any ? icon for help on a specific topic

Low Flow

AOP

Energy Dissipation

Analyze Crossing

OK

Cancel

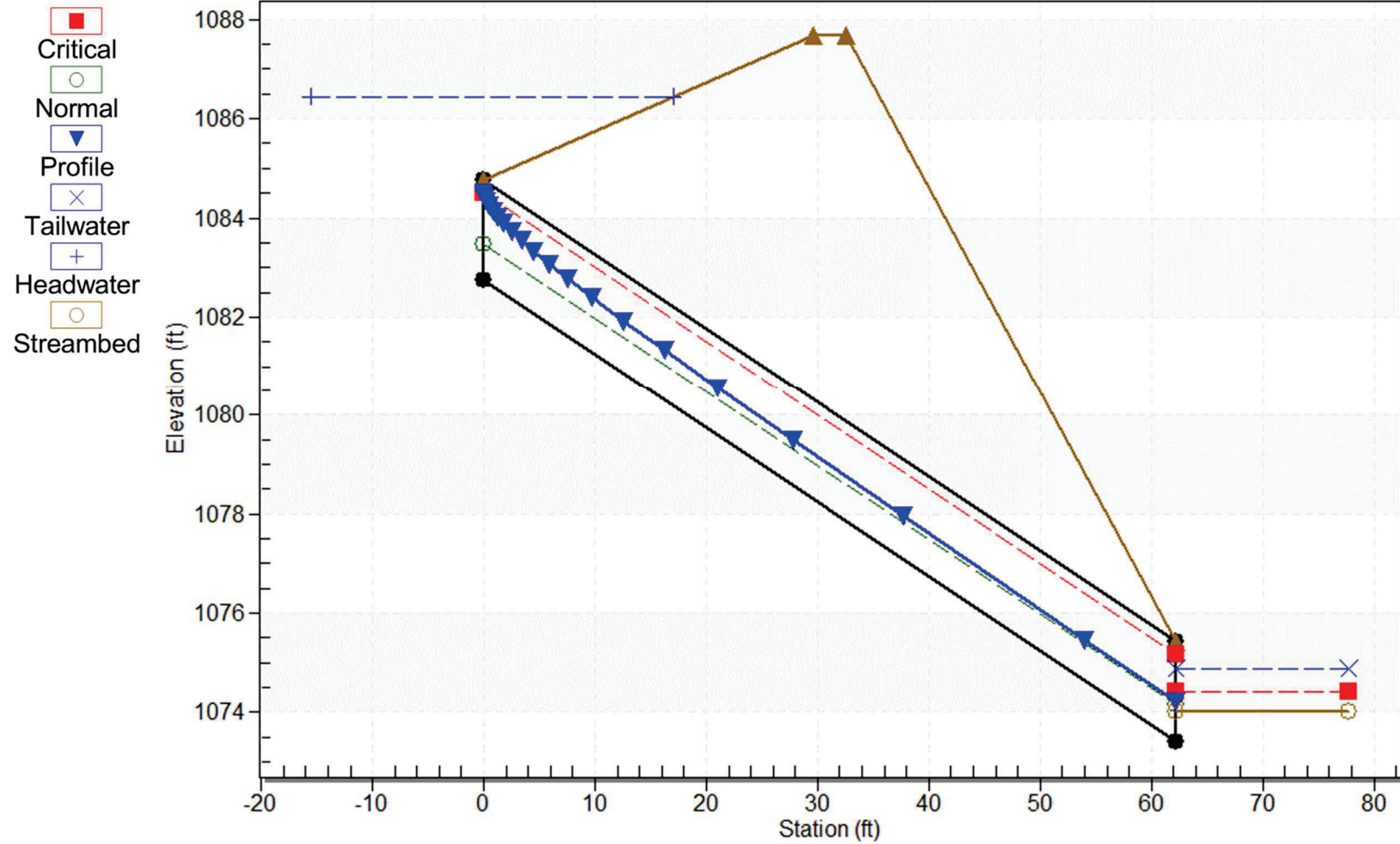
Headwater Elevation (ft)	Total Discharge (cfs)	Single 24 RCP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
1084.31	10.00	10.00	0.00	1
1084.74	14.00	14.00	0.00	1
1085.25	18.00	18.00	0.00	1
1085.87	22.00	22.00	0.00	1
1086.44	25.00	25.00	0.00	1
1087.55	30.00	30.00	0.00	1
1088.04	34.00	31.94	2.06	6
1088.33	38.00	33.03	4.97	5
1088.58	42.00	33.94	8.06	5
1088.81	46.00	34.76	11.24	5
1089.02	50.00	35.48	14.52	5
1087.67	30.47	30.47	0.00	Overtopping

Peak Culvert
Discharge Rate

Water Surface Profile Plot for Culvert: 24" RCP

Crossing - Single 24 RCP, Design Discharge - 25.0 cfs

Culvert - Single 24 RCP, Culvert Discharge - 25.0 cfs



Future Channel Realignment Required Flow Hydraulic Capacity

Condition	Triple 84" Culvert Peak Flow (cfs)	Single 24" Culvert Peak Flow (cfs)	Basin A 100-year Peak Runoff (cfs)	Total Peak Flow Rate (cfs)
Existing	1372.14	30.47	312.8	1715.41
Future	1372.14	30.47	350.66	1753.27
Change	-	-	37.86	37.86

Attachment I-5: Water Quality Calculations

Sioux Gateway Airport Runway Program EA

Comp. By: JKK
Date: 5/13/2025
Chk. By: LMM
Job No: 10144998.003

Water Quality Volume & Peak Flow

Sub-basin Name: Basin A
Condition: Future
Water Quality Storm (in) (P): 1.25

Water Quality Volume (WQv)

Area	243.67	ac
Impervious	44.99	ac
% Impervious	18.46	%
Rv (ISWMM Equation C3-S6-1)	0.22	
Water Quality Volume (WQv) (ISWMM Equation C3-S6-2)	5.49	ac-ft
WQv	239011	cu ft
Water Quality Runoff Volume (Qa) (Qa = 1.25*Rv)	0.27	watershed in

Water Quality Peak Flow (Qwq)

Drainage Area	0.38	sq mi
Modified CN (ISWMM Equation C3-S6-3)	83.93	
Initial Abstraction (Use TR-55 Table 4-1) (I _a)	0.38	in
I _a /P	0.31	
Unit Peak Discharge (Use TR-55 Exhibit 4-II) (q _u)	195	csm/in
Potential Maximum Retention (Use TR-55 Equation 2-4) (S)	1.91	in
Runoff (From TR-55 Worksheet 2) (Q)	0.27	in
WQv Peak Flow (Qwq)	20.06	cfs

Sioux Gateway Airport Runway Program EA

Comp. By: JKK
Date: 5/13/2025
Chk. By: LMM
Job No: 10144998.003

Water Quality Volume & Peak Flow

Sub-basin Name: Basin B
Condition: Future
Water Quality Storm (in) (P): 1.25

Water Quality Volume (WQv)

Area	43.56	ac
Impervious	3.71	ac
% Impervious	8.52	%
Rv (ISWMM Equation C3-S6-1)	0.13	
Water Quality Volume (WQv) (ISWMM Equation C3-S6-2)	0.57	ac-ft
WQv	25033	cu ft
Water Quality Runoff Volume (Qa) (Qa = 1.25*Rv)	0.16	watershed in

Water Quality Peak Flow (Qwq)

Drainage Area	0.07	sq mi
Modified CN (ISWMM Equation C3-S6-3)	79.28	
Initial Abstraction (Use TR-55 Table 4-1) (I _a)	0.52	in
I _a /P	0.42	
Unit Peak Discharge (Use TR-55 Exhibit 4-II) (q _u)	300	csm/in
Potential Maximum Retention (Use TR-55 Equation 2-4) (S)	2.61	in
Runoff (From TR-55 Worksheet 2) (Q)	0.16	in
WQv Peak Flow (Qwq)	3.23	cfs

Sioux Gateway Airport Runway Program EA

Comp. By: JKK
Date: 5/13/2025
Chk. By: LMM
Job No: 10144998.003

Water Quality Volume & Peak Flow

Sub-basin Name: Basin C
Condition: Future
Water Quality Storm (in) (P): 1.25

Water Quality Volume (WQv)

Area	34.01	ac
Impervious	4.08	ac
% Impervious	12.00	%
Rv (ISWMM Equation C3-S6-1)	0.16	
Water Quality Volume (WQv) (ISWMM Equation C3-S6-2)	0.56	ac-ft
WQv	24378	cu ft
Water Quality Runoff Volume (Qa) (Qa = 1.25*Rv)	0.20	watershed in

Water Quality Peak Flow (Qwq)

Drainage Area	0.05	sq mi
Modified CN (ISWMM Equation C3-S6-3)	81.11	
Initial Abstraction (Use TR-55 Table 4-1) (I _a)	0.47	in
I _a /P	0.37	
Unit Peak Discharge (Use TR-55 Exhibit 4-II) (q _u)	357	csm/in
Potential Maximum Retention (Use TR-55 Equation 2-4) (S)	2.33	in
Runoff (From TR-55 Worksheet 2) (Q)	0.20	in
WQv Peak Flow (Qwq)	3.75	cfs

Sioux Gateway Airport Runway Program EA	Comp. By: JKK Date: 5/13/2025 Chk. By: LMM Job No: 10144998.003																								
Water Quality Volume & Peak Flow																									
Sub-basin Name: Basin D Condition: Future Water Quality Storm (in) (P): 1.25																									
Water Quality Volume (WQv) <table><tr><td>Area</td><td>40.13</td><td>ac</td></tr><tr><td>Impervious</td><td>4.69</td><td>ac</td></tr><tr><td>% Impervious</td><td>11.69</td><td>%</td></tr><tr><td>Rv (ISWMM Equation C3-S6-1)</td><td>0.16</td><td></td></tr><tr><td>Water Quality Volume (WQv) (ISWMM Equation C3-S6-2)</td><td>0.65</td><td>ac-ft</td></tr><tr><td>WQv</td><td>28257</td><td>cu ft</td></tr><tr><td>Water Quality Runoff Volume (Qa) (Qa = 1.25*Rv)</td><td>0.19</td><td>watershed in</td></tr></table>		Area	40.13	ac	Impervious	4.69	ac	% Impervious	11.69	%	Rv (ISWMM Equation C3-S6-1)	0.16		Water Quality Volume (WQv) (ISWMM Equation C3-S6-2)	0.65	ac-ft	WQv	28257	cu ft	Water Quality Runoff Volume (Qa) (Qa = 1.25*Rv)	0.19	watershed in			
Area	40.13	ac																							
Impervious	4.69	ac																							
% Impervious	11.69	%																							
Rv (ISWMM Equation C3-S6-1)	0.16																								
Water Quality Volume (WQv) (ISWMM Equation C3-S6-2)	0.65	ac-ft																							
WQv	28257	cu ft																							
Water Quality Runoff Volume (Qa) (Qa = 1.25*Rv)	0.19	watershed in																							
Water Quality Peak Flow (Qwq) <table><tr><td>Drainage Area</td><td>0.06</td><td>sq mi</td></tr><tr><td>Modified CN (ISWMM Equation C3-S6-3)</td><td>80.95</td><td></td></tr><tr><td>Initial Abstraction (Use TR-55 Table 4-1) (I_a)</td><td>0.47</td><td>in</td></tr><tr><td>I_a/P</td><td>0.38</td><td></td></tr><tr><td>Unit Peak Discharge (Use TR-55 Exhibit 4-II) (q_u)</td><td>260</td><td>csm/in</td></tr><tr><td>Potential Maximum Retention (Use TR-55 Equation 2-4) (S)</td><td>2.35</td><td>in</td></tr><tr><td>Runoff (From TR-55 Worksheet 2) (Q)</td><td>0.19</td><td>in</td></tr><tr><td>WQv Peak Flow (Qwq)</td><td>3.16</td><td>cfs</td></tr></table>		Drainage Area	0.06	sq mi	Modified CN (ISWMM Equation C3-S6-3)	80.95		Initial Abstraction (Use TR-55 Table 4-1) (I _a)	0.47	in	I _a /P	0.38		Unit Peak Discharge (Use TR-55 Exhibit 4-II) (q _u)	260	csm/in	Potential Maximum Retention (Use TR-55 Equation 2-4) (S)	2.35	in	Runoff (From TR-55 Worksheet 2) (Q)	0.19	in	WQv Peak Flow (Qwq)	3.16	cfs
Drainage Area	0.06	sq mi																							
Modified CN (ISWMM Equation C3-S6-3)	80.95																								
Initial Abstraction (Use TR-55 Table 4-1) (I _a)	0.47	in																							
I _a /P	0.38																								
Unit Peak Discharge (Use TR-55 Exhibit 4-II) (q _u)	260	csm/in																							
Potential Maximum Retention (Use TR-55 Equation 2-4) (S)	2.35	in																							
Runoff (From TR-55 Worksheet 2) (Q)	0.19	in																							
WQv Peak Flow (Qwq)	3.16	cfs																							

Sioux Gateway Airport Runway Program EA	Comp. By: JKK Date: 5/13/2025 Chk. By: LMM Job No: 10144998.003																								
Water Quality Volume & Peak Flow																									
Sub-basin Name: Basin E Condition: Future Water Quality Storm (in) (P): 1.25																									
Water Quality Volume (WQv) <table><tr><td>Area</td><td>15.92</td><td>ac</td></tr><tr><td>Impervious</td><td>3.42</td><td>ac</td></tr><tr><td>% Impervious</td><td>21.48</td><td>%</td></tr><tr><td>Rv (ISWMM Equation C3-S6-1)</td><td>0.24</td><td></td></tr><tr><td>Water Quality Volume (WQv) (ISWMM Equation C3-S6-2)</td><td>0.40</td><td>ac-ft</td></tr><tr><td>WQv</td><td>17578</td><td>cu ft</td></tr><tr><td>Water Quality Runoff Volume (Qa) (Qa = 1.25*Rv)</td><td>0.30</td><td>watershed in</td></tr></table>		Area	15.92	ac	Impervious	3.42	ac	% Impervious	21.48	%	Rv (ISWMM Equation C3-S6-1)	0.24		Water Quality Volume (WQv) (ISWMM Equation C3-S6-2)	0.40	ac-ft	WQv	17578	cu ft	Water Quality Runoff Volume (Qa) (Qa = 1.25*Rv)	0.30	watershed in			
Area	15.92	ac																							
Impervious	3.42	ac																							
% Impervious	21.48	%																							
Rv (ISWMM Equation C3-S6-1)	0.24																								
Water Quality Volume (WQv) (ISWMM Equation C3-S6-2)	0.40	ac-ft																							
WQv	17578	cu ft																							
Water Quality Runoff Volume (Qa) (Qa = 1.25*Rv)	0.30	watershed in																							
Water Quality Peak Flow (Qwq) <table><tr><td>Drainage Area</td><td>0.02</td><td>sq mi</td></tr><tr><td>Modified CN (ISWMM Equation C3-S6-3)</td><td>85.06</td><td></td></tr><tr><td>Initial Abstraction (Use TR-55 Table 4-1) (I_a)</td><td>0.35</td><td>in</td></tr><tr><td>I_a/P</td><td>0.28</td><td></td></tr><tr><td>Unit Peak Discharge (Use TR-55 Exhibit 4-II) (q_u)</td><td>483</td><td>csm/in</td></tr><tr><td>Potential Maximum Retention (Use TR-55 Equation 2-4) (S)</td><td>1.76</td><td>in</td></tr><tr><td>Runoff (From TR-55 Worksheet 2) (Q)</td><td>0.30</td><td>in</td></tr><tr><td>WQv Peak Flow (Qwq)</td><td>3.65</td><td>cfs</td></tr></table>		Drainage Area	0.02	sq mi	Modified CN (ISWMM Equation C3-S6-3)	85.06		Initial Abstraction (Use TR-55 Table 4-1) (I _a)	0.35	in	I _a /P	0.28		Unit Peak Discharge (Use TR-55 Exhibit 4-II) (q _u)	483	csm/in	Potential Maximum Retention (Use TR-55 Equation 2-4) (S)	1.76	in	Runoff (From TR-55 Worksheet 2) (Q)	0.30	in	WQv Peak Flow (Qwq)	3.65	cfs
Drainage Area	0.02	sq mi																							
Modified CN (ISWMM Equation C3-S6-3)	85.06																								
Initial Abstraction (Use TR-55 Table 4-1) (I _a)	0.35	in																							
I _a /P	0.28																								
Unit Peak Discharge (Use TR-55 Exhibit 4-II) (q _u)	483	csm/in																							
Potential Maximum Retention (Use TR-55 Equation 2-4) (S)	1.76	in																							
Runoff (From TR-55 Worksheet 2) (Q)	0.30	in																							
WQv Peak Flow (Qwq)	3.65	cfs																							

Sioux Gateway Airport Runway Program EA	Comp. By: JKK Date: 5/13/2025 Chk. By: LMM Job No: 10144998.003																								
Water Quality Volume & Peak Flow																									
Sub-basin Name: Basin F Condition: Future Water Quality Storm (in) (P): 1.25																									
Water Quality Volume (WQv) <table><tr><td>Area</td><td>17.83</td><td>ac</td></tr><tr><td>Impervious</td><td>3.91</td><td>ac</td></tr><tr><td>% Impervious</td><td>21.93</td><td>%</td></tr><tr><td>Rv (ISWMM Equation C3-S6-1)</td><td>0.25</td><td></td></tr><tr><td>Water Quality Volume (WQv) (ISWMM Equation C3-S6-2)</td><td>0.46</td><td>ac-ft</td></tr><tr><td>WQv</td><td>20013</td><td>cu ft</td></tr><tr><td>Water Quality Runoff Volume (Qa) (Qa = 1.25*Rv)</td><td>0.31</td><td>watershed in</td></tr></table>		Area	17.83	ac	Impervious	3.91	ac	% Impervious	21.93	%	Rv (ISWMM Equation C3-S6-1)	0.25		Water Quality Volume (WQv) (ISWMM Equation C3-S6-2)	0.46	ac-ft	WQv	20013	cu ft	Water Quality Runoff Volume (Qa) (Qa = 1.25*Rv)	0.31	watershed in			
Area	17.83	ac																							
Impervious	3.91	ac																							
% Impervious	21.93	%																							
Rv (ISWMM Equation C3-S6-1)	0.25																								
Water Quality Volume (WQv) (ISWMM Equation C3-S6-2)	0.46	ac-ft																							
WQv	20013	cu ft																							
Water Quality Runoff Volume (Qa) (Qa = 1.25*Rv)	0.31	watershed in																							
Water Quality Peak Flow (Qwq) <table><tr><td>Drainage Area</td><td>0.03</td><td>sq mi</td></tr><tr><td>Modified CN (ISWMM Equation C3-S6-3)</td><td>85.22</td><td></td></tr><tr><td>Initial Abstraction (Use TR-55 Table 4-1) (I_a)</td><td>0.35</td><td>in</td></tr><tr><td>I_a/P</td><td>0.28</td><td></td></tr><tr><td>Unit Peak Discharge (Use TR-55 Exhibit 4-II) (q_u)</td><td>390</td><td>csm/in</td></tr><tr><td>Potential Maximum Retention (Use TR-55 Equation 2-4) (S)</td><td>1.73</td><td>in</td></tr><tr><td>Runoff (From TR-55 Worksheet 2) (Q)</td><td>0.31</td><td>in</td></tr><tr><td>WQv Peak Flow (Qwq)</td><td>3.36</td><td>cfs</td></tr></table>		Drainage Area	0.03	sq mi	Modified CN (ISWMM Equation C3-S6-3)	85.22		Initial Abstraction (Use TR-55 Table 4-1) (I _a)	0.35	in	I _a /P	0.28		Unit Peak Discharge (Use TR-55 Exhibit 4-II) (q _u)	390	csm/in	Potential Maximum Retention (Use TR-55 Equation 2-4) (S)	1.73	in	Runoff (From TR-55 Worksheet 2) (Q)	0.31	in	WQv Peak Flow (Qwq)	3.36	cfs
Drainage Area	0.03	sq mi																							
Modified CN (ISWMM Equation C3-S6-3)	85.22																								
Initial Abstraction (Use TR-55 Table 4-1) (I _a)	0.35	in																							
I _a /P	0.28																								
Unit Peak Discharge (Use TR-55 Exhibit 4-II) (q _u)	390	csm/in																							
Potential Maximum Retention (Use TR-55 Equation 2-4) (S)	1.73	in																							
Runoff (From TR-55 Worksheet 2) (Q)	0.31	in																							
WQv Peak Flow (Qwq)	3.36	cfs																							

Sioux Gateway Airport Runway Program EA

Comp. By: JKK
Date: 5/13/2025
Chk. By: LMM
Job No: 10144998.003

Water Quality Volume & Peak Flow

Sub-basin Name: Basin G
Condition: Future
Water Quality Storm (in) (P): 1.25

Water Quality Volume (WQv)

Area	154.17	ac
Impervious	51.68	ac
% Impervious	33.52	%
Rv (ISWMM Equation C3-S6-1)	0.35	
Water Quality Volume (WQv) (ISWMM Equation C3-S6-2)	5.65	ac-ft
WQv	246026	cu ft
Water Quality Runoff Volume (Qa) (Qa = 1.25*Rv)	0.44	watershed in

Water Quality Peak Flow (Qwq)

Drainage Area	0.24	sq mi
Modified CN (ISWMM Equation C3-S6-3)	88.77	
Initial Abstraction (Use TR-55 Table 4-1) (I _a)	0.25	in
I _a /P	0.20	
Unit Peak Discharge (Use TR-55 Exhibit 4-II) (q _u)	263	csm/in
Potential Maximum Retention (Use TR-55 Equation 2-4) (S)	1.26	in
Runoff (From TR-55 Worksheet 2) (Q)	0.44	in
WQv Peak Flow (Qwq)	27.85	cfs

Sioux Gateway Airport Runway Program EA

Comp. By: JKK
Date: 5/13/2025
Chk. By: LMM
Job No: 10144998.003

Water Quality Volume & Peak Flow

Sub-basin Name: Basin H
Condition: Future
Water Quality Storm (in) (P): 1.25

Water Quality Volume (WQv)

Area	358.45	ac
Impervious	82.3	ac
% Impervious	22.96	%
Rv (ISWMM Equation C3-S6-1)	0.26	
Water Quality Volume (WQv) (ISWMM Equation C3-S6-2)	9.58	ac-ft
WQv	417416	cu ft
Water Quality Runoff Volume (Qa) (Qa = 1.25*Rv)	0.32	watershed in

Water Quality Peak Flow (Qwq)

Drainage Area	0.56	sq mi
Modified CN (ISWMM Equation C3-S6-3)	85.58	
Initial Abstraction (Use TR-55 Table 4-1) (I _a)	0.34	in
I _a /P	0.27	
Unit Peak Discharge (Use TR-55 Exhibit 4-II) (q _u)	170	csm/in
Potential Maximum Retention (Use TR-55 Equation 2-4) (S)	1.69	in
Runoff (From TR-55 Worksheet 2) (Q)	0.32	in
WQv Peak Flow (Qwq)	30.54	cfs

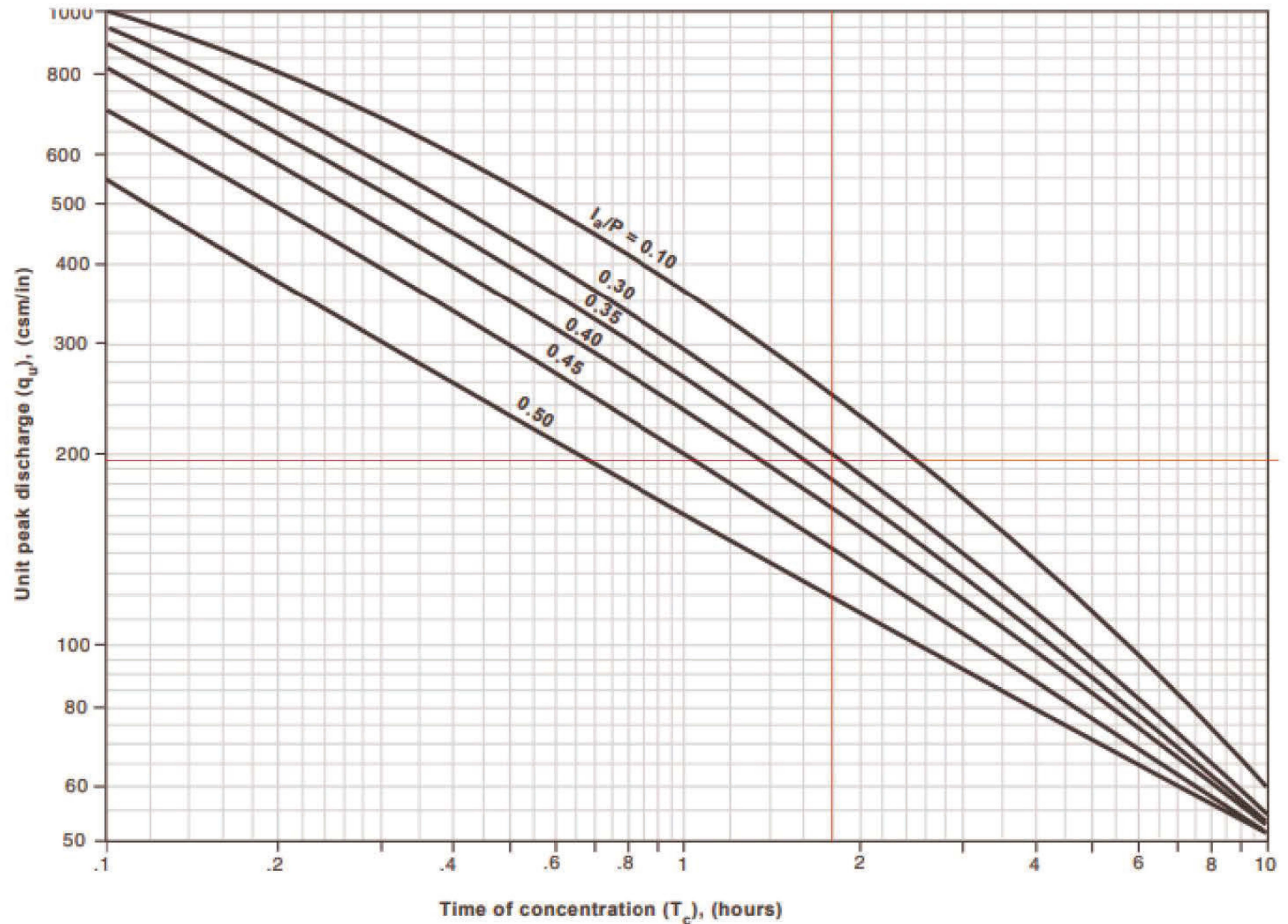
Exhibit 4-II Unit peak discharge (q_u) for NRCS (SCS) type II rainfall distribution

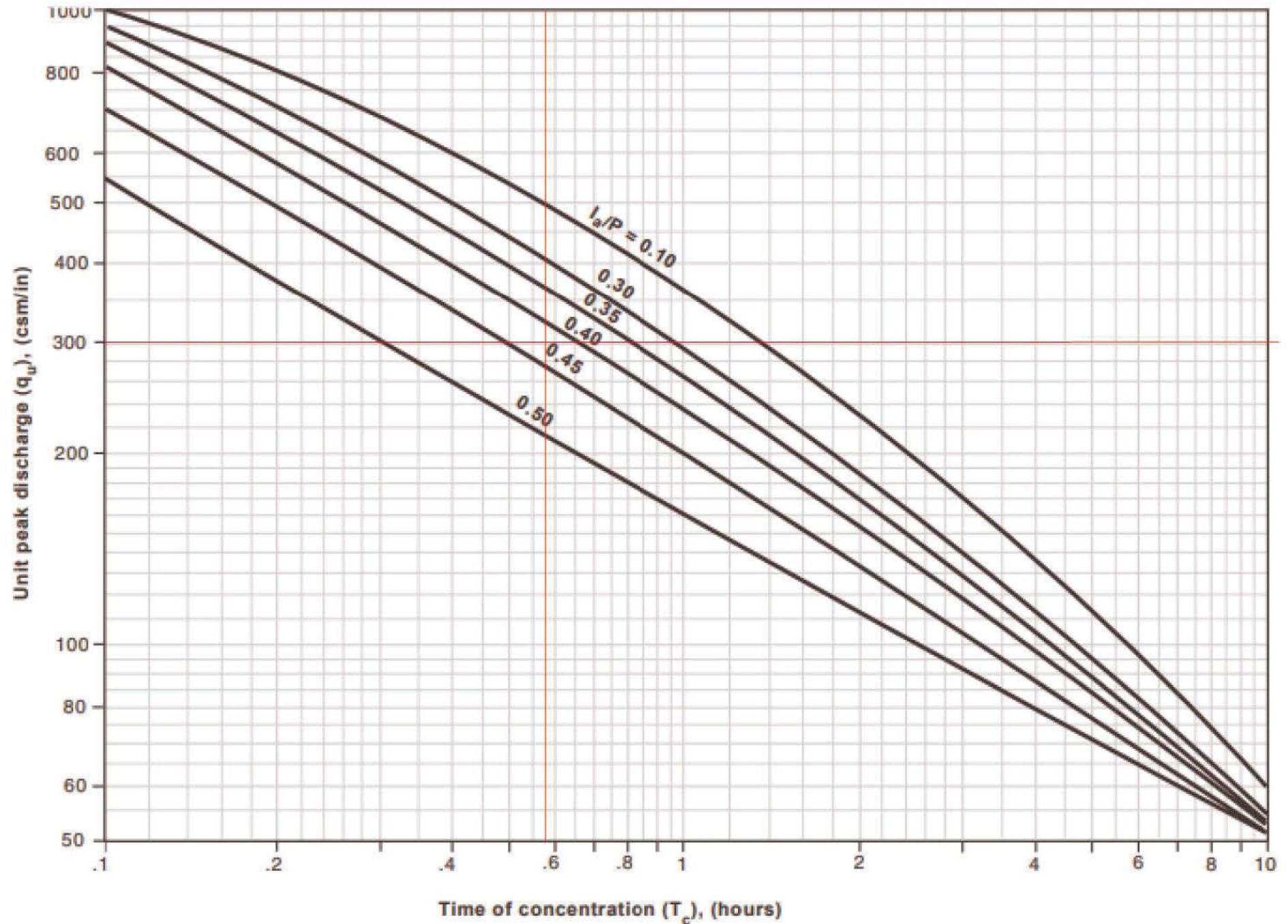
Exhibit 4-II Unit peak discharge (q_u) for NRCS (SCS) type II rainfall distribution

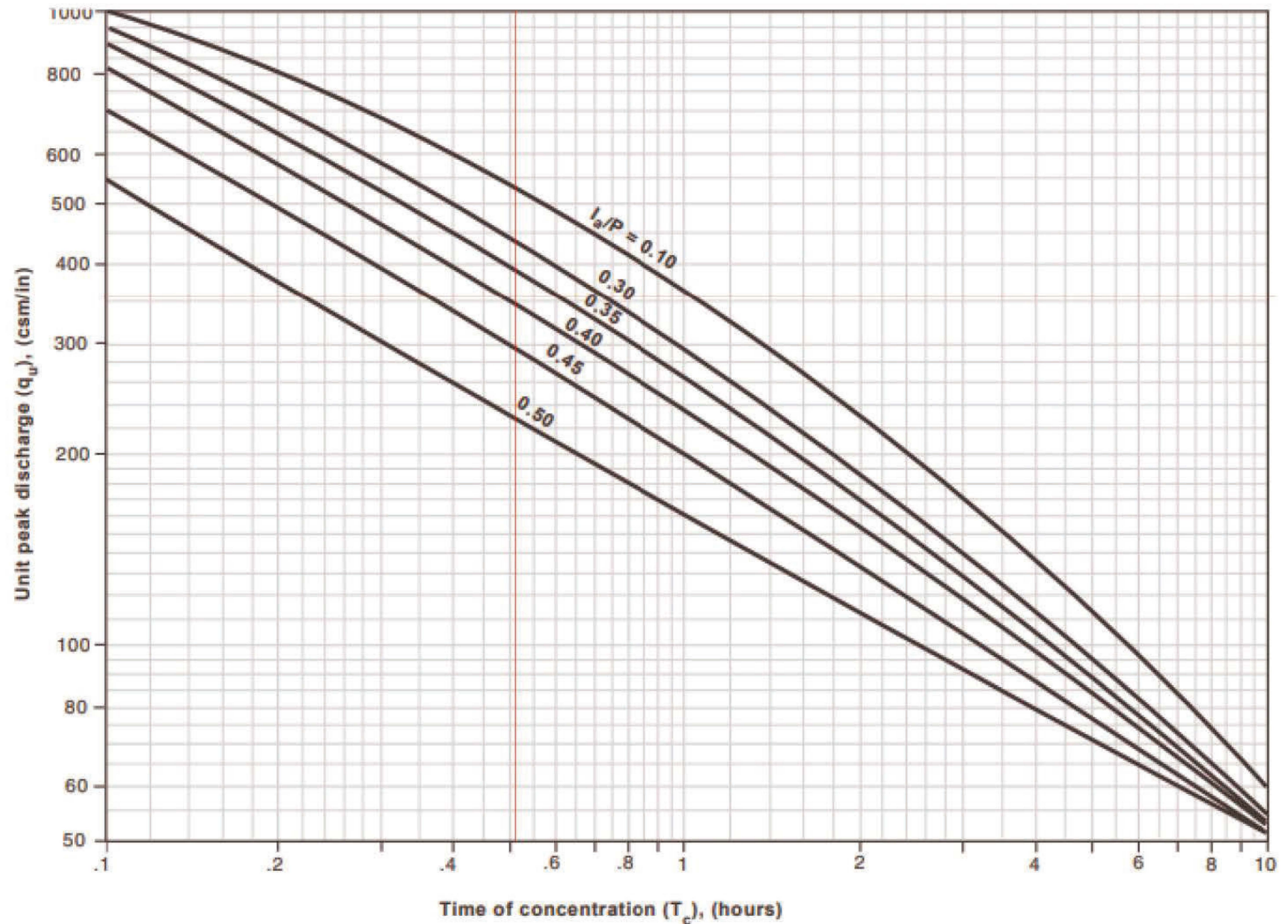
Exhibit 4-II Unit peak discharge (q_u) for NRCS (SCS) type II rainfall distribution

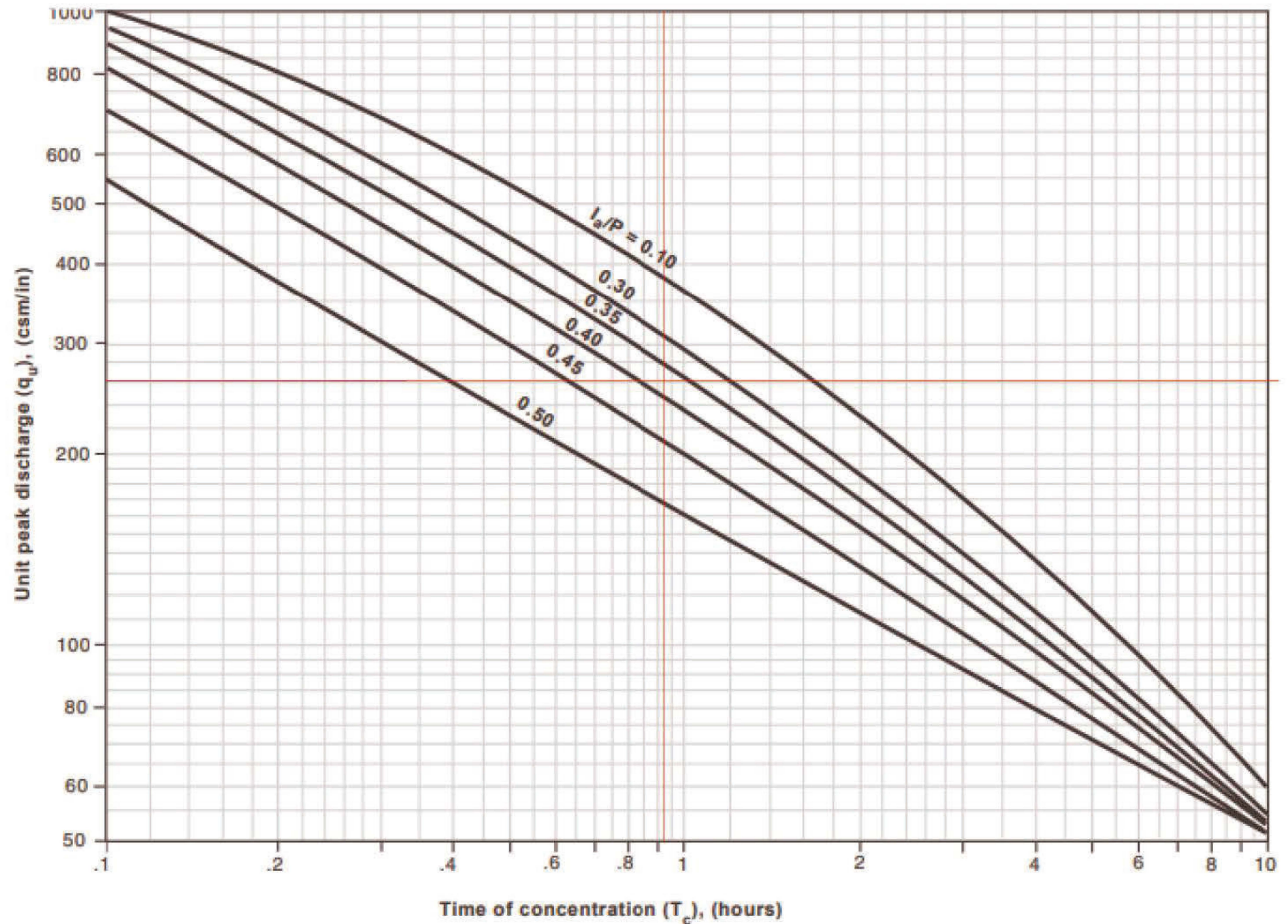
Exhibit 4-II Unit peak discharge (q_u) for NRCS (SCS) type II rainfall distribution

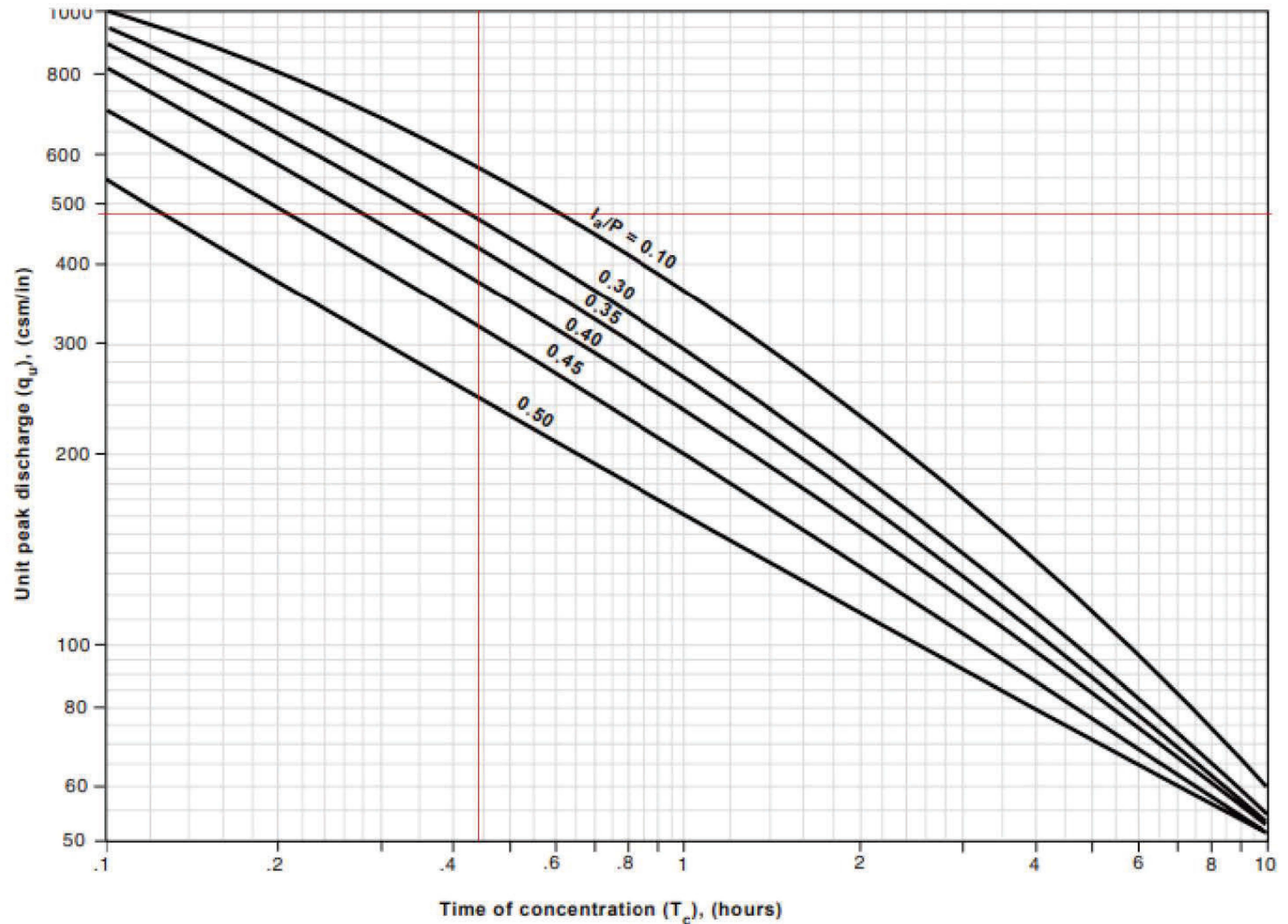
Exhibit 4-II Unit peak discharge (q_u) for NRCS (SCS) type II rainfall distribution

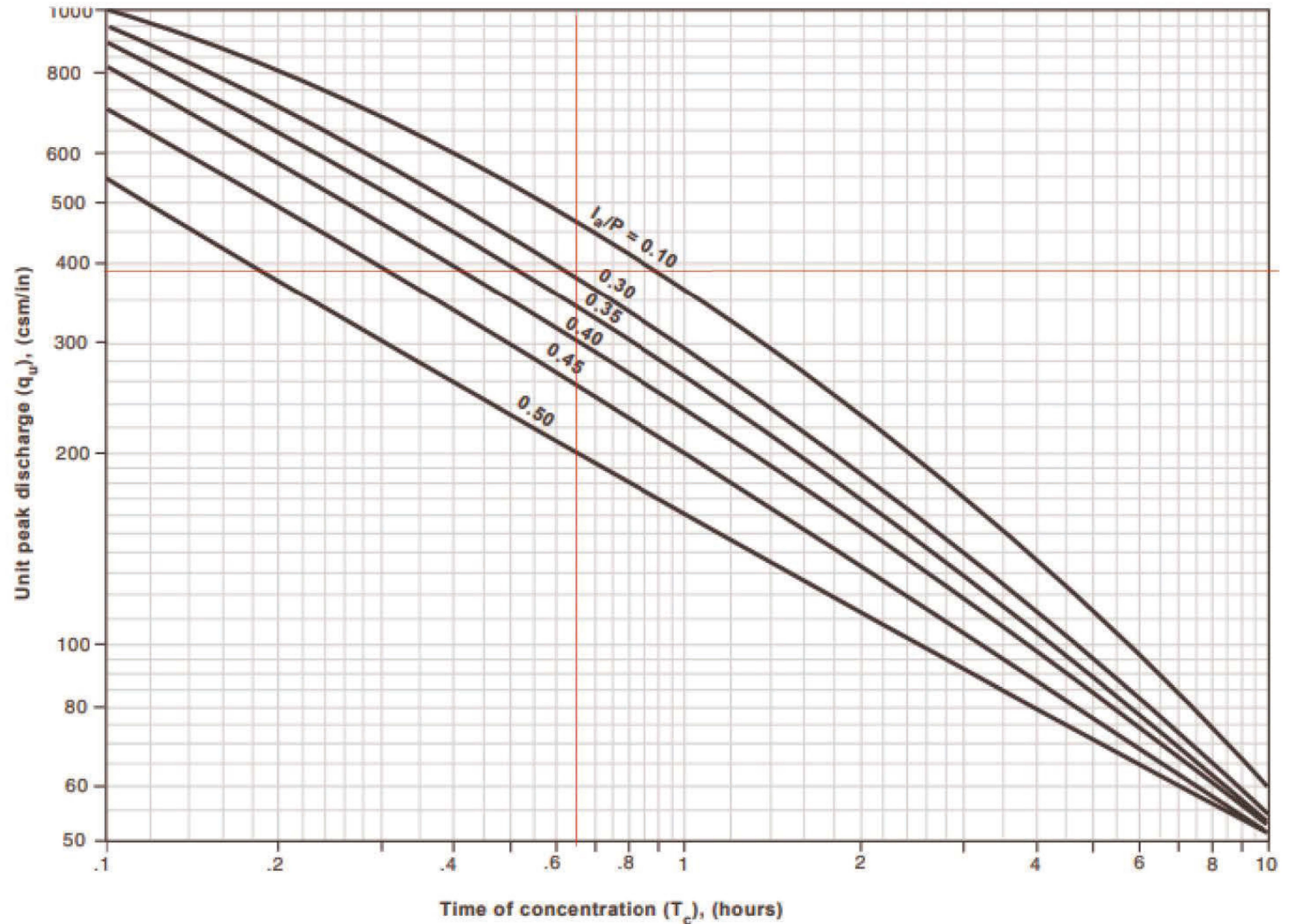
Exhibit 4-II Unit peak discharge (q_u) for NRCS (SCS) type II rainfall distribution

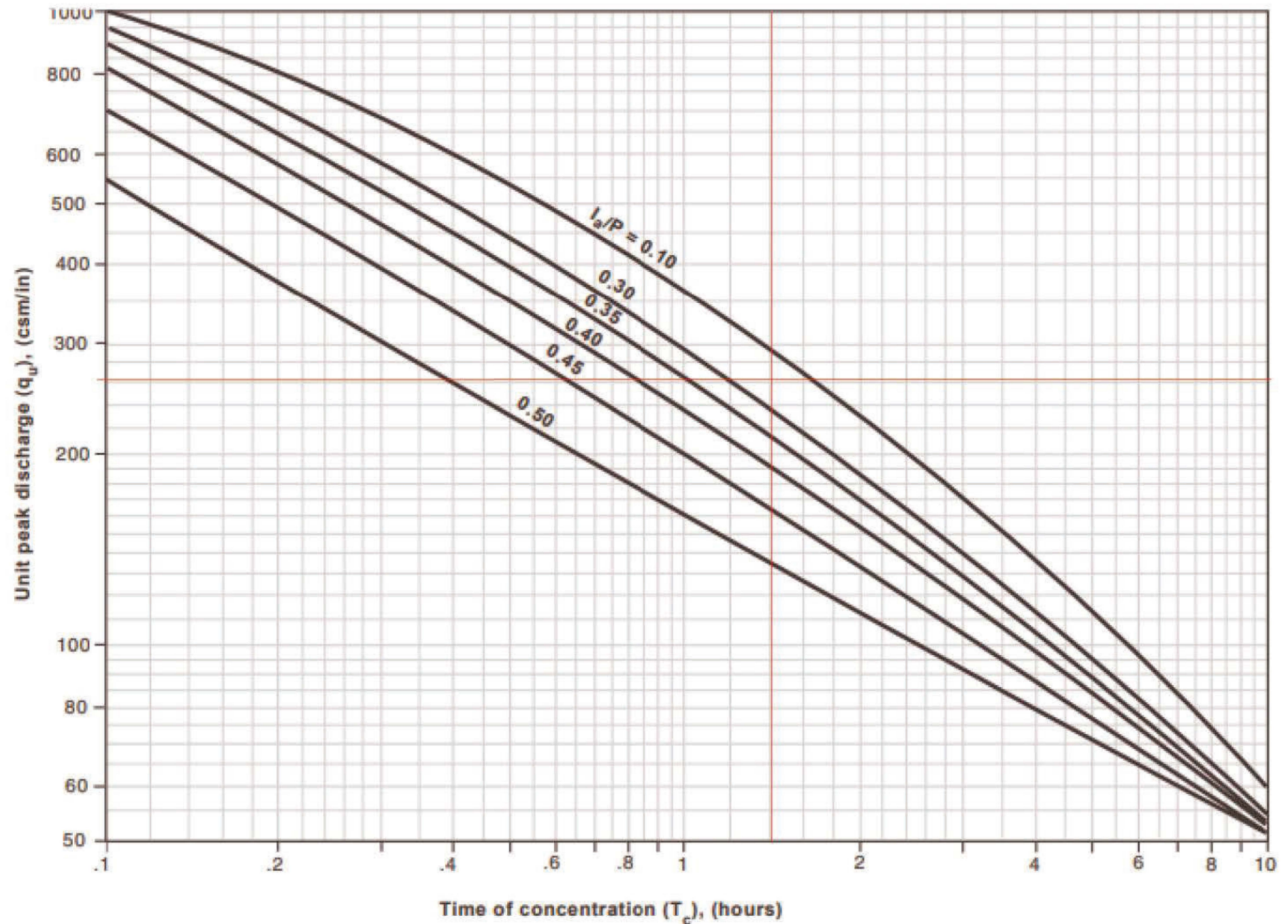
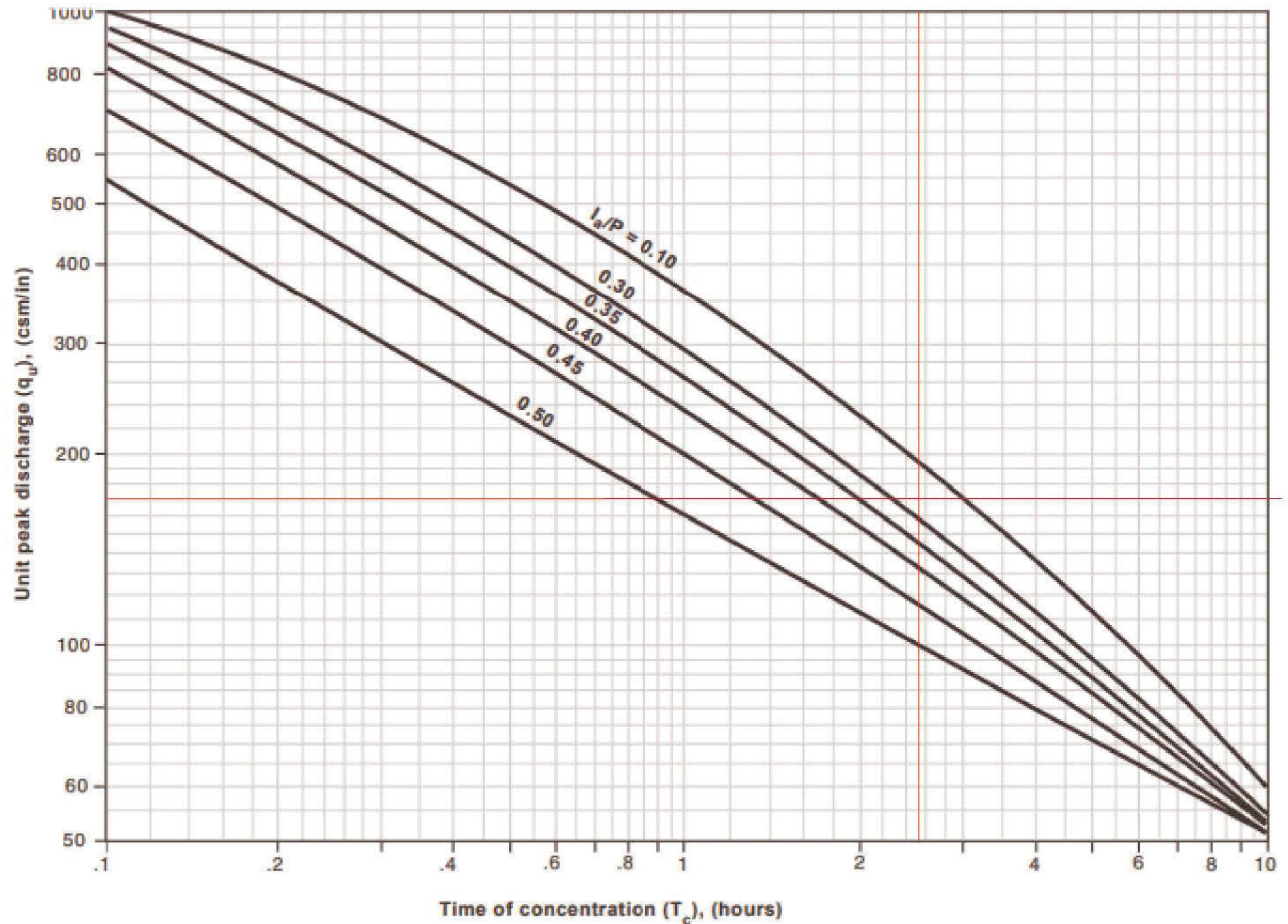
Exhibit 4-II Unit peak discharge (q_u) for NRCS (SCS) type II rainfall distribution

Exhibit 4-II Unit peak discharge (q_u) for NRCS (SCS) type II rainfall distribution

Attachment I-6: Groundwater Recharge Calculations

Sioux Gateway Airport Runway Program EA	Comp. By: JKK Date: 5/13/2025 Chk. By: LMM Job No: 10144998.003												
Groundwater Recharge													
Sub-basin Name: Basin A Condition: Future Recharge Depth (in) 1.00 *ISWMM Section 3.01 <u>Groundwater Recharge Volume (Rev)</u><table><tr><td>Measured Impervious</td><td>1959571</td><td>sq ft</td></tr><tr><td>Runoff Coefficient (C)</td><td>0.95</td><td></td></tr><tr><td>Groundwater Recharge Volume (Rev) (ISWMM Equation 3.01-2-1)</td><td>42.74</td><td>ac-in</td></tr><tr><td>Rev</td><td>155133</td><td>cu ft</td></tr></table> *ISWMM Section 3.01		Measured Impervious	1959571	sq ft	Runoff Coefficient (C)	0.95		Groundwater Recharge Volume (Rev) (ISWMM Equation 3.01-2-1)	42.74	ac-in	Rev	155133	cu ft
Measured Impervious	1959571	sq ft											
Runoff Coefficient (C)	0.95												
Groundwater Recharge Volume (Rev) (ISWMM Equation 3.01-2-1)	42.74	ac-in											
Rev	155133	cu ft											

Sioux Gateway Airport Runway Program EA	Comp. By: JKK Date: 5/13/2025 Chk. By: LMM Job No: 10144998.003												
Groundwater Recharge													
Sub-basin Name: Basin B Condition: Future Recharge Depth (in) 1.00 *ISWMM Section 3.01 <u>Groundwater Recharge Volume (Rev)</u><table><tr><td>Measured Impervious</td><td>161608</td><td>sq ft</td></tr><tr><td>Runoff Coefficient (C)</td><td>0.95</td><td></td></tr><tr><td>Groundwater Recharge Volume (Rev) (ISWMM Equation 3.01-2-1)</td><td>3.52</td><td>ac-in</td></tr><tr><td>Rev</td><td>12794</td><td>cu ft</td></tr></table>		Measured Impervious	161608	sq ft	Runoff Coefficient (C)	0.95		Groundwater Recharge Volume (Rev) (ISWMM Equation 3.01-2-1)	3.52	ac-in	Rev	12794	cu ft
Measured Impervious	161608	sq ft											
Runoff Coefficient (C)	0.95												
Groundwater Recharge Volume (Rev) (ISWMM Equation 3.01-2-1)	3.52	ac-in											
Rev	12794	cu ft											

*ISWMM Section 3.01

Sioux Gateway Airport Runway Program EA	Comp. By: JKK Date: 5/13/2025 Chk. By: LMM Job No: 10144998.003												
Groundwater Recharge													
Sub-basin Name: Basin C Condition: Future Recharge Depth (in) 1.00 *ISWMM Section 3.01 <u>Groundwater Recharge Volume (Rev)</u><table><tr><td>Measured Impervious</td><td>177725</td><td>sq ft</td></tr><tr><td>Runoff Coefficient (C)</td><td>0.95</td><td></td></tr><tr><td>Groundwater Recharge Volume (Rev) (ISWMM Equation 3.01-2-1)</td><td>3.88</td><td>ac-in</td></tr><tr><td>Rev</td><td>14070</td><td>cu ft</td></tr></table>		Measured Impervious	177725	sq ft	Runoff Coefficient (C)	0.95		Groundwater Recharge Volume (Rev) (ISWMM Equation 3.01-2-1)	3.88	ac-in	Rev	14070	cu ft
Measured Impervious	177725	sq ft											
Runoff Coefficient (C)	0.95												
Groundwater Recharge Volume (Rev) (ISWMM Equation 3.01-2-1)	3.88	ac-in											
Rev	14070	cu ft											

*ISWMM Section 3.01

Sioux Gateway Airport Runway Program EA	Comp. By: JKK Date: 5/13/2025 Chk. By: LMM Job No: 10144998.003												
Groundwater Recharge													
Sub-basin Name: Basin D Condition: Future Recharge Depth (in) 1.00 *ISWMM Section 3.01 <u>Groundwater Recharge Volume (Rev)</u><table><tr><td>Measured Impervious</td><td>204296</td><td>sq ft</td></tr><tr><td>Runoff Coefficient (C)</td><td>0.95</td><td></td></tr><tr><td>Groundwater Recharge Volume (Rev) (ISWMM Equation 3.01-2-1)</td><td>4.46</td><td>ac-in</td></tr><tr><td>Rev</td><td>16173</td><td>cu ft</td></tr></table> *ISWMM Section 3.01		Measured Impervious	204296	sq ft	Runoff Coefficient (C)	0.95		Groundwater Recharge Volume (Rev) (ISWMM Equation 3.01-2-1)	4.46	ac-in	Rev	16173	cu ft
Measured Impervious	204296	sq ft											
Runoff Coefficient (C)	0.95												
Groundwater Recharge Volume (Rev) (ISWMM Equation 3.01-2-1)	4.46	ac-in											
Rev	16173	cu ft											

Sioux Gateway Airport Runway Program EA	Comp. By: JKK Date: 5/13/2025 Chk. By: LMM Job No: 10144998.003												
Groundwater Recharge													
Sub-basin Name: Basin E Condition: Future Recharge Depth (in) 1.00 *ISWMM Section 3.01 <u>Groundwater Recharge Volume (Rev)</u><table><tr><td>Measured Impervious</td><td>148975</td><td>sq ft</td></tr><tr><td>Runoff Coefficient (C)</td><td>0.95</td><td></td></tr><tr><td>Groundwater Recharge Volume (Rev) (ISWMM Equation 3.01-2-1)</td><td>3.25</td><td>ac-in</td></tr><tr><td>Rev</td><td>11794</td><td>cu ft</td></tr></table> *ISWMM Section 3.01		Measured Impervious	148975	sq ft	Runoff Coefficient (C)	0.95		Groundwater Recharge Volume (Rev) (ISWMM Equation 3.01-2-1)	3.25	ac-in	Rev	11794	cu ft
Measured Impervious	148975	sq ft											
Runoff Coefficient (C)	0.95												
Groundwater Recharge Volume (Rev) (ISWMM Equation 3.01-2-1)	3.25	ac-in											
Rev	11794	cu ft											

Sioux Gateway Airport Runway Program EA	Comp. By: JKK Date: 5/13/2025 Chk. By: LMM Job No: 10144998.003												
Groundwater Recharge													
Sub-basin Name: Basin F Condition: Future Recharge Depth (in) 1.00 *ISWMM Section 3.01 <u>Groundwater Recharge Volume (Rev)</u><table><tr><td>Measured Impervious</td><td>170320</td><td>sq ft</td></tr><tr><td>Runoff Coefficient (C)</td><td>0.95</td><td></td></tr><tr><td>Groundwater Recharge Volume (Rev) (ISWMM Equation 3.01-2-1)</td><td>3.71</td><td>ac-in</td></tr><tr><td>Rev</td><td>13484</td><td>cu ft</td></tr></table>		Measured Impervious	170320	sq ft	Runoff Coefficient (C)	0.95		Groundwater Recharge Volume (Rev) (ISWMM Equation 3.01-2-1)	3.71	ac-in	Rev	13484	cu ft
Measured Impervious	170320	sq ft											
Runoff Coefficient (C)	0.95												
Groundwater Recharge Volume (Rev) (ISWMM Equation 3.01-2-1)	3.71	ac-in											
Rev	13484	cu ft											

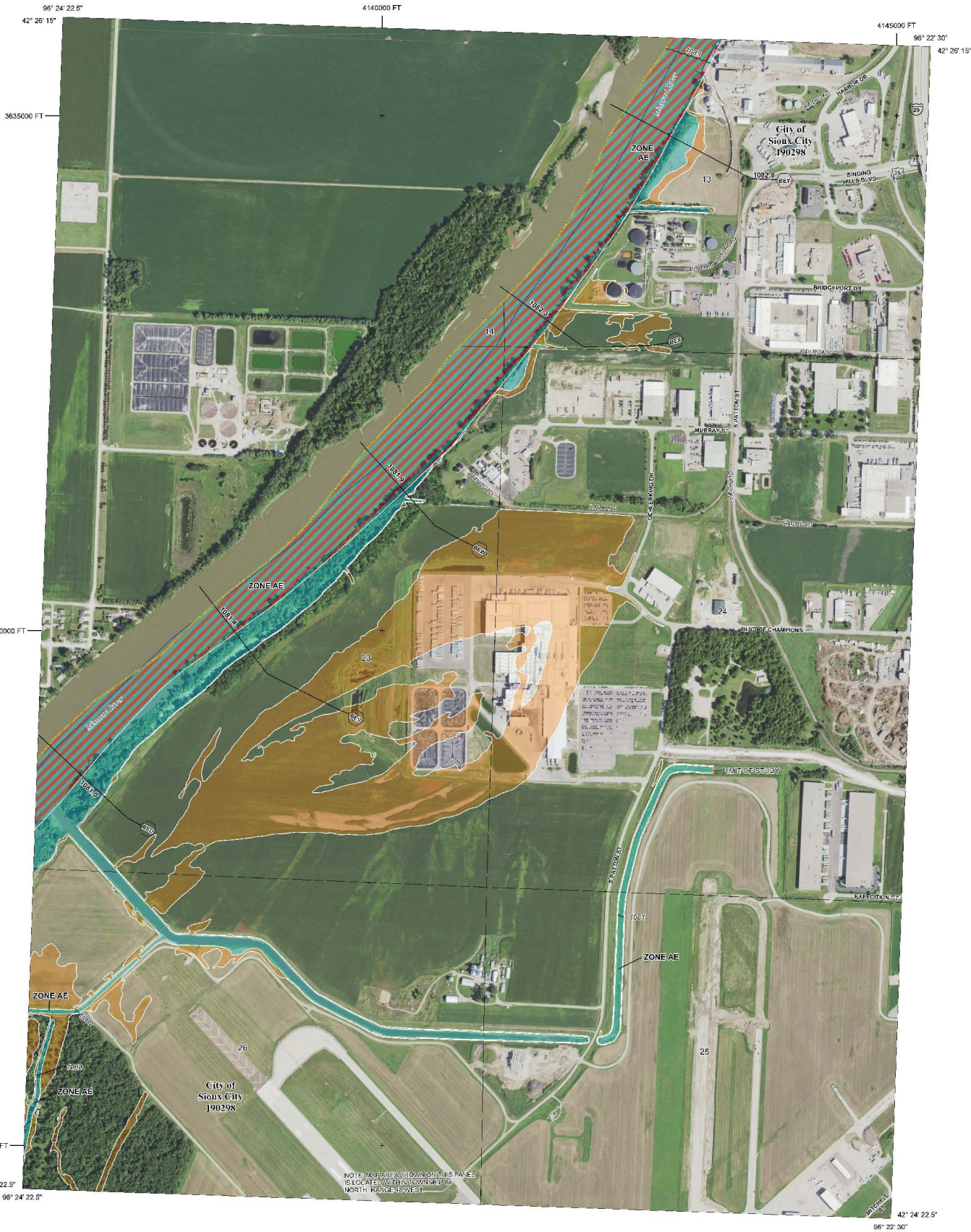
*ISWMM Section 3.01

Sioux Gateway Airport Runway Program EA	Comp. By: JKK Date: 5/13/2025 Chk. By: LMM Job No: 10144998.003												
Groundwater Recharge													
Sub-basin Name: Basin G Condition: Future Recharge Depth (in) 1.00 *ISWMM Section 3.01 <u>Groundwater Recharge Volume (Rev)</u><table><tr><td>Measured Impervious</td><td>2251225</td><td>sq ft</td></tr><tr><td>Runoff Coefficient (C)</td><td>0.95</td><td></td></tr><tr><td>Groundwater Recharge Volume (Rev) (ISWMM Equation 3.01-2-1)</td><td>49.10</td><td>ac-in</td></tr><tr><td>Rev</td><td>178222</td><td>cu ft</td></tr></table>		Measured Impervious	2251225	sq ft	Runoff Coefficient (C)	0.95		Groundwater Recharge Volume (Rev) (ISWMM Equation 3.01-2-1)	49.10	ac-in	Rev	178222	cu ft
Measured Impervious	2251225	sq ft											
Runoff Coefficient (C)	0.95												
Groundwater Recharge Volume (Rev) (ISWMM Equation 3.01-2-1)	49.10	ac-in											
Rev	178222	cu ft											

*ISWMM Section 3.01

Sioux Gateway Airport Runway Program EA	Comp. By: JKK Date: 5/13/2025 Chk. By: LMM Job No: 10144998.003												
Groundwater Recharge													
Sub-basin Name: Basin H Condition: Future Recharge Depth (in) 1.00 *ISWMM Section 3.01 <u>Groundwater Recharge Volume (Rev)</u><table><tr><td>Measured Impervious</td><td>3584988</td><td>sq ft</td></tr><tr><td>Runoff Coefficient (C)</td><td>0.95</td><td></td></tr><tr><td>Groundwater Recharge Volume (Rev) (ISWMM Equation 3.01-2-1)</td><td>78.19</td><td>ac-in</td></tr><tr><td>Rev</td><td>283812</td><td>cu ft</td></tr></table> *ISWMM Section 3.01		Measured Impervious	3584988	sq ft	Runoff Coefficient (C)	0.95		Groundwater Recharge Volume (Rev) (ISWMM Equation 3.01-2-1)	78.19	ac-in	Rev	283812	cu ft
Measured Impervious	3584988	sq ft											
Runoff Coefficient (C)	0.95												
Groundwater Recharge Volume (Rev) (ISWMM Equation 3.01-2-1)	78.19	ac-in											
Rev	283812	cu ft											

Attachment I-7: FEMA FIRMs



FLOOD HAZARD INFORMATION

SEE THIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT
THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING
DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT
[HTTPS://MSC.FEMA.GOV](https://MSC.FEMA.GOV)

	Without Base Flood Elevation (BFE) Zone A, V, AG
	With BFE or Depth Zone AE, AD, AH, VE, AR
	Regulatory Floodway
	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
	Future Conditions 1% Annual Chance Flood Hazard Zone X
	Area with Reduced Flood Risk due to Levee See Notes, Zone X
	Area with Flood Risk due to Levee Zone D
	NO SCREEN Areas of Minimal Flood Hazard Zone X
	Area of Undetermined Flood Hazard Zone D
	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
	Cross Sections with 1% Annual Chance Water Surface Elevation
	Coastal Transect
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
	Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary

NOTES TO USERS

For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM, including historic versions, the current map date for each FIRM panel, how to order products, or the National Flood Insurance Program (NFIP) in general, please call the FEMA Mapping and Insurance Exchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at <https://fms.fema.gov>. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website.

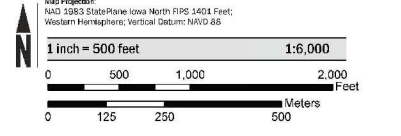
Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study Report for this jurisdiction.

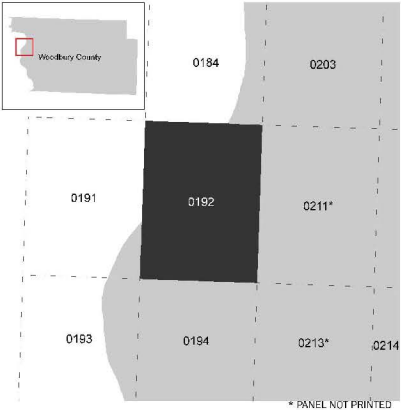
To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Base map information shown on this FIRM was provided in digital format by the United States Geological Survey (USGS). This information was derived from digital orthophotography at a 2-foot resolution from photography dated 2019.

SCALE



PANEL LOCATOR



FEMA
National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

WOODBURY COUNTY, IOWA
And Incorporated Areas

PANEL 192 OF 675

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
SIoux CITY, CITY OF	190298	0192	E

VERSION NUMBER
2.6.4.1
MAP NUMBER
19193C0192E
MAP REVISED
JULY 17, 2024

FEMA

City of Sioux City
190298

T88N R48W S36

AREA OF MINIMAL FLOOD HAZARD
Zone X

19193C0194E
eff. 7/17/2024

19193C0213E
9/29/2011
Not Printed

T88N R47W S31

T87N R48W S1

T87N R47W S6

1:6,000

96°21'57"W 42°23'4"N

Basemap Imagery Source: USGS National Map 2023

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) <i>Zone A, V, A99</i>
		With BFE or Depth <i>Zone AE, AO, AH, VE, AR</i>
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile <i>Zone X</i>
		Future Conditions 1% Annual Chance Flood Hazard <i>Zone X</i>
		Area with Reduced Flood Risk due to Levee. See Notes. <i>Zone X</i>
		Area with Flood Risk due to Levee <i>Zone D</i>
		Effective LOMRs
OTHER AREAS		Area of Undetermined Flood Hazard <i>Zone D</i>
GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		Cross Sections with 1% Annual Chance Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
		Hydrographic Feature
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **3/10/2025 at 11:08 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Attachment I-8: Floodplain Compensatory Calculations

Cut/Fill Report

Generated: 2025-05-12 12:41:27

By user: GentileN

Drawing: P:\City_of_Sioux_City\10144998_SUX_GC_2023_2028\10144998003_SUX_Runway_Program_EA\05.00 Deliverables\L - CAD\X\Drainage\P:\City_of_Sioux_City\10144998_SUX_GC_2023_2028\10144998003_SUX_Runway_Program_EA\05.00 Deliverables\L - CAD\X\Drainage\FLOODPLAIN STORAGE CALCS.dwg

Volume Summary							
Name	Type	Cut Factor	Fill Factor	2d Area (Sq. Ft.)	Cut (Cu. Yd.)	Fill (Cu. Yd.)	Net (Cu. Yd.)
PROPOSED STORAGE VOLUME	full	1.000	1.000	430810.05	18850.48	65564.55	46714.07<Fill>
EX STORAGE VOLUME	full	1.000	1.000	720223.39	58986.72	64630.67	5643.96<Fill>
Totals							
				2d Area (Sq. Ft.)	Cut (Cu. Yd.)	Fill (Cu. Yd.)	Net (Cu. Yd.)
Total				1151033.44	77837.19	130195.22	52358.03<Fill>

Net difference:
934 cubic yards

* Value adjusted by cut or fill factor other than 1.0

Attachment I-9: Report of Geotechnical Exploration



REPORT OF GEOTECHNICAL EXPLORATION

Sioux Gateway Airport, Siouxland Nexus Project
Sioux City, Iowa

AET Project No. P-0025900

Date: December 20, 2024

Prepared for:

RS&H, Inc.

Geotechnical • Materials
Forensic • Environmental
Building Technology
Petrography/Chemistry

American Engineering Testing

550 Cleveland Avenue North
St. Paul, MN 55114-1804
TeamAET.com • 800.972.6364



December 20, 2024

RS&H, Inc.
4525 Airport Approach Rd, Suite A
Duluth, MN 55811

Attn: Mr. Darren Christopher

RE: Geotechnical Exploration
Sioux Gateway Airport, Siouxland Nexus Project
Sioux City, Iowa
AET Report No. P-0025900

Dear Mr. Christopher:

American Engineering Testing, Inc. (AET) is pleased to present the results to date of our subsurface exploration program and geotechnical engineering review for the Sioux Gateway Airport Siouxland Nexus project in Sioux City, Iowa. These services were performed according to Work Order No. 1 from RS&H dated April 10, 2024.

Please contact us if you have any questions about the report. We can also be contacted to arrange construction observation and testing services during the earthwork phase.

Sincerely,
American Engineering Testing, Inc.

Neil G. Lund
Senior Project Manager
nlund@teamaet.com
612-369-3163

SIGNATURE PAGE

Prepared for:

Attn: _____

Prepared by:

American Engineering Testing, Inc.
550 Cleveland Avenue North
St. Paul, Iowa 55114
(651) 659-9001/www.TeamAET.com

Authored by:

Name
Title

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

Name: _____

Date: _____ **License #:** _____

Reviewed by:

Name
Title

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Pavement Core Photographs
Proctor and CBR Test Results
Report of Petrographic Analysis

APPENDIX B – Geotechnical Report Limitations and Guidelines for Use

1.0 INTRODUCTION

The proposed Siouxland Nexus Project at the Sioux Gateway Airport (SUX) in Sioux City, Iowa will include reconstruction and expansion of Runway 13-31 among many other related projects. To assist in planning and design, RS&H authorized American Engineering Testing, Inc. (AET) to conduct a subsurface exploration program at the site, conduct soil laboratory testing, and perform a geotechnical engineering review for the project. This report presents the current results of our services.

2.0 SCOPE OF SERVICES

AET's services were performed according to our revised proposal to RS&H dated December 1, 2023, which was authorized via Work Order No. 1 on April 10, 2024. The authorized scope consisted of the following:

- Coordinating the planning, site access, and utility clearances with RS&H, our drilling subcontractor Certified Testing Services, Inc. (CTS), and airport personnel.
- Performing 100 standard penetration test (SPT) borings to a depth of 10 feet for runways, taxiways, and apron reconstructions or expansion and blast pad construction.
- Performing 34 SPT borings to a depth of 20 feet for various proposed structures.
- Performing 6 SPT borings to a depth of 50 feet for ditch regrading at the northwest end of the site. This was later revised to 30-foot borings.
- In October 2024, the project team requested additional borings near the apron reconstruction to evaluate the soil conditions at potential structures in the area.
- Cut cores through the existing pavement at each boring location, and in five proposed locations without an associated boring.
- In October 2024, the project team requested additional pavement cores on the Runway 13-31 apron to evaluate the condition of the asphalt pavement and underlying stabilized full-depth reclamation (SFDR).
- Measure and record the groundwater level (if encountered) at the time of drilling.
- Perform bulk and thinwall sampling for laboratory testing where pertinent.
- Install two piezometers to monitor the groundwater level within the proposed ditch area.
- Backfill the boreholes and patch the core holes with quick-set, high strength grout.
- Performing soil laboratory testing including moisture content, California Bearing Ratio (CBR), Atterberg limits, sieve analyses, and triaxial compression tests.
- Providing this report with our results and recommendations. We understand RS&H will complete the pavement thickness designs. We will provide additional recommendations for grading, foundation design and construction of project elements when details are

available.

Following project authorization, RS&H removed some of the originally proposed borings from the scope, resulting in the following:

- 85 borings to 10 feet
- 11 borings to 20 feet
- 6 borings to 50 feet
- 7 standalone pavement cores

Also following authorization, at the request of RS&H we performed petrographic analysis on pavement cores extracted from the runway and apron. The purpose of this analysis was to document evidence of alkali-silica reactivity (ASR) within the concrete.

In October 2024, the project team also requested the completion of double-ring infiltrometer (DRI) tests at 10 sites at the runway perimeter outside of the runway safety area. We performed these tests as requested in November 2024 and the results were provided under separate cover.

These services were intended for geotechnical purposes only. The scope is not intended to explore for the presence or extent of environmental contamination in the soil or groundwater.

3.0 PROJECT INFORMATION

Based on a preliminary plan provided by RS&H, we understand the following construction is proposed:

- Runway 13-31 reconstruction. This will require the removal of the existing concrete pavement, regrading, and pavement replacement.
- Hardened overruns (1,000 feet long) at each end of Runway 13-31.
- Blast pads (1,000 feet long) at the end of each hardened overrun.
- Localizers at the end of each blast pad.
- Aircraft arresting systems.
- Demolition of existing taxiways and construction of new connectors for Taxiway A.
- Extension of Taxiway A at Runway 13.
- A warm-up/holding off Taxiway A near Runway 13.
- Perimeter roads at each end of the runway.
- Ditch regrading for drainage improvements north of Runway 13.
- Assorted structures including localizers and pre-fabricated, at-grade buildings such as the

localizer building, MARSR building and glide slope buildings.

The above stated information represents our understanding of the proposed construction. This information is an integral part of our engineering review. It is important that you contact us if there are changes from our description so that we can evaluate whether modifications to our recommendations are appropriate. We intend to update this report with recommendations for grading, pavement construction and support of structures once soil borings are complete and more detailed design information is available.

4.0 SUBSURFACE EXPLORATION AND TESTING

4.1 Field Exploration Program

The subsurface exploration program conducted for the project to date consisted of 82 standard penetration test borings. RS&H provided the number of borings, boring depths, and boring locations. The logs of the borings and details of the methods used appear in Appendix A. The logs contain information concerning soil layering, soil classification, geologic origins, and moisture condition. A density description or consistency is also noted for the natural soils, which is based on the standard penetration resistance (N-value).

The boring locations are shown on Figure 1 in Appendix A. The borings were located and marked in the field by RS&H personnel or their subcontractors.

4.2 Soil Laboratory Testing

The laboratory test program included moisture-density testing and CBR testing of cohesive soils. The test results appear in Appendix A on the individual boring logs adjacent to the samples upon which they were performed, or on the data sheets following the logs.

4.3 Petrographic Analysis

AET performed a petrographic analysis on six pavement cores in accordance with AET Standard Operating Procedure 24- LAB-001, "Petrographic Examination of Hardened Concrete," ASTM C856-latest revision. The complete report is attached in the Appendix.

The petrographic analysis consisted of reviewing the cement paste and aggregate qualities on a whole basis on sawcut, lapped, and fractured sections; performing reflected light microscopy at magnifications up to 160x; documenting the depth of carbonation using a phenolphthalein pH indicator solution; and characterizing the paste-coarse aggregate bond quality was by fracturing a sound section of the concrete with a rock hammer.

5.0 SITE CONDITIONS

5.1 Geology and Site Description

The SUX property is situated within the Missouri Alluvial Plain and the principal native soil type includes floodplain alluvial soils that vary widely in texture and composition, with significant fine-grained (silt and clay) deposits. The site is generally flat, with elevations varying by less than 10 feet. Nearby areas are subject to flooding and occasional high groundwater conditions are possible.

5.2 Pavement and Subsurface Soils

The overall subsurface soil profile at the borings in paved areas consisted of an average of about 11 ½ inches of concrete underlain by variable depths of apparent aggregate base that sometimes appeared to be up to 30 inches thick. Photos of the pavement cores are included in the appendix, which generally show the concrete is in good material condition. A single boring on Taxiway A at Runway 31 encountered a thin layer of bituminous pavement over a thin layer of concrete.

In unpaved areas, the topsoil materials were typically composed of lean clay or fat clay, occasionally with trace roots; we also noted silty sand and silt with sand material at the surface, or surface gravel on upgraded roadways. Fill soils were generally clayey and extended on average to about 4 feet in depth.

The native soils are comprised mostly of lean clay and fat clay at shallow depths, and sandy soils at greater depths, each with variable color, moisture content and unit weight. Additional comments on the evaluation of recovered soil samples are presented within the report appendices.

5.3 Groundwater

Measurable groundwater was encountered during drilling operations at a depth of about 2 feet in two locations, and 10 feet at a third location. Given the limited nature of these observations across the site and the layered soil profile present in the borings, it is likely these observations represent a perched groundwater condition.

The boreholes were not open long enough for groundwater to seep through the lean and fat clay and silt soils to its true hydrostatic levels, and piezometers would be required for long-term monitoring of local conditions. The depth to groundwater can also vary annually and seasonally precipitation. Such soils and other regional dependent conditions may produce groundwater

entry of project excavations. We direct your attention to other report sections and appendices concerning groundwater issues and subsurface drainage.

5.4 Concrete Petrographic Analysis

For our petrographic analysis of the concrete pavement, we selected six cores (from locations B-002, B-007, B-011, B-015, B-022, and B-057) to analyze for the presence of ASR. Our conclusion based on petrographic lab work is that the core samples did not exhibit any evidence of bulk, expansive ASR. An innocuous level of alkali-silica gel deposits was documented in core samples #2, #11, #22, and #57. The deposits were present within air voids adjacent to a few shale fine aggregate particles. Core samples #7 and #15 contained similar shale particles; however, no secondary gel deposits were found in these cores. The reactivity has not caused any emanating or expansive cracking in the core samples.

The coarse aggregate in the samples consisted of quarried and crushed fossiliferous limestone. No evidence of any ASR of the coarse aggregates was found. Based on the reported age of the pavement and the petrographic observations of the core samples, we do not expect the concrete to be susceptible to long-term, bulk/expansive ASR.

Our complete Report of Petrographic Analysis is attached in the report Appendix.

6.0 RECOMMENDATIONS

The following section assumes buildings and structures will consist of slab-on-grade or shallow footing construction and provides general recommendations. We will update this section when structure information becomes available.

6.1 Structure Grading

6.1.1 Excavations

To prepare the building or structure areas for shallow foundation and slab support, we recommend complete excavation of the fill, topsoil, and soft or unstable clayey and silty soils, thereby exposing stiffer clayey materials or coarse sandy alluvial soils. This may necessitate subcutting depending on the nature of each structure and foundation; we can provide detailed recommendations on potential subcuts with additional structural design information.

Subcut recommendations will be limited to our interpretation of each exploration location. Since conditions will vary away from these locations, we recommend that AET geotechnical personnel observe and confirm the competency of the soils in the entire excavation bottom

prior to new fill or footing placement.

Where the excavation extends below foundation grade, the excavation bottom and resultant engineered fill system must be oversized laterally beyond the planned outside edges of the foundations to properly support the loads exerted by that foundation. This excavation/engineered fill lateral extension should at least be equal to the vertical depth of fill needed to attain foundation grade at that location (i.e., 1:1 lateral oversize).

6.1.2 Fill Placement and Compaction

Fill placed to attain grade for foundation support should be compacted in thin lifts, such that the entire lift achieves a minimum compaction level of 98% of the standard maximum dry unit weight per ASTM D698 (Standard Proctor test). Fill placed which supports the floor slab only (outside of the 1:1 oversize zone below footings) can have a reduced minimum compaction level of 95% of the standard maximum dry unit weight.

Soils encountered in our borings that can be reused as fill include lean clay, sandy lean clay, clayey sand, silty sand and sand. We caution that it will be difficult to properly grade and compact soils described as silt (or silt with sand) and fat clay. Additionally, these soil types are moderately to highly frost-susceptible and may result in differential movement under foundations and across the sites. These soils should be replaced with imported or on-site fill meeting the moisture and compaction requirements described elsewhere in this report. We will update our subcut recommendations when structure foundation details are available.

If there are areas where fill is placed on slopes, we recommend benching the sloped surface (benches cut parallel to the slope contour) prior to placing the fill. Benching is recommended where slopes are steeper than 1:4 (V:H).

6.2 Embankment and Ditch Grading

We recommend grading and soil compaction for new ditch areas in general accordance with FAA Advisory Circular (AC) 150/5370-10H, *Standard Specifications for Construction of Airports*, including Item P-151 (Clearing and Grubbing), Item P-152 (Excavation, Subgrade, and Embankment).

Remove topsoil where encountered as described in Item P-152-2.2, and stockpile all salvageable topsoil for future use.

Per Item P-152-1.3, "[m]aterials containing vegetable or organic matter, such as muck, peat,

organic silt, or sod shall be considered unsuitable for use in embankment construction.” Shallow soils in the ditch area included silt and sandy silt to depths of about 7 feet, which then overlay coarse alluvial sands. Although not unsuitable by the above definition, these soils will be difficult to compact, particularly when wet, and should not be used to construct new embankments where possible. Removing these soils will also reduce the risk of long-term settlement of the embankment sections where additional loads are applied. Place any unsuitable material in designated waste areas per P-152-2.5.

Compact all embankment materials as described in Item P-152-2.10.

6.2 Foundation Design

Our current assumption is that structures will be supported on conventional spread foundations placed on competent native soils as described in this report and verified by field observations. We recommend perimeter foundations for heated building space is placed such that the bottom is a minimum of 42 inches below exterior grade. We recommend foundations for unheated building space (such as canopy foundations) be extended to a minimum of 60 inches below exterior grade.

Assuming the foundation soils will be treated as described above and based on the conditions encountered in our borings, our opinion is the building foundations can be designed based on a net maximum allowable soil bearing pressure of 2,000 psf for each of the following structures:

- Localizers, at both ends of Runway 13-31 ends
- Glide slope antenna and shelter locations; based on the depth of fill and nature of the structure and foundation, some removals may be required to reach native soils with this bearing capacity at 7 feet in depth
- Aircraft arrest system pits
- Apron-adjacent structures – some removals required to reach native soils at approximately 7 feet below grade

It is our judgment the stated design pressure will have a factor of safety of at least 3 against the ultimate bearing capacity. We judge that total settlements under this loading should not exceed 1 inch. We also judge that differential settlements of conditions depicted by the borings should not exceed ½ inch. These are preliminary recommendations that will need to be revised when more detailed information on proposed site structures is available.

6.3 Exterior Building Backfilling

Many of the on-site soils are at least moderately frost susceptible. Because of this, certain design considerations are needed to mitigate these frost effects. For details, we refer you to the attached sheet entitled “Freezing Weather Effects on Building Construction.”

6.4 Pavements

6.4.1 Design CBR

We performed eight CBR tests on composite bulk samples obtained from the borings as detailed in Table 6.4.1. The complete Proctor and CBR reports follow in the Appendix.

Table 6.4.1. CBR Test Results

Sample	Boring Location(s)	Soil Classification	Maximum Dry Density (pcf) ^(A)	CBR (%) ^(B)
1	B-66, B-68, B-95	Sandy Silt (ML)	114.3	28
2	B-82, B-85, B-87	Silty Sand, a little gravel, mostly fine grained (SM)	126.7	36
3	B-1, B-2, B-6	Sandy Lean Clay, a little gravel (CL)	114.4	8
4	B-10, B-13, B-15	Gravelly Silty Sand, mostly medium grained (SM)	121.9	91
5	B-22, B-26, B-28	Sandy Lean Clay, a little gravel (CL)	105.8	4
6	B-35, B-40, B-42	Silty Sand w/Gravel, medium grained (SM)	121.9	2
7	B-51, B-54, B-57	Sandy Lean Clay, with gravel (CL)	113.3	3
8	B-30, B-36, B-63	Sandy Lean Clay, Brown (CL)	116.9	4

(A) ASTM D 1557 *Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort*

(B) Reported at 95 percent of maximum dry density

It appears the CBR results for Samples 1, 2 and 4 contained more than typical gravel content, suggesting the bulk materials also included various proportions of aggregate base in addition to subgrade soils. The results of the remaining samples appear to be more typical for the soil types encountered within the subgrade zone in the areas drilled for this project.

If discounting the Sample 1, 2 and 4 results from the CBR sample set, the resulting design CBR (average minus one standard deviation) per FAA AC 150/5320-6G, Section 3.15.6.5, is 2.2 percent. FAA guidelines recommend subgrade stabilization for design CBRs of less than 3; we provide an estimated cement content for stabilization in the following section.

6.4.2 Soil Stabilization

Laboratory mix design for soil stabilization was not a part of AET's scope of services. However, given the results of the CBR tests, we understand the project team intends to stabilize subgrade materials per FAA guidelines for pavement construction.

AET tested subgrade soils at Sioux Gateway Airport in 2018 and reported results in our report 28-01244E. The work included bulk sampling of the materials on Runway 18-36 (formerly 17-35) and performing several sets of laboratory tests including pH tests, organic content tests, freeze-thaw durability at various cement contents, and unconfined compressive strength tests of the prepared samples with both lime and cement as stabilizing materials.

Based on the results of previous tests, it appeared cement stabilization strength was maximized at 10% cement content. However, no cement content met the minimum required strength of 250 psi suggested by the US Army Corps of Engineers UFC 3-250-11 manual. In addition, long-term durability was limited, and each cement content exceeded the maximum loss recommended by the ASTM D560 standard.

Lime-treated soils exhibited similar strength characteristics as the cement, with a maximum compressive strength at 10% lime content, and sufficient strength at 8% cement to meet the guidelines set by the National Lime Association *Mixture Design and Testing Procedures for Lime Stabilized Soil*.

In the absence of additional testing, we recommend using the same material and proportions used on the reconstruction of Runway 18-36. In-situ moisture content, soil plasticity, soil pH and soil organic content, among other things, will affect the suitability of the selected stabilization medium at the chosen proportions. Prior to construction, we recommend performing additional testing to evaluate stabilization options and estimate quantities.

7.0 CONSTRUCTION CONSIDERATIONS

7.1 Potential Difficulties

7.1.1 Runoff Water in Excavation

Water can be expected to collect in the excavation bottom during times of inclement weather or snow melt. To allow observation of the excavation bottom, to reduce the potential for soil disturbance, and to facilitate filling operations, we recommend water be removed from within the excavation during construction. Based on the soils encountered, we anticipate the

groundwater can be handled with conventional sump pumping.

7.1.2 Disturbance of Soils

The on-site soils can be disturbed under construction traffic, especially if the soils are wet. If soils become disturbed, they should be subcut to the underlying undisturbed soils. The subcut soils can then be dried and recompact back into place, or they should be removed and replaced with drier imported fill.

7.1.3 Cobbles and Boulders

The soils at this site can include cobbles and boulders. This may make excavating procedures somewhat more difficult than normal if they are encountered.

7.2 Excavation Backsloping

If excavation faces are not retained, the excavations should maintain maximum allowable slopes in accordance with *OSHA Regulations (Standards 29 CFR), Part 1926, Subpart P, "Excavations"* (can be found on www.osha.gov). Even with the required OSHA sloping, water seepage or surface runoff can potentially induce sideslope erosion or sloughing which could require slope maintenance.

7.3 Observation and Testing

The recommendations in this report are based on the subsurface conditions found at our test boring locations. Since the soil conditions can be expected to vary away from the soil boring locations, we recommend on-site observation by a geotechnical engineer/technician during construction to evaluate these potential changes. Soil density testing should also be performed on new fill placed to document that project specifications for compaction have been satisfied.

8.0 TEST STANDARDS

When we refer to an ASTM Standard in this report, we mean that our services were performed in general accordance with that standard. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

9.0 LIMITATIONS

Within the limitations of scope, budget, and schedule, we have endeavored to provide our services according to generally accepted geotechnical engineering practices at this time and location. Other than this, no warranty, express or implied, is intended.

Important information regarding risk management and proper use of this report is given in Appendix B entitled “Geotechnical Report Limitations and Guidelines for Use.”

Appendix A

Boring Log Notes
Unified Soil Classification System
AASHTO Soil Classification System
Boring Locations (provided by RS&H)
Subsurface Boring Logs
Pavement Core Photographs
Proctor and CBR Test Results
Report of Petrographic Analysis

Appendix A
Geotechnical Field Exploration and Testing
Report No. P-0025900

A.1 FIELD EXPLORATION

The subsurface conditions at the site were explored by drilling and sampling standard penetration test borings. The locations of the borings appear on Figure 1, preceding the Subsurface Boring Logs in this appendix.

A.2 SAMPLING METHODS

A.2.1 Split-Spoon Samples (SS)

Standard penetration (split-spoon) samples were collected in general accordance with ASTM: D1586. The ASTM test method consists of driving a 2-inch O.D. split-barrel sampler into the in-situ soil with a 140-pound hammer dropped from a height of 30 inches. The sampler is driven a total of 18 inches into the soil. After an initial set of 6 inches, the number of hammer blows to drive the sampler the final 12 inches is known as the standard penetration resistance or N-value.

A.2.2 Disturbed Samples (DS)/Spin-up Samples (SU)

Sample types described as “DS” or “SU” on the boring logs are disturbed samples, which are taken from the flights of the auger. Because the auger disturbs the samples, possible soil layering and contact depths should be considered approximate.

A.2.3 Sampling Limitations

Unless 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, and they may be present in the ground even if they are not noted on the boring logs.

Determining the thickness of “topsoil” layers is usually limited, due to variations in topsoil definition, sample recovery, and other factors. Visual-manual description often relies on color for determination, and transitioning changes can account for significant variation in thickness judgment. Accordingly, the topsoil thickness presented on the logs should not be the sole basis for calculating topsoil stripping depths and volumes. If more accurate information is needed relating to thickness and topsoil quality definition, alternate methods of sample retrieval and testing should be employed.

A.3 CLASSIFICATION METHODS

Soil descriptions 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 (sieve analysis or Atterberg Limits) have been performed, accurate classifications per ASTM: D2487 are possible. Otherwise, soil descriptions shown on the boring logs are visual-manual judgments. Charts are attached which provide information on the USC system, the descriptive terminology, and the symbols used on the boring logs.

Visual-manual judgment of the AASHTO Soil Group is also noted as a part of the soil description. A chart presenting details of the AASHTO Soil Classification System is also attached.

The boring logs include descriptions of apparent geology. The geologic depositional origin of each soil layer is interpreted primarily by observation of the soil samples, which can be limited. Observations of the surrounding topography, vegetation, and development can sometimes aid this judgment.

A.4 WATER LEVEL MEASUREMENTS

The groundwater level measurements are shown at the bottom of the boring logs. The following information appears under “Water Level Measurements” on the logs:

- ♦ 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 that the liquid in the borehole is drilling fluid

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

Appendix A
Geotechnical Field Exploration and Testing
Report No. P-0025900

A.5 LABORATORY TEST METHODS

A.5.1 Water Content Tests

Conducted per AET Procedure 01-LAB-010, which is performed in general accordance with ASTM: D2216 and AASHTO: T265.

A.5.2 Atterberg Limits Tests

Conducted per AET Procedure 01-LAB-030, which is performed in general accordance with ASTM: D4318 and AASHTO: T89, T90.

A.5.3 Sieve Analysis of Soils (thru #200 Sieve)

Conducted per AET Procedure 01-LAB-040, which is performed in general conformance with ASTM: D6913, Method A.

A.5.4 Particle Size Analysis of Soils (with hydrometer)

Conducted per AET Procedure 01-LAB-050, which is performed in general accordance with ASTM: D422 and AASHTO: T88.

A.5.5 Unconfined Compressive Strength of Cohesive Soil

Conducted per AET Procedure 01-LAB-080, which is performed in general accordance with ASTM: D2166 and AASHTO: T208.

A.5.6 Laboratory Soil Resistivity using the Wenner Four-Electrode Method

Conducted per AET Procedure 01-LAB-090, which is performed using Soil Box apparatus in the laboratory in general accordance with ASTM: G57

A.5.7 Organic Content Tests

Conducted per AET Procedure 20-SOI-010, which is performed in general accordance with ASTM D2974, Test Method C.

A.6 TEST STANDARD LIMITATIONS

Field and laboratory testing is done in general conformance with the described procedures. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

A.7 SAMPLE STORAGE

Unless notified to do otherwise, we routinely retain representative samples of the soils recovered from the borings for a period of 30 days.

UNIFIED SOIL CLASSIFICATION SYSTEM
ASTM Designations: D 2487, D2488

**AMERICAN
ENGINEERING
TESTING, INC.**



Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A				Soil Classification		Notes
				Group Symbol	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	Cu≥4 and 1≤Cc≤3 ^E	GW	Well graded gravel ^F	^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
			Cu<4 and/or 1>Cc>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	Cu≥6 and 1≤Cc≤3 ^E	SW	Well-graded sand ^I	
			Cu<6 and/or 1>Cc>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 <0.75	OL	Organic clay ^{K,L,M,N}	
			Liquid limit – not dried		Organic silt ^{K,L,M,O}	
		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 <0.75	OH	Organic clay ^{K,L,M,P}		
		Liquid limit – not dried		Organic silt ^{K,L,M,Q}		
Highly organic soil		Primarily organic matter, dark in color, and organic in odor	PT	Peat ^R		
		MH OR OH ML OR OL Plasticity Chart				^E Cu = D ₆₀ /D ₁₀ , Cc = $\frac{(D_{30})^2}{D_{10} \times D_{60}}$ ^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, soil 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.

Notes

^ABased on the material passing the 3-in (75-mm) sieve.

^BIf field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^CGravels 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

^DSands 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

$$C_u = \frac{(D_{60})^2}{D_{10} \times D_{60}}$$

$$C_u = D_{60} / D_{10}$$

^FIf soil contains ≥15% sand, add "with sand" to group name.

^GIf fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^HIf fines are organic, add "with organic fines" to group name.

^IIf soil contains ≥15% gravel, add "with gravel" to group name.

^JIf Atterberg limits plot is hatched area, soil is a CL-ML silty clay.

^KIf soil contains 15 to 29% plus No. 200 add "with sand" or "with gravel", whichever is predominant.

^LIf soil contains ≥30% plus No. 200, predominantly sand, add "sandy" to group name.

^MIf soil contains ≥30% plus No. 200, predominantly gravel, add "gravelly" to group name.

^NPI≥4 and plots on or above "A" line.

^OPI<4 or plots below "A" line.

^PPI plots on or above "A" line.

^QPI plots below "A" line.

^RFiber Content description shown below.

ADDITIONAL TERMINOLOGY NOTES USED BY AET FOR SOIL IDENTIFICATION AND DESCRIPTION

Grain Size		Gravel Percentages		Consistency of Plastic Soils		Relative Density of Non-Plastic Soils	
Term	Particle Size	Term	Percent	Term	N-Value, BPF	Term	N-Value, BPF
Boulders	Over 12"	A Little Gravel	3% - 14%	Very Soft	less than 2	Very Loose	0 - 4
Cobbles	3" to 12"	With Gravel	15% - 29%	Soft	2 - 4	Loose	5 - 10
Gravel	#4 sieve to 3"	Gravelly	30% - 50%	Firm	5 - 8	Medium Dense	11 - 30
Sand	#200 to #4 sieve			Stiff	9 - 15	Dense	31 - 50
Fines (silt & clay)	Pass #200 sieve			Very Stiff	16 - 30	Very Dense	Greater than 50
				Hard	Greater than 30		
Moisture/Frost Condition (MC Column)		Layering Notes		Peat Description		Organic Description (if no lab tests)	
D (Dry):	Absence of moisture, dusty, dry to touch.	Laminations:	Layers less than ½" thick of differing material or color.	Term	Fiber Content (Visual Estimate)	Soils are described as <i>organic</i> , if soil is not peat and is judged to have sufficient organic fines content to influence the Liquid Limit properties. <i>Slightly organic</i> used for borderline cases.	
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.	Lenses:	Pockets or layers greater than ½" thick of differing material or color.	Fibric Peat:	Greater than 67%	Root Inclusions With roots: Judged to have sufficient quantity of roots to influence the soil properties.	
F (Frozen):	Soil frozen			Hemic Peat:	33 – 67%		
				Sapric Peat:	Less than 33%	Trace roots: Small roots present, but not judged to be in sufficient quantity to significantly affect soil properties.	

AASHTO SOIL CLASSIFICATION SYSTEM

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

Classification of Soils and Soil-Aggregate Mixtures

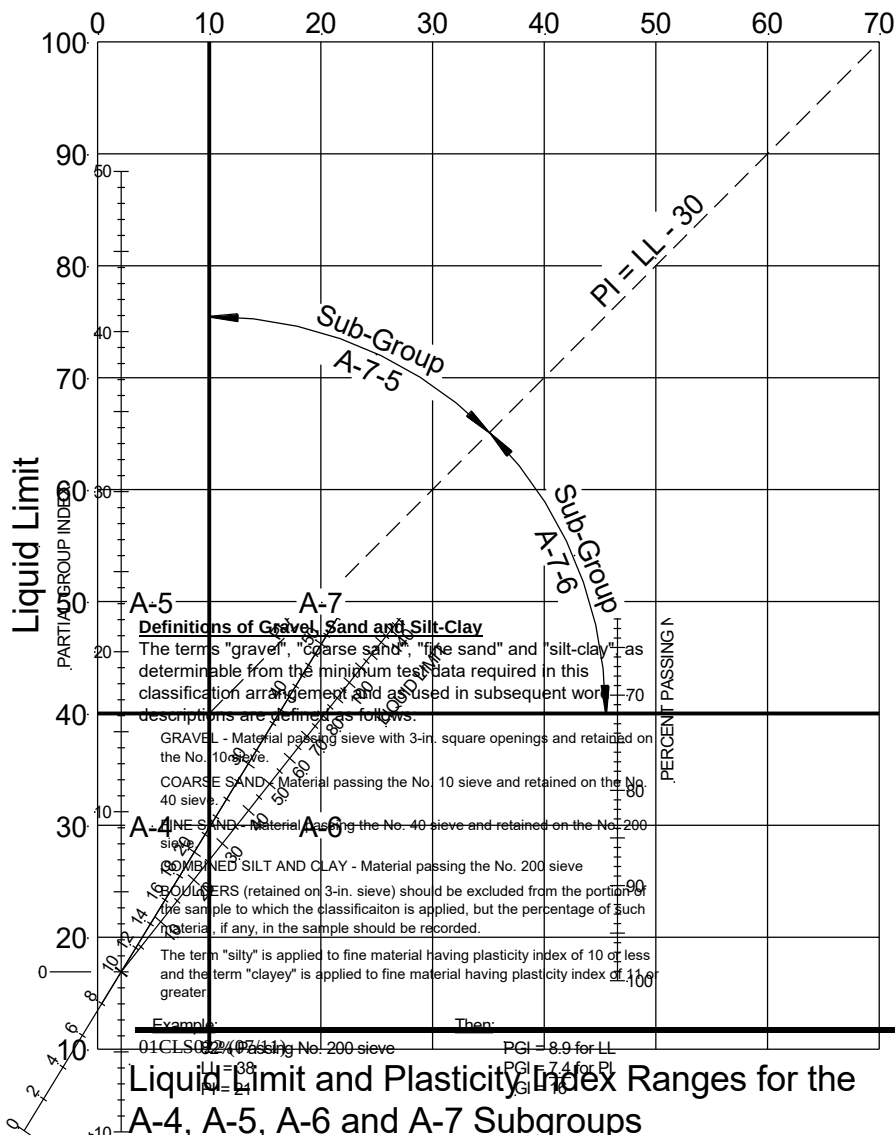
General Classification	Granular Materials (35% or less passing No. 200 sieve)							Silt-Clay Materials (More than 35% passing No. 200 sieve)			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6
Sieve Analysis, Percent passing:											
No. 10 (2.00 mm)	50 max.	....	....	....	....	....	....	....	....	....	....
No. 40 (0.425 mm)	30 max.	50 max.	51 min.	....	....	....	....	....	....	....	....
No. 200 (0.075 mm)	15 max.	25 max.	10 max.	35 max.	35 max.	35 max.	35 max.	36 min.	36 min.	36 min.	36 min.
Characteristics of Fraction Passing No. 40 (0.425 mm)											
Liquid limit . . . . .	....		....	40 max.	41 min.	40 max.	41 min.	40 max.	41 min.	40 max.	41 min.
Plasticity index	6 max.		N.P.	10 max.	10 max.	11 min.	11 min.	10 max.	10 max.	11 min.	11 min.
Usual Types of Significant Constituent Materials	Stone Fragments, Gravel and Sand		Fine Sand	Silty or Clayey Gravel and Sand				Silty Soils		Clayey Soils	
General Ratings as Subgrade	Excellent to Good							Fair to Poor			

The placing of A-3 before A-2 is necessary in the "left to right elimination process" and does not indicate superiority of A-3 over A-2.

Plasticity index of A-7-5 subgroup is equal to or less than LL minus 30. Plasticity index of A-7-6 subgroup is greater than LL minus 30.

Group A-8 soils are organic clays or peat with organic content >5%.

PLASTICITY INDEX (PI)



BORING LOG NOTES

DRILLING AND SAMPLING SYMBOLS

Symbol	Definition
AR:	Sample of material obtained from cuttings blown out the top of the borehole during air rotary procedure.
B, H, N:	Size of flush-joint casing
CAS:	Pipe casing, number indicates nominal diameter in inches
COT:	Clean-out tube
DC:	Drive casing; number indicates diameter in inches
DM:	Drilling mud or bentonite slurry
DR:	Driller (initials)
DS:	Disturbed sample from auger flights
DP:	Direct push drilling; a 2.125 inch OD outer casing with an inner 1½ inch ID plastic tube is driven continuously into the ground.
FA:	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
LG:	Field logger (initials)
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
RDA:	Rotary drilling with compressed air and roller or drag bit.
RDF:	Rotary drilling with drilling fluid and roller or drag bit
REC:	In split-spoon (see notes), direct push and 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.
SS:	Standard split-spoon sampler (steel; 1.5" is 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
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 hammer
WR:	Sampler advanced by static weight of drill rod
94mm:	94 millimeter wireline core barrel
▼:	Water level directly measured in boring
▽:	Estimated water level based solely on sample appearance

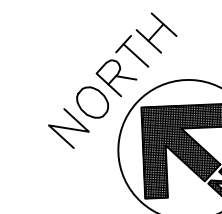
TEST SYMBOLS

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 (<u>approximate</u>)
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

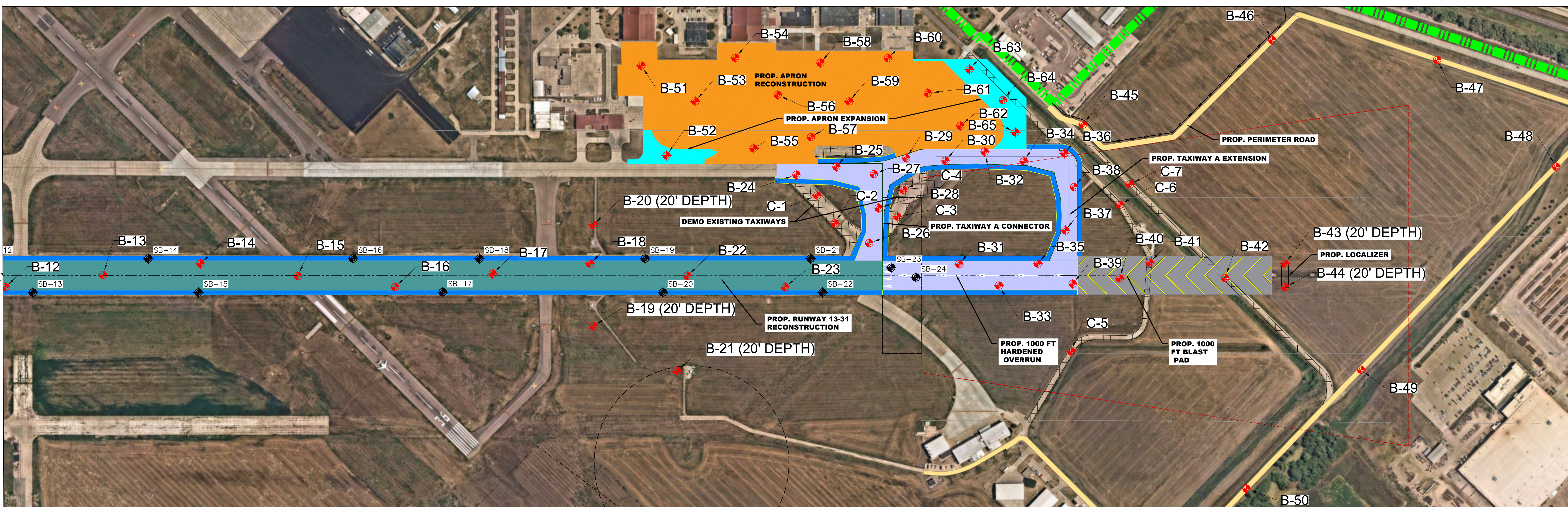
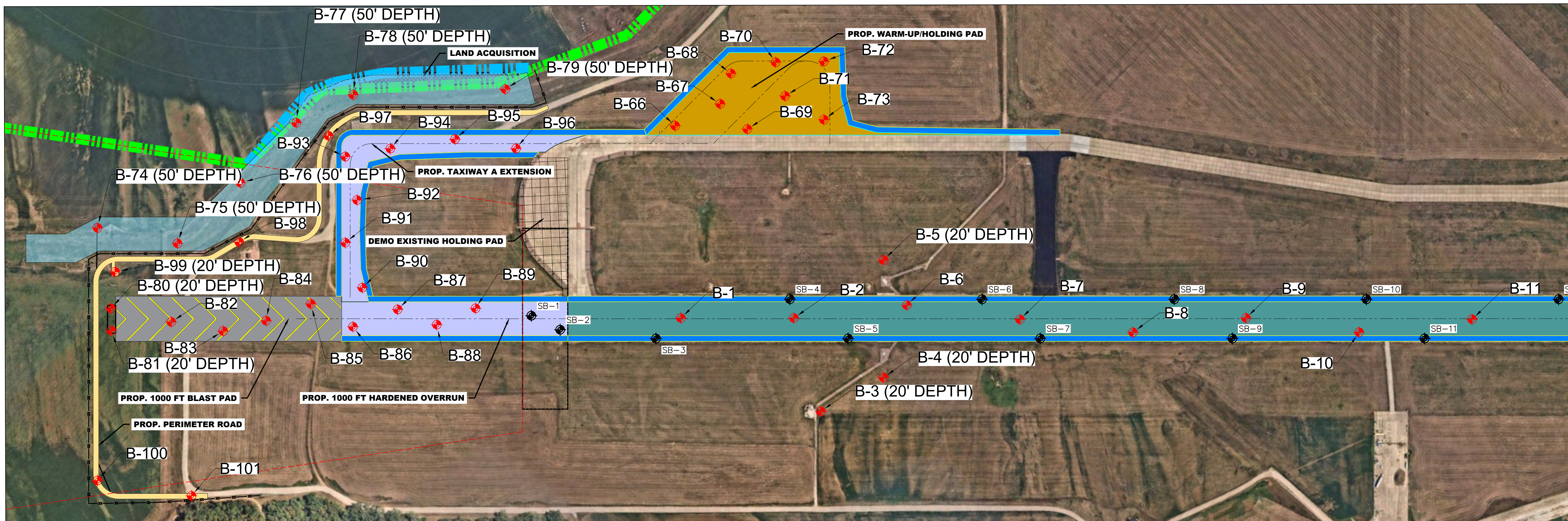
The standard penetration test consists of driving a split-spoon sampler with a drop hammer counting the number of blows applied in each of three 6" increments of penetration. If the sampler is driven less than 18" (usually in highly resistant material), permitted in ASTM: D1586, the blows for each complete 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.

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").



LEGEND:

- RUNWAY 13-31 EXTENSION
- RUNWAY 13-31 RECONSTRUCTION
- IANG APRON RECONSTRUCTION
- IANG APRON EXPANSION
- B-##
PROPOSED SOIL BORING
(10FT DEPTH UNLESS NOTED OTHERWISE)
- C-##
PROPOSED CORE
- SB-##
PREVIOUSLY COMPLETED
SOIL BORING (DEC 2021)





SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-001 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	11.5" Concrete pavement	FILL	33	M	SS	14					
2	10.5" Base fill, mostly sand with silt and gravel, brown (A-1-b)										
3	FILL, mostly lean clay, a little silty sand, gray and brown (A-6)										
4											
5	FILL, mixture of lean clay and silt, gray and brown (A-6)										
6											
7	FILL, mixture of lean clay and fat clay, gray and brown (A-6 & A-7-6)										
8		FINE ALLUVIUM	7	M	SS	18					
9	LEAN CLAY, gray and brown mottled, soft, lenses of silt (CL) (A-6)										
10											
11	END OF BORING										
DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG		
0-9½' 2.25" HSA		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL			
				11.0	9.5			None			
				11.0		9.0		None			
BORING COMPLETED:											
DR: BK LG: AK Rig: 4											

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24

SUBSURFACE BORING LOG



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-003 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly silty sand, trace roots, brown (A-2-4)	FILL		M							
2											
3	FAT CLAY, a little brown mottled, firm, a lens of lean clay (CH) (A-7-6)	FINE ALLUVIUM	6	M	SS	18					
4											
5	LEAN CLAY, brown and grayish brown mottled, soft, lenses of fat clay and laminations of silt (CL) (A-7-6)		4	M	SS	18					
6											
7	SAND, fine grained, brown, moist, loose, laminations of silt (SP) (SP)	COARSE ALLUVIUM	6	M	SS	10					
8											
9											
10	SAND, fine grained, brown, moist, loose to medium dense (SP) (A-3)		6	M	SS	18					
11											
12											
13			14	M	SS	18					
14											
15			11	M	SS	18					
16											
17											
18											
19											
20			13	M	SS	18					
21	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-19½'								None	
BORING COMPLETED: 5/17/24									
DR:	LG:	Rig:							

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-004 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
								WC	DEN	LL	PL	%-#200	
1	LEAN CLAY, trace roots, brown (CL) (A-6)		FINE ALLUVIUM		M								
2	SANDY SILT, grayish brown, moist, medium dense to loose (ML) (A-4)												
3				14	M		SS	18					
4													
5	SAND, fine grained, brown, moist, loose to medium dense (SP) (A-3)		COARSE ALLUVIUM	6	M			SS	18				
6													
7													
8					6	M		SS	18				
9													
10													
11				12	M			SS	20				
	END OF BORING												

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'								None	
BORING COMPLETED:									
DR: LG: Rig:									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-005 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mixture of lean clay and silty sand, grayish brown and brown	FILL	5	M	SS	19					
2	SANDY SILT, grayish brown, moist, loose, laminations of sand (ML) (A-4)	FINE ALLUVIUM	7	M	SS	18					
3											
4											
5	SILTY SAND, fine grained, brown and gray mottled, moist, loose (SM) (A-2-40)	COARSE ALLUVIUM	5	M	SS	18					
6											
7											
8											
9	SAND, fine grained, brown, moist, loose to medium dense (SP) (A-3)		5	M	SS	18					
10											
11											
12											
13											
14											
15											
16											
17			11	M	SS	18					
18											
19											
20											
21	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-19½'	3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/13/24		21.0	19.5	21.0		None	
BORING COMPLETED: 5/13/24									
DR: LG: RH Rig: 63									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-006 (p. 1 of 1)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
SURFACE ELEVATION: _____		LATITUDE: _____				LONGITUDE: _____					
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	14" Concrete pavement	FILL	8	M		16					
2	4" Base, fill, mostly silty sand with gravel and pieces of concrete, brown (A-2-4)										
3	FILL, mostly clayey sand, a little sand, brownish gray and brown (A-6)										
4	SILT, brown, moist, medium dense, laminations of lean clay (ML) (A-4)	FINE ALLUVIUM	23	M		18					
5											
6											
7	SAND WITH SILT, fine grained, light brown, moist, loose (SP-SM) (A-3)	COARSE ALLUVIUM	7	M		18					
8											
9											
10	SILTY SAND, fine grained, brown, moist, loose, laminations of silt (SM) (A-2-4)		5	M		18					
11	END OF BORING										

DEPTH: 0-9½'		DRILLING METHOD: 3.25" HSA		WATER LEVEL MEASUREMENTS					NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/13/24		11.0	9.5	11.0		None	
BORING COMPLETED: 5/13/24									
DR: LG: RH Rig: 63									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-007 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	13" Concrete pavement	FILL	39	M	SS						
	6.5" Base										
2	FILL, mostly sandy lean clay with a little gravel, brown and gray (A-6)										
3	FILL, mixture of sandy lean clay and lean clay with sand with a little silty sand and gravel, brown (A-6)										
4											
5		COARSE ALLUVIUM	28	M	SS	16					
6											
7											
8											
9											
10	SAND, fine grained, light brown, moist, medium dense (SP) (A-3)	COARSE ALLUVIUM	15	M	SS	16					
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'	2.25" HSA	5/14/24		11.0	9.5			None	
		5/14/24		11.0		9.0		None	
BORING COMPLETED: 5/14/24									
DR: BK LG: AK Rig: 4									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900				LOG OF BORING NO. B-008 (p. 1 of 1)											
PROJECT: Sioux City Gateway Airport; Sioux City, IA															
SURFACE ELEVATION: _____				LATITUDE: _____				LONGITUDE: _____							
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS								
							WC	DEN	LL	PL	%-#200				
1	12.25" Concrete pavement	FILL	21	M		10									
2	6.5" Base														
3	FILL, mostly sandy lean clay with ????? and pieces of concrete, brown														
4															
5	FILL, mostly lean clay, a little silt, gray and brown, a little dark brown (A-6)														
6		COARSE ALLUVIUM	8	M		16									
7															
8															
9	SAND, fine grained, brown, moist, medium dense (SP) (A-3)														
10															
11	END OF BORING														

DEPTH: 0-9½'		DRILLING METHOD: 2.25" HSA		WATER LEVEL MEASUREMENTS					NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/14/24		11.0	9.5			None	
		5/14/24		11.0		9.0		None	
BORING COMPLETED: 5/14/24									
DR: BK LG: AK Rig: 4									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-009 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	12" Concrete pavement	FILL									
2	FILL, mostly clayey sand with a little gravel, brown (A-6)		40	M	SS	13					
3	FILL, mostly lean clay, brown and gray (A-6)		18	M	SS	18					
4	SILTY SAND, fine grained, brown and gray mottled, moist, medium dense (SM) (A-2-4) (may be fill)	COARSE ALLUVIUM OR FILL									
5			16	M	SS	18					
6											
7											
8			13	M	SS	18					
9	SILT, brown and gray mottled, moist, medium dense (ML) (A-4)	FINE ALLUVIUM									
10			16	M	SS						
11	SAND, fine grained, brown, moist, medium dense (SP) (A-3)	COARSE ALLUVIUM									
	END OF BORING										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	
0-9½'								
							None	
BORING COMPLETED: 5/13/24								
DR: _____ LG: RH Rig: 63								

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-010 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
	12" Concrete pavement	FILL									
1	6" Apparent base, mostly gravelly silty sand with pieces of concrete, possible recycled concrete (A-1-b)										
2											
3			FILL, mostly gravelly silty sand with pieces of concrete, grayish brown (possible base) (A-1-b)	60	M	SS	16				
4	FILL, mostly lean clay, gray and brown (A-6)										
5				20	M	SS	18				
6											
7											
8	FILL, mixture of lean clay and silty sand, gray and brown (A-6 and A-2-4)		14	M	SS	18					
9	LEAN CLAY, gray and brown mottled, lenses and laminations of silt (CL) (A-6)					SS					
10				20	M	SS	12				
11											
END OF BORING											

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'		5/13/24						1.9	
BORING COMPLETED: 5/13/24									
DR: LG: Rig:									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-011 (p. 1 of 1)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
SURFACE ELEVATION: _____		LATITUDE: _____			LONGITUDE: _____						
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	12.25" Concrete pavement	FILL	85	M		14					
2	FILL, mostly silty sand with a little gravel, brown (A-2-4) (possible base)										
3	FILL, mostly lean clay with sand, gray, brown and a little reddish brown (A-6)										
4											
5											
6		13	M		18						
7											
8											
9	SILT, brown, moist, very loose (ML) (A-4)		9	M		18					
10											
11	END OF BORING										

DEPTH: 0-9½'		DRILLING METHOD: 3.25" HSA		WATER LEVEL MEASUREMENTS					NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/13/24		11.0	9.5			None	
		5/13/24		11.0		9.0		None	
BORING COMPLETED: 5/13/24									
DR: BK LG: AK Rig: 4									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-012 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	13" Concrete pavement	FILL	35	M	SS	14					
2	11" Base, fill, mostly recycled concrete and gravel, brown (A-1-b)			M	SS						
3	FILL, mixture of sandy lean clay and lean clay, a little gravel, gray and brown (A-6)			M	SS						
4											
5				M	SS						
6											
7	LEAN CLAY, brown mottled, soft (CL) (A-6)	FINE ALLUVIUM	4	M	SS	18					
8											
9											
10				M	SS						
11	END OF BORING		3	M	SS	16					

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'	3.25" HSA	5/13/24		11.0	9.5	11.0		None	
BORING COMPLETED: 5/13/24									
DR: LG: RH Rig: 63									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-013 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	12" Concrete pavement	FILL	10	M							
2	6" Apparent base, mostly generally silty sand with pieces of concrete, grayish brown (A-1-b) (possible recycled concrete)			M							
3	FILL, mostly lean clay, grayish brown (A-6)			M	SS	10					
4	LEAN CLAY, grayish brown (A-6)	FINE ALLUVIUM	9	M	SS	12					
5											
6											
7	SILT, brown, a little gray mottled, very loose (ML) (A-4)		3	M	SS	14					
8											
9	LEAN CLAY, brown and grayish brown mottled, soft, laminations of silt (CL) (A-6)			M	SS						
10			4								
11											
	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-9½'		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
								None	
BORING COMPLETED: 5/13/24									
DR:	LG:	Rig:							

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-014 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
	12' Concrete pavement	FILL									
1	FILL, mostly silty sand with gravel, brown (A-2-4)										
2											
3	FILL, mostly lean clay, dark brown (A-6)	FILL OR TOPSOIL	18	M	SS	18					
4	LEAN CLAY, brown and gray mottled, soft to firm, lenses of silt (CL) (A-6)	FINE ALLUVIUM									
5			6	M	SS	18					
6											
7											
8			3	M	SS	18					
9											
10											
11			6	M	SS	18					
	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'								None	
BORING COMPLETED: 5/13/24									
DR: LG: Rig:									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-015 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE		REC IN.	FIELD & LABORATORY TESTS				
									WC	DEN	LL	PL	%-#200
1	12.5" Concrete pavement		FILL	25	M		SS	14					
2	23.5" Base												
3	FILL, mostly lean clay, gray and brown (A-6)												
4			FINE ALLUVIUM	6	M		SS	16					
5	LEAN CLAY, gray and brown mottled and a little reddish brown, firm, laminations of silt (CL) (A-6)												
6													
7													
8													
9													
10													
11	END OF BORING												

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-9½' 2.25" HSA		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/14/24		11.0	9.5			None	
		5/14/24		11.0		9.0		None	
BORING COMPLETED: 5/14/24									
DR: BK LG: AK Rig: 4									



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-016 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	13" Concrete pavement	FILL	56	M							
2	12" Base, fill, mostly recycled concrete and gravel, brown (A-1-b)			M	SS	16					
3	FILL, mostly sandy lean clay, brown (A-6)			M	SS	18					
4	FILL, mostly fat clay, dark gray (A-7-6)	FINE ALLUVIUM	11	M							
5	FAT CLAY, gray and brown mottled, firm (CH) (A-7-6)			M	SS	18					
6				M							
7				M							
8	LEAN CLAY, gray and brown mottled, firm (CL) (A-6)		5	M	SS	18					
9				M							
10				M	SS	18					
11	END OF BORING										
DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG		
0-9½'	3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL			
		5/13/24		11.0	9.5	11.0		None			
BORING COMPLETED: 5/13/24											
DR: LG: RH Rig: 63											

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900				LOG OF BORING NO. B-017 (p. 1 of 1)											
PROJECT: Sioux City Gateway Airport; Sioux City, IA															
SURFACE ELEVATION: _____				LATITUDE: _____				LONGITUDE: _____							
DEPTH IN FEET	MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS							
								WC	DEN	LL	PL	%-#200			
1	12" Concrete pavement		FILL	46	M		SS	10							
2	18" Base														
3	FILL, mostly fat clay, dark gray and brown (A-7-6)														
4															
5															
6															
7	LEAN CLAY, gray and brown mottled, firm (CL) (A-6)			FINE ALLUVIUM	5	M		SS	18						
8															
9															
10															
11	END OF BORING														

DEPTH: 0-9½'		DRILLING METHOD: 2.25" HSA		WATER LEVEL MEASUREMENTS					NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/13/24		11.0	9.5			None	
		5/14/24		11.0		9.0		None	
BORING COMPLETED: 5/13/24									
DR: BK LG: AK Rig: 4									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-018 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	13" Concrete pavement	FILL									
2	9" Base, fill, mixture of recycled concrete over silty sand with gravel, gray and brown (A-2-4)	FINE ALLUVIUM	18	M	SS	16					
3	FAT CLAY, dark gray and gray mottled, stiff to firm, (CH/CL) (A-7-6)		9	M	SS	16					
4	LEAN CLAY, gray and reddish brown mottled, firm (CL) (A-6)		7	M	SS	10					
5			5	M	SS	18					
6			4	M	SS	17					
7											
8											
9											
10											
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'	3.25" HSA	5/13/24		11.0	9.5	11.0		None	
BORING COMPLETED: 5/13/24									
DR: LG: RH Rig: 63									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-020 (p. 1 of 1)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
SURFACE ELEVATION: _____		LATITUDE: _____			LONGITUDE: _____						
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly lean clay, trace roots, brown	FILL OR FINE ALLUVIUM	4	M	SS	18					
2	LEAN CLAY, brown and gray mottled, firm (CL) (A-6) (may be fill)	FINE ALLUVIUM OR FILL	7	M	SS	18					
3											
4											
5	LEAN CLAY, brown mottled, firm, lenses of silt (CL) (A-6) (may be fill)		7	M	SS	18					
6											
7	FAT CLAY, grayish brown and reddish brown mottled, stiff to firm (CH) (A-7-6)	FINE ALLUVIUM	11	M	SS	18					
8											
9											
10			8	M	SS	18					
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
0-9½'	3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
		5/13/24		11.0	9.5				None
BORING COMPLETED: 5/13/24									
DR: LG: RH Rig: 63									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-020A (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
								WC	DEN	LL	PL	%-#200
1	LEAN CLAY WITH A LITTLE GRAVEL, trace roots, dark grayish brown (CL/CH) (A-7-6)		FINE ALLUVIUM		M							
2	LEAN CLAY, gray and brown mottled, firm, laminations of silt (CL/CH) (A-7-6)											
3				6	M	SS	14					
4												
5	LEAN CLAY, gray and brown mottled, firm (CL) (A-6)			6	M	SS	18					
6												
7												
8												
9	SILTY SAND, fine grained, brown, moist, loose, laminations of silt (SM) (A-7-4)		COARSE ALLUVIUM	5	M	SS	18					
10												
11				6	M	SS	14					
12	SANDY SILT, gray and brown mottled, loose (ML) (A-4)		FINE ALLUVIUM									
13				7	M	SS	18					
14												
15	SAND, fine grained, brown, moist, medium dense, lenses of silty sand (SP) (A-3)		COARSE ALLUVIUM	14	M	SS	18					
16												
17												
18												
19												
20												
21				13	M	SS	18					
END OF BORING												

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-19½'								None	
BORING COMPLETED: 5/13/24									
DR: LG: Rig:									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-021 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	GRAVEL, gray and brown	FILL									
	FILL, mostly lean clay, trace roots, gray and brown (A-7-6)			M							
2	LEAN CLAY, dark grayish brown, firm (CL) (A-7-6)	FINE ALLUVIUM	7	M	SS	12					
3	LEAN CLAY, brown and gray mottled, firm (CL) (A-7-6)										
4											
5	LEAN CLAY, brown and gray mottled, firm (CL) (A-6)		5	M	SS	14					
6											
7	LEAN CLAY, grayish brown, brown mottled, firm, laminations of silt (CL/CH) (A-7-6)		8	M	SS	18					
8											
9											
10			7	M	SS	18					
11											
12											
13			8	M	SS	16					
14											
15			6	M	SS	16					
16											
17											
18	SANDY SILT, grayish brown, moist, loose (ML) (A-4)										
19											
20			7	M	SS	12					
21	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-19½'		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
								None	
BORING COMPLETED: 5/17/24									
DR:	LG:	Rig:							

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-022 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE		REC IN.	FIELD & LABORATORY TESTS				
									WC	DEN	LL	PL	%-#200
1	12.5" Concrete pavement		FILL	16	M		SS	12					
	8" Base												
2	FILL, mostly lean clay, dark gray and brown, piece of bituminous (A-6)												
3			FINE ALLUVIUM	11	M		SS	16					
4	LEAN CLAY, gray and brown mottled, firm (CL) (A-6)												
5													
6													
7													
8	LEAN CLAY, brown, firm, lenses of silt (CL) (A-6)			6	M		SS	16					
9													
10													
11				5	M		SS	14					
11	END OF BORING												

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-9½' 2.25" HSA		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/13/24		11.0	9.5			None	
		5/13/24		11.0		9.0		None	
BORING COMPLETED: 5/13/24									
DR: BK LG: AK Rig: 4									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-023 (p. 1 of 1)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
SURFACE ELEVATION: _____		LATITUDE: _____			LONGITUDE: _____						
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	Concrete pavement	FILL									
2	FILL, mostly sandy lean clay with a little gravel, brownish gray (A-6)										
3	LEAN CLAY, dark gray, stiff (CL) (A-6)	FINE ALLUVIUM	14	M		SS	18				
4	LEAN CLAY, gray and brown and a little reddish brown mottled, firm (CL) (A-6)										
5											
6											
7		COARSE ALLUVIUM	7	M		SS	14				
8											
9											
10	SILTY SAND, fine grained, brown, moist, loose (SM) (A-2-4)	COARSE ALLUVIUM	7	M		SS	18				
11											
END OF BORING											

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
0-9½'		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
									None
BORING COMPLETED: 5/13/24									
DR:	LG:	Rig:							

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-024 (p. 1 of 1)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
SURFACE ELEVATION: _____		LATITUDE: _____			LONGITUDE: _____						
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	8" Concrete pavement	FILL									
2	1.5' Base fill, mostly recycled bituminous pavement (A-1-a)			M							
3	12" Concrete pavement										
4	4.5" Base fill, mostly sand with silt and gravel, brown (A-1-b)										
5	FILL, mixture of lean clay and fat clay, gray and dark gray (A-6)		8	M	SS	18					
6	FAT CLAY, gray and brown mottled, firm (CH) (A-7-6)	FINE ALLUVIUM	7	M	SS	10					
7											
8	LEAN CLAY, brown and gray mottled firm (CL) (A-6)		7	M	SS	18					
9											
10	FAT CLAY, brown, firm (CH) (A-7-6)		7	M	SS	18					
11	END OF BORING										

DEPTH: 0-9½'		DRILLING METHOD: 3.25" HSA		WATER LEVEL MEASUREMENTS					NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/14/24		11.0	9.5	11.0		None	
BORING COMPLETED: 5/14/24									
DR: LG: RH Rig: 63									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-025 (p. 1 of 1)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
SURFACE ELEVATION: _____		LATITUDE: _____			LONGITUDE: _____						
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly sandy lean clay with a little gravel, trace roots, brown and light brown	FILL	5	M	SS	12					
2											
3											
4											
5	FAT CLAY, brown mottled, firm (CH) (A-7-6)	FINE ALLUVIUM	7	M	SS	14					
6											
7	LEAN CLAY, brown and gray mottled, firm (CL) (A-6)										
8											
9											
10	SILT, brown, moist to wet, loose (ML) (A-4)		5	M	SS						
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-9½'	2.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/14/24		11.0	9.5			None	
		5/14/24		11.0		9.0		None	
BORING COMPLETED: 5/14/24									
DR: BK LG: AK Rig: 4									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-026 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	12.75" Concrete pavement	FILL									
2	9.5" Base fill, mostly recycled concrete with limestone aggregate, gray		30	M	SS	15					
3	FILL, mostly sandy lean clay, grayish brown (A-6)		9	M	SS	18					
4	FILL, mostly fat clay, dark gray and brown (A-7-6)										
5	FAT CLAY, brownish gray to brown, firm (CH) (A-7-6)	FINE ALLUVIUM	5	M	SS	18					
6											
7											
8			7	M	SS	18					
9	LEAN CLAY, brown, firm (CL) (A-6)										
10			5	M	SS	18					
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'	3.25" HSA	5/14/24		11.0	9.5	11.0		None	
BORING COMPLETED: 5/14/24									
DR: _____ LG: RH Rig: 63									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-027 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	LEAN CLAY, trace roots, grayish brown and dark brown mottled, firm (CL/CH) (A-7-6)	FINE ALLUVIUM	5	M	SS	12					
2											
3											
4	LEAN CLAY, brown and gray mottled, firm, laminations of silt (CL/CH) (A-7-6)		7	M	SS	12					
5											
6											
7	LEAN CLAY, brown and gray mottled, firm (CL) (A-6)		7	M	SS	8					
8											
9											
10	SILT, brown, moist, loose, lenses of lean clay (ML) (A-4)		5	M	SS	10					
11	END OF BORING										

DEPTH: 0-9½'	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG		
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL			
								None			
BORING COMPLETED: 5/14/24											
DR:	LG:	Rig:									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-028 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE		REC IN.	FIELD & LABORATORY TESTS				
									WC	DEN	LL	PL	%-#200
1	FILL, mixture of sandy lena clay with a little gravel, lean clay and silty sand, a piece of bituminous pavement, brown, grayish brown and light brown (A-6)		FILL	6	M		SS	12					
2													
3													
4													
5	FAT CLAY, gray and brown mottled, laminations of silt (CH) (A-7-6)		FINE ALLUVIUM	7	M		SS	14					
6													
7	LEAN CLAY, gray and brown mottled, firm to soft (CL) (A-6)			5	M		SS	14					
8													
9													
10													
11	END OF BORING												
DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG				
0-9½' 2.25" HSA		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL					
		5/14/24		11.0	9.5			None					
		5/14/24		11.0		9.0		None					
BORING COMPLETED: 5/14/24													
DR: BK LG: CA Rig: 4													

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-029 (p. 1 of 1)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
SURFACE ELEVATION: _____		LATITUDE: _____			LONGITUDE: _____						
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	11.75" Concrete pavement	FILL	39	M		14					
2	11.25" Base fill, mostly gravelly silty sand, brown (A-1-b)										
3	FILL, mostly sandy lean clay, a little gravel, brown (A-6)										
4											
5	FAT CLAY, brown and gray mottled, firm (CH) (A-7-6)		7	M		18					
6											
7											
8											
9											
10	SILT, brown, moist, loose, a lens of lean clay (ML) (A-4)		6	M		14					
11											
11	END OF BORING										

DEPTH: 0-9½'		DRILLING METHOD: 2.25" HSA		WATER LEVEL MEASUREMENTS					NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/14/24		11.0	9.5			None	
		5/14/24		11.0				None	
BORING COMPLETED: 5/14/24									
DR: BK LG: AK Rig: 4									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24

SUBSURFACE BORING LOG



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-031 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	10" Bituminous pavement	FILL	12	M	 SS	16					
2	14" Base fill, mostly sand with silt with gravel, brown (A-1-b)										
3	LEAN CLAY, dark gray and brown mottled, firm (CL) (A-6) (may be fill)	FINE ALLUVIUM OR FILL	7	M	 SS						
4											
5	LEAN CLAY, brown and gray mottled, firm (CL) (A-6)	FINE ALLUVIUM	5	M	 SS						
6											
7											
8											
9	SILT, brown, moist to wet, very loose (ML) (A-4)		5	M	 SS						
10											
11	END OF BORING		4	M/W	 SS						

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'	3.25" HSA	5/13/24		11.0	9.5	11.0		None	
BORING COMPLETED: 5/13/24									
DR: LG: RH Rig: 63									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-032 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE		REC IN.	FIELD & LABORATORY TESTS				
									WC	DEN	LL	PL	%-#200
1	12" Concrete pavement		FILL	12	M		SS	18					
2	3" Base fill												
3	FILL, mixture of lean clay and sandy lean clay, brown and gray (A-6)												
4	LEAN CLAY, gray and brown mottled, firm to soft (CL) (A-6)		FINE ALLUVIUM	7	M		SS	16					
5													
6													
7													
8													
9	SILT WITH SAND, brown, moist to wet, very loose (ML) (A-4)			3	M		SS	10					
10													
11													
END OF BORING													

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-9½'	2.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/14/24		11.0	9.0			None	
		5/14/24		11.0		9.0		None	
BORING COMPLETED: 5/14/24									
DR: BK LG: AK Rig: 4									



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-033 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS																																																													
							WC	DEN	LL	PL	%-#200																																																									
1	6" Bituminous pavement	FILL																																																																		
2	22" Base fill, mostly silty sand with gravel, brown (A-1-b)																																																																			
3	LEAN CLAY, dark gray and brown mottled, firm (CL) (A-6) (may be fill)	FINE ALLUVIUM	5	M	SS	14																																																														
4	LEAN CLAY, gray and brown mottled (CL) (A-6)		7	M	SS	18																																																														
5																																																																				
6																																																																				
7																																																																				
8			5	M	SS	18																																																														
9	SILT, brown and gray mottled, moist, loose (ML) (A-4)																																																																			
10			7	M	SS	18																																																														
11	END OF BORING																																																																			
<table border="1"> <tr> <td colspan="2">DEPTH: DRILLING METHOD</td><td colspan="7">WATER LEVEL MEASUREMENTS</td><td colspan="3" rowspan="6">NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG</td></tr> <tr> <td>0-9½'</td><td>2.25" HSA</td><td>DATE</td><td>TIME</td><td>SAMPLED DEPTH</td><td>CASING DEPTH</td><td>CAVE-IN DEPTH</td><td>DRILLING FLUID LEVEL</td><td>WATER LEVEL</td></tr> <tr> <td></td><td></td><td>5/13/24</td><td></td><td>11.0</td><td>9.5</td><td></td><td></td><td>None</td></tr> <tr> <td></td><td></td><td>5/13/24</td><td></td><td>11.0</td><td></td><td>9.0</td><td></td><td>None</td></tr> <tr> <td colspan="2">BORING COMPLETED: 5/13/24</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr> <td colspan="2">DR: BK LG: AK Rig: 4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>												DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG			0-9½'	2.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL			5/13/24		11.0	9.5			None			5/13/24		11.0		9.0		None	BORING COMPLETED: 5/13/24									DR: BK LG: AK Rig: 4								
DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG																																																											
0-9½'	2.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL																																																												
		5/13/24		11.0	9.5			None																																																												
		5/13/24		11.0		9.0		None																																																												
BORING COMPLETED: 5/13/24																																																																				
DR: BK LG: AK Rig: 4																																																																				

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-034 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	LEAN CLAY, trace roots, grayish brown, firm (CL) (A-6)	TOPSOIL/ FINE ALLUVIUM	5	M	SS	16					
2	LEAN CLAY, brown mottled, soft, lenses of silt (CL) (A-6)	FINE ALLUVIUM	3	M	SS						
3	SILT, brown mottled, moist, loose (ML) (A-4)										
4											
5	SILTY SAND, fine grained, brown, moist, loose (SM) (A-2-4)	COARSE ALLUVIUM	7	M	SS	14					
6											
7	SILT, brown, moist to wet, very loose, laminations of lean clay (ML) (A-4)	FINE ALLUVIUM	2	M	SS	16					
8											
9											
10			3	M	SS						
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'	3.25" HSA	5/16/24		11.0	9.5			None	
		5/16/24		11.0		9.0		None	
BORING COMPLETED: 5/16/24									
DR: BK LG: AK Rig: 4									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-035 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	6" Bituminous pavement	FILL									
	18" Base, fill, mostly sand with silt with gravel, brown (A-1-b)										
2	FILL, mostly lean clay, gray and dark gray mottled (A-6)	FILL OR FINE ALLUVIUM	5	M	SS	14					
3											
4	LEAN CLAY, gray and brown mottled, firm (CL/CH) (A-7-6)	FINE ALLUVIUM	6	M	SS	16					
5											
6											
7											
8											
9											
10											
11	END OF BORING										
DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG		
0-9½' 3.25" HSA		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL			
		5/13/24		11.0	9.5	11.0		None			
BORING COMPLETED: 5/13/24											
DR: LG: RH Rig: 63											

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-036 (p. 1 of 1)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
SURFACE ELEVATION: _____		LATITUDE: _____			LONGITUDE: _____						
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	8" Concrete pavement	FILL									
	FILL, mostly sand, brown (A-3)										
2	FILL, mostly fat clay, dark gray and gray (A-7-6)		4	M		SS	12				
3	LEAN CLAY, brown mottled, soft (CL) (A-6)	FINE ALLUVIUM	4	M		SS	14				
4											
5			4	M		SS	12				
6											
7											
8	SILTY SAND, fine grained, brown, moist, loose (SM) (A-2-4)	COARSE ALLUVIUM	9	M		SS	16				
9	SANDY SILT, brown, moist to about 10' then wet (ML) (A-4)										
10		MIXED ALLUVIUM	6								
11	END OF BORING										

DEPTH: 0-9½' DRILLING METHOD: 3.25" HSA		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/15/24		11.0	9.5	11.0		10.0	
BORING COMPLETED: 5/15/24									
DR: _____ LG: RH Rig: 63									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-037 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	LEAN CLAY, trace roots, dark brown (CL) (A-6) (may be fill)	TOPSOIL OR FILL		M	SS						
2	LEAN CLAY, trace roots, grayish brown, firm (CL/CH) (A-7-6) (may be fill)	FINE ALLUVIUM OR FILL	8	M	SS	6					
3											
4	FAT CLAY, grayish brown and brown, a little black, firm to stiff (CH) (A-7-6) (may be fill)		5	M	SS	20					
5											
6											
7	LEAN CLAY, brown, a little gray mottled, stiff to firm, lenses of silty sand and silt (CL) (A-6)		9	M	SS						
8											
9											
10											
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'								None	
BORING COMPLETED: 5/14/24									
DR: _____ LG: _____ Rig: _____									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-038 (p. 1 of 1)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
SURFACE ELEVATION: _____		LATITUDE: _____			LONGITUDE: _____						
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly fat clay, trace roots, dark gray and brown (A-7-6)	FILL	7	M	SS	12					
2	FILL, mixture of lean clay and silt, brown and gray (A-6)		4	M	SS	8					
3											
4											
5			7	M	SS	10					
6											
7											
8	SILTY SAND, fine grained, brown, moist, lens of silt (SM) (A-2-4)	COARSE ALLUVIUM	11	M	SS	10					
9											
10	LEAN CLAY, gray and brown mottled, soft (CL) (A-6)	FINE ALLUVIUM	4	M	SS	16					
11	END OF BORING										

DEPTH: 0-9½'		DRILLING METHOD: 2.25" HSA		WATER LEVEL MEASUREMENTS					NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/14/24		11.0	9.5			None	
		5/14/24		11.0		9.0		None	
BORING COMPLETED: 5/14/24									
DR: BK LG: AK Rig: 4									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-039 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	4" Bituminous pavement	FILL		M							
2	20" Base, fill, mostly silty sand with gravel, brown (A-1-b)										
3	LEAN CLAY, gray and brown mottled, firm (CL) (A-6)	FINE ALLUVIUM	5	M	SS	14					
4											
5			6	M	SS	18					
6											
7											
8			5	M	SS	18					
9											
10			5	M	SS	18					
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'	2.25" HSA	5/13/24		11.0	9.5			None	
		5/13/24		11.0		9.0		None	
BORING COMPLETED: 5/13/24									
DR: BK LG: AK Rig: 4									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-040 (p. 1 of 1)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
SURFACE ELEVATION: _____		LATITUDE: _____			LONGITUDE: _____						
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly fat clay, brown and gray (A-7-6)	FILL	3	M	SS	18					
2	FAT CLAY, gray and brown mottled, firm (CH) (A-7-6)	FINE ALLUVIUM	5	M	SS	18					
3											
4											
5											
6											
7			6	M	SS	18					
8											
9											
10	SILT, brown and gray mottled, wet, very loose (ML/CL-ML) (A-4)		3	M/W	SS	18					
11	END OF BORING										

DEPTH: 0-9½'		DRILLING METHOD: 3.25" HSA		WATER LEVEL MEASUREMENTS					NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/14/24		11.0	9.5	11.0		None	
BORING COMPLETED: 5/14/24									
DR: LG: RH Rig: 63									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-041 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
	8" Concrete pavement	FILL									
1	2" Base fill	FINE ALLUVIUM	3	M	SS	10					
2	LEAN CLAY, dark brown and brown mottled, soft (CL) (A-6)										
3	LEAN CLAY, brown mottled, firm (CL) (A-6)		5	M	SS	14					
4											
5	FAT CLAY, brown and gray mottled, soft (CH) (A-7-6)	COARSE ALLUVIUM	3	M	SS	18					
6											
7											
8	SAND WITH SILT, fine grained, brown, moist, loose (SP-SM) (A-3)		9	M	SS	10					
9		FINE ALLUVIUM									
10	SILT, brown, moist to wet, very loose, lenses of lean clay and sand (ML) (A-4)		4	M	SS	12					
11	END OF BORING										
DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG		
0-9½' 2.25" HSA		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL			
		5/16/24		11.0	9.5			None			
		5/16/24		11.0		9.0		None			
BORING COMPLETED: 5/16/24											
DR: BK LG: AK Rig: 4											

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-042 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	9" Concrete pavement	FILL		M							
2	FILL, mixture of lean clay and fat clay, brown and gray (A-6)		4	M	SS	16					
3			4	M	SS	14					
4											
5			4	M	SS	12					
6											
7	SANDY SILT, brown, moist, loose (ML (A-4)	MIXED ALLUVIUM	6	M	SS	14					
8											
9	SILTY SAND, fine grained, brown, moist, loose (SM) (A-2-4)	COARSE ALLUVIUM	7	M	SS	16					
10											
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'	3.25" HSA	5/15/24		11.0	9.5	11.0		None	
BORING COMPLETED: 5/15/24									
DR: LG: RH Rig: 63									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-043 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	Frozen to 2"			F/M							
2	LEAN CLAY, brown and gray, firm to stiff, laminations of silt (CL) (A-7-6) (possible fill)	FINE ALLUVIUM OR FILL	7	M	SS	12	25				
3											
4											
5											
6											
7											
8	SANDY SILT, light brown, moist, loose to medium dense (SM) (A-4)	FINE ALLUVIUM	9	M	SS	12					
9											
10											
11											
12											
13	SAND, fine grained, light brown, moist, loose, laminations of silt (SP) (A-3)	COARSE ALLUVIUM	13	M	SS	12					
14											
15											
16											
17											
18	SAND WITH SILT, fine grained, brown, moist, loose, laminations of sandy silt (SP-SM) (A-3)		8	M	SS	11					
19											
20											
21	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-19½'									
BORING COMPLETED: 11/25/24									
DR: LG: Rig:									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24

LOG OF BORING NO. **B-044** (p. 1 of 1)

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

AET CORPW-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET+CPT+WELL.GDT 12/20/2403/2011

01-DHR-060



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-045 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1											
2	LEAN CLAY, grayish brown and light brown, stiff, lenses of silt (CL) (A-7-6 and A-6)	FINE ALLUVIUM	9	M	SS	7	17				
3											
4											
5	SILTY SAND, fine grained, brown, moist, loose (SM) (A-2-4)	COARSE ALLUVIUM	9	M	SS	10	26				
6											
7											
8	SILT, brown, moist to wet, loose, lenses of silty clay and lean clay (ML) (A-4)	FINE ALLUVIUM	7	M	SS	8					
9											
10											
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'									
BORING COMPLETED: 11/16/24									
DR: LG: Rig:									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-046 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1											
2	LEAN CLAY, brown and light brown, firm, laminations of silt (CL) (A-6 and A-4)	FINE ALLUVIUM	7	M	SS	6	20				
3											
4											
5	SILT, light brown, moist, loose to medium dense (ML) (A-4)	FINE ALLUVIUM OR LOESS	7	M	SS	12	6				
6											
7											
8											
9											
10	SILTY SAND, fine grained, light brown, moist, medium dense (SM) (A-2-4)	COARSE ALLUVIUM OR LOESS	14	M	SS	7	8				
11											
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'									
BORING COMPLETED: 11/16/24									
DR: LG: Rig:									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-047 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1											
2	LEAN CLAY, trace roots, dark grayish brown and brown mottled, stiff, laminations of silt (CL) (A-7-6)	FINE ALLUVIUM	9	M	SS	10	26				
3											
4	LEAN CLAY, trace roots, brown and light brown, stiff, laminations of silt (CL) (A-7-6)		9	M	SS	12	31				
5											
6	SILTY SAND, fine grained, light brown, moist, medium dense to loose, laminations of sandy silt (SM) (A-2-4)		11	M	SS	14					
7											
8			7	M	SS	12					
9											
10											
11											
11	END OF BORING										

DEPTH: 0-9½'	DRILLING METHOD	WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	
BORING COMPLETED: 11/16/24								
DR:	LG:	Rig:						

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-048 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1											
2	LEAN CLAY, brown and grayish brown, a little reddish brown mottled, firm to stiff (CL) (A-7-6)	FINE ALLUVIUM	8	M	SS	12	35				
3											
4											
5			9	M	SS	13	33				
6											
7	SAND WITH SILT, fine grained, brown and reddish brown mottled, moist, loose (SP-SM) (A-2-4)	COARSE ALLUVIUM	8	M	SS	14					
8											
9											
10	LEAN CLAY, gray and reddish brown mottled, soft, lenses of silt and laminations of sand (CL) (A-6)	FINE ALLUVIUM	3	M	SS	12	32				
11											
	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'									
BORING COMPLETED: 11/16/24									
DR:	LG:	Rig:							

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-049 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
								WC	DEN	LL	PL	%-#200
1	LEAN CLAY, trace roots, brown (CL) (A-6) (tilled field)		FINE ALLUVIUM OR FILL	7	M		12					
2	LEAN CLAY, dark brown, firm (CL) (A-6)		TOPSOIL									
3	LEAN CLAY, brown, firm (CL) (A-6)		FINE ALLUVIUM									
4				8	M		14					
5	FAT CLAY, grayish brown and brown mottled, firm (CH) (A-7-6)											
6	SILT, brown, moist, loose (ML) (A-4)											
7				11	M		12					
8	SANDY SILT, brown, moist, medium dense to loose (ML) (A-4)											
9												
10				9	M		12					
11	END OF BORING											

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-9½'		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
								None
BORING COMPLETED: 5/17/24								
DR:	LG:	Rig:						

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900					LOG OF BORING NO. B-050 (p. 1 of 1)				
PROJECT: Sioux City Gateway Airport; Sioux City, IA									
SURFACE ELEVATION: _____			LATITUDE: _____			LONGITUDE: _____			

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
	8.5" Concrete pavement	FILL									
1	SILT, dark brown, moist, loose, lenses of lean clay (ML) (A-4)	FINE ALLUVIUM	9	M	SS	18					
2	SILT, brown, moist, very loose (ML) (A-4)		4	M	SS	14					
3											
4	LEAN CLAY, brown, soft (CL) (A-6)		4	M	SS	16					
5			3	M	SS	12					
6											
7											
8											
9	FAT CLAY, gray and brown mottled, firm, lenses of lean clay (CH) (A-7-6)		5	M	SS	12					
10											
11	END OF BORING										

DEPTH: 0-9½'		DRILLING METHOD: 2.25" HSA		WATER LEVEL MEASUREMENTS					NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/16/24		11.0	9.5			None	
		5/16/24		11.0		9.0		None	
BORING COMPLETED: 5/16/24									
DR: BK LG: AK Rig: 4									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900				LOG OF BORING NO. B-051 (p. 1 of 1)											
PROJECT: Sioux City Gateway Airport; Sioux City, IA															
SURFACE ELEVATION: _____				LATITUDE: _____				LONGITUDE: _____							
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS								
							WC	DEN	LL	PL	%-#200				
1	12" Concrete pavement	FILL	8	M		SS	16								
2	8" Base fill, mostly silty sand with gravel, brown (A-2-4)														
3	FILL, mixture of sandy lean clay, silty sand, brown and gray (A-6 and A-4)														
4															
5	LEAN CLAY, brown and gray mottled, firm, lenses of fat clay and laminations of silt (CL) (A-6)	FINE ALLUVIUM	5	M		SS	16								
6															
7															
8															
9															
10															
11	END OF BORING														

DEPTH: 0-9½'		DRILLING METHOD: 2.25" HSA		WATER LEVEL MEASUREMENTS					NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/16/24		11.0	9.5			None	
		5/16/24		11.0		9.0		None	
BORING COMPLETED: 5/16/24									
DR: BK LG: AK Rig: 4									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-052 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly lean clay, gray, grayish brown, trace roots	FILL	7	M	SS	10					
2											
3	FILL, mostly silty sand with gravel, brown (A-2-4)	FINE ALLUVIUM	7	M	SS	12					
4											
5	FAT CLAY, gray, firm, lenses and laminations of lean clay and silt (CH) (A-7-6)										
6											
7											
8			6	M	SS	12					
9											
10			7	M	SS	12					
11											
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-9½'		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
								None	
BORING COMPLETED: 5/14/24									
DR:	LG: Rig:								

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-053 (p. 1 of 1)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
SURFACE ELEVATION: _____		LATITUDE: _____			LONGITUDE: _____						
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	16" Concrete pavement	FILL	20	M	SS	16					
2	7" Base fill, mostly recycled concrete and gravel with a piece of geo fabric, light brown (A-1-b)										
3	FILL, mixture of lean clay, clayey sand and silt with pieces of concrete, brown, gray and light brown		14	M	SS	18					
4											
5			17	M	SS	8					
6											
7											
8	LEAN CLAY, brown, firm (CL) (A-6)	FINE ALLUVIUM	5	M	SS	10					
9											
10				5	M	SS	14				
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-9½'	2.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/16/24		11.0	9.5			None	
		5/16/24		11.0		9.0		None	
BORING COMPLETED: 5/16/24									
DR: BK LG: AK Rig: 4									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-054 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	14' Concrete pavement	FILL									
2	FILL, mostly gravel with silt and sand, brown (A-1-b) (apparent base)										
3	FILL, mixture of fat clay, lean clay and a little silt, gray and brown (A-7-6)		10	M	SS	12					
4											
5			5	M	SS	12					
6											
7											
8			4	M	SS	12					
9	LEAN CLAY, gray and brown mottled, soft, lenses of silty sand (CL) (A-6)	FINE ALLUVIUM									
10	SILTY SAND, fine grained, brown, moist, loose (SM) (A-2-4)	COARSE ALLUVIUM	5	M	SS	8					
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-9½'		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
								None	
BORING COMPLETED: 5/16/24									
DR:	LG:	Rig:							

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-055 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	14" Concrete pavement	FILL									
2	11.5" FILL, mostly gravel with pieces of concrete and a piece of geo fabric, gray and reddish brown			M	SS	12					
3	FILL, mixture of fat clay and lean clay, dark gray, gray and brown (A-7-6)			M	SS	16					
4	FAT CLAY, gray and brown mottled, firm (CH) (A-7-6)	FINE ALLUVIUM									
5			7	M	SS	18					
6											
7											
8			7	M	SS	18					
9	LEAN CLAY, brown and gray mottled, firm (CL) (A-6)										
10			7	M	SS	17					
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'	3.25" HSA	5/15/24		11.0	9.5	11.0		None	
BORING COMPLETED: 5/15/24									
DR: LG: RH Rig: 63									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900				LOG OF BORING NO. B-056 (p. 1 of 1)												
PROJECT: Sioux City Gateway Airport; Sioux City, IA																
SURFACE ELEVATION: _____				LATITUDE: _____				LONGITUDE: _____								
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS									
							WC	DEN	LL	PL	%-#200					
	11.25" Concrete pavement	FILL														
1	FILL, mostly silty sand, brown (A-2-4)															
2	FILL, mostly fat clay, dark gray (A-7-6)			6	M	SS	13									
3	FAT CLAY, gray and brown mottled, firm (CH) (A-7-6)	FINE ALLUVIUM	7	M	SS	17										
4	LEAN CLAY, brownish gray and gray mottled, firm (CL) (A-6)															
5				5	M	SS	18									
6																
7																
8			5	M	SS	15										
9	SANDY SILT, grayish brown, moist, loose (ML) (A-4)															
10			5	M	SS	18										
11	END OF BORING															

DEPTH: 0-9½'		DRILLING METHOD: 3.25" HSA		WATER LEVEL MEASUREMENTS					NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/15/24		11.0	9.5	11.0		None	
BORING COMPLETED: 5/15/24									
DR: _____ LG: RH Rig: 63									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-057 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	13.75" Concrete pavement	FILL	12	M	SS	14					
2	9.25' Base fill, mostly silty sand with gravel, brown (A-1-b)	FINE ALLUVIUM	9	M	SS	18					
3	FAT CLAY, gray to grayish brown, stiff to firm (CH) (A-7-6)										
4											
5											
6											
7											
8											
9											
10											
11	END OF BORING										
DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG		
0-9½' 2.25" HSA		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL			
		5/16/24		11.0	9.5			None			
		5/16/24		11.0		9.0		None			
BORING COMPLETED: 5/16/24											
DR: BK LG: AK Rig: 4											

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-058 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	12.5" Concrete pavement	FILL									
2	FILL, mostly silty sand with a little gravel and pieces of concrete, brown (A-2-4)		12	M	SS	12					
3	FAT CLAY, gray and brown mottled, stiff to firm (CH) (A-7-6)	FINE ALLUVIUM	9	M	SS	18					
4											
5			8	M	SS	18					
6											
7											
8			8	M	SS	18					
9											
10											
11	END OF BORING		7	M	SS	18					

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'	3.25" HSA	5/15/24		11.0	9.5	11.0		None	
BORING COMPLETED: 5/15/24									
DR: LG: RH Rig: 63									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-059 (p. 1 of 1)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
SURFACE ELEVATION: _____		LATITUDE: _____			LONGITUDE: _____						
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	6" Concrete pavement	FILL									
2	FILL, mostly silty sand, brown, possible waterbearing in fill at about 1.5' (A-2-4)										
3			12	M	SS	10					
4	LEAN CLAY, gray and brown mottled, stiff (CL) (A-6)	FINE ALLUVIUM									
5			9	M	SS	12					
6											
7	FAT CLAY, gray, firm (CH/CL) (A-7-6)		8	M	SS	14					
8											
9											
10	LEAN CLAY, grayish brown, firm (CL) (A-6)		7	M	SS	8					
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
0-9½'		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
		5/16/24		2.0	0.0	2.0			1.8
		5/16/24		2.0	0.0	2.0			1.7
BORING COMPLETED: 5/16/24									
DR: LG: Rig:									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-060 (p. 1 of 1)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
SURFACE ELEVATION: _____		LATITUDE: _____				LONGITUDE: _____					
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	13" Concrete pavement	FILL									
2	10" Fill, mostly silty sand with a little lean clay and gravel, brown and a little gray (A-2-4)	FINE ALLUVIUM OR FILL	3	M	SS	13					
3	FAT CLAY, gray, firm (CH) (A-7-6) (may be fill)		7	M	SS	16					
4	FAT CLAY, brown mottled, firm (CH) (A-7-6)	FINE ALLUVIUM									
5			6	M	SS	8					
6											
7	LEAN CLAY, brown and gray mottled, firm, lenses of wet silt at about 10.3' (CL) (A-6)		5	M	SS	18					
8											
9											
10			4	M	SS						
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
0-9½'	3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
									None
BORING COMPLETED: 5/15/24									
DR: LG: RH Rig: 63									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-061 (p. 1 of 1)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
SURFACE ELEVATION: _____		LATITUDE: _____			LONGITUDE: _____						
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	Concrete pavement	FILL									
2	6" Apparent base, gravel with sand and silt, brown and reddish brown (A-1-a)										
3	FILL, mostly fat clay, dark gray to grayish brown (A-7-6)		7	M	SS	14					
4											
5	FAT CLAY, gray and brown mottled, stiff (CH) (A-7-6)	FINE ALLUVIUM	9	M	SS	14					
6											
7											
8	LEAN CLAY, gray and brown mottled, firm, lens of silt (CL) (A-6)		6	M	SS	12					
9											
10	SILT, gray and brown mottled, moist to waterbearing, very loose, lenses of waterbearing sand below about 10' (ML) (A-4)		3	M/W	SS	16					
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
0-9½'		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
									None
BORING COMPLETED: 5/16/24									
DR:	LG:	Rig:							

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-062 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	14.5" Concrete pavement	FILL									
2	10" Base fill, mostly silty sand with gravel, brown (A-1-b)	FINE ALLUVIUM	18	M	SS	12					
3	FAT CLAY, gray and brown mottled, stiff to firm (CH) (A-7-6)		9	M	SS	17					
4											
5			7	M	SS	18					
6											
7											
8			7	M	SS	17					
9											
10	SILT, brown, moist, loose (ML) (A-4)		7	M	SS	17					
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'	3.25" HSA	5/15/24		11.0	9.5	11.0		None	
BORING COMPLETED: 5/15/24									
DR: LG: RH Rig: 63									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-063 (p. 1 of 1)										
PROJECT: Sioux City Gateway Airport; Sioux City, IA												
SURFACE ELEVATION: _____		LATITUDE: _____			LONGITUDE: _____							
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	LL	PL	%-#200	
1	FILL, mostly lean clay with sand, a little gravel, trace roots, grayish brown (A-6)	FILL	11	M		SS	18					
2			4	M		SS	10					
3												
4												
5	LEAN CLAY, brown and gray mottled, soft (CL) (A-6)		2	M		SS	8					
6												
7	LEAN CLAY, brown and gray mottled, soft (CL/CH) (A-7-6)		3	M		SS	18					
8												
9	SANDY SILT, brown, moist to wet, loose (ML) (A-4)		5	M/W		SS	18					
10												
11	END OF BORING											

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-9½'	2.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/16/24		11.0	9.5			None	
		5/16/24		11.0		9.0		None	
		BORING COMPLETED: 5/16/24							
DR: BK LG: AK Rig: 4									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-064 (p. 1 of 1)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
SURFACE ELEVATION: _____		LATITUDE: _____			LONGITUDE: _____						
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly lean clay with sand, trace roots, dark brown and brown (A-6)	FILL	9	M	SS	16					
2											
3											
4	LEAN CLAY, brown and a little reddish brown, soft (CL) (A-6)	FINE ALLUVIUM									
5											
6											
7											
8	SILTY SAND, fine grained, brown, moist to waterbearing, loose, lenses of silt (SM) (A-2-4)	COARSE ALLUVIUM	6	M	SS	18					
9	SILT, brown and reddish brown mottled, moist, very loose, lenses of lean clay (ML) (A-4)	FINE ALLUVIUM									
10											
11											
END OF BORING											

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-9½'	2.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/16/24		11.0	9.5			None	
		5/16/24		11.0		9.0		None	
BORING COMPLETED: 5/16/24									
DR: BK LG: AK Rig: 4									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-065 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly sandy lean clay with gravel, brown	FILL		M	SS						
2	FILL, mostly sand, cement, light gray										
3	LEAN CLAY, brown, firm, lenses of fat clay and silt (CL) (A-6)	FINE ALLUVIUM	5	M	SS	16					
4											
5			4	M	SS	16					
6											
7	SAND, fine grained, brown, moist, medium dense (SP) (A-3)	COARSE ALLUVIUM	11	M	SS	16					
8											
9	SANDY SILT, brown, wet below about 10', very loose (ML) (A-4)	MIXED ALLUVIUM	2	M	SS	18					
10											
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'	3.25" HSA	5/15/24		9.5		11.0		Wet	
BORING COMPLETED: 5/15/24									
DR: LG: RH Rig: 63									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-066 (p. 1 of 1)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
SURFACE ELEVATION: _____		LATITUDE: _____			LONGITUDE: _____						
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	SILTY SAND, trace roots, fine grained, brown, medium dense (SM) (A-2-4)	COARSE ALLUVIUM OR FILL	14	M	SS	14					
2											
3											
4	LEAN CLAY, grayish brown and brown mottled, firm, lenses of silt and sand (CL) (A-6)	FINE ALLUVIUM	5	M	SS	14					
5											
6											
7	SILTY SAND, fine grained, brown, moist, loose (SM) (A-2-4)	COARSE ALLUVIUM	5	M	SS	12					
8											
9											
10	SAND, fine grained, brown, moist, medium dense (SP) (A-3)		21	M	SS	6					
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
0-9½'		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
									None
BORING COMPLETED: 5/16/24									
DR:	LG:	Rig:							

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-067 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	SILT (ML)	TOPSOIL									
2	SAND, fine grained, light brown, moist, loose (SP) (A-3)	FINE ALLUVIUM									
3		COARSE ALLUVIUM	5	M	SS	18					
4											
5	SANDY SILT, brown, moist, very loose, lenses of sand and a lamination of lean clay (ML) (A-4)	FINE ALLUVIUM	2	M	SS	16	23				
6											
7											
8	SAND, fine grained, light brown, moist, loose, lenses of silt and laminations of lean clay (SP) (A-3)	COARSE ALLUVIUM	7	M	SS	14					
9											
10			9	M	SS	17					
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'	3.25" HSA	11/15/24						None	
BORING COMPLETED: 11/15/24									
DR: CF LG: MH Rig: 68C									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-068 (p. 1 of 1)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
SURFACE ELEVATION: _____		LATITUDE: _____			LONGITUDE: _____						
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	SILT WITH SAND, trace roots, brown, very loose (ML) (A-4)	FINE ALLUVIUM	3	M	SS	2					
2											
3											
4	FAT CLAY, gray and reddish brown mottled, soft (CH) (A-7-6)										
5											
6	SAND, fine grained, brown, moist, very loose to loose, laminations of lean clay (SP) (A-3)	COARSE ALLUVIUM	3	M	SS	18					
7											
8											
9											
10											
11	END OF BORING										

DEPTH: 0-9½'		DRILLING METHOD: 3.25" HSA		WATER LEVEL MEASUREMENTS					NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/15/24		11.0	9.5	11.0		None	
BORING COMPLETED: 5/15/24									
DR: LG: RH Rig: 63									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-069 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly silty sand, trace roots, brown (A-2-4)	FILL									
2											
3			16	M	SS	14					
4	LEAN CLAY, gray and brown mottled, stiff to firm, laminations of silty sand (CL) (A-6) (may be fill)	FINE ALLUVIUM									
5			5	M	SS	16					
6											
7	SILTY SAND, fine grained, brown, moist, very loose (SM) (A-2-4)	COARSE ALLUVIUM									
8			4	M	SS	16					
9											
10	SAND WITH SILT, fine grained, brown, moist, very loose with lenses and laminations of silt and silty sand (SP-SM) (A-3)										
11	SILTY SAND, fine grained, brown and gray mottled, moist, very loose with laminations of silt (SM) (A-2-4)		4	M	SS	16					
	END OF BORING										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL		
0-9½'								None		
BORING COMPLETED: 5/17/24										
DR: _____ LG: _____ Rig: _____										

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-070 (p. 1 of 1)										
PROJECT: Sioux City Gateway Airport; Sioux City, IA												
SURFACE ELEVATION: _____		LATITUDE: _____				LONGITUDE: _____						
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	LL	PL	%-#200	
1	SANDY SILT, trace roots, brown, moist (ML/SM) (A-4)	FINE ALLUVIUM		M								
2	SANDY SILT, brown, moist, loose, lenses of lean clay and laminations of silt (ML/SM) (A-4)			M		SS	18					
3			6									
4												
5			9	M				SS	18			
6												
7												
8			5	M	SS	18						
9												
10	SAND, fine grained, brown, moist, very loose (SP) (A-3)	COARSE ALLUVIUM	4	M	SS	18						
11	END OF BORING											

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
0-9½'		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
									None
BORING COMPLETED: 5/17/24									
DR: LG: Rig:									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-071 (p. 1 of 1)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
SURFACE ELEVATION: _____		LATITUDE: _____			LONGITUDE: _____						
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	SILT (ML) SILT (ML)	TOPSOIL FINE ALLUVIUM									
2	SAND, fine grained, light brown, moist, loose, lenses of silty sand and silty clay (SP) (A-3)	COARSE ALLUVIUM	5	M	SS	16					
3											
4											
5											
6											
7	SAND, fine grained, light brown, moist, medium dense (SP) (A-3)		14	M	SS	18					
8											
9											
10											
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
0-9½'	3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
		11/15/24							None
BORING COMPLETED: 11/15/24									
DR: CF LG: MH Rig: 68C									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-072 (p. 1 of 1)										
PROJECT: Sioux City Gateway Airport; Sioux City, IA												
SURFACE ELEVATION: _____		LATITUDE: _____				LONGITUDE: _____						
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	LL	PL	%-#200	
1	FILL, mixture of lean clay and silt, trace roots, brown (A-6)	FILL OR FINE ALLUVIUM		M								
2	SANDY SILT, brown, moist, very loose, lenses of lean clay (ML) (A-4)	FINE ALLUVIUM	4	M		SS	18					
3												
4												
5	SILT, light brown, moist, loose (ML) (A-4)		7	M		SS	18					
6												
7	SILTY SAND, fine grained, brown, moist, loose (SM) (A-2-4)	COARSE ALLUVIUM	4	M		SS	18					
8												
9	SAND WITH SILT, fine grained, brown, moist, loose (A-3)		5	M		SS	18					
10												
11	END OF BORING											

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
0-9½'		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
									None
BORING COMPLETED: 5/17/24									
DR:	LG:	Rig:							

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-073 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	LEAN CLAY, trace roots, grayish brown (CL) (A-6)	FINE ALLUVIUM	12	M							
2	LEAN CLAY, grayish brown, stiff, lenses and laminations of silt and sandy silt (CL) (A-6)			M	SS	16					
3	SILT, brown, moist, loose, lenses of sandy silt (ML) (A-4)			M	SS	14					
4		COARSE ALLUVIUM	5	M	SS	14					
5				M	SS	12					
6				M	SS	12					
7	SAND, fine grained, light brown, moist, loose (SP) (A-3)			M	SS	16					
8			9	M	SS	12					
9				M	SS	16					
10			7	M	SS	16					
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'								None	
BORING COMPLETED: 5/12/24									
DR: LG: Rig:									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-074 (p. 1 of 2)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

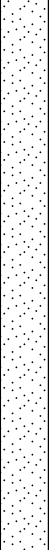
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
	SILT	TOPSOIL									
1	SILT, brown, moist, loose, lenses of silty sand and a lens of silty clay (ML) A-4	FINE ALLUVIUM OR MIXED ALLUVIUM		M							
2											
3			6	M	SS	18					
4											
5	SAND, fine grained, light brown, moist, medium dense (SP) A-3	COARSE ALLUVIUM	18	M	SS	16					
6											
7	SAND, fine grained, light brown and brown mottled, moist, very loose, laminations of silt (SP) A-3		4	M	SS	15					
8											
9											
10			4	M	SS	15					
11	SAND, fine grained, light brown, moist, loose to medium dense (SP) A-3										
12			7	M	SS	15					
13											
14			14	M	SS	15					
15	SAND, fine to medium grained, brown, moist to about 19½' then waterbearing, medium dense to loose (SP) A-3										
16											
17											
18											
19											
20			13	W	SS	15					
21											

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG		
0-29½'	3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL			
		11/25/24	2:09	19.5	21.0			19.5			
BORING COMPLETED: 11/25/24											
DR: CF LG: MH Rig: 68C											

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-074 (p. 2 of 2)										
PROJECT: Sioux City Gateway Airport; Sioux City, IA												
LATITUDE: _____		LONGITUDE: _____										
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	LL	PL	%-#200	
23	SAND, fine to medium grained, brown, moist to about 19½' then waterbearing, medium dense to loose (SP) A-3 (continued)		6	W		SS	16					
24												
25												
26												
27												
28												
29						SS	17					
30												
31												
END OF BORING												

AET_CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-075 (p. 1 of 2)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly lean clay, brown and light brown (A-6)	FILL	8	M	SS	23	18				
2	SANDY SILT, trace roots, light brown, moist, loose (ML) (A-4)	COARSE ALLUVIUM									
3	SILTY SAND, fine grained, light brown, moist, loose (SM) (A-2-4)		5	M	SS	18					
4											
5	LEAN CLAY, grayish brown and reddish brown mottled, soft, lenses of sandy silt (CL/CH) (A-7-6)	FINE ALLUVIUM	4	M	SS	16	36				
6											
7											
8			3	M	SS	16	39				
9											
10	LEAN CLAY, gray, soft, lenses of sandy silt (CL/CH) (A-7-6)		2	M	SS	15	52				
11											
12	SILT, gray, wet, very loose, lenses of silty clay (ML) (A-4)		2	M	SS	15	32				
13											
14											
15	SAND, fine grained, light brown, moist to about 20' then waterbearing, loose to very loose to loose (SP) (A-3)	COARSE ALLUVIUM	7	M	SS	15					
16											
17											
18											
19											
20			9	M/W	SS	16					
21											

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-29½'	3.25" HSA	11/14/24	10:48	26.0	24.5			22.0	
BORING COMPLETED: 11/14/24									
DR: CF LG: MH Rig: 68C									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-075 (p. 2 of 2)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
LATITUDE: _____		LONGITUDE: _____									
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
23	SAND, fine grained, light brown, moist to about 20' then waterbearing, loose to very loose to loose (SP) (A-3) (continued)	COARSE ALLUVIUM (continued)	4	W	SS	16					
24											
25											
26											
27											
28											
29	END OF BORING										
30											
31											

AET_CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-076 (p. 1 of 2)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly lean clay, trace roots, brown and light brown (A-6)	FILL	5	M	SS	20	11				
2	SANDY SILT, trace roots, brown, moist, loose, lenses of silt (ML) (A-4)	FINE ALLUVIUM	2	M	SS	16	17				
3											
4											
5	SAND, fine grained, light brown, moist, loose to medium dense, a lens of sandy silt and fat clay at about 12½' (SP) (A-3)	COARSE ALLUVIUM	2	M	SS	18					
6											
7											
8			5	M	SS	18					
9											
10											
11											
12											
13				M	SS						
14											
15			14	M	SS	17					
16											
17											
18	SILTY SAND, a little gravel, fine grained, brown, moist, medium dense (SM) (A-2-4)										
19											
20			14	M	SS	6					
21											

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-29½'	3.25" HSA	11/14/24	1:40	26.0	24.5			23.0	
BORING COMPLETED: 11/14/24									
DR: CF LG: MH Rig: 68C									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-076 (p. 2 of 2)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
LATITUDE: _____		LONGITUDE: _____									
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
23	SILTY SAND, a little gravel, fine grained, brown, moist, medium dense (SM) (A-2-4) (continued)										
24	SAND WITH SILT, trace organics, fine grained, gray, waterbearing, very loose to loose (SP-SM) (A-3)										
25			2	W	SS	16					
26											
27											
28											
29											
30			7	W	SS	19					
31	END OF BORING										

AET_CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-077 (p. 1 of 2)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
		TOPSOIL									
1	LEAN CLAY, trace roots, brown, stiff (CL) (A-6)	FINE ALLUVIUM	11	M	SS	22	7				
2	SILT, brown, moist, loose (ML) (A-4)	COARSE ALLUVIUM									
3	SAND, fine grained, light brown, moist to about 23' then waterbearing, medium dense to very loose, a lens of gray silty sand with trace organics at about 30' (SP) (A-3)		14	M	SS	18					
4											
5			17	M	SS	17					
6											
7											
8			16	M	SS	18					
9											
10			18	M	SS	18					
11											
12											
13			23	M	SS	18					
14											
15			11	M	SS	16					
16											
17											
18											
19											
20			17	M	SS	18					
21											

DEPTH: 0-29½'	DRILLING METHOD: 3.25" HSA	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG		
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL			
		11/14/24	2:43	26.0	24.5			23.0			
BORING COMPLETED: 11/14/24											
DR: CF LG: MH Rig: 68C											

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-077 (p. 2 of 2)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
LATITUDE: _____		LONGITUDE: _____									
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
23	SAND, fine grained, light brown, moist to about 23' then waterbearing, medium dense to very loose, a lens of gray silty sand with trace organics at about 30' (SP) (A-3) (continued)	COARSE ALLUVIUM (continued)									
24											
25			4	W	SS	16					
26											
27											
28											
29											
30			7	W	SS	16					
31	END OF BORING										

AET_CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-078 (p. 1 of 2)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
								WC	DEN	LL	PL	%-#200
1					M							
2	SILTY CLAY, trace roots, brown, firm, laminations of fine sand (CL-ML) (A-4) SILT, brown and reddish brown mottled, moist, loose (ML) (A-4)		FINE ALLUVIUM	5	M		18	29				
3												
4												
5	SAND, fine grained, light brown, moist, loose to medium dense, a lamination of lean clay at about 15' (SP) (A-3)		COARSE ALLUVIUM	8	M		18					
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-29½'	3.25" HSA	11/14/24	4:06	26.0	24.5			24.0	
BORING COMPLETED: 11/14/24									
DR: CF LG: MH Rig: 68C									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-078 (p. 2 of 2)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
LATITUDE: _____		LONGITUDE: _____									
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
23	SAND, fine grained, light brown, moist, loose to medium dense, a lamination of lean clay at about 15' (SP) (A-3) <i>(continued)</i>	COARSE ALLUVIUM <i>(continued)</i>									
24											
25											
26											
27											
28	SILTY SAND, trace roots and organics, fine grained, gray, waterbearing, loose (SM) (A-2-4)		5	W		SS	18				
29											
30											
31											
30	SAND, fine grained, light brown, waterbearing, loose (SP) (A-3)		6	W		SS	16				
31											
END OF BORING											

AET_CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-079 (p. 1 of 2)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	SILT (ML)	TOPSOIL									
2		FINE ALLUVIUM		M							
3	SILTY SAND, fine grained, light brown, moist, loose (SM) (A-2-4)	COARSE ALLUVIUM	5	M	SS	18					
4											
5	SILT, trace roots, brown, moist, loose (ML) (A-4)	FINE ALLUVIUM	6	M	SS	17	28				
6											
7	SAND, fine grained, light brown, moist, loose to medium dense (SP) (A-3)	COARSE ALLUVIUM	7	M	SS	17					
8											
9											
10			25	M	SS	18					
11											
12											
13			21	M	SS	18					
14											
15			13	M	SS	17					
16											
17											
18											
19											
20			11	M	SS	16					
21											

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-29½'	3.25" HSA	11/14/24	4:55	26.0	24.5			24.0	
BORING COMPLETED: 11/14/24									
DR: CF LG: MH Rig: 68C									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-079 (p. 2 of 2)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
23	SAND, fine grained, light brown, moist, loose to medium dense (SP) (A-3) (continued)	COARSE ALLUVIUM (continued)									
24											
25	SAND, fine grained, light brown, waterbearing, loose, lenses of gray, fat clay and lean clay (SP) (A-3 and A-7-6)		9	W	SS	12					
26											
27	SAND, a little gravel, trace roots, fine to medium grained, gray, waterbearing, loose (SP) (A-3)										
28											
29											
30			9	W	SS						
31	END OF BORING										

AET_CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-080 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	SILT	TOPSOIL									
2		FINE ALLUVIUM		M							
3	SANDY SILT, brown, moist, medium dense, lenses of silty sand and laminations of lean clay (ML) A-4	FINE ALLUVIUM OR MIXED ALLUVIUM	12	M	SS	17					
4											
5	LEAN CLAY, gray, firm, laminations of silt and fat clay (CL) A-7-6	FINE ALLUVIUM	8	M	SS	10	33				
6											
7	SILT WITH SAND, brown, moist, medium dense (ML) A-4										
8			11	M	SS	16					
9	SAND, fine grained, light brown, moist, loose to medium dense, laminations of silt, silty sand and lean clay (SP) A-6	COARSE ALLUVIUM									
10			6	M	SS	15					
11											
12											
13			14	M	SS	16					
14											
15			9	M	SS	15					
16											
17											
18											
19											
20			16	M	SS	15					
21	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-19½'	3.25" HSA								
BORING COMPLETED: 11/25/24									
DR: CF LG: MH Rig: 68C									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-081 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	SILT	TOPSOIL OR FILL		M							
2	SANDY LEAN CLAY, brown mottled, stiff, lenses of fine sand (CL) A-6	FINE ALLUVIUM OR FILL									
3		MIXED ALLUVIUM OR FILL	12	M	SS	18					
4											
5	LEAN CLAY, brown and grayish brown mottled, firm, lenses of fat clay (CL) A-7-6	FINE ALLUVIUM	6	M	SS	18	26				
6											
7	SILT, brown and gray mottled, moist, very loose, lenses of lean clay (ML) A-4										
8			3	M	SS	16					
9											
10	SAND, fine grained, light brown and brown mottled, moist, loose to medium dense, a lamination of lean clay at about 14½' and a lamination of silt at about 20' (SP) A-3	COARSE ALLUVIUM	8	M	SS	18					
11											
12											
13			13	M	SS	17					
14											
15			12	M	SS	17					
16											
17											
18											
19											
20											
21	END OF BORING		7	M	SS						

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-19½'	3.25" HSA							None	
BORING COMPLETED: 11/25/24									
DR: CF LG: MH Rig: 68C									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-082 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	SILTY SAND, trace roots, brown (A-2-4)	FILL	4	M	SS	18					
2											
3				M							
4											
5	SILTY SAND, fine grained, brown, moist, very loose to loose, lens of silt (SM) (A-2-4)	COARSE ALLUVIUM	4	M	SS	18					
6											
7	SAND, fine grained, brown, moist, loose (SP) (A-3)		9	M	SS	18					
8											
9											
10				M							
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-9½'		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
								None	
BORING COMPLETED: 5/17/24									
DR:	LG:	Rig:							

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-083 (p. 1 of 1)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
SURFACE ELEVATION: _____		LATITUDE: _____			LONGITUDE: _____						
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mixture of silty sand, lean clay, a little fat clay, brown and a little gray (A-2-4)	FILL		M	SS	19					
2	LEAN CLAY, gray and brown mottled, firm (CL) (A-6)	FINE ALLUVIUM	8	M	SS	18					
3											
4	SILTY SAND, fine grained, brown, moist, medium dense (SM) (A-2-4)	COARSE ALLUVIUM	4	M	SS	18					
5	SAND, fine grained, light brown, moist, loose to medium dense (SP) (A-3)										
6											
7											
8			19	M	SS	15					
9											
10			13	M	SS	18					
11	END OF BORING										
DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG		
0-9½' 3.25" HSA		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL			
								None			
BORING COMPLETED: 5/13/24											
DR: LG: RH Rig: 63											

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900				LOG OF BORING NO. B-084 (p. 1 of 1)											
PROJECT: Sioux City Gateway Airport; Sioux City, IA															
SURFACE ELEVATION: _____				LATITUDE: _____				LONGITUDE: _____							
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS								
							WC	DEN	LL	PL	%-#200				
1	FILL, mostly lean clay with sand, trace roots, brown	FILL	4	M		SS	16								
2	FILL, mostly sand, trace roots, brown (A-3)														
3	FILL, mostly clayey sand, brown (A-6)														
4															
5	FILL, mixture of silt and fat clay, brown and gray (A-4 and A-7-6)														
6		COARSE ALLUVIUM	6	M		SS	14								
7	SILTY SAND, fine grained, brown mottled, moist, loose (SM) (A-2-4)														
8															
9															
10	SAND, fine grained, brown, moist, loose, a lens of lean clay (SP) (A-3)														
11	END OF BORING														

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-9½'	2.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/14/24		11.0	9.5			None	
		5/14/24		11.0		9.0		None	
BORING COMPLETED: 5/14/24									
DR: BK LG: AK Rig: 4									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-085 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
								WC	DEN	LL	PL	%-#200
1	LEAN CLAY, trace roots, grayish brown (CL) (A-6)		FINE ALLUVIUM		M							
2	SANDY SILT, brown, moist, loose, lens of lean clay (ML) (A-4)											
3				9	M	SS	18					
4												
5	SAND, fine grained, light brown, moist, medium dense (SP) (A-3)		COARSE ALLUVIUM	18	M		SS	18				
6												
7												
8				17	M	SS	18					
9												
10												
11				25	M	SS	20					
END OF BORING												

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'								None	
BORING COMPLETED: 5/14/24									
DR: LG: Rig:									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-086 (p. 1 of 1)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
SURFACE ELEVATION: _____		LATITUDE: _____			LONGITUDE: _____						
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	5" Bituminous pavement	FILL		M							
	14" Base fill, mostly sand with silt with gravel, brown (A-2-4)			2	M	SS	18				
2	FILL, mostly sandy lean clay with a little gravel, brown and gray (A-6)			10	M	SS	16				
3	LEAN CLAY WITH SAND, gray and brown mottled, stiff (CL) (A-6)	FINE ALLUVIUM									
4	LEAN CLAY, gray, stiff (CL) (A-6)										
5	SANDY LEAN CLAY, gray and brown mottled, stiff (CL) (A-6)	MIXED ALLUVIUM		M	SS	18					
6											
7	SAND, fine grained, light brown, moist, medium dense (SP) (A-3)	COARSE ALLUVIUM									
8				25	M	SS	18				
9											
10			12	M	SS						
11	END OF BORING										

DEPTH: 0-9½'		DRILLING METHOD: 3.25" HSA		WATER LEVEL MEASUREMENTS					NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/13/24		11.0	9.5	11.0		None	
BORING COMPLETED: 5/13/24									
DR: LG: RH Rig: 63									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-087 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	5" Bituminous pavement	FILL									
	Apparent base, sand with silt and gravel, brown (A-1-b)			M							
2	SILTY SAND, fine grained, brown, moist, medium dense, lenses of silt with sand and laminations of silt (SM) (A-4)	COARSE ALLUVIUM									
3			13	M	SS	14					
4											
5	SAND, fine grained, brown, moist, loose to medium dense, laminations of silty sand (SP) (A-3)		19	M	SS	18					
6											
7											
8			10	M	SS	18					
9											
10											
11			15	M	[	18					
	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'								None	
BORING COMPLETED: 5/14/24									
DR: LG: Rig:									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-088 (p. 1 of 1)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
SURFACE ELEVATION: _____		LATITUDE: _____			LONGITUDE: _____						
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	5.75" Bituminous pavement	FILL	25	M	SS	12					
2	30.25" Base, fill, mostly sand with silt and gravel, brown (A-1-b)										
3	SILTY SAND, fine grained, brown, moist to about 8' then waterbearing, medium dense to loose (SM) (A-2-4)	COARSE ALLUVIUM	11	M	SS	16					
4											
5											
6											
7			13	M	SS	18					
8											
9											
10											
11	SAND, fine grained, brown, moist, loose, lenses of silty sand (SP) (A-3)		10	M	SS	18					
END OF BORING											

DEPTH: 0-9½'		DRILLING METHOD: 2.25" HSA		WATER LEVEL MEASUREMENTS					NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/14/24		11.0	9.5			None	
		5/14/24		11.0		9.0		None	
BORING COMPLETED: 5/14/24									
DR: BK LG: AK Rig: 4									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-089 (p. 1 of 1)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
SURFACE ELEVATION: _____		LATITUDE: _____			LONGITUDE: _____						
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	5" Bituminous pavement	FILL		M							
2	FILL, mostly sand with silt with gravel, brown (A-1-b)		25	M	SS	18					
3	SILTY SAND, fine grained, grayish brown and reddish brown mottled, moist, medium dense (SM) (A-2-4) (may be fill)	COARSE ALLUVIUM OR FILL	13	M	SS	18					
4											
5	SANDY SILT, gray and brown mottled, moist, medium dense (ML) (A-4) (may be fill)	MIXED ALLUVIUM OR FILL	11	M	SS	17					
6											
7	LEAN CLAY, trace roots, brown and gray mottled with a little black, firm (CL) (A-6) (may be fill)	FINE ALLUVIUM OR FILL	8	M	SS	18					
8											
9											
10	SILTY SAND, fine grained, brown, moist, loose (SM) (A-2-4)	COARSE ALLUVIUM	7	M	SS	18					
11	END OF BORING										

DEPTH: 0-9½'		DRILLING METHOD: 3.25" HSA		WATER LEVEL MEASUREMENTS					NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/13/24		11.0	9.5	11.0		None	
BORING COMPLETED: 5/13/24									
DR: LG: RH Rig: 63									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900				LOG OF BORING NO. B-090 (p. 1 of 1)			
PROJECT: Sioux City Gateway Airport; Sioux City, IA							
SURFACE ELEVATION: _____		LATITUDE: _____		LONGITUDE: _____			

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mixture of silty sand and lean clay, trace roots, brown (A-2-4 and A-6)	FILL	5	M	SS	18					
2	SILTY SAND, fine grained, brown, moist, loose (SM) (A-2-4)	COARSE ALLUVIUM	6	M	SS	16					
3											
4											
5											
6	SAND, fine grained, brown, moist, loose, laminations of lean clay (SP) (A-3)		8	M	SS	18					
7											
8											
9											
10			10	M	SS	16					
11											
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
0-9½'	2.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
		5/14/24		11.0	9.5				None
		5/14/24		11.0		9.0			None
BORING COMPLETED: 5/14/24									
DR: BK LG: AK Rig: 4									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-091 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS						
							WC	DEN	LL	PL	%-#200		
1	FILL, mixture of silty sand, sandy lean clay, silt and fat clay, brown and gray (A-2-4 and A-6)	FILL	4	M		SS	19						
2													
3					11	M		SS	18				
4	SAND, fine grained, light brown, moist, loose to medium dense (SP) (A-3)												
5					17	M		SS	18				
6													
7													
8					9	M		SS	18				
9													
10					13	M		SS	18				
11	END OF BORING												

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
0-9½'	3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL		
				11.0	9.5	11.0		None		
BORING COMPLETED:										
DR: LG: Rig:										

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-092 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	SILTY SAND, fine grained, brown, moist, loose (SM) (A-2-4)	COARSE ALLUVIUM	5	M	SS	20					
2											
3			8	M	SS	18					
4	SAND, fine grained, light brown, moist, loose to medium dense (SP) (A-3)	COARSE ALLUVIUM									
5			17	M	SS	18					
6											
7											
8			5	M	SS	18					
9											
10											
11			11	M	SS	18					
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'	3.25" HSA	5/15/24		11.0	9.5	11.0		None	
BORING COMPLETED: 5/15/24									
DR: LG: TA Rig: 63									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-093 (p. 1 of 1)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
SURFACE ELEVATION: _____		LATITUDE: _____			LONGITUDE: _____						
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly sandy silt, brown (A-4)	FILL	5	M	SS	16					
2											
3											
4											
5	SAND, fine grained, light brown, moist, medium dense (SP) (A-3)	COARSE ALLUVIUM	12	M	SS	16					
6											
7											
8											
9											
10											
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-9½'	2.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/16/24		11.0	9.5			None	
		5/16/24		11.0		9.0		None	
BORING COMPLETED: 5/16/24									
DR: BK LG: AK Rig: 4									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-094 (p. 1 of 1)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
SURFACE ELEVATION: _____		LATITUDE: _____			LONGITUDE: _____						
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly sandy silt, brown (A-4)	FILL	4	M	SS	18					
2	LEAN CLAY, brown, soft (CL) (A-6)	FINE ALLUVIUM									
3	SAND, fine grained, light brown, moist, loose (SP) (A-3)	COARSE ALLUVIUM	6	M	SS	16					
4											
5											
6											
7	SAND WITH SILT, fine grained, light brown, moist, loose (SP-SM) (A-3)		6	M	SS	16					
8											
9	SILT, brown, moist, loose, laminations of sand (ML) (A-4)	FINE ALLUVIUM	6	M	SS	16					
10											
11	END OF BORING										

DEPTH: 0-9½'		DRILLING METHOD: 2.25" HSA		WATER LEVEL MEASUREMENTS					NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/16/24		11.0	9.5			None	
		5/16/24		11.0		9.0		None	
BORING COMPLETED: 5/16/24									
DR: BK LG: AK Rig: 4									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-095 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	LL	PL	%-#200	
1	FILL, mostly silty sand with gravel and pieces of concrete, brown (A-1-b) SILT, brown, moist, loose, laminations of lean clay and fine sand (ML) (A-4)	FILL	13	M		SS	18					
2		FINE ALLUVIUM										
3												
4		6	M		SS	13						
5												
6												
7	5	M		SS	14							
8												
9												
10	5	M		SS	16							
11												
12												
13	4	M		SS	12							
14												
15												
16	END OF BORING											
DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG			
0-9½' 2.25" HSA		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL				
		5/16/24		11.0	9.5			None				
		5/16/24		11.0		9.0		None				
BORING COMPLETED: 5/16/24												
DR: BK LG: AK Rig: 4												

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-096 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION			GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
									WC	DEN	LL	PL	%-#200	
1	SILT, trace roots, brown, loose (ML/CL) (A-4)			FINE ALLUVIUM	8	M		SS	21					
2	SILT, brown, moist, very loose, lenses of silty sand (ML) (A-4)				4	M		SS	18					
3														
4														
5						5	M		SS	18				
6	SAND, fine grained, brown, moist, medium dense, a lens of silty sand (SP) (A-3)			COARSE ALLUVIUM										
7								SS	18					
8						15	M							
9														
10						29	M		SS	18				
11	END OF BORING													

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'	3.25" HSA	5/15/24		11.0	9.5	11.0		None	
BORING COMPLETED: 5/15/24									
DR: _____ LG: RH Rig: 63									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-097 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	LEAN CLAY, brown and reddish brown, firm (CL) (A-6)	FINE ALLUVIUM OR FILL		M							
2	SAND, fine grained, light brown, moist, loose (SP) (A-3)										
3		COARSE ALLUVIUM	8	M	SS	16	12				
4											
5			8	M	SS	16					
6											
7											
8			7	M	SS	16					
9											
10			10	M	SS	17					
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'	3.25" HSA	11/15/24						None	
BORING COMPLETED: 11/15/24									
DR: CF LG: MH Rig: 68C									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-098 (p. 1 of 1)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
SURFACE ELEVATION: _____		LATITUDE: _____			LONGITUDE: _____						
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL, mostly silty sand with gravel and pieces of concrete, brown (A-1-b)	FILL	39	M	SS	16					
2											
3			63	M	SS	10					
4											
5	SILTY SAND, fine grained, brown, moist, medium dense to loose (SM) (A-2-4)	COARSE ALLUVIUM	15	M	SS	10					
6											
7											
8			6	M	SS	14					
9	SAND WITH SILT, fine grained, brown, moist, very loose (SP-SM) (A-3)										
10			4	M	SS	14					
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-9½'	2.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		5/16/24		11.0	9.5			None	
		5/16/24		11.0		9.0		None	
BORING COMPLETED: 5/16/24									
DR: BK LG: AK Rig: 4									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-099 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	SILT	TOPSOIL									
2		FINE ALLUVIUM		M							
3	FAT CLAY, trace roots, brown, firm, laminations of silt (CH) A-7-6		7	M	SS	18	31				
4											
5	SAND, fine grained, light brown, moist, loose, a lense of silt at about 4½' (SP) A-3	COARSE ALLUVIUM	10	M	SS	16					
6											
7			7	M	SS	15					
8											
9											
10	SILTY CLAY, brown, firm, lamination of silt (CL/ML)	FINE ALLUVIUM	6	M	SS	15	36				
11	SILTY SAND, fine grained, brown and reddish brown mottled, moist, loose (SM) A-2-4	COARSE ALLUVIUM									
12											
13	SAND, fine grained, light brown and brown mottled, moist, loose to medium dense (SP) A-3		11	M	SS	15					
14											
15			11	M	SS	15					
16											
17											
18											
19	SAND, fine to medium grained, brown, moist to about 20½' then waterbearing, loose (SP) A-3										
20			6		SS						
21	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-19½'	3.25" HSA	11/25/24	11:46	19.5	21.0			20.5	
BORING COMPLETED: 11/25/24									
DR: CF LG: MH Rig: 68C									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-100 (p. 1 of 1)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
SURFACE ELEVATION: _____		LATITUDE: _____			LONGITUDE: _____						
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	SILT, brown mottled, moist, loose, laminations of lean clay (ML) A-4 (possible fill)	TOPSOIL					30				
2		FINE ALLUVIUM OR FILL		M							
3			6	M	SS	18					
4											
5	LEAN CLAY, brown mottled, firm, laminations of silt (CL) A-6	FINE ALLUVIUM	6	▼	SS	18	31				
6											
7	SILTY SAND, fine grained, grayish brown and brown mottled, moist, very loose (SM) A-2-4	COARSE ALLUVIUM OR MIXED ALLUVIUM	4	M	SS	13					
8											
9	SAND WITH SILT, fine grained, brown, moist, very loose (SP-SM) A-3	COARSE ALLUVIUM									
10	SILTY SAND, fine grained, gray, waterbearing, very loose, lenses of silt (SM) A-2-4		3	W	SS	13					
11	END OF BORING										

DEPTH: 0-9½'		DRILLING METHOD: 3.25" HSA		WATER LEVEL MEASUREMENTS					NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		11/25/24	9:39	4.5	6.0			5.5	
BORING COMPLETED: 11/25/24									
DR: CF LG: MH Rig: 68C									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-102 (p. 1 of 2)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1											
2	LEAN CLAY, trace roots, brown and light brown mottled, stiff, laminations of silt (CL) (A-7-6) (possible fill)	FINE ALLUVIUM OR FILL	14	M	SS	12	18				
3											
4											
5	LEAN CLAY, trace roots, brown, light brown and a little reddish brown mottled, firm (CL) (A-7-6)	FINE ALLUVIUM	5	M	SS	12	16				
6											
7											
8	SAND WITH SILT, fine grained, brown, moist, loose, a lens of silty sand (SP-SM) (A-3)	COARSE ALLUVIUM	6	M	SS	10	35				
9											
10											
11	SILTY SAND, fine grained, brown, moist, medium dense (SM) (A-2-4)		10	M	SS	12					
12											
13											
14			13	M	SS	14					
15											
16											
17	SAND, fine grained, light brown, moist, dense to medium dense, a lens of lean clay (SP) (A-3)		38	M	SS	12					
18											
19											
20											
21											

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-24½'									
BORING COMPLETED: 11/15/24									
DR:	LG:	Rig:							

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-102 (p. 2 of 2)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
LATITUDE: _____		LONGITUDE: _____									
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
23	SAND, fine grained, light brown, moist, dense to medium dense, a lens of lean clay (SP) (A-3) <i>(continued)</i>		13	M		16					
24											
25											
26	END OF BORING										

AET_CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-103 (p. 1 of 2)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1											
2	LEAN CLAY, trace roots, brown and grayish brown mottled, very stiff to firm, lenses of fat clay and laminations of silt (CL) (A-7-6) (possible fill)	FINE ALLUVIUM OR FILL	16	M	SS	12	26				
3											
4											
5											
6											
7											
8											
9											
10	SILTY SAND, fine grained, brown, a little reddish brown mottled, moist, loose (SM) (A-2-4)	COARSE ALLUVIUM	5	M	SS	10					
11											
12											
13											
14											
15	SAND WITH SILT, fine grained, brown, moist, medium dense, a lens of silt (SP-SM) (A-3)		27	M	SS	12					
16											
17											
18	SAND, fine grained, light brown, moist, loose (SP) (A-3)		9	M	SS	12					
19											
20											
21											

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-24½'									
BORING COMPLETED: 11/15/24									
DR:	LG:	Rig:							

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24

LOG OF BORING NO. **B-103 (p. 2 of 2)**

LATITUDE: _____												
LONGITUDE: _____												
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	LL	PL	%-#200	
23	SAND, fine grained, light brown, moist, loose (SP) (A-3) <i>(continued)</i>											
24	SAND, fine to medium grained, brown, moist, medium dense, laminations of black silt (SP) (A-3)											
25												
26	END OF BORING			11	M		SS	12				



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-104 (p. 1 of 2)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1											
2	SILTY CLAY, trace roots, brown, soft, lenses of lean clay and silt (CL-ML) (A-4)	FINE ALLUVIUM	4	M	SS	12	27				
3											
4											
5	LEAN CLAY, brown and gray mottled, firm, lenses of silt and silty clay (CL) (A-7-6)		6	M	SS	14	36				
6											
7											
8			6	M	SS	16	28				
9											
10											
11	SANDY SILT, brown mottled, wet, lenses of silt (ML) (A-4)	FINE ALLUVIUM/ MIXED ALLUVIUM	3	M/W	SS	6	30				
12											
13											
14	LEAN CLAY, gray, soft, lenses of silty clay and laminations of silt (CL) (A-6)	FINE ALLUVIUM	2	M	SS	10	41				
15											
16											
17			1	M	SS	12	49				
18											
19											
20	LEAN CLAY, gray, very soft (CL) (A-6)										
21											

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG		
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL			
0-24½'											
BORING COMPLETED: 11/15/24											
DR:	LG:	Rig:									

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-104 (p. 2 of 2)**
 PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
23	LEAN CLAY, gray, very soft (CL) (A-6) <i>(continued)</i>	COARSE ALLUVIUM	18	M	SS	12					
24	SILTY SAND, fine grained, brown, moist, medium dense, lenses of sand and lenses of gray lean clay (SM) (A-2-4)										
25											
26	END OF BORING										

AET_CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-105 (p. 1 of 2)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	FILL	FILL									
2	FILL, mostly lena clay, grayish brown and brown, possible brick at about 7' (A-7-6 and A-6)		7	M	SS	12	31				
3											
4											
5			3	M	SS	8	28				
6											
7											
8	LEAN CLAY, brown and gray mottled, soft to firm, lenses of silt and laminations of fine sand (CL) (A-7-6, A-6 and A-4)	FINE ALLUVIUM	3	M	SS	14	39				
9											
10											
11			5	M	SS	8	28				
12											
13											
14			4	M	SS	10	30				
15											
16											
17			5	M	SS	9	5				
18											
19											
20											
21											

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-24½'									
BORING COMPLETED: 11/15/24									
DR:	LG:	Rig:							

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-105 (p. 2 of 2)**
 PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
23	SILTY SAND, fine grained, brown, moist, medium dense, a lens of silt at about 24.5' (SM) (A-2-4)	FINE ALLUVIUM (continued) COARSE ALLUVIUM	16	M	SS	16					
24											
25											
26	END OF BORING										

AET_CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-106 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	Concrete pavement	FILL									
2	Possible aggregate base										
3	SILTY CLAY WITH SAND, brown, a little reddish brown mottled, very stiff (CL-ML) (A-4) (possible fill)	FINE ALLUVIUM OR FILL	18	M	SS	16	22				
4											
5	SILT, brown, moist, loose (ML) (A-4)	FINE ALLUVIUM	8	M	SS	10	26				
6											
7											
8	LEAN CLAY, brown, a little reddish brown mottled, firm, lenses and laminations of silt and silty clay (CL) (A-7-6)		6	M	SS	18	30				
9											
10			6	M	SS	18	41				
11	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'									
BORING COMPLETED: 11/25/24									
DR:	LG:	Rig:							

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-107 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1											
2	FILL, mostly sandy lean clay, trace roots, brown	FILL									
3	LEAN CLAY, grayish brown and light brown, stiff, lenses and laminations of silt (CL) (A-7-6) (possible fill)		12	M	SS	18	16				
4											
5	LEAN CLAY, grayish brown and light brown mottled, firm, lenses and laminations of silt and silty clay (CL) (A-7-6 and A-4)	FINE ALLUVIUM	7	M	SS	18	33				
6											
7											
8	SILTY SAND, fine grained, brown, moist, medium dense, laminations of silt (SM) (A-2-4)	COARSE ALLUVIUM	11	M	SS	12					
9											
10	SAND, fine grained, light brown, moist, medium dense (SP)		15	M	SS	13					
11											
12											
13											
14											
15			14	M	SS	12					
16											
17											
18											
19											
20			26	M	SS	10					
21	END OF BORING										

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-19½'									
BORING COMPLETED: 11/25/24									
DR:	LG:	Rig:							

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-108 (p. 1 of 1)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION		GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
								WC	DEN	LL	PL	%-#200
1												
2	FILL, mostly lean clay, a little silt, a little gravel and brick, trace roots, brown and light brown (A-7-6 and A-4)		FILL	10	M		SS	14	26			
3												
4												
5												
6												
7	LEAN CLAY, gray and brown mottled, firm to stiff, laminations of silt (CL/CH) (A-7-6)		FINE ALLUVIUM	7	M		SS	16	35			
8												
9												
10												
11												
12	LEAN CLAY, gray and brown mottled, firm, laminations of silt (CL) (A-7-6)			12	M		SS	14	31			
13												
14												
15												
16												
17	LEAN CLAY, gray and brown mottled, firm, laminations of silt (CL) (A-7-6)			6	M		SS	18	37			
18												
19												
20	SILTY SAND, fine grained, grayish brown, moist, medium dense, laminations of sandy silt (SM) (A-2-4)		COARSE ALLUVIUM	12	M		SS	14				
21												
	END OF BORING											

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-19½'									
BORING COMPLETED: 11/25/24									
DR:	LG:	Rig:							

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-109 (p. 1 of 2)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

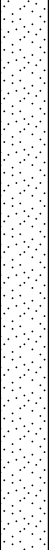
SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	3" SILT SILT, brown, moist, loose, laminations of lean clay (ML) A-4	TOPSOIL FINE ALLUVIUM		M							
2											
3			6	M	SS	18					
4											
5	SANDY SILT, brown, moist, loose (ML/SM) A-4	FINE ALLUVIUM OR MIXED ALLUVIUM	5	M	SS	18					
6											
7	SILT, brown and reddish brown mottled, moist, loose (ML) A-4	FINE ALLUVIUM									
8	SAND, fine grained, light brown, moist, loose (SP) A-3	COARSE ALLUVIUM	7	M	SS	16					
9											
10			5	M	SS	16					
11											
12											
13			7	M	SS	16					
14											
15			8	M	SS	15					
16											
17											
18											
19	SAND, fine to medium grained, brown, moist to about 19½' then waterbearing, loose (SP) A-3										
20											
21			9	W	SS	15					
DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG		
0-29½'	3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL			
								None			
BORING COMPLETED: 11/25/24											
DR: CF LG: MH Rig: 68C											

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-109 (p. 2 of 2)										
PROJECT: Sioux City Gateway Airport; Sioux City, IA												
LATITUDE: _____		LONGITUDE: _____										
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	LL	PL	%-#200	
23	SAND, fine to medium grained, brown, moist to about 19½' then waterbearing, loose (SP) A-3 <i>(continued)</i>		7	W		SS	15					
24												
25												
26												
27												
28												
29						SS	16					
30												
31												
END OF BORING												

AET_CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET+CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-110.1 (p. 1 of 2)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1				M	SS						
2				M	SS						
3	SAND, fine grained, light brown, moist (SP) (A-3)	COARSE ALLUVIUM		M	SS						
4											
5	SILTY SAND, fine grained, brown, moist, a lens of lean clay (SM) (A-2-4)			M	SS						
6											
7											
8	SAND, fine grained, light brown, moist, loose (SP) (A-3)		9	M	SS						
9											
10			9	M	SS						
11	END OF BORING										
DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG		
0-9½'	3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL			
								None			
BORING COMPLETED:											
DR: CF LG: MH Rig: 68C											

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900

LOG OF BORING NO. B-110.1 (p. 2 of 2)

PROJECT: Sioux City Gateway Airport; Sioux City, IA

LATITUDE: LONGITUDE:

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	LL	PL	%-#200	
							20					



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-110.2 (p. 1 of 2)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
1	SILT	TOPSOIL									
2	SILT	FINE ALLUVIUM		M							
3	SAND WITH SILT, fine grained, light brown, moist, loose (SP-SM) A-3	COARSE ALLUVIUM	5	M	SS	18					
4											
5	SILTY SAND, fine grained, brown, moist, very loose, a lense of lean clay (SM) A-2-4		3	M	SS	16					
6											
7											
8	SAND, fine grained, light brown, moist, loose (SP) A-3		9	M	SS	17					
9											
10			9	M	SS	17					
11											
12											
13			8	M	SS	16					
14											
15			7	M	SS	16					
16											
17											
18											
19	SAND, fine to medium grained, light brown, moist to about 21' then waterbearing, medium dense to very loose (SP) A-3										
20											
21			11	M	SS	16					

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-29½'	3.25" HSA	11/25/24	1:15	24.5	26.0			21.0	
BORING COMPLETED: 11/25/24									
DR: CF LG: MH Rig: 68C									

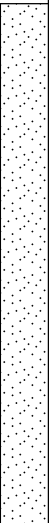
AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-110.2 (p. 2 of 2)**
 PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
23	SAND, fine to medium grained, light brown, moist to about 21' then waterbearing, medium dense to very loose (SP) A-3 (<i>continued</i>)		7	W		SS	15				
24											
25											
26											
27											
28											
29											
30											
31	LEAN CLAY, trace roots, gray, soft (CL) A-7-6		4	W/M		SS	15				
	END OF BORING	FINE ALLUVIUM									

AET_CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: **P-0025900** LOG OF BORING NO. **B-111 (p. 1 of 2)**

PROJECT: **Sioux City Gateway Airport; Sioux City, IA**

SURFACE ELEVATION: _____ LATITUDE: _____ LONGITUDE: _____

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
		TOPSOIL									
1	LEAN CLAY, trace roots, brown, firm (CL) (A-6)	FINE ALLUVIUM OR FILL	6	M	SS	20	18				
2											
3	SANDY SILT, brown, moist, very loose, a lamination of lean clay at about 2.5' (ML) (A-4)	FINE ALLUVIUM	4	M	SS	18	18				
4											
5			3	M	SS	18	23				
6											
7	SAND, fine grained, light brown to brown, moist to about 20' then waterbearing, very loose to medium dense, a piece of wood at about 30' (SP) (A-3)	COARSE ALLUVIUM	6	M	SS	18					
8											
9											
10			5	M	SS	18					
11											
12											
13			11	M	SS	16					
14											
15			5	M	SS	16					
16											
17											
18											
19											
20			15	W	SS	16					
21											

DEPTH: 0-29½'	DRILLING METHOD: 3.25" HSA	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG		
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL			
		11/14/24	11:43	21.0	19.5			21.0			
BORING COMPLETED: 11/14/24											
DR: CF LG: MH Rig: 68C											

AET CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24



SUBSURFACE BORING LOG

AET JOB NO: P-0025900		LOG OF BORING NO. B-111 (p. 2 of 2)									
PROJECT: Sioux City Gateway Airport; Sioux City, IA											
LATITUDE: _____		LONGITUDE: _____									
DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-#200
23	SAND, fine grained, light brown to brown, moist to about 20' then waterbearing, very loose to medium dense, a piece of wood at about 30' (SP) (A-3) (continued)	COARSE ALLUVIUM (continued)	4	W	SS	18					
24											
25											
26											
27											
28											
29											
30											
31											
END OF BORING											

AET_CORP W-LAT-LONG P-0025900 SIOUX CITY GATEWAY AIRPORT.GPJ AET-CPT+WELL.GDT 12/20/24

B-001



B-002



B-006



Coring performed in May 2024



Pavement Core Photographs

Cores B-001, B-002, and B-006

Geotechnical Exploration

Sioux Gateway Airport, Siouxland Nexus Project

Sioux City, IA

Date: 6/21/2024

AET Project P-0025900

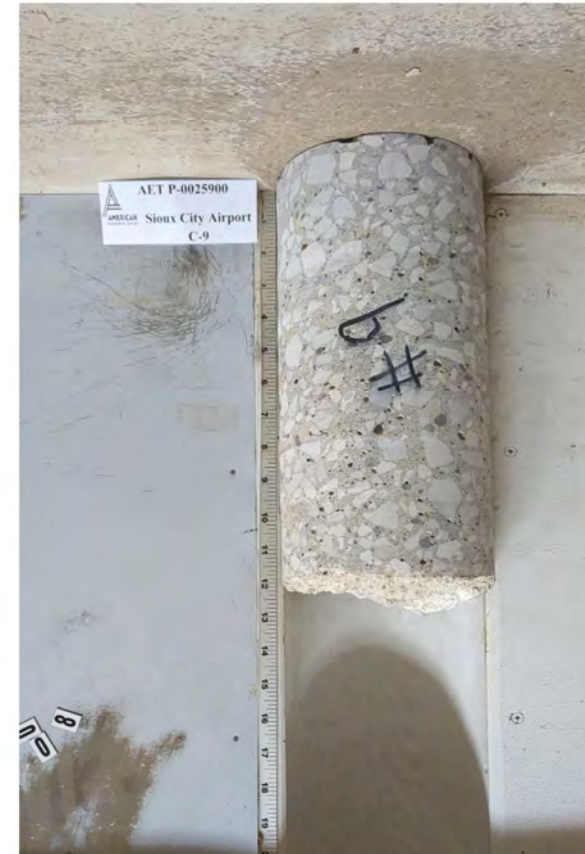
B-007



B-008



B-009



Coring performed in May 2024



Pavement Core Photographs

Cores B-007, B-008, and B-009

Geotechnical Exploration

Sioux Gateway Airport, Siouxland Nexus Project

Sioux City, IA

Date: 6/21/2024

AET Project P-0025900

B-010



B-011



B-012



Coring performed in May 2024



Pavement Core Photographs

Cores B-010, B-011, and B-012

Geotechnical Exploration

Sioux Gateway Airport, Siouxland Nexus Project

Sioux City, IA

Date: 6/21/2024

AET Project P-0025900

B-013



B-014



B-015



Coring performed in May 2024



Pavement Core Photographs

Cores B-013, B-014, and B-015

Geotechnical Exploration

Sioux Gateway Airport, Siouxland Nexus Project

Sioux City, IA

Date: 6/21/2024

AET Project P-0025900

B-016



B-017



B-019



Coring performed in May 2024



Pavement Core Photographs

Cores B-016, B-017, and B-019

Geotechnical Exploration

Sioux Gateway Airport, Siouxland Nexus Project

Sioux City, IA

Date: 6/21/2024

AET Project P-0025900

B-022



B-023



B-024



Coring performed in May 2024



Pavement Core Photographs	
Cores B-022, B-023, and B-024	
Geotechnical Exploration	
Sioux Gateway Airport, Siouxland Nexus Project	
Sioux City, IA	
Date: 6/21/2024	AET Project P-0025900

B-026



B-029



B-030



Coring performed in May 2024



Pavement Core Photographs

Cores B-026, B-029, and B-030

Geotechnical Exploration

Sioux Gateway Airport, Siouxland Nexus Project

Sioux City, IA

Date: 6/21/2024

AET Project P-0025900

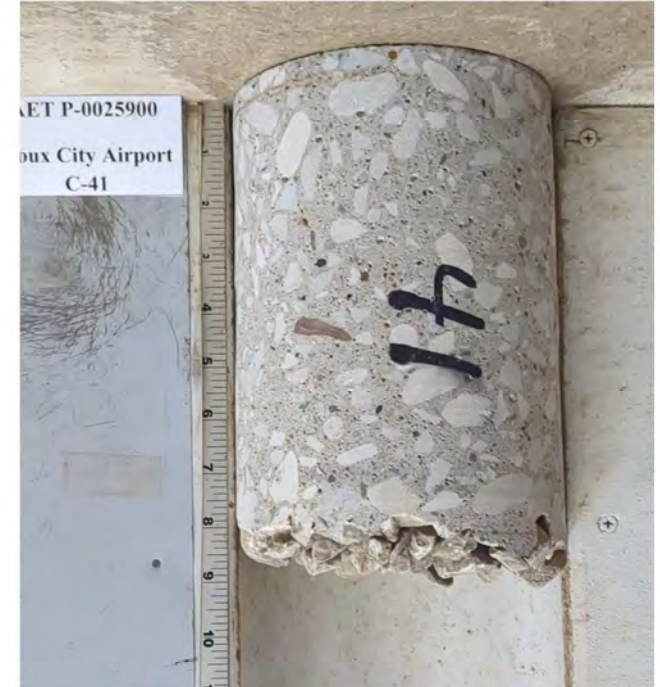
B-032



B-036



B-041



Coring performed in May 2024



Pavement Core Photographs

Cores B-032, B-036, and B-041

Geotechnical Exploration

Sioux Gateway Airport, Siouxland Nexus Project

Sioux City, IA

Date: 6/21/2024

AET Project P-0025900

B-042



B-050



B-051



Coring performed in May 2024



Pavement Core Photographs

Cores B-042, B-050, and B-051

Geotechnical Exploration

Sioux Gateway Airport, Siouxland Nexus Project

Sioux City, IA

Date: 6/21/2024

AET Project P-0025900

B-053



B-054



B-055



Coring performed in May 2024



Pavement Core Photographs

Cores B-053, B-054, and B-055

Geotechnical Exploration

Sioux Gateway Airport, Siouxland Nexus Project

Sioux City, IA

Date: 6/21/2024

AET Project P-0025900

B-056



B-057



B-058



Coring performed in May 2024



Pavement Core Photographs

Cores B-056, B-057, and B-058

Geotechnical Exploration

Sioux Gateway Airport, Siouxland Nexus Project

Sioux City, IA

Date: 6/21/2024

AET Project P-0025900

B-056



B-057



B-058



Coring performed in May 2024



Pavement Core Photographs

Cores B-056, B-057, and B-058

Geotechnical Exploration

Sioux Gateway Airport, Siouxland Nexus Project

Sioux City, IA

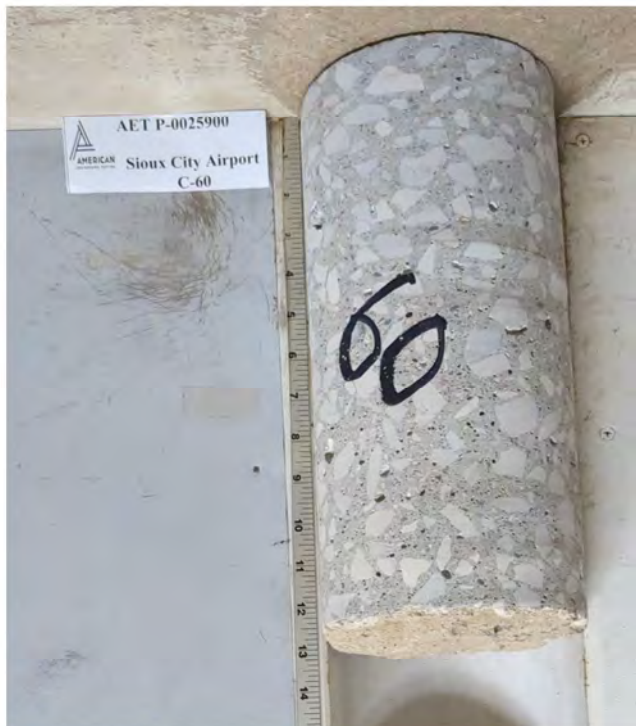
Date: 6/21/2024

AET Project P-0025900

B-059



B-060



B-061



Coring performed in May 2024



Pavement Core Photographs

Cores B-059, B-060, and B-061

Geotechnical Exploration

Sioux Gateway Airport, Siouxland Nexus Project

Sioux City, IA

Date: 6/21/2024

AET Project P-0025900

B-062



C-1



C-2



Coring performed in May 2024



Pavement Core Photographs

Cores B-062, C-1, and C-2

Geotechnical Exploration

Sioux Gateway Airport, Siouxland Nexus Project

Sioux City, IA

Date: 6/21/2024

AET Project P-0025900

C-3



C-4



C-5



Coring performed in May 2024



Pavement Core Photographs

Cores C-3, C-4, and C-5

Geotechnical Exploration

Sioux Gateway Airport, Siouxland Nexus Project

Sioux City, IA

Date: 6/21/2024

AET Project P-0025900

C-6



C-7



Coring performed in May 2024



Pavement Core Photographs

Cores C-6, , and C-7

Geotechnical Exploration

Sioux Gateway Airport, Siouxland Nexus Project

Sioux City, IA

Date: 6/21/2024

AET Project P-0025900



American Engineering Testing, Inc.
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St. Paul, MN 55114
(651) 659-9001
www.teamAET.com

Report No: MAT:AET-158477-S1

Material Test Report

Client: Reynolds Smith & Hills, Inc	CC:
Project: Sioux Gateway Airport Siouxland Nexus	
Sioux City IA	
Job No: P-0025900	Date of Issue: 8/6/2024

Sample Details Sample ID AET-158477-S1 Field Sample ID B-66, B-68, B-95 Date Sampled 5/17/2024 Source Material Sandy Silt, Brown (ML) Specification Sampling Method Location Composite: B-66,, B-68, B-95, Jar #306 Date Submitted	Particle Size Distribution																																																				
Other Test Results <table><thead><tr><th>Description</th><th>Method</th><th>Result</th><th>Limits</th></tr></thead><tbody><tr><td>Maximum Dry Unit Weight (lb/ft³)</td><td>ASTM D 1557</td><td>114.3</td><td></td></tr><tr><td>Corrected Maximum Dry Unit Weight (lb/ft³)</td><td></td><td>114.3</td><td></td></tr><tr><td>Optimum Water Content (%)</td><td></td><td>12.2</td><td></td></tr><tr><td>Corrected Optimum Water Content (%)</td><td></td><td>12.2</td><td></td></tr><tr><td>Method</td><td></td><td>A</td><td></td></tr><tr><td>Preparation Method</td><td></td><td>Dry</td><td></td></tr><tr><td>Retained Sieve No 4 (4.75mm) (%)</td><td></td><td>2</td><td></td></tr><tr><td>Date Tested</td><td></td><td>6/13/2024</td><td></td></tr><tr><td>CBR At 0.1in (%)</td><td>ASTM D 1883</td><td></td><td></td></tr><tr><td>CBR At 0.2in (%)</td><td></td><td></td><td></td></tr><tr><td>Maximum Dry Density (lb/ft³)</td><td></td><td>114.3</td><td></td></tr><tr><td>Date Tested</td><td></td><td>7/5/2024</td><td></td></tr></tbody></table>	Description	Method	Result	Limits	Maximum Dry Unit Weight (lb/ft³)	ASTM D 1557	114.3		Corrected Maximum Dry Unit Weight (lb/ft³)		114.3		Optimum Water Content (%)		12.2		Corrected Optimum Water Content (%)		12.2		Method		A		Preparation Method		Dry		Retained Sieve No 4 (4.75mm) (%)		2		Date Tested		6/13/2024		CBR At 0.1in (%)	ASTM D 1883			CBR At 0.2in (%)				Maximum Dry Density (lb/ft³)		114.3		Date Tested		7/5/2024		Chart
Description	Method	Result	Limits																																																		
Maximum Dry Unit Weight (lb/ft³)	ASTM D 1557	114.3																																																			
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Method		A																																																			
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Date Tested		6/13/2024																																																			
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CBR At 0.2in (%)																																																					
Maximum Dry Density (lb/ft³)		114.3																																																			
Date Tested		7/5/2024																																																			

Comments
N/A



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St. Paul, MN 55114
(651) 659-9001
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Report No: MAT:AET-158477-S2

Material Test Report

Client: Reynolds Smith & Hills, Inc	CC:
Project: Sioux Gateway Airport Siouxland Nexus	
Sioux City IA	
Job No: P-0025900	Date of Issue: 8/6/2024

Sample Details Sample ID AET-158477-S2 Field Sample ID B-82, B-85, B-87 Date Sampled 5/17/2024 Source Material Silty Sand, a little gravel, mostly fine grained, Brown (SM) Specification Sampling Method Location Composite: B-82,, B-85, B-87, Jar #305 Date Submitted	Particle Size Distribution																																																								
Other Test Results <table><thead><tr><th>Description</th><th>Method</th><th>Result</th><th>Limits</th></tr></thead><tbody><tr><td>Maximum Dry Unit Weight (lb/ft³)</td><td>ASTM D 1557</td><td>123.8</td><td></td></tr><tr><td>Corrected Maximum Dry Unit Weight (lb/ft³)</td><td></td><td>126.7</td><td></td></tr><tr><td>Optimum Water Content (%)</td><td></td><td>10.4</td><td></td></tr><tr><td>Corrected Optimum Water Content (%)</td><td></td><td>9.6</td><td></td></tr><tr><td>Method</td><td></td><td>B</td><td></td></tr><tr><td>Preparation Method</td><td></td><td>Dry</td><td></td></tr><tr><td>Retained Sieve 3/8" (9.5mm) (%)</td><td></td><td>9</td><td></td></tr><tr><td>Specific Gravity (Oversize)</td><td></td><td>2.68</td><td></td></tr><tr><td>Date Tested</td><td></td><td>6/13/2024</td><td></td></tr><tr><td>CBR At 0.1in (%)</td><td>ASTM D 1883</td><td></td><td></td></tr><tr><td>CBR At 0.2in (%)</td><td></td><td></td><td></td></tr><tr><td>Maximum Dry Density (lb/ft³)</td><td></td><td>126.7</td><td></td></tr><tr><td>Date Tested</td><td></td><td>6/28/2024</td><td></td></tr></tbody></table>	Description	Method	Result	Limits	Maximum Dry Unit Weight (lb/ft³)	ASTM D 1557	123.8		Corrected Maximum Dry Unit Weight (lb/ft³)		126.7		Optimum Water Content (%)		10.4		Corrected Optimum Water Content (%)		9.6		Method		B		Preparation Method		Dry		Retained Sieve 3/8" (9.5mm) (%)		9		Specific Gravity (Oversize)		2.68		Date Tested		6/13/2024		CBR At 0.1in (%)	ASTM D 1883			CBR At 0.2in (%)				Maximum Dry Density (lb/ft³)		126.7		Date Tested		6/28/2024		Chart
Description	Method	Result	Limits																																																						
Maximum Dry Unit Weight (lb/ft³)	ASTM D 1557	123.8																																																							
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Corrected Optimum Water Content (%)		9.6																																																							
Method		B																																																							
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Retained Sieve 3/8" (9.5mm) (%)		9																																																							
Specific Gravity (Oversize)		2.68																																																							
Date Tested		6/13/2024																																																							
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Maximum Dry Density (lb/ft³)		126.7																																																							
Date Tested		6/28/2024																																																							

Comments
N/A



Report No: MAT:AET-158477-S3

CC:

Draft Report - Subject to
change pending final review

Date of Issue:

8/6/2024

Job No: P-0025900

Particle Size Distribution

Sample ID	AET-158477-S3
Field Sample ID	B-1, B-2, B-6
Date Sampled	5/17/2024
Source	
Material	Sandy Lean Clay, a little gravel, Brown (CL)
Specification	
Sampling Method	
Location	Composite: B-1,, B-2, B-6, Jar #382
Date Submitted	

Description	Method	Result	Limits
Maximum Dry Unit Weight (lb/ft³)	ASTM D 1557	114.4	
Corrected Maximum Dry Unit Weight (lb/ft³)		114.4	
Optimum Water Content (%)		15.0	
Corrected Optimum Water Content (%)		15.0	
Method		B	
Preparation Method		Dry	
Retained Sieve 3/8" (9.5mm) (%)		1	
Date Tested		7/12/2024	
CBR At 0.1in (%)	ASTM D 1883		
CBR At 0.2in (%)			
Maximum Dry Density (lb/ft³)		114.4	
Date Tested		7/19/2024	

Chart

N/A



American Engineering Testing, Inc.
St. Paul Pavements
550 Cleveland Ave N
St. Paul, MN 55114
(651) 659-9001
www.teamAET.com

Report No: MAT:AET-158477-S4

Material Test Report

Client: Reynolds Smith & Hills, Inc	CC:
Project: Sioux Gateway Airport Siouxland Nexus	
Sioux City IA	
Job No: P-0025900	Date of Issue: 8/6/2024

Sample Details	Particle Size Distribution																																																								
Sample ID AET-158477-S4 Field Sample ID B-10, B-13, B-15 Date Sampled 5/17/2024 Source Material Gravelly Silty Sand, mostly medium grained, Brown (SM) Specification Sampling Method Location Composite: B-10,, B-13, B-15, Jar #346 Date Submitted																																																									
Other Test Results																																																									
<table><thead><tr><th>Description</th><th>Method</th><th>Result</th><th>Limits</th></tr></thead><tbody><tr><td>Maximum Dry Unit Weight (lb/ft³)</td><td>ASTM D 1557</td><td>116.1</td><td></td></tr><tr><td>Corrected Maximum Dry Unit Weight (lb/ft³)</td><td></td><td>124.4</td><td></td></tr><tr><td>Optimum Water Content (%)</td><td></td><td>13.8</td><td></td></tr><tr><td>Corrected Optimum Water Content (%)</td><td></td><td>11.1</td><td></td></tr><tr><td>Method</td><td></td><td>B</td><td></td></tr><tr><td>Preparation Method</td><td></td><td>Dry</td><td></td></tr><tr><td>Retained Sieve 3/8" (9.5mm) (%)</td><td></td><td>22</td><td></td></tr><tr><td>Specific Gravity (Oversize)</td><td></td><td>2.68</td><td></td></tr><tr><td>Date Tested</td><td></td><td>6/28/2024</td><td></td></tr><tr><td>CBR At 0.1in (%)</td><td>ASTM D 1883</td><td></td><td></td></tr><tr><td>CBR At 0.2in (%)</td><td></td><td></td><td></td></tr><tr><td>Maximum Dry Density (lb/ft³)</td><td></td><td>121.9</td><td></td></tr><tr><td>Date Tested</td><td></td><td>7/17/2024</td><td></td></tr></tbody></table>	Description	Method	Result	Limits	Maximum Dry Unit Weight (lb/ft³)	ASTM D 1557	116.1		Corrected Maximum Dry Unit Weight (lb/ft³)		124.4		Optimum Water Content (%)		13.8		Corrected Optimum Water Content (%)		11.1		Method		B		Preparation Method		Dry		Retained Sieve 3/8" (9.5mm) (%)		22		Specific Gravity (Oversize)		2.68		Date Tested		6/28/2024		CBR At 0.1in (%)	ASTM D 1883			CBR At 0.2in (%)				Maximum Dry Density (lb/ft³)		121.9		Date Tested		7/17/2024		
Description	Method	Result	Limits																																																						
Maximum Dry Unit Weight (lb/ft³)	ASTM D 1557	116.1																																																							
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Maximum Dry Density (lb/ft³)		121.9																																																							
Date Tested		7/17/2024																																																							
	Chart																																																								

Comments
N/A



American Engineering Testing, Inc.
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550 Cleveland Ave N
St. Paul, MN 55114
(651) 659-9001
www.teamAET.com

Report No: MAT:AET-158477-S5

Material Test Report

Client: Reynolds Smith & Hills, Inc	CC:
Project: Sioux Gateway Airport Siouxland Nexus	
Sioux City IA	
Job No: P-0025900	Date of Issue: 8/6/2024

Sample Details Sample ID AET-158477-S5 Field Sample ID B-22, B-26, B-28 Date Sampled 5/17/2024 Source Material Sandy Lean Clay, a little gravel, Brown (CL) Specification Sampling Method Location Composite: B-22,, B-26, B-28, Jar #378 Date Submitted	Particle Size Distribution																																																				
Other Test Results <table><thead><tr><th>Description</th><th>Method</th><th>Result</th><th>Limits</th></tr></thead><tbody><tr><td>Maximum Dry Unit Weight (lb/ft³)</td><td>ASTM D 1557</td><td>105.8</td><td></td></tr><tr><td>Corrected Maximum Dry Unit Weight (lb/ft³)</td><td></td><td>105.8</td><td></td></tr><tr><td>Optimum Water Content (%)</td><td></td><td>17.6</td><td></td></tr><tr><td>Corrected Optimum Water Content (%)</td><td></td><td>17.6</td><td></td></tr><tr><td>Method</td><td></td><td>B</td><td></td></tr><tr><td>Preparation Method</td><td></td><td>Dry</td><td></td></tr><tr><td>Retained Sieve 3/8" (9.5mm) (%)</td><td></td><td>1</td><td></td></tr><tr><td>Date Tested</td><td></td><td>7/11/2024</td><td></td></tr><tr><td>CBR At 0.1in (%)</td><td>ASTM D 1883</td><td></td><td></td></tr><tr><td>CBR At 0.2in (%)</td><td></td><td></td><td></td></tr><tr><td>Maximum Dry Density (lb/ft³)</td><td></td><td>105.8</td><td></td></tr><tr><td>Date Tested</td><td></td><td>7/16/2024</td><td></td></tr></tbody></table>	Description	Method	Result	Limits	Maximum Dry Unit Weight (lb/ft³)	ASTM D 1557	105.8		Corrected Maximum Dry Unit Weight (lb/ft³)		105.8		Optimum Water Content (%)		17.6		Corrected Optimum Water Content (%)		17.6		Method		B		Preparation Method		Dry		Retained Sieve 3/8" (9.5mm) (%)		1		Date Tested		7/11/2024		CBR At 0.1in (%)	ASTM D 1883			CBR At 0.2in (%)				Maximum Dry Density (lb/ft³)		105.8		Date Tested		7/16/2024		Chart
Description	Method	Result	Limits																																																		
Maximum Dry Unit Weight (lb/ft³)	ASTM D 1557	105.8																																																			
Corrected Maximum Dry Unit Weight (lb/ft³)		105.8																																																			
Optimum Water Content (%)		17.6																																																			
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Method		B																																																			
Preparation Method		Dry																																																			
Retained Sieve 3/8" (9.5mm) (%)		1																																																			
Date Tested		7/11/2024																																																			
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CBR At 0.2in (%)																																																					
Maximum Dry Density (lb/ft³)		105.8																																																			
Date Tested		7/16/2024																																																			

Comments
N/A



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Report No: MAT:AET-158477-S6

Material Test Report

Client: Reynolds Smith & Hills, Inc

CC:

Project: Sioux Gateway Airport Siouxland Nexus

Sioux City IA

Job No: P-0025900

Draft Report - Subject to
change pending final review

Date of Issue:

8/6/2024

Sample Details

Sample ID AET-158477-S6
Field Sample ID B-35, B-40, B-42
Date Sampled 5/17/2024
Source
Material Silty Sand w/Gravel, medium grained, Dark Brown (SM)
Specification
Sampling Method
Location Composite: B-35,, B-40, B-42, Jar #350
Date Submitted

Particle Size Distribution

Other Test Results

Description	Method	Result	Limits
Maximum Dry Unit Weight (lb/ft³)	ASTM D 1557	120.1	
Corrected Maximum Dry Unit Weight (lb/ft³)		121.9	
Optimum Water Content (%)		9.9	
Corrected Optimum Water Content (%)		9.5	
Method		B	
Preparation Method		Dry	
Retained Sieve 3/8" (9.5mm) (%)		5	
Specific Gravity (Oversize)		2.68	
Date Tested		6/28/2024	
CBR At 0.1in (%)	ASTM D 1883		
CBR At 0.2in (%)			
Maximum Dry Density (lb/ft³)		121.9	
Date Tested		7/15/2024	

Chart

Comments

N/A



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Report No: MAT:AET-158477-S7

Material Test Report

Client: Reynolds Smith & Hills, Inc

CC:

Project: Sioux Gateway Airport Siouxland Nexus

Sioux City IA

Job No: P-0025900

Draft Report - Subject to
change pending final review

Date of Issue:

8/6/2024

Sample Details

Sample ID AET-158477-S7
Field Sample ID B-51, B-54, B-57
Date Sampled 5/17/2024
Source
Material Sandy Lean Clay, with gravel, Brown (CL)
Specification
Sampling Method
Location Composite: B-51,, B-54, B-57, Jar #381
Date Submitted

Particle Size Distribution

Other Test Results

Description	Method	Result	Limits
Maximum Dry Unit Weight (lb/ft³)	ASTM D 1557	113.3	
Corrected Maximum Dry Unit Weight (lb/ft³)		113.3	
Optimum Water Content (%)		15.1	
Corrected Optimum Water Content (%)		15.1	
Method		B	
Preparation Method		Dry	
Retained Sieve 3/8" (9.5mm) (%)		2	
Date Tested		7/12/2024	
CBR At 0.1in (%)	ASTM D 1883		
CBR At 0.2in (%)			
Maximum Dry Density (lb/ft³)		113.3	
Date Tested		7/22/2024	

Chart

Comments

N/A



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Report No: MAT:AET-158477-S8

Material Test Report

Client: Reynolds Smith & Hills, Inc

CC:

Project: Sioux Gateway Airport Siouxland Nexus

Sioux City IA

Job No: P-0025900

Draft Report - Subject to
change pending final review

Date of Issue:

8/6/2024

Sample Details

Sample ID AET-158477-S8
Field Sample ID B-30, B-36, B-63
Date Sampled 5/17/2024
Source
Material Sandy Lean Clay, Brown (CL)
Specification
Sampling Method
Location Composite: B-31,, B-36, B-63, Jar #307
Date Submitted

Particle Size Distribution

Other Test Results

Description	Method	Result	Limits
Maximum Dry Unit Weight (lb/ft³)	ASTM D 1557	116.9	
Corrected Maximum Dry Unit Weight (lb/ft³)		116.9	
Optimum Water Content (%)		12.6	
Corrected Optimum Water Content (%)		12.6	
Method		A	
Preparation Method		Dry	
Retained Sieve No 4 (4.75mm) (%)		1	
Date Tested		6/13/2024	
CBR At 0.1in (%)	ASTM D 1883		
CBR At 0.2in (%)			
Maximum Dry Density (lb/ft³)		116.9	
Date Tested		7/16/2024	

Chart

Comments

N/A



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Report No: CBR:AET-158477-S1

California Bearing Ratio Report

Client: Reynolds Smith & Hills, Inc

CC:

Project: Sioux Gateway Airport Siouxland Nexus

Sioux City IA

Job No: P-0025900

Draft Report - Subject to
change pending final review

Date of Issue:

8/6/2024

Sample Details

Sample ID: AET-158477-S1

Field ID: B-66, B-68, B-95

Date Sampled: 5/17/2024

Sampling Method:

Source:

Material: Sandy Silt, Brown (ML)

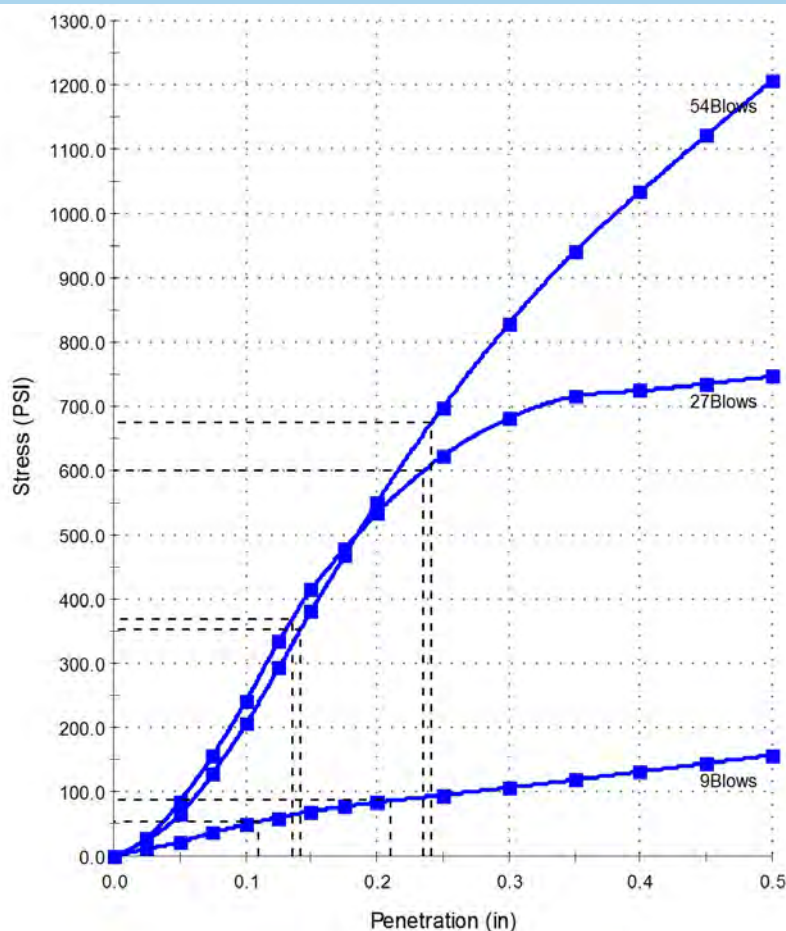
Specification:

Location: Composite: B-66,, B-68, B-95, Jar #306

Tested By: Gregory Burgess

Date Tested: 7/5/2024

Stress vs Penetration



Overall Results

ASTM D 1883

CBR At 0.1in (%): 28

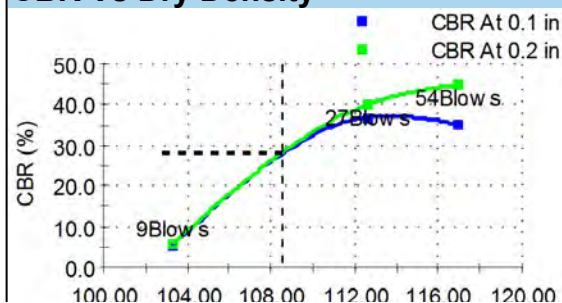
CBR At 0.2in (%): 29

At Dry Density (lb/ft³): 108.6

Test Results

Blows	27	9	54
Comp. Eff.	ASTM D 1557	ASTM D 1557	ASTM D 1557
Initial MC (%)	12.5	12.8	12.7
MC of Top 1in (%)	19.1	24.5	17.8
MC After (%)	15.1	19.2	14.1
DD Before (lb/ft³)	112.55	103.28	116.88
DD After (lb/ft³)	112.32	102.79	116.33
CBR (%)	40.0	5.8	45.0
% MDD	98.5	90.4	102.3
Sample Condition	Soaked	Soaked	Soaked
Immersion Period (h)	96	96	96
Surcharge (lb)	10.00	10.00	10.00
Swell (%)	0.72	1.29	0.57

CBR Vs Dry Density



Comments

Sample CBR measured at 95% max dry density as determined by ASTM D1557



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Report No: CBR:AET-158477-S2

California Bearing Ratio Report

Client: Reynolds Smith & Hills, Inc

CC:

Project: Sioux Gateway Airport Siouxland Nexus

Sioux City IA

Job No: P-0025900

Draft Report - Subject to
change pending final review

Date of Issue:

8/6/2024

Sample Details

Sample ID: AET-158477-S2

Field ID: B-82, B-85, B-87

Date Sampled: 5/17/2024

Sampling Method:

Source:

Material: Silty Sand, a little gravel, mostly fine grained,
Brown (SM)

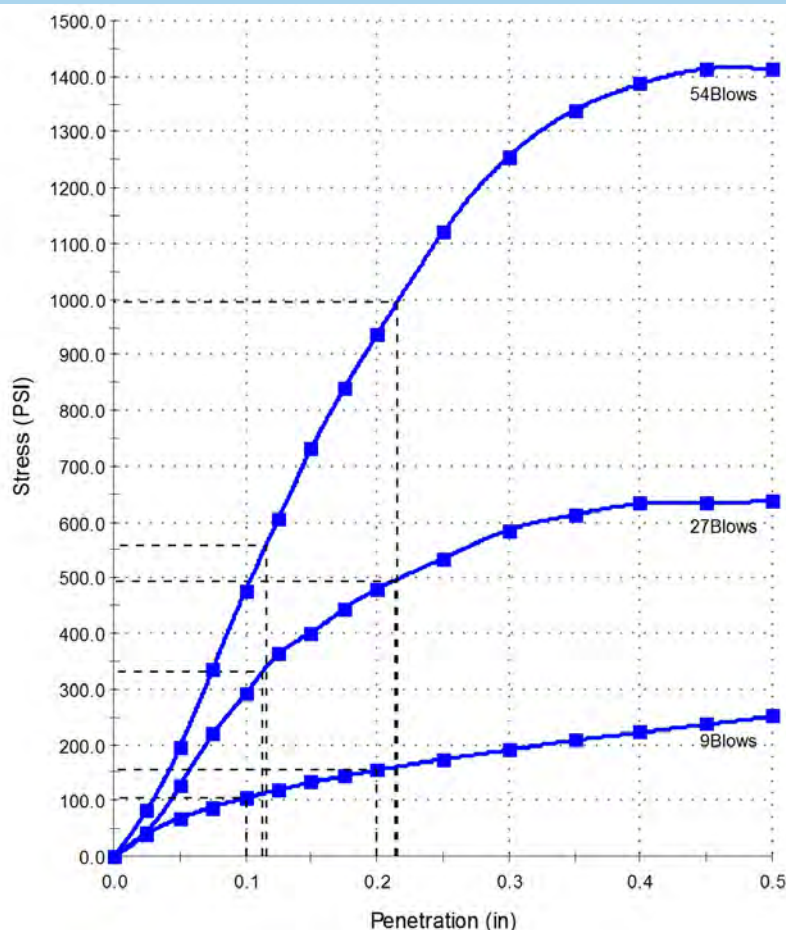
Specification:

Location: Composite: B-82,, B-85, B-87, Jar #305

Tested By: Gregory Burgess

Date Tested: 6/28/2024

Stress vs Penetration



Overall Results

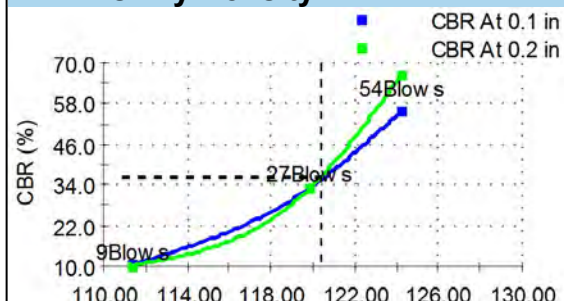
ASTM D 1883

CBR At 0.1in (%): 36
CBR At 0.2in (%): 36
At Dry Density (lb/ft³): 120.4

Test Results

Blows	27	9	54
Comp. Eff.	ASTM D 1557	ASTM D 1557	ASTM D 1557
Initial MC (%)	9.9	9.7	9.8
MC of Top 1in (%)	14.6	16.5	12.4
MC After (%)	11.6	15.0	10.9
DD Before (lb/ft ³)	119.85	111.36	124.23
DD After (lb/ft ³)	120.84	111.53	124.82
CBR (%)	33.1	10.5	66.4
% MDD	94.6	87.9	98.0
Sample Condition	Soaked	Soaked	Soaked
Immersion Period (h)	96	95	96
Surcharge (lb)	10.00	10.00	10.00
Swell (%)	0.28	0.31	0.00

CBR Vs Dry Density



Comments

Sample CBR measured at 95% max dry density as determined by ASTM D1557 corrected by ASTM D4718.



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Report No: CBR:AET-158477-S3

California Bearing Ratio Report

Client: Reynolds Smith & Hills, Inc

CC:

Project: Sioux Gateway Airport Siouxland Nexus

Sioux City IA

Job No: P-0025900

Draft Report - Subject to
change pending final review

Date of Issue:

8/6/2024

Sample Details

Sample ID: AET-158477-S3

Field ID: B-1, B-2, B-6

Date Sampled: 5/17/2024

Sampling Method:

Source:

Material: Sandy Lean Clay, a little gravel, Brown (CL)

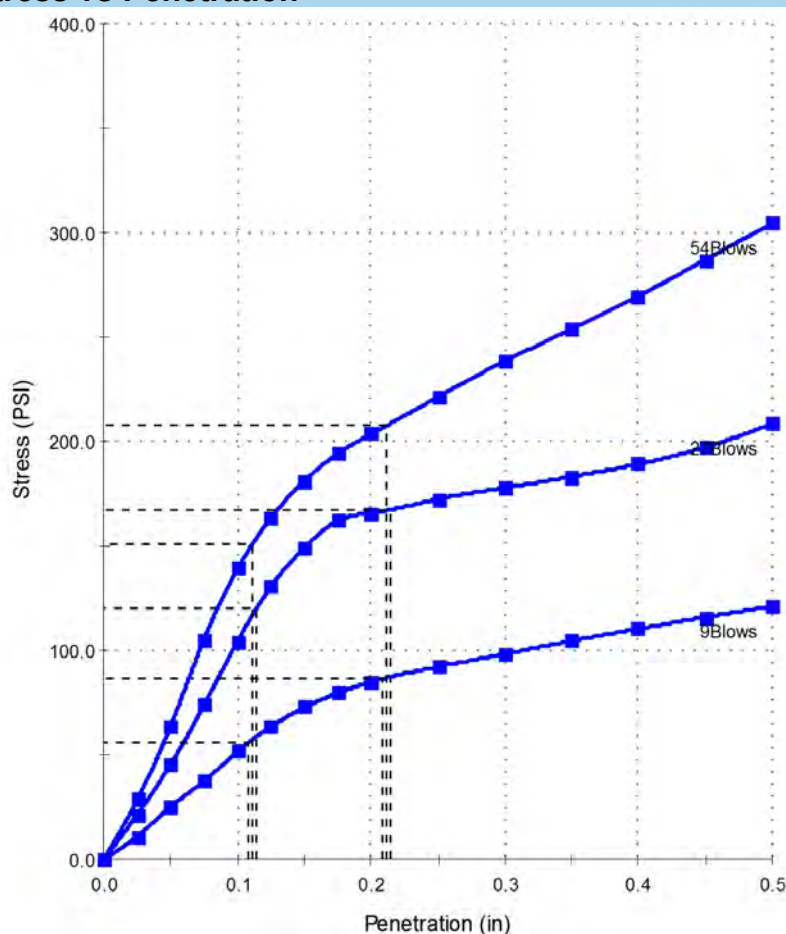
Specification:

Location: Composite: B-1,, B-2, B-6, Jar #382

Tested By: Benjamin Pomroy

Date Tested: 7/19/2024

Stress vs Penetration



Overall Results

ASTM D 1883

CBR At 0.1in (%): 8

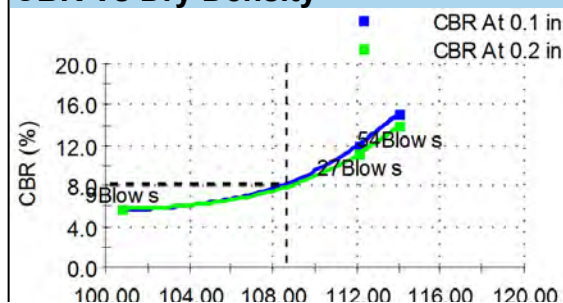
CBR At 0.2in (%): 8

At Dry Density (lb/ft³): 108.7

Test Results

Blows	27	9	54
Comp. Eff.	ASTM D 1557	ASTM D 1557	ASTM D 1557
Initial MC (%)	15.2	14.9	15.3
MC of Top 1in (%)	22.3	26.3	22.1
MC After (%)	18.5	23.2	16.5
DD Before (lb/ft³)	112.08	100.72	113.99
DD After (lb/ft³)	110.44	98.84	113.11
CBR (%)	12.0	5.8	15.1
% MDD	98.0	88.1	99.7
Sample Condition	Soaked	Soaked	Soaked
Immersion Period (h)	94	94	94
Surcharge (lb)	10.00	10.00	10.00
Swell (%)	2.47	2.92	2.13

CBR Vs Dry Density



Comments



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Report No: CBR:AET-158477-S4

California Bearing Ratio Report

Client: Reynolds Smith & Hills, Inc

CC:

Project: Sioux Gateway Airport Siouxland Nexus

Sioux City IA

Job No: P-0025900

Draft Report - Subject to
change pending final review

Date of Issue:

8/6/2024

Sample Details

Sample ID: AET-158477-S4

Field ID: B-10, B-13, B-15

Date Sampled: 5/17/2024

Sampling Method:

Source:

Material: Gravelly Silty Sand, mostly medium grained,
Brown (SM)

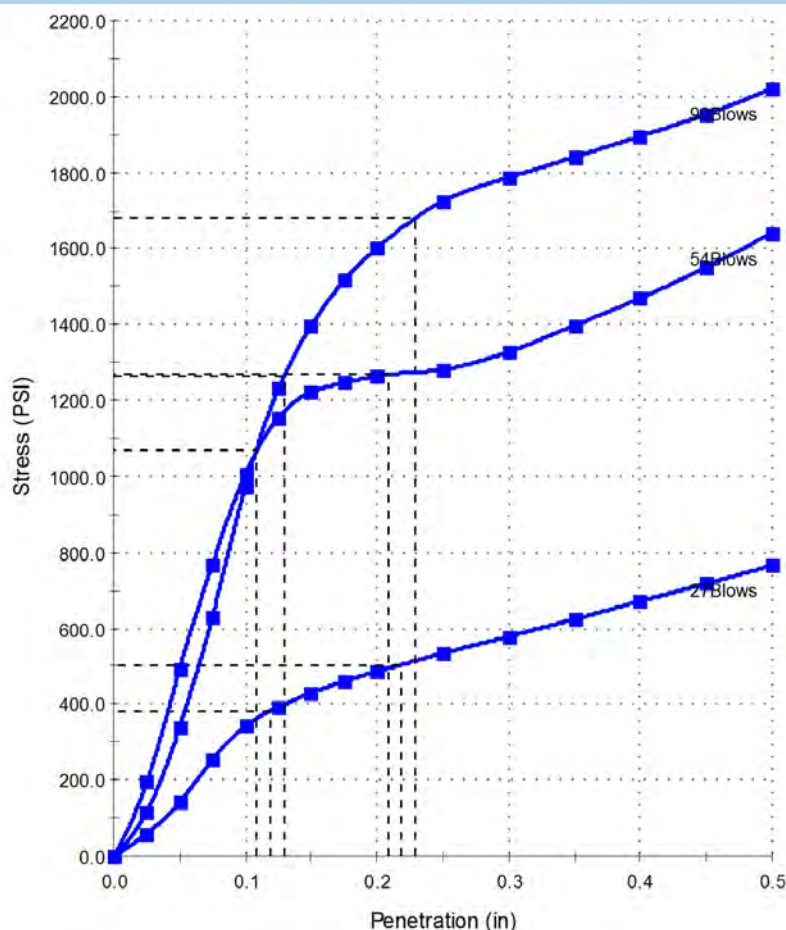
Specification:

Location: Composite: B-10,, B-13, B-15, Jar #346

Tested By: Benjamin Pomroy

Date Tested: 7/17/2024

Stress vs Penetration



Overall Results

ASTM D 1883

CBR At 0.1in (%): 113

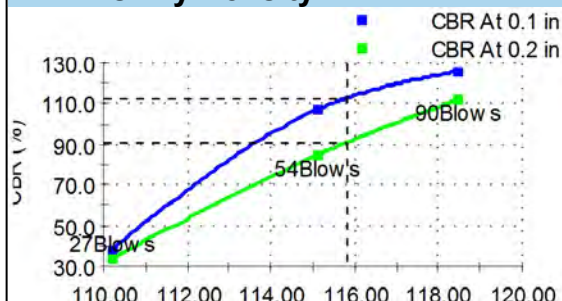
CBR At 0.2in (%): 91

At Dry Density (lb/ft³): 115.8

Test Results

Blows	27	90	54
Comp. Eff.	ASTM D 1557	ASTM D 1557	ASTM D 1557
Initial MC (%)	12.3	11.4	12.4
MC of Top 1in (%)	19.9	17.0	16.7
MC After (%)	17.6	14.3	15.7
DD Before (lb/ft³)	110.19	118.45	115.09
DD After (lb/ft³)	109.78	117.82	114.96
CBR (%)	38.2	126.2	107.0
% MDD	90.4	97.2	94.4
Sample Condition	Soaked	Soaked	Soaked
Immersion Period (h)	96	96	96
Surcharge (lb)	10.00	10.00	10.00
Swell (%)	0.76	0.50	0.33

CBR Vs Dry Density



Comments



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Report No: CBR:AET-158477-S5

California Bearing Ratio Report

Client: Reynolds Smith & Hills, Inc

CC:

Project: Sioux Gateway Airport Siouxland Nexus

Sioux City IA

Job No: P-0025900

Draft Report - Subject to
change pending final review

Date of Issue:

8/6/2024

Sample Details

Sample ID: AET-158477-S5

Field ID: B-22, B-26, B-28

Date Sampled: 5/17/2024

Sampling Method:

Source:

Material: Sandy Lean Clay, a little gravel, Brown (CL)

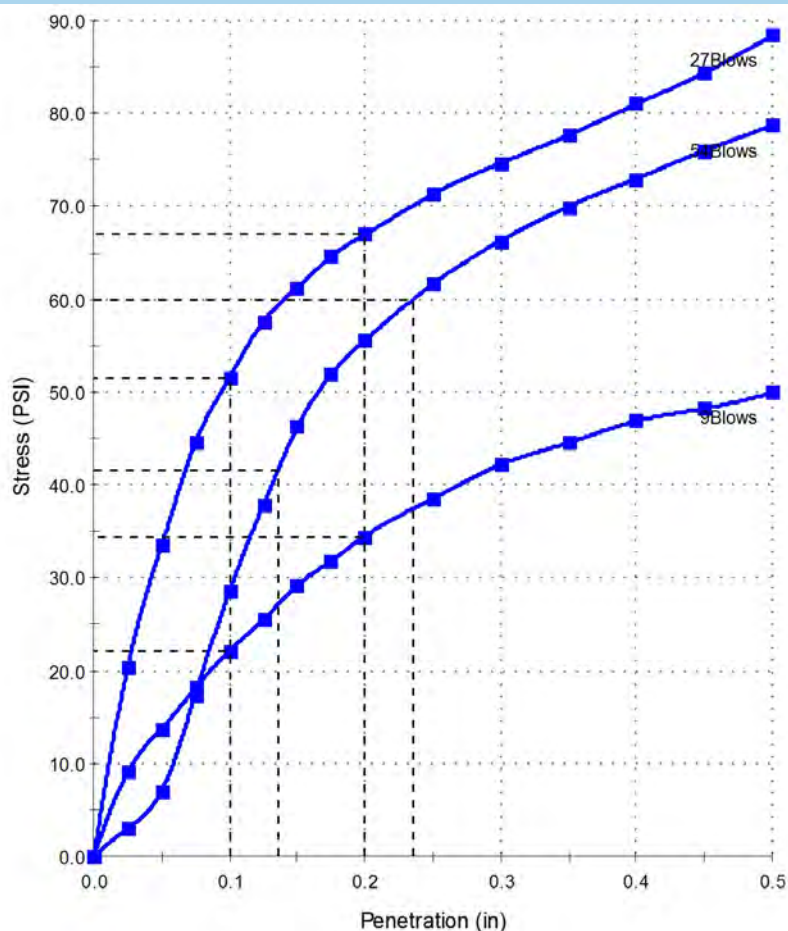
Specification:

Location: Composite: B-22,, B-26, B-28, Jar #378

Tested By: Benjamin Pomroy

Date Tested: 7/16/2024

Stress vs Penetration



Overall Results

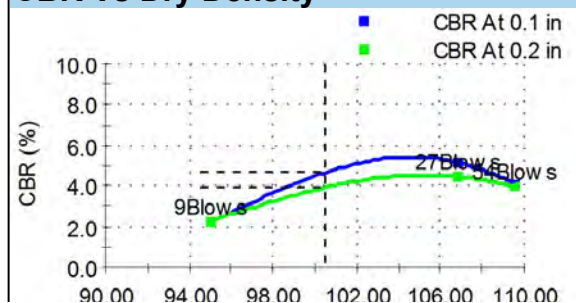
ASTM D 1883

CBR At 0.1in (%): 5
CBR At 0.2in (%): 4
At Dry Density (lb/ft³): 100.5

Test Results

Blows	27	9	54
Comp. Eff.	ASTM D 1557	ASTM D 1557	ASTM D 1557
Initial MC (%)	17.2	17.3	18.1
MC of Top 1in (%)	31.0	37.2	32.2
MC After (%)	24.3	29.2	21.2
DD Before (lb/ft³)	106.85	95.04	109.51
DD After (lb/ft³)	99.99	89.74	104.23
CBR (%)	5.2	2.3	4.2
% MDD	101.0	89.8	103.5
Sample Condition	Soaked	Soaked	Soaked
Immersion Period (h)	96	96	96
Surcharge (lb)	10.00	10.00	10.00
Swell (%)	6.65	6.70	7.02

CBR Vs Dry Density



Comments



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Report No: CBR:AET-158477-S6

California Bearing Ratio Report

Client: Reynolds Smith & Hills, Inc

CC:

Project: Sioux Gateway Airport Siouxland Nexus

Sioux City IA

Job No: P-0025900

Draft Report - Subject to
change pending final review

Date of Issue:

8/6/2024

Sample Details

Sample ID: AET-158477-S6

Field ID: B-35, B-40, B-42

Date Sampled: 5/17/2024

Sampling Method:

Source:

Material: Silty Sand w/Gravel, medium grained, Dark Brown (SM)

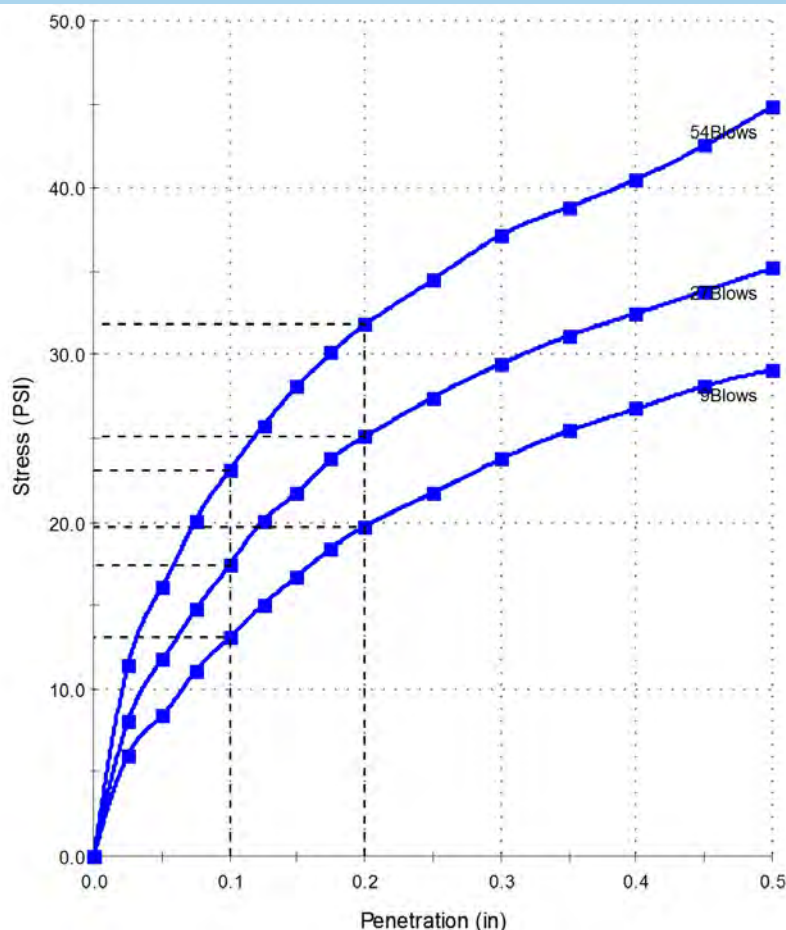
Specification:

Location: Composite: B-35,, B-40, B-42, Jar #350

Tested By: Benjamin Pomroy

Date Tested: 7/15/2024

Stress vs Penetration



Overall Results

ASTM D 1883

CBR At 0.1in (%): 2

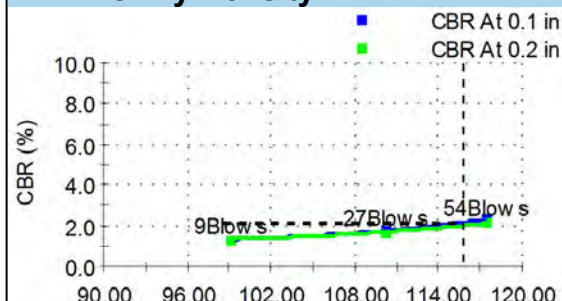
CBR At 0.2in (%): 2

At Dry Density (lb/ft³): 115.8

Test Results

Blows	27	9	54
Comp. Eff.	ASTM D 1557	ASTM D 1557	ASTM D 1557
Initial MC (%)	10.4	10.6	10.3
MC of Top 1in (%)	30.5	33.7	28.0
MC After (%)	22.0	27.0	17.7
DD Before (lb/ft³)	110.26	99.07	117.40
DD After (lb/ft³)	101.16	92.85	108.33
CBR (%)	1.7	1.3	2.3
% MDD	90.5	81.3	96.3
Sample Condition	Soaked	Soaked	Soaked
Immersion Period (h)	96	96	96
Surcharge (lb)	10.00	10.00	10.00
Swell (%)	10.50	7.51	10.67

CBR Vs Dry Density



Comments



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Report No: CBR:AET-158477-S7

California Bearing Ratio Report

Client: Reynolds Smith & Hills, Inc

CC:

Project: Sioux Gateway Airport Siouxland Nexus

Sioux City IA

Job No: P-0025900

Draft Report - Subject to
change pending final review

Date of Issue:

8/6/2024

Sample Details

Sample ID: AET-158477-S7

Field ID: B-51, B-54, B-57

Date Sampled: 5/17/2024

Sampling Method:

Source:

Material: Sandy Lean Clay, with gravel, Brown (CL)

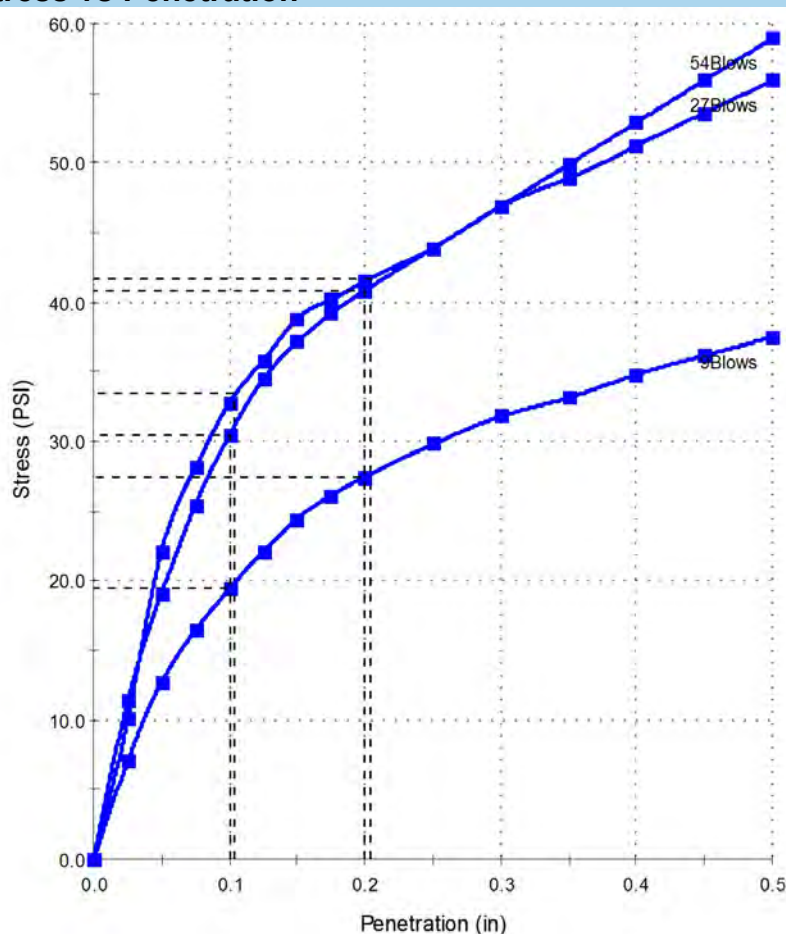
Specification:

Location: Composite: B-51,, B-54, B-57, Jar #381

Tested By: Benjamin Pomroy

Date Tested: 7/22/2024

Stress vs Penetration



Overall Results

ASTM D 1883

CBR At 0.1in (%): 3

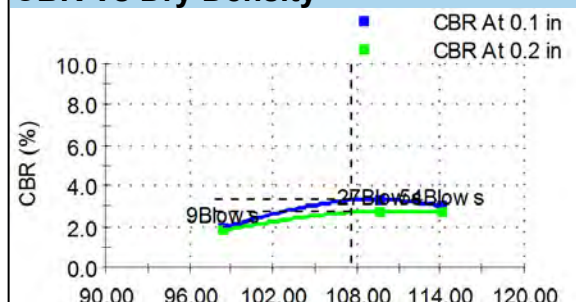
CBR At 0.2in (%): 3

At Dry Density (lb/ft³): 107.6

Test Results

Blows	27	9	54
Comp. Eff.	ASTM D 1557	ASTM D 1557	ASTM D 1557
Initial MC (%)	15.4	15.5	15.5
MC of Top 1in (%)	30.8	33.8	28.8
MC After (%)	21.7	25.8	19.3
DD Before (lb/ft ³)	109.68	98.33	114.02
DD After (lb/ft ³)	103.34	90.56	107.73
CBR (%)	3.3	1.9	3.0
% MDD	96.8	86.8	100.6
Sample Condition	Soaked	Soaked	Soaked
Immersion Period (h)	96	96	96
Surcharge (lb)	10.00	10.00	10.00
Swell (%)	7.39	10.49	7.02

CBR Vs Dry Density



Comments



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St. Paul, MN 55114
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Report No: CBR:AET-158477-S8

California Bearing Ratio Test Report

Client: Reynolds Smith & Hills, Inc

CC:

Project: Sioux Gateway Airport Siouxland Nexus

Sioux City IA

Job No: P-0025900

Draft Report - Subject to
change pending final review

Date of Issue:

8/6/2024

Sample Details

Sample ID: AET-158477-S8

Date Sampled: 5/17/2024

Sampling Method:

Source:

Specification:

Tested By: Benjamin Pomroy

CBR At 0.1in (%): 3.9

Field ID: B-30, B-36, B-63

Sampled By: Roger Hanson

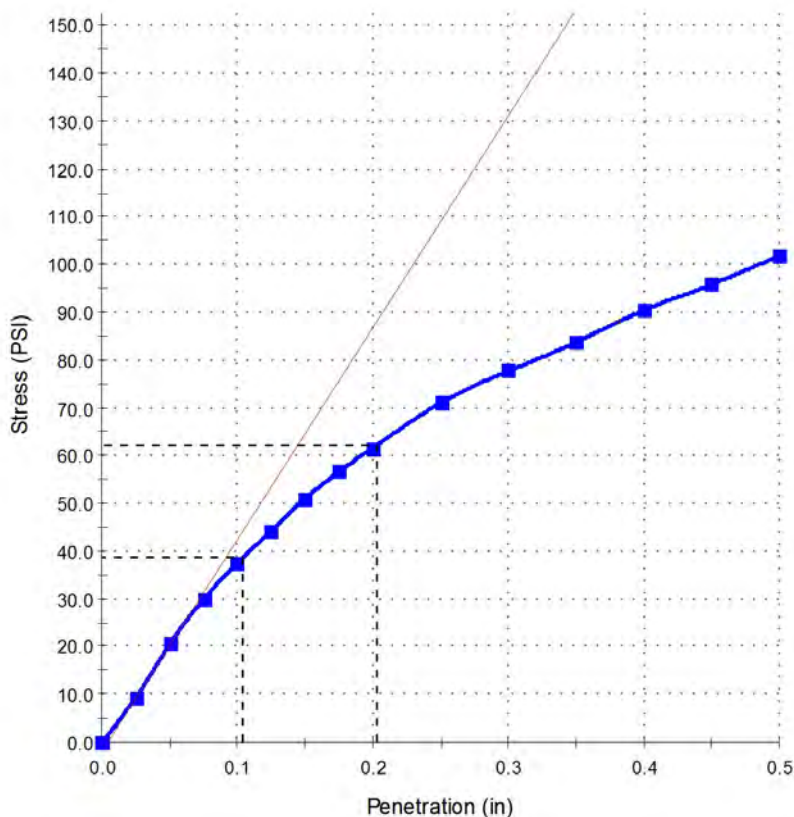
Material: Sandy Lean Clay, Brown (CL)

Location: Composite: B-31,, B-36, B-63, Jar #307

Date Tested: 7/17/2024

CBR At 0.2in (%): 4.2

Stress vs Penetration



Test Results

ASTM D 1883

CBR At 0.1in (%): 3.9
CBR At 0.2in (%): 4.2
Compactive Effort: ASTM D 1557
Number of Blows: 27
% of Maximum Dry Density: 96.1
Dry Density Before Soaking (lb/ft³): 112.4
Dry Density After Soaking (lb/ft³): 106.5
MC Before Compaction (%): 12.3
MC After Compaction (%): 13.7
Moisture Content of Top 1in (%): 26.2
Average Moisture Content (%): 19.5
Maximum Dry Density (lb/ft³): 116.9
Optimum Moisture Content (%): 12.6
Sample Condition: Soaked
Immersion Period (h): 96
Swell (%): 5.7
Surcharge Mass (lb): 10.00
Date Tested: 7/17/2024

Comments



REPORT OF PETROGRAPHIC ANALYSIS

Project:

Sioux Gateway Airport, Siouxland Nexus
Sioux City, Iowa

Reported To:

RS&H, Inc.
4525 Airport Approach Rd, Suite A
Duluth, MN 55811

AET Project No.: P-0025900

Attn: Darren Christopher

Date: August 3, 2024

INTRODUCTION

This report presents the results of laboratory work performed by our firm on six concrete core samples that were procured by AET personnel and submitted to AET's petrographic laboratory by Mr. Neil Lund on July 25, 2024. We understand the concrete cores were obtained from the above-referenced location and were procured through the full-depth of the runway pavement. We also understand that the presence of alkali-silica reactivity (ASR) within the concrete is in question. The concrete is thought to be approximately 30 years old. The scope of our work was limited to performing petrographic analysis on the samples to document the presence/severity of any ASR in the concrete cores.

CONCLUSIONS

Based on our observations and analysis:

1. The analyzed core samples did not exhibit any evidence of bulk, expansive ASR. An innocuous level of alkali-silica gel deposits were documented in core samples #2, #11, #22, and #57. The deposits were present within air voids adjacent to a few shale fine aggregate particles. Core samples #7 and #15 contained similar shale particles; however, no secondary gel deposits were found in these cores. The reactivity has not caused any emanating or expansive cracking in the core samples. The coarse aggregate in the samples consisted of quarried and crushed fossiliferous limestone. No evidence of any ASR of the coarse aggregates was found. Based on the reported age of the pavement and the petrographic observations of the core samples, we do not expect the concrete to be susceptible to long-term, bulk/expansive ASR.
2. It is common for many concretes to exhibit minute or innocuous levels of ASR of fine aggregate that does not result in expansive cracking or negatively impact durability or service life. The natural sand fine aggregate in the analyzed core samples contained a very small portion of shale. While the quantity of shale was not formally quantified, it was visually estimated to

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comprise less than 1% of the fine aggregate and was likely less than 0.5%. The sand composition was consistent with natural glacial deposits of southern Minnesota and northern Iowa. These deposits are known to contain particles derived from the Pierre Shale. Many concretes in this region have been produced with similar sand and in AET's experience have not shown evidence of bulk expansion from ASR. Further, the Pierre Shale is known to be a 'fast reactor' often producing secondary alkali-silica gel within twenty-four hours of a concrete's life, with typically little or no additional reactivity thereafter.

3. The concrete samples exhibited diamond-grooved or saw-cut top surfaces with minor mortar erosion/traffic worn surfaces. Carbonation was very shallow for the reported age of the concrete, ranging from mostly negligible up to 4 mm (5/32") depth. The concrete samples were well consolidated and appeared air entrained.

SAMPLE IDENTIFICATION

Sample Type: Hardened Concrete Cores

<u>Sample ID</u>	<u>Diameter</u>	<u>Length</u>
#2	152 mm (6")	330 mm (13")
#11	152 mm (6")	343 mm (13-1/2")
#22	152 mm (6")	330 mm (13")

TEST RESULTS

Our complete petrographic analysis documentation appears on the attached sheets entitled 24-LAB-001 "Petrographic Examination of Hardened Concrete, ASTM C856." A brief summary of the general physical characteristics of the concrete is as follows:

1. The coarse aggregate was comprised of 25 mm (1") nominal sized quarried and crushed limestone that appeared well graded and exhibited good overall distribution. The fine aggregate was a natural glacial sand.
2. The paste color ranged from light brownish gray to light and medium gray. The paste hardness was judged to be moderate (Mohs ~ 3) with the paste/aggregate bond considered good.
3. The top surfaces were diamond grooved and exhibited traffic wear/mortar erosion. The depth of carbonation ranged from the top surfaces was mostly negligible but was observed locally 'spiking' along sub-vertical microcracking to 16 mm (5/8").

TEST PROCEDURES

Laboratory testing was performed on July 26, 2024, and subsequent dates. Our procedures were as follows:

1.0 Petrographic Analysis

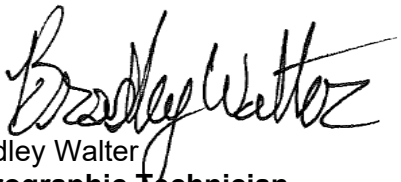
A petrographic analysis was performed in accordance with AET Standard Operating Procedure 24-LAB-001, "Petrographic Examination of Hardened Concrete," ASTM C856-latest revision. The petrographic analysis consisted of reviewing the cement paste and aggregate qualities on a whole basis on saw cut, lapped, and fractured sections. Reflected light microscopy was performed under an Olympus SZX-12 binocular stereozoom microscope at magnifications up to 160x. The depth of carbonation was documented using a phenolphthalein pH indicator solution applied on freshly saw cut and lapped surfaces of the concrete sample. The paste-coarse aggregate bond quality was determined by fracturing a sound section of the concrete in the laboratory with a rock hammer.

REMARKS

The test sample will be retained for a period of at least sixty days from the date of this report. Unless further instructions are received by that time, the sample may be discarded. Test results relate only to the items tested. No warranty, expressed or implied, is made.

We appreciate the opportunity to have been of service to you on this project. If you have any questions regarding the information presented in this report or if we can be of additional assistance, please contact us.

Report Prepared By
American Engineering Testing, Inc.



Bradley Walter
Petrographic Technician
brwalter@teamAET.com



Senior Petrographer/Geologist
MN License #50337
blemcke@teamAET.com
Work: 651-659-1362

24-LAB-001 PETROGRAPHIC EXAMINATION OF HARDENED CONCRETE, ASTM C856

Project No.	P-0025900	Date:	8/2/2024	Date reviewed:	8/2/2024
Sample ID:	#2	Performed by:	B. Walter	Reviewed by:	B. Lemcke

I. GENERAL OBSERVATIONS

1. Sample Dimensions: Our analysis was performed on a 330 mm (13") x 146 mm (5-3/4") x 51 mm (2") thick lapped profile section and a 76 mm (3") x 52 mm (2") thin section that were saw-cut and prepared from the original 152 mm (6") diameter x 330 mm (13") long core.
2. Surface Conditions:
Top: Rough, diamond grooved surface exhibiting traffic wear/erosion.
Bottom: Rough, irregular, formed surface; placed on grade.
3. Reinforcement: None observed.
4. General Physical Conditions: The top surface of the concrete was diamond grooved with three parallel saw-cuts that were approximately 5 mm (3/16") wide by 3 mm (1/8") deep. The top surface exhibited mortar erosion/traffic wear with several exposed fine aggregate surfaces. A few sub-vertical drying-shrinkage microcracks proceeded from the top surface up to a maximum observed depth of 12 mm (1/2"). Carbonation from the top surface was negligible but was observed along sub-vertical microcracking up to 12 mm (1/2") depth. A few secondary deposits of white, acicular ettringite were observed within the bottom approximately 20 mm (13/16") of the core. A single deposit of alkali-silica gel was observed filling an air void adjacent to a reactive shale fine aggregate particle at approximately 51 mm (2") from the bottom surface of the core. A few shale fine aggregate particles with fine internal microcracking were observed in the sample. The concrete was well consolidated and appeared air-entrained.

II. AGGREGATE

1. Coarse: 25 mm (1") nominal sized quarried and crushed stone consisting of fossiliferous limestone. The particles were mostly sub-angular in shape. The coarse aggregate appeared well graded and exhibited good overall distribution.
2. Fine: Natural quartz, feldspar, and lithic sand (carbonates, chert, granite, and basalt with a few iron oxide and shale particles). The grains were mostly sub-rounded with many smaller sub-angular particles. The fine aggregate appeared well graded and exhibited good overall uniform distribution.

III. CEMENTITIOUS PROPERTIES

1. Air Content: Not documented.
2. Depth of carbonation: Negligible but spiking up to 12 mm (1/2") depth from the top surface along surficial sub-vertical microcracking.
3. Paste/aggregate bond: Good.
4. Paste color: Light brownish gray (Munsell® 5YR 6/1) overall, darkening to medium dark gray (Munsell® N4) within base 20 mm (13/16") depth from the bottom surface.
5. Paste hardness: Moderate (Mohs ≈3.0).

6. Microcracking: A few sub-vertical microcracks were observed extending from the top surface ranging from 4 mm (5/32") up to 12 mm (1/2") deep.
7. Secondary deposits: Colorless to white acicular ettringite was observed within the dark colored base 20 mm (13/16") layer of the paste. A single deposit of alkali-silica gel was observed filling an air void adjacent to a reactive shale fine aggregate particle at approximately 51 mm (2") from the bottom surface.

24-LAB-001 PETROGRAPHIC EXAMINATION OF HARDENED CONCRETE, ASTM C856

Project No.	P-0025900	Date:	8/2/2024	Date reviewed:	8/3/2024
Sample ID:	#7	Performed by:	B. Walter	Reviewed by:	B. Lemcke

I. GENERAL OBSERVATIONS

1. Sample Dimensions: Our analysis was performed on a 362 mm (14-1/4") x 140 mm (5-1/2") x 51 mm (2") thick lapped profile section and a 76 mm (3") x 52 mm (2") thin section that were saw-cut and prepared from the original 152 mm (6") diameter x 362 mm (14-1/4") long core.
2. Surface Conditions:
Top: Rough, diamond grooved surface exhibiting traffic wear/erosion.
Bottom: Rough, irregular, formed surface; placed on grade.
3. Reinforcement: None observed.
4. General Physical Conditions: The top surface of the concrete was diamond grooved with three parallel saw-cuts that were approximately 5 mm (3/16") wide by 3 mm (1/8") deep. The top surface exhibited mortar erosion/traffic wear with several exposed fine aggregate surfaces. A few sub-vertical drying-shrinkage microcracks proceeded from the top surface up to a maximum observed depth of 9 mm (3/8"). Carbonation from the top surface was negligible but was observed along sub-vertical microcracking up to 9 mm (3/8") depth. A few secondary deposits of white, acicular ettringite were observed within the bottom approximately 10 mm (3/8") of the core. Secondary deposits of alkali-silica gel were not observed in the sample. However, a few shale fine aggregate particles with fine internal microcracking were observed in the sample. The concrete was well consolidated and appeared air-entrained.

II. AGGREGATE

1. Coarse: 25 mm (1") nominal sized quarried and crushed stone consisting of fossiliferous limestone. The particles were mostly sub-angular in shape. The coarse aggregate appeared well graded and exhibited good overall distribution.
2. Fine: Natural quartz, feldspar, and lithic sand (carbonates, chert, granite, and basalt with a few iron oxide and shale particles). The grains were mostly sub-rounded with many smaller sub-angular particles. The fine aggregate appeared fairly graded and exhibited good overall uniform distribution.

III. CEMENTITIOUS PROPERTIES

1. Air Content: Not documented.
2. Depth of carbonation: Negligible but spiking up to 9 mm (3/8") depth from the top surface along surficial sub-vertical microcracks.
3. Paste/aggregate bond: Good.
4. Paste color: Light brownish gray (Munsell® 5YR 6/1) overall, darkening to medium dark gray (Munsell® N4) within base 20 mm (13/16") depth from the bottom surface.
5. Paste hardness: Moderate (Mohs ≈3.0).

6. Microcracking: Several sub-vertical microcracks were observed extending from the top surface ranging from 4 mm (5/32") up to 9 mm (3/8") deep.
7. Secondary deposits: Colorless to white acicular ettringite was observed within the dark colored base 10 mm (3/8") layer of the paste.

24-LAB-001 PETROGRAPHIC EXAMINATION OF HARDENED CONCRETE, ASTM C856

Project No.	P-0025900	Date:	8/2/2024	Date reviewed:	8/3/2024
Sample ID:	#11	Performed by:	B. Walter	Reviewed by:	B. Lemcke

I. GENERAL OBSERVATIONS

1. Sample Dimensions: Our analysis was performed on a 343 mm (13-1/2") x 140 mm (5-1/2") x 44 mm (1-3/4") thick lapped profile section and a 76 mm (3") x 52 mm (2") thin section that were saw-cut and prepared from the original 140 mm (5-1/2") diameter x 343 mm (13-1/2") long core.
2. Surface Conditions:
Top: Rough, diamond grooved surface exhibiting traffic wear/erosion.
Bottom: Rough, irregular, formed surface; placed on thin concrete base layer.
3. Reinforcement: None observed.
4. General Physical Conditions: The top surface of the concrete was diamond grooved with three parallel saw-cuts that were approximately 5 mm (3/16") wide by 3 mm (1/8") deep. The top surface exhibited mortar erosion/traffic wear with several exposed fine aggregate surfaces. The sample was a composite core containing a thin (~1") dark gray base concrete that was overlain with the concrete pavement. The light brownish gray comprised the top 292 mm (11-1/2") of the sample, separated from the concrete by a construction joint oriented sub-horizontal to the top surface. A few sub-vertical drying-shrinkage microcracks proceeded from the top surface up to a maximum observed depth of 13 mm (1/2"). Carbonation from the top surface was negligible but was observed along sub-vertical microcracking up to 13 mm (1/2") depth. A few secondary deposits of white, acicular ettringite were observed in proximity, approximately 10 mm (3/8") deep, in either direction from of the construction joint. A single deposit of alkali-silica gel was observed within microcracks in a shale fine aggregate particle at approximately 65 mm (2-9/16") from the bottom surface of the core. A few shale fine aggregate particles with fine internal microcracking were observed within the sample. The concrete was well consolidated and appeared air-entrained.

II. AGGREGATE

1. Coarse: 25 mm (1") nominal sized quarried and crushed stone consisting of fossiliferous limestone. The particles were mostly sub-angular in shape. The coarse aggregate appeared well graded and exhibited good overall distribution.
2. Fine: Natural quartz, feldspar, and lithic sand (carbonates, chert, granite, and basalt with a few iron oxide and shale particles). The grains were mostly sub-rounded with many smaller sub-angular particles. The fine aggregate appeared well graded and exhibited good overall uniform distribution.

III. CEMENTITIOUS PROPERTIES

1. Air Content: Not documented.
2. Depth of carbonation: Negligible but spiking up to 13 mm (1/2") depth from the top surface along surficial sub-vertical microcracking.
3. Paste/aggregate bond: Good.
4. Paste color: Light brownish gray (Munsell® 5YR 6/1) overall.

5. Paste hardness: Moderate (Mohs $\approx$ 3.0).
6. Microcracking: A few sub-vertical microcracks were observed extending from the top surface ranging from 3 mm (1/8") up to 13 mm (1/2") deep.
7. Secondary deposits: Colorless to white acicular ettringite was observed within 10 mm (3/8") on either side of the construction joint near the base of the core sample. A single deposit of alkali-silica gel was observed filling an air void adjacent to a reactive shale fine aggregate particle at approximately 65 mm (2-9/16") from the bottom surface of the core.

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Project No.	P-0025900	Date:	8/2/2024	Date reviewed:	8/3/2024
Sample ID:	#15	Performed by:	B. Walter	Reviewed by:	B. Lemcke

I. GENERAL OBSERVATIONS

1. Sample Dimensions: Our analysis was performed on a 330 mm (13") x 133 mm (5-1/4") x 44 mm (1-3/4") thick lapped profile section and a 76 mm (3") x 52 mm (2") thin section that were saw-cut and prepared from the original 152 mm (6") diameter x 330 mm (13") long core.
2. Surface Conditions:
Top: Rough, diamond grooved surface exhibiting traffic wear/erosion.
Bottom: Rough, irregular, formed surface; placed on grade.
3. Reinforcement: None observed.
4. General Physical Conditions: The top surface of the concrete was diamond grooved with three parallel saw-cuts that were approximately 5 mm (3/16") wide by 5 mm (3/16") deep. The top surface exhibited mortar erosion/traffic wear with several exposed fine aggregate surfaces. A few sub-vertical drying-shrinkage microcracks proceeded from the top surface up to a maximum observed depth of 30 mm (1-3/16"). Carbonation from the top surface was negligible but was observed along sub-vertical microcracking up to 15 mm (9/16") depth. A few secondary deposits of white, acicular ettringite were observed within the bottom approximately 20 mm (13/16") of the core. Secondary deposits of alkali-silica gel were not observed in the sample. However, a few shale fine aggregate particles with fine internal microcracking were observed in the sample. The concrete was well consolidated and appeared air-entrained.

II. AGGREGATE

1. Coarse: 25 mm (1") nominal sized quarried and crushed stone consisting of fossiliferous limestone. The particles were mostly sub-angular in shape. The coarse aggregate appeared well graded and exhibited good overall distribution.
2. Fine: Natural quartz, feldspar, and lithic sand (carbonates, chert, granite, and basalt with a few iron oxide and shale particles). The grains were mostly sub-rounded with many smaller sub-angular particles. The fine aggregate appeared well graded and exhibited good overall uniform distribution.

III. CEMENTITIOUS PROPERTIES

1. Air Content: Not documented.
2. Depth of carbonation: Negligible but spiking up to 15 mm (9/16") depth from the top surface along surficial sub-vertical microcracking.
3. Paste/aggregate bond: Good.
4. Paste color: Light brownish gray (Munsell® 5YR 6/1) overall, darkening to medium dark gray (Munsell® N4) within base 20 mm (13/16") depth from the bottom surface.
5. Paste hardness: Moderate (Mohs ≈3.0).

- | | |
|------------------------|---|
| 6. Microcracking: | A few sub-vertical microcracks were observed extending from the top surface ranging from 4 mm (5/32") up to 30 mm (1-3/16") deep. |
| 7. Secondary deposits: | Colorless to white acicular ettringite was observed within the dark colored base 20 mm (13/16") layer of the paste. |

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Project No.	P-0025900	Date:	8/2/2024	Date reviewed:	8/3/2024
Sample ID:	#22	Performed by:	B. Walter	Reviewed by:	B. Lemcke

I. GENERAL OBSERVATIONS

1. Sample Dimensions: Our analysis was performed on a 330 mm (13") x 140 mm (5-1/2") x 51 mm (2") thick lapped profile section and a 76 mm (3") x 52 mm (2") thin section that were saw-cut and prepared from the original 152 mm (6") diameter x 330 mm (13") long core.
2. Surface Conditions:
Top: Rough, diamond grooved surface exhibiting traffic wear/erosion.
Bottom: Rough, irregular, formed surface; placed on grade.
3. Reinforcement: None observed.
4. General Physical Conditions: The top surface of the concrete was diamond grooved with four parallel saw-cuts that were approximately 5 mm (3/16") wide by 5 mm (3/16") deep. The top surface exhibited mortar erosion/traffic wear with several exposed fine aggregate surfaces. A few sub-vertical drying-shrinkage microcracks proceeded from the top surface up to a maximum observed depth of 16 mm (5/8"). Carbonation from the top surface was negligible but was observed along sub-vertical microcracking up to 16 mm (5/8") depth. A few secondary deposits of white, acicular ettringite were observed within the bottom approximately 15 mm (9/16") of the core. A single deposit of alkali-silica gel was observed filling an air void adjacent to a reactive shale fine aggregate particle at approximately 60 mm (2-3/8") from the bottom surface of the core. An entrapped-sized air void at approximately 76 mm (3") depth from the top surface was thinly lined with colorless alkali-silica gel. The reactive particle was not observed on the lapped surface, but was likely a shale fine aggregate particle. A few shale fine aggregate particles with fine internal microcracking were observed in the sample. The concrete was well consolidated and appeared air-entrained.

II. AGGREGATE

1. Coarse: 25 mm (1") nominal sized quarried and crushed stone consisting of fossiliferous limestone. The particles were mostly sub-angular in shape. The coarse aggregate appeared well graded and exhibited good overall distribution.
2. Fine: Natural quartz, feldspar, and lithic sand (carbonates, chert, granite, and basalt with a few iron oxide and shale particles). The grains were mostly sub-rounded with many smaller sub-angular particles. The fine aggregate appeared well graded and exhibited good overall uniform distribution.

III. CEMENTITIOUS PROPERTIES

1. Air Content: Not documented.
2. Depth of carbonation: Negligible but spiking up to 16 mm (5/8") depth from the top surface along surficial sub-vertical microcracking.
3. Paste/aggregate bond: Good.

4. Paste color: Light brownish gray (Munsell® 5YR 6/1) overall, darkening to medium dark gray (Munsell® N4) within base 20 mm (13/16") depth from the bottom surface.
5. Paste hardness: Moderate (Mohs ≈3.0).
6. Microcracking: A few sub-vertical microcracks were observed extending from the top surface ranging from 5 mm (3/16") up to 16 mm (5/8") deep.
7. Secondary deposits: Colorless to white acicular ettringite was observed within the dark colored base 15 mm (9/16") layer of the paste. A single deposit of alkali-silica gel was observed filling an air void adjacent to a reactive shale fine aggregate particle at approximately 60 mm (2-3/8") from the bottom surface. An entrapped-sized air void at approximately 76 mm (3") depth from the top surface was thinly lined with colorless alkali-silica gel.

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Project No.	P-0025900	Date:	8/2/2024	Date reviewed:	8/3/2024
Sample ID:	#57	Performed by:	B. Walter	Reviewed by:	B. Lemcke

I. GENERAL OBSERVATIONS

1. Sample Dimensions: Our analysis was performed on a 375 mm (14-3/4") x 140 mm (5-1/2") x 51 mm (2") thick lapped profile section and a 76 mm (3") x 52 mm (2") thin section that were saw-cut and prepared from the original 152 mm (6") diameter x 375 mm (14-3/4") long core.
2. Surface Conditions:
Top: Rough, broomed finish surface exhibiting traffic wear/erosion.
Bottom: Rough, irregular surface placed on black felt substrate.
3. Reinforcement: None observed.
4. General Physical Conditions: The top surface of the concrete was a flat, broomed finish surface that exhibited mortar erosion/traffic wear with several exposed fine aggregate surfaces. During preparation, the core sample was intentionally broken approximately 178 mm (7") from the top surface for ease of preparation. A few sub-vertical drying-shrinkage microcracks proceeded from the top surface up to a maximum observed depth of 6 mm (1/4"). Carbonation from the top surface was negligible. A single deposit of alkali-silica gel was observed filling an air void proximate to a reactive shale fine aggregate particle at approximately 19 mm (3/4") depth from the top surface of the core. A few shale fine aggregate particles with fine internal microcracking were observed in the sample. The concrete was well consolidated and appeared air-entrained.

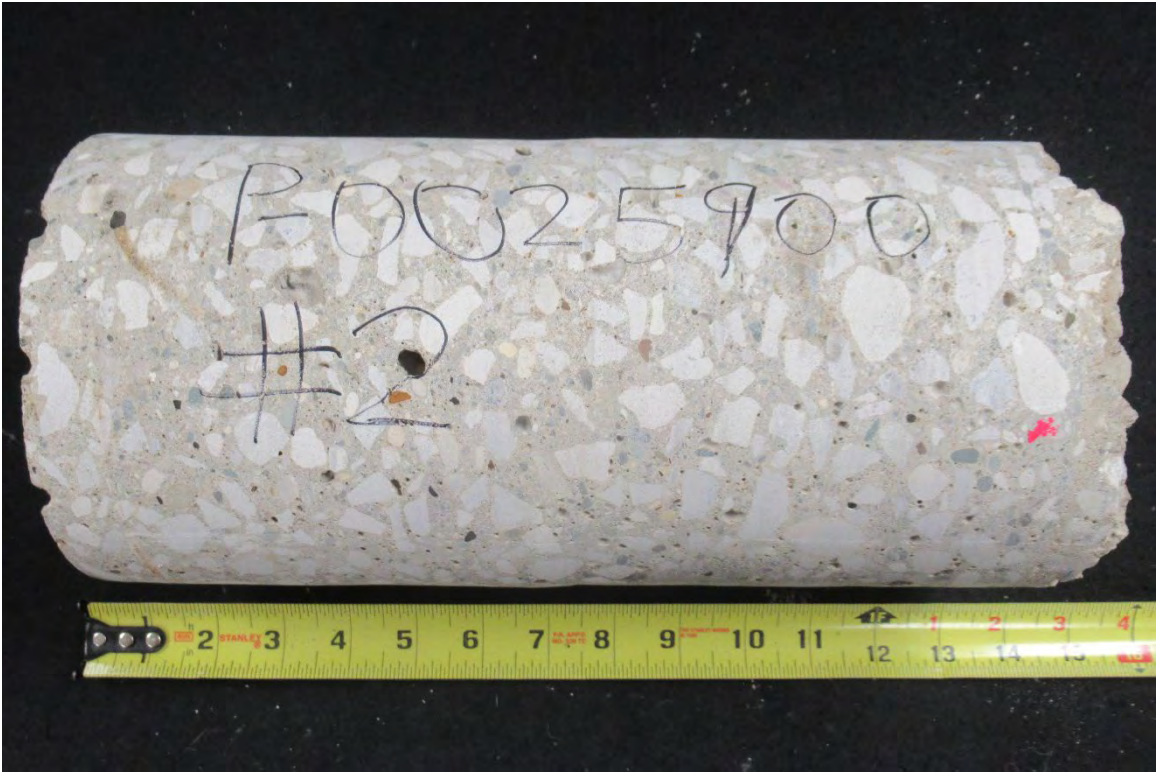
II. AGGREGATE

1. Coarse: 25 mm (1") nominal sized quarried and crushed stone consisting of fossiliferous limestone. The particles were mostly sub-angular in shape. The coarse aggregate appeared well graded and exhibited good overall distribution.
2. Fine: Natural quartz, feldspar, and lithic sand (carbonates, chert, granite, and basalt with a few iron oxide and shale particles). The grains were mostly sub-rounded with many smaller sub-angular particles. The fine aggregate appeared well graded and exhibited good overall uniform distribution.

III. CEMENTITIOUS PROPERTIES

1. Air Content: Not documented.
2. Depth of carbonation: Negligible
3. Paste/aggregate bond: Good.
4. Paste color: Very light gray (Munsell® N8).
5. Paste hardness: Moderate (Mohs ≈3.0).
6. Microcracking: A few sub-vertical drying-shrinkage microcracks proceeded from the top surface up to a maximum observed depth of 6 mm (1/4").
7. Secondary deposits: Colorless to white acicular ettringite was observed within the dark colored base 10 mm (3/8") layer of the paste.

Photo: 1



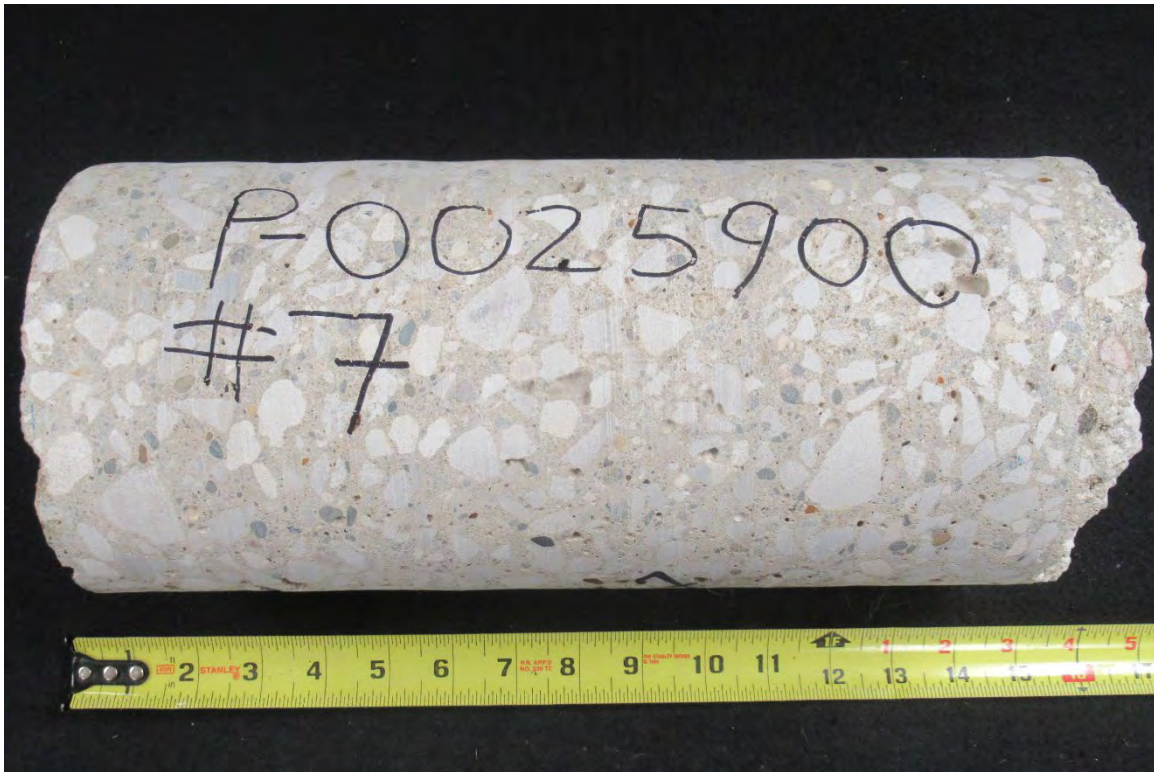
Sample ID: #2 Description: Profile of the core sample as received with the top surface to the left.

Photo: 2



Sample ID: #2 Description: The diamond grooved top surface of the sample as received.

Photo: 3

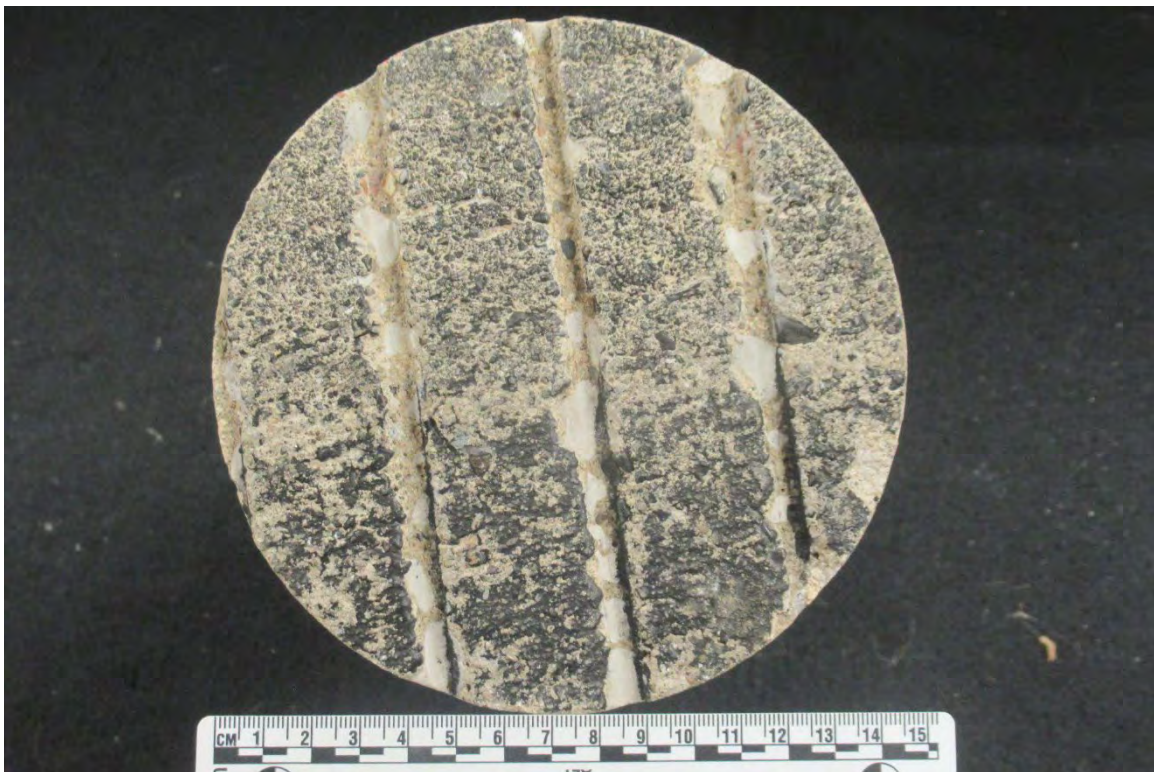


Sample ID:

#7

Description: Profile of the core sample as received with the top surface to the left.

Photo: 4

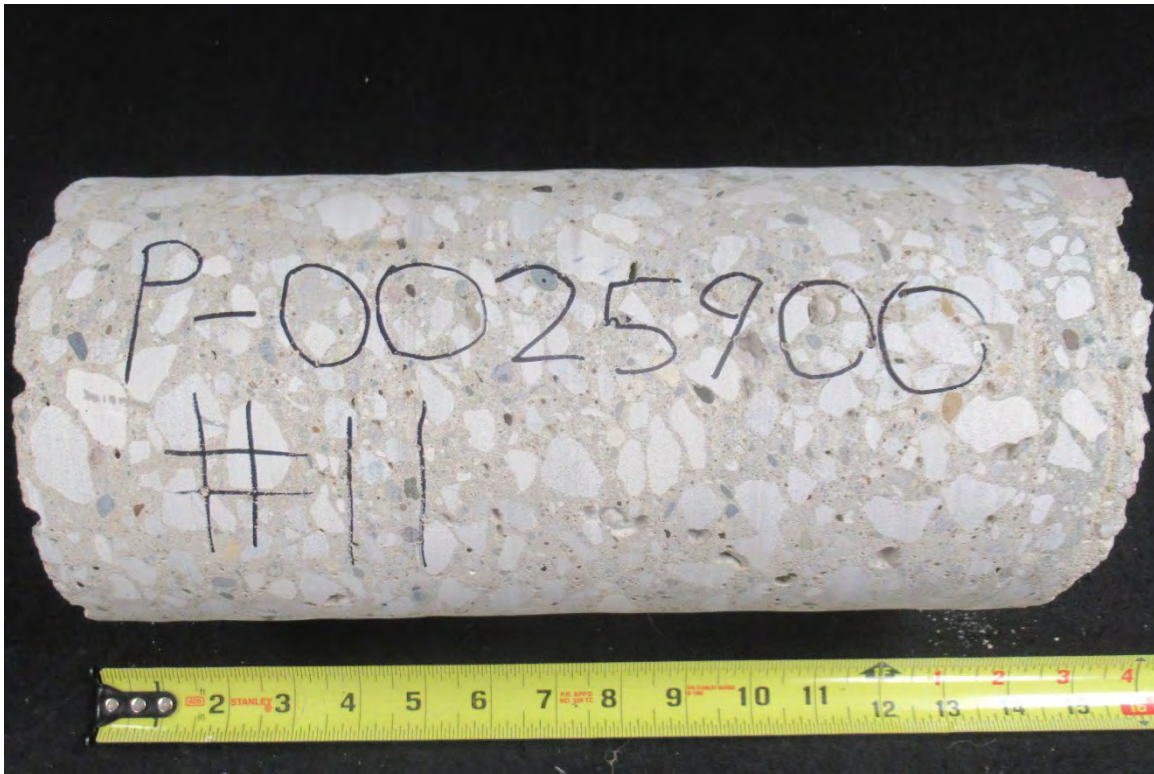


Sample ID:

#7

Description: The diamond grooved top surface of the sample as received.

Photo: 5

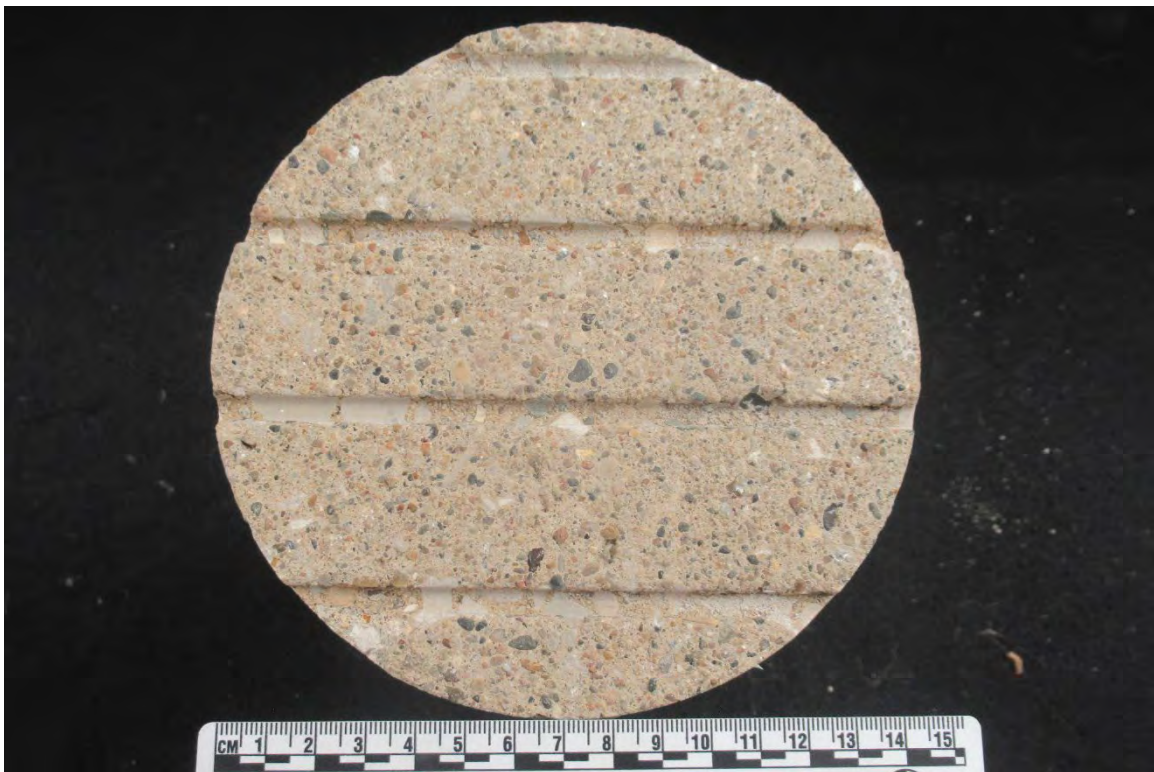


Sample ID:

#11

Description: Profile of the core sample as received with the top surface to the left.

Photo: 6

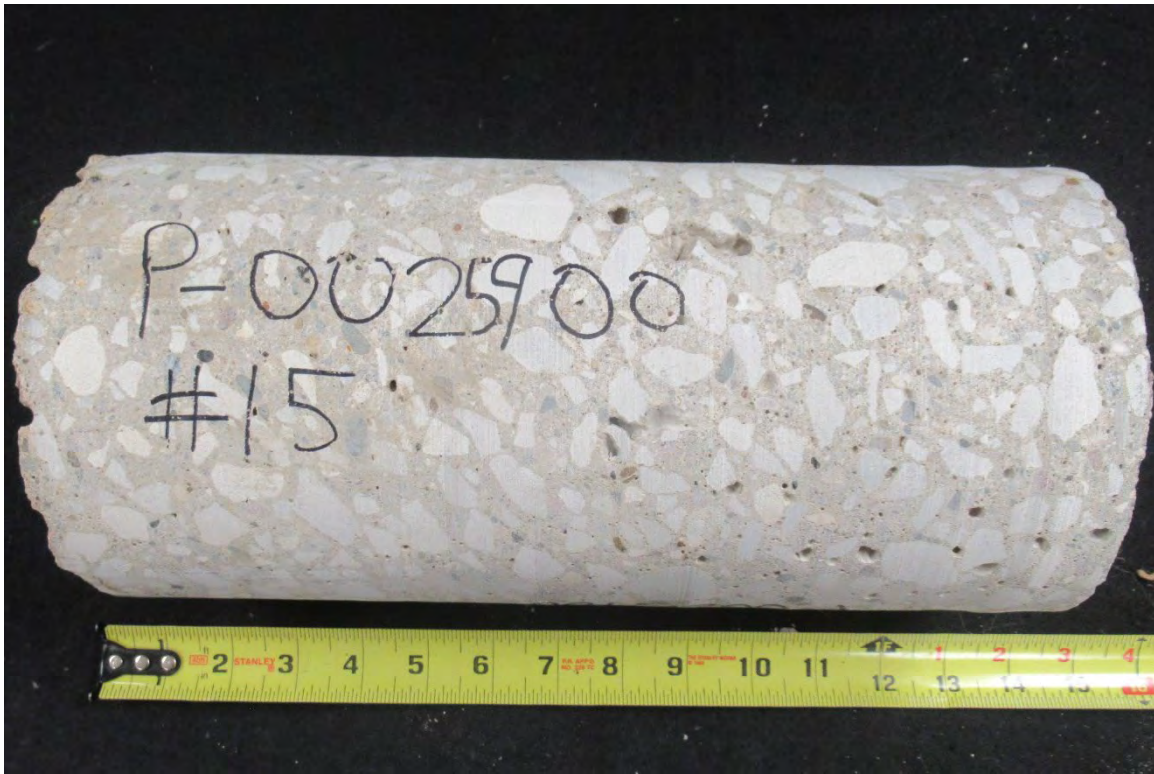


Sample ID:

#11

Description: The diamond grooved top surface of the sample as received.

Photo: 7



Sample ID:

#15

Description: Profile of the core sample as received with the top surface to the left.

Photo: 8

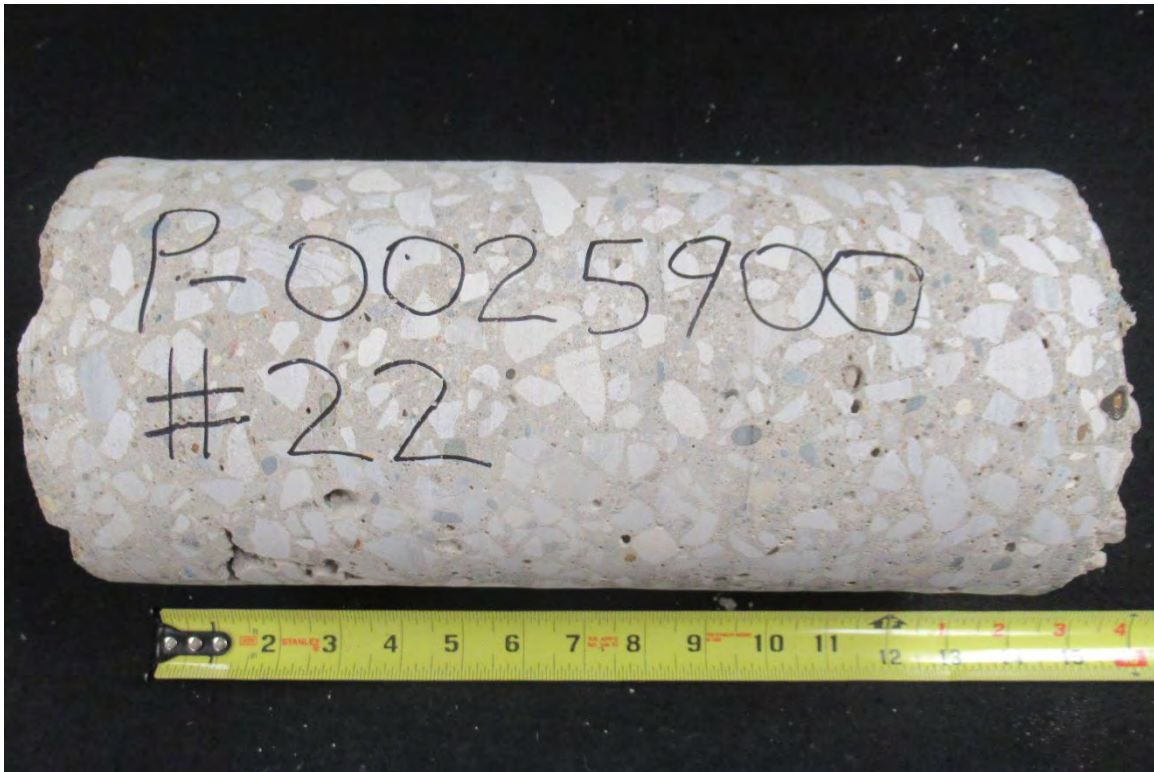


Sample ID:

#15

Description: The diamond grooved top surface of the sample as received.

Photo: 9

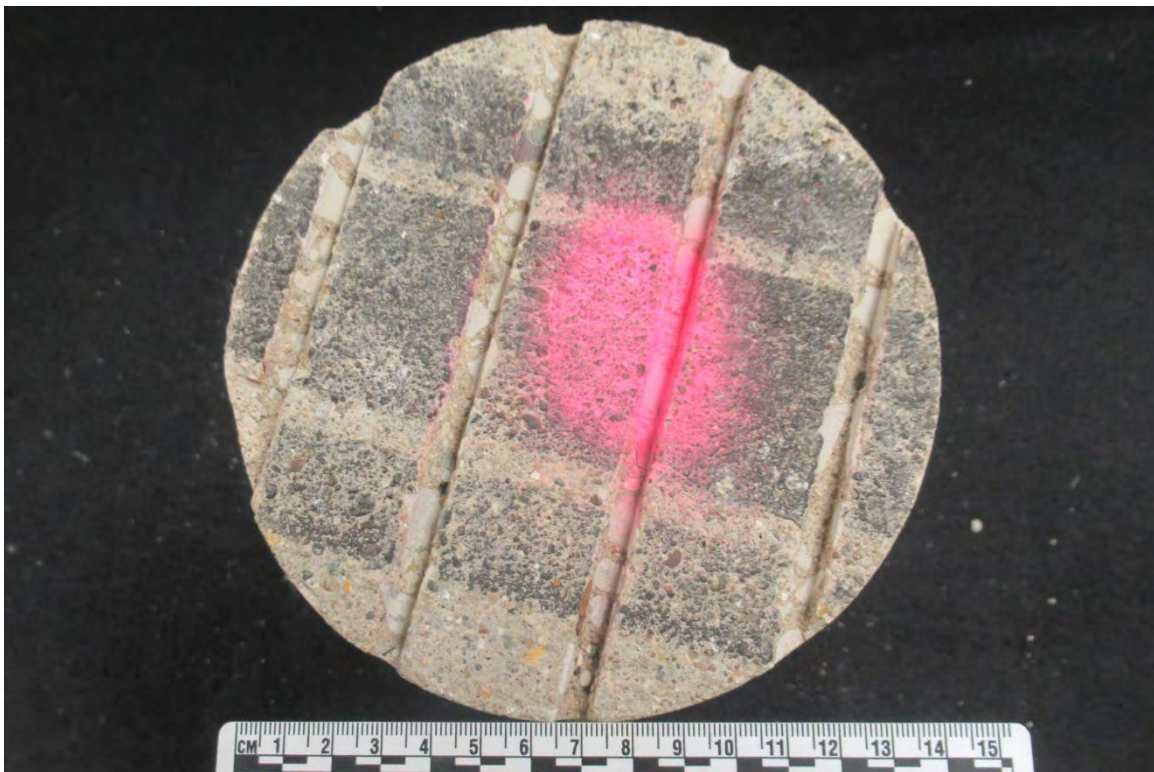


Sample ID:

#22

Description: Profile of the core sample as received with the top surface to the left.

Photo: 10

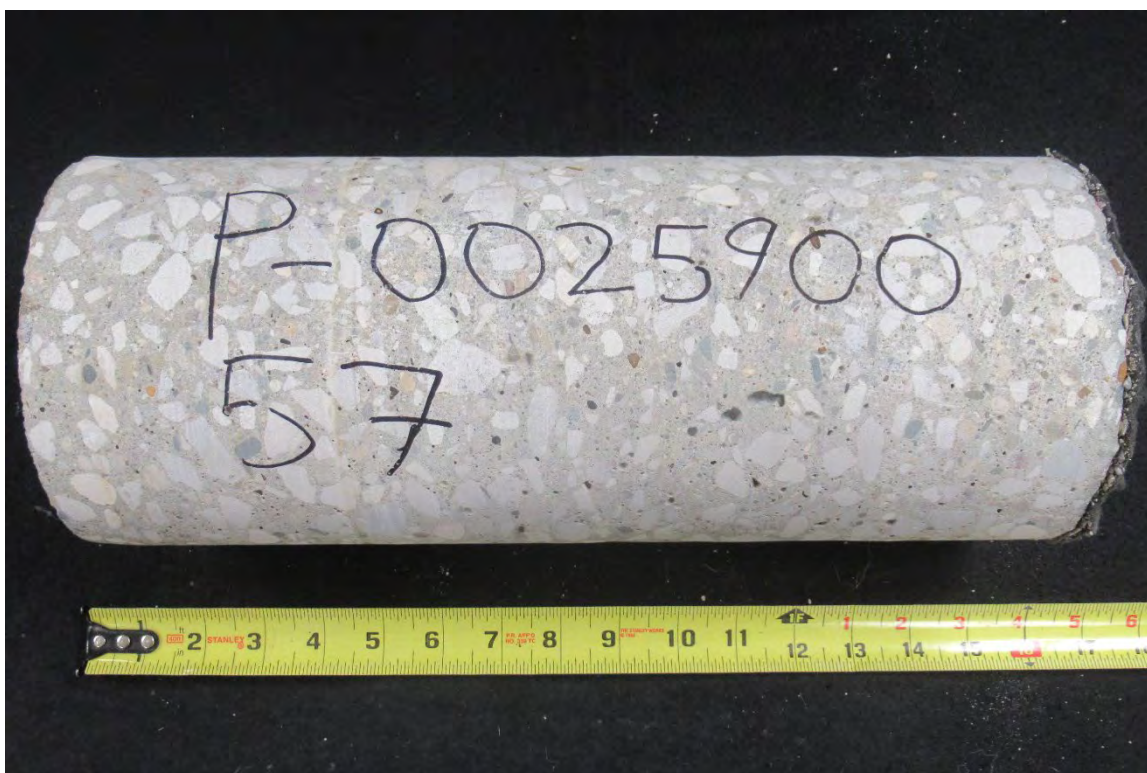


Sample ID:

#22

Description: The diamond grooved top surface of the sample as received.

Photo: 11

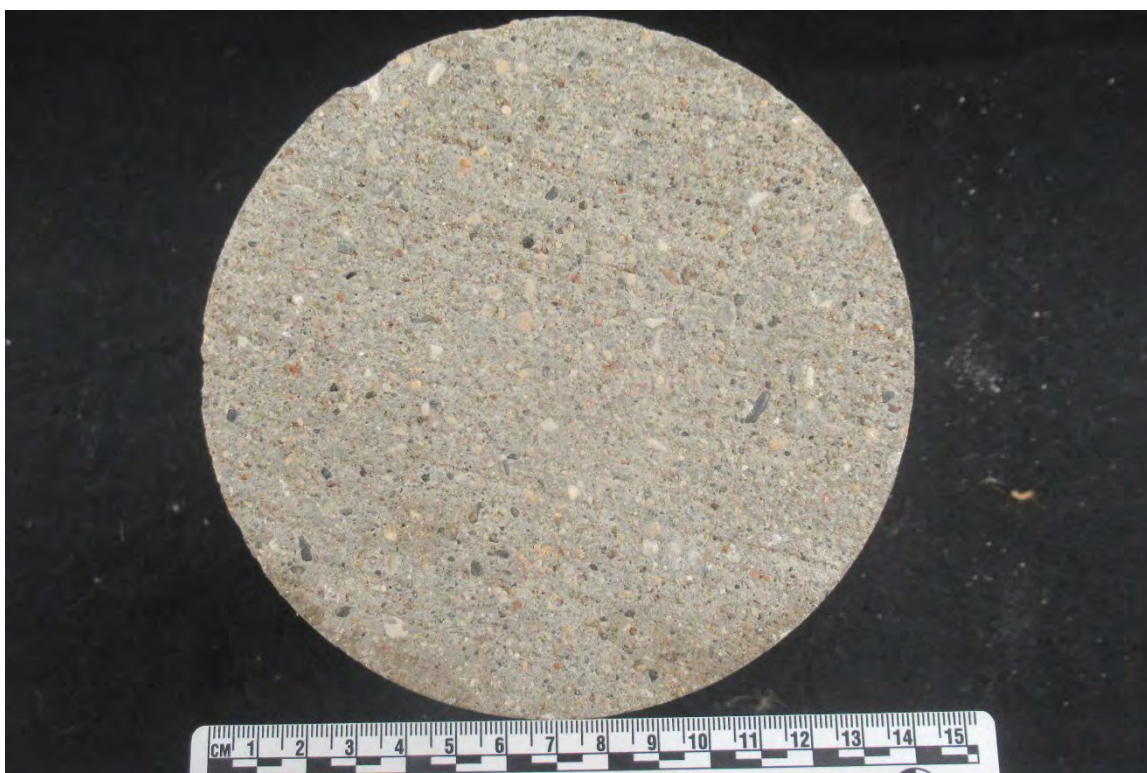


Sample ID:

#57

Description: Profile of the core sample as received with the top surface to the left.

Photo: 12



Sample ID:

#57

Description: The broomed top surface of the sample as received.



Photo: 13

Sample ID:

#2

Description: A saw-cut and lapped cross section of the sample with the top surface oriented up. Phenolphthalein applied to a corner to determine carbonation (unstained paste).



Photo: 14

Sample ID:

#7

Description: A saw-cut and lapped cross section of the sample with the top surface oriented up. Phenolphthalein applied to a corner to determine carbonation (unstained paste).



Photo: 15

Sample ID:

#11

Description: A saw-cut and lapped cross section of the sample with the top surface oriented up. Phenolphthalein applied to a corner to determine carbonation (unstained paste).



Photo: 16

Sample ID:

#15

Description: A saw-cut and lapped cross section of the sample with the top surface oriented up. Phenolphthalein applied to a corner to determine carbonation (unstained paste).

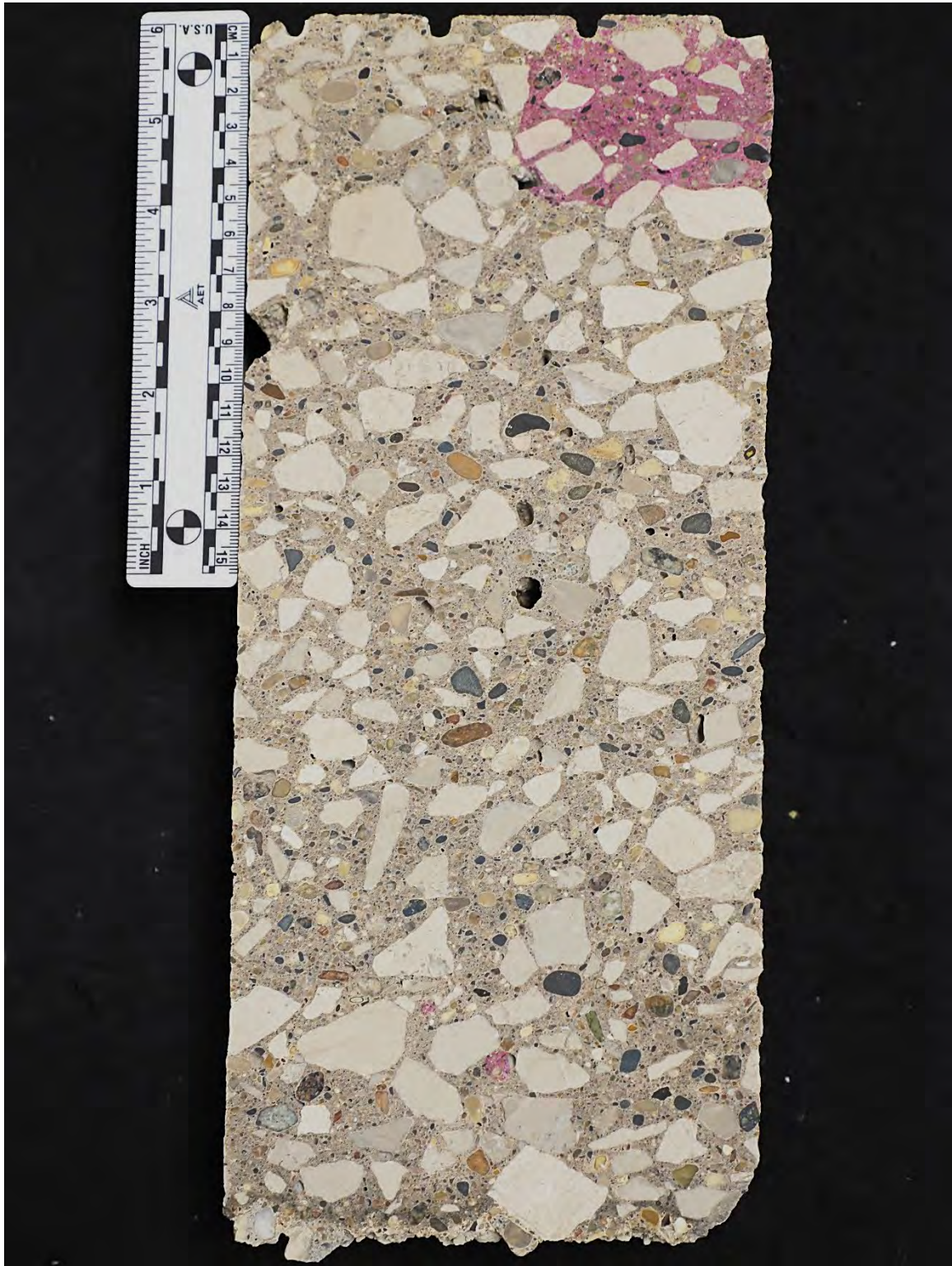


Photo: 17

Sample ID:

#22

Description: A saw-cut and lapped cross section of the sample with the top surface oriented up. Phenolphthalein applied to a corner to determine carbonation (unstained paste).



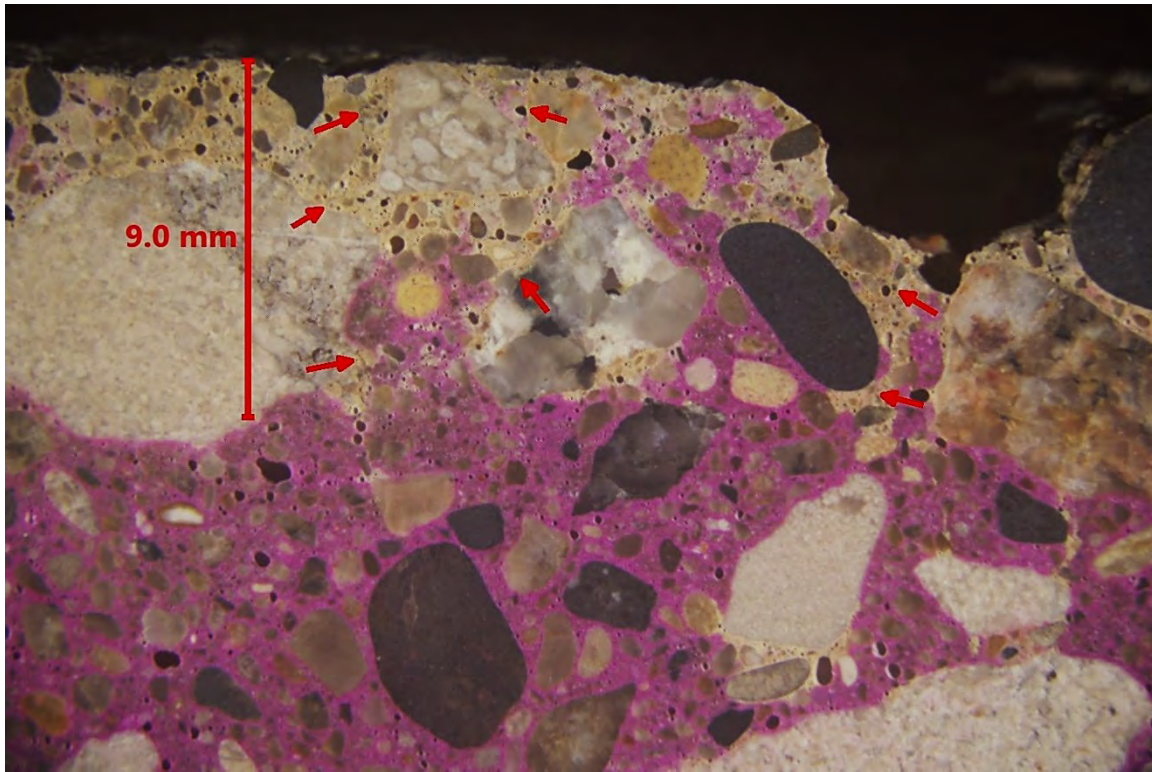
Photo: 18

Sample ID:

#57

Description: A saw-cut and lapped cross section of the sample with the top surface oriented up. Phenolphthalein applied to a corner to determine carbonation (unstained paste).

Photo: 19

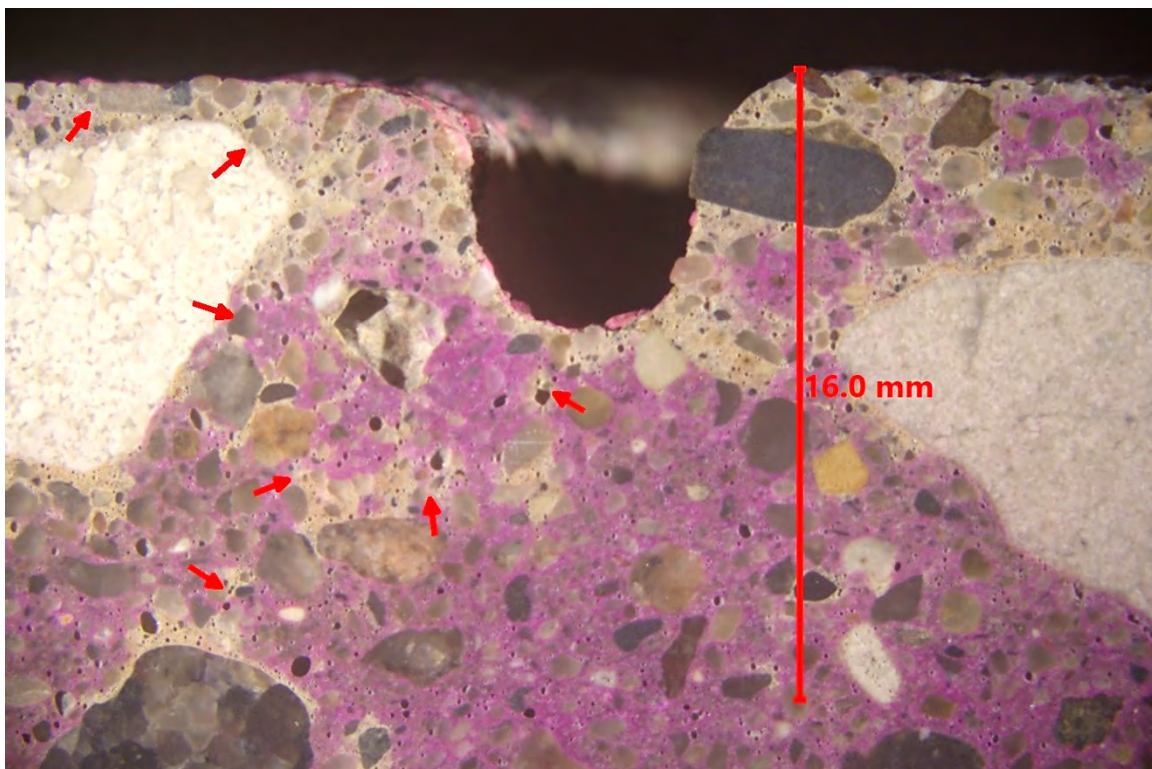


Sample ID:
Mag:

#7
7x

Description: Sub-vertical microcrack (red arrows) extending from the top surface approximately 9 mm (3/8") deep, viewed in saw cut and lapped core profile under low magnification.

Photo: 20

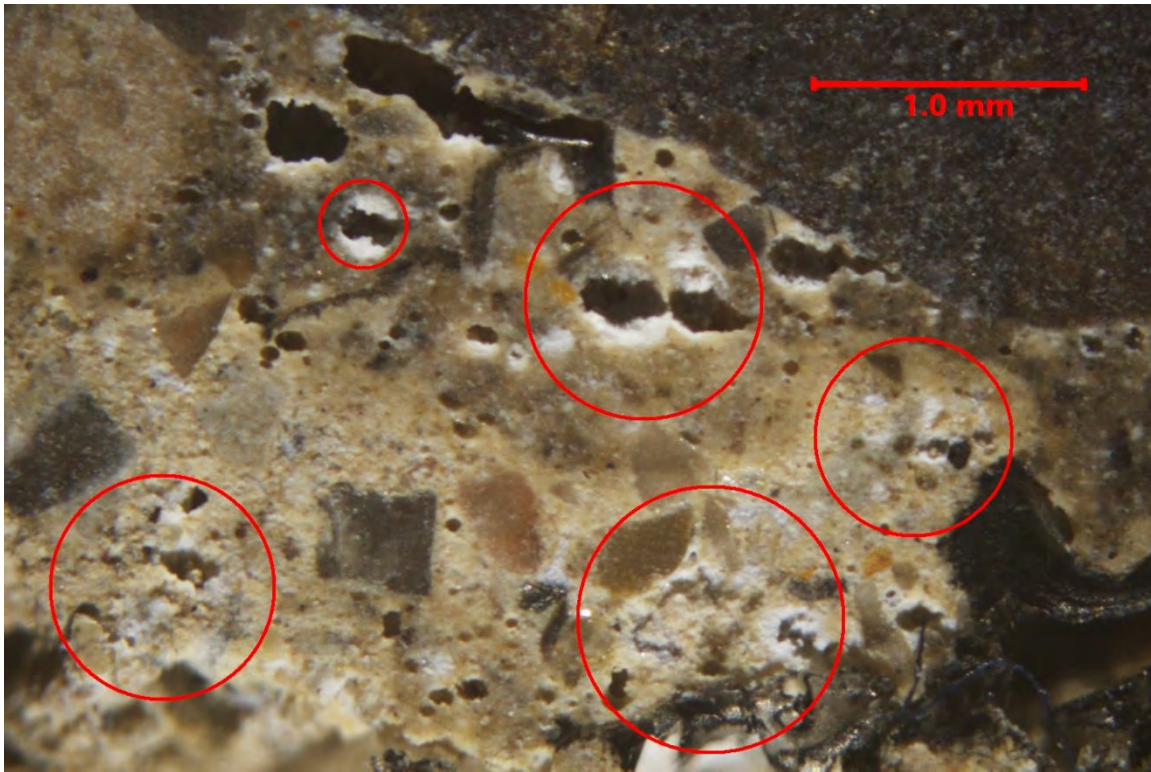


Sample ID:
Mag:

#15
7x

Description: Sub-vertical microcrack (red arrows) extending from the top surface approximately 16 mm (5/8") deep, viewed in saw cut and lapped core profile under low magnification.

Photo: 21

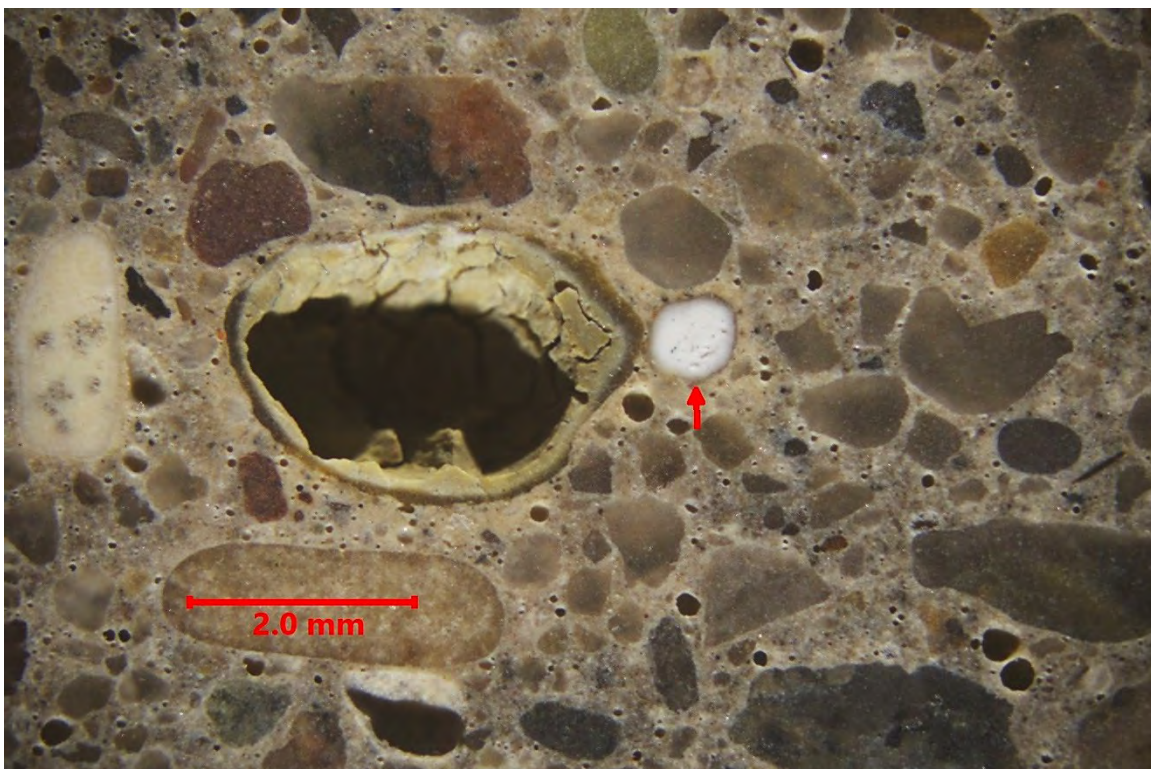


Sample ID:
Mag:

#2
50x

Description: Secondary ettringite deposits within air voids (red circles), viewed in saw cut and lapped core profile under magnification.

Photo: 22

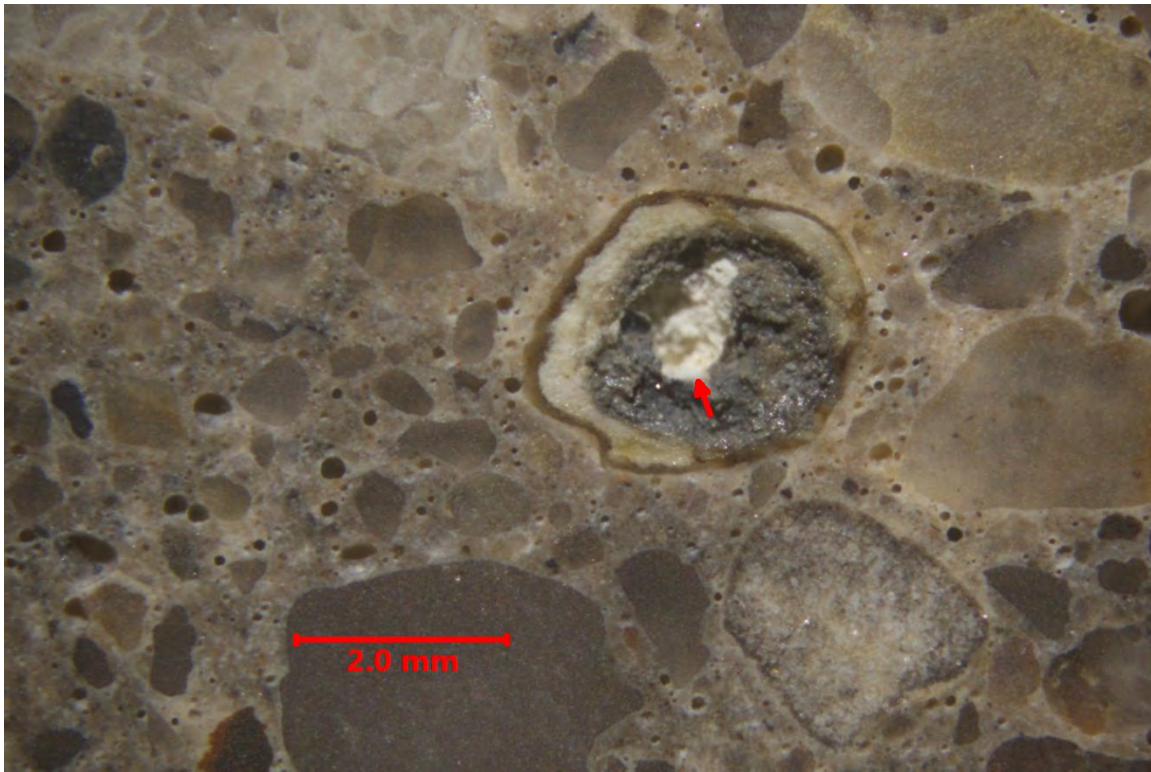


Sample ID:
Mag:

#2
20x

Description: White alkali-silica gel filling an air void (red arrow) proximal to a reactive shale fine aggregate particle. Viewed on saw cut and lapped core profile under low magnification.

Photo: 23

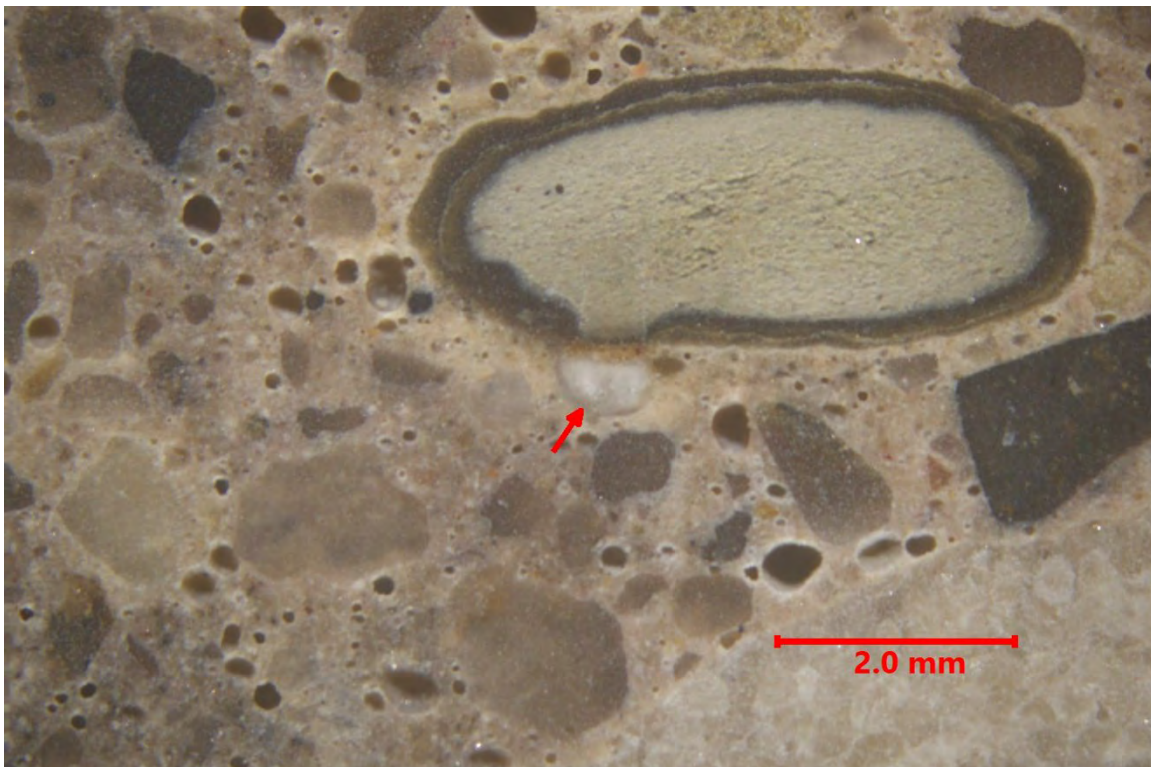


Sample ID:
Mag:

#11
25x

Description: White alkali-silica gel (red arrow) within a reactive shale fine aggregate particle. Viewed on saw cut and lapped core profile under low magnification.

Photo: 24



Sample ID:
Mag:

#22
32x

Description: White alkali-silica gel filling an air void (red arrow) proximal to a reactive shale fine aggregate particle. Viewed on saw cut and lapped core profile under low magnification.

FREEZING WEATHER EFFECTS ON BUILDING CONSTRUCTION

GENERAL

Because water expands upon freezing and soils contain water, soils which are allowed to freeze will heave and lose density. Upon thawing, these soils will not regain their original strength and density. The extent of heave and density/strength loss depends on the soil type and moisture condition. Heave is greater in soils with higher percentages of fines (silts/clays). High silt content soils are most susceptible, due to their high capillary rise potential which can create ice lenses. Fine grained soils generally heave about 1/4" to 3/8" for each foot of frost penetration. This can translate to 1" to 2" of total frost heave. This total amount can be significantly greater if ice lensing occurs.

DESIGN CONSIDERATIONS

Clayey and silty soils can be used as perimeter backfill, although the effect of their poor drainage and frost properties should be considered. Basement areas will have special drainage and lateral load requirements which are not discussed here. Frost heave may be critical in doorway areas. Stoops or sidewalks adjacent to doorways could be designed as structural slabs supported on frost footings with void spaces below. With this design, movements may then occur between the structural slab and the adjacent on-grade slabs. Non-frost susceptible sands (with less than 40% by weight passing a #40 sieve and no more than 5% by weight passing a #200 sieve) can be used below such areas. Depending on the function of surrounding areas, the sand layer may need a thickness transition away from the area where movement is critical. With sand placement over slower draining soils, subsurface drainage would be needed for the sand layer. High density extruded polystyrene insulation could be used within the sand to reduce frost penetration, thereby reducing the sand thickness needed. We caution that insulation placed near the surface can increase the potential for ice glazing of the surface.

The possible effects of adfreezing should be considered if clayey or silty soils are used as backfill. Adfreezing occurs when backfill adheres to rough surfaced foundation walls and lifts the wall as it freezes and heaves. This occurrence is most common with masonry block walls, unheated or poorly heated building situations and clay backfill. The potential is also increased where backfill soils are poorly compacted and become saturated. The risk of adfreezing can be decreased by placing a low friction separating layer between the wall and backfill.

Adfreezing can occur on exterior piers (such as deck, fence, or other similar pier footings), even if a smooth surface is provided. This is more likely in poor drainage situations where soils become saturated. Additional footing embedment and/or widened footings below the frost zones (which include tensile reinforcement) can be used to resist uplift forces. Specific designs would require individual analysis.

CONSTRUCTION CONSIDERATIONS

Foundations, slabs and other improvements which may be affected by frost movements should be insulated from frost penetration during freezing weather. If filling takes place during freezing weather, all frozen soils, snow and ice should be stripped from areas to be filled prior to new fill placement. The new fill should not be allowed to freeze during transit, placement or compaction. This should be considered in the project scheduling, budgeting and quantity estimating. It is usually beneficial to perform cold weather earthwork operations in small areas where grade can be attained quickly rather than working larger areas where a greater amount of frost stripping may be needed. If slab subgrade areas freeze, we recommend the subgrade be thawed prior to floor slab placement. The frost action may also require reworking and recompaction of the thawed subgrade.

Appendix A

Geotechnical Field Exploration and Testing

Report No. P-0025900

A.1 FIELD EXPLORATION

The subsurface conditions at the site were explored by drilling and sampling standard penetration test borings. The locations of the borings appear on Figure 1, preceding the Subsurface Boring Logs in this appendix.

A.2 SAMPLING METHODS

A.2.1 Split-Spoon Samples (SS)

Standard penetration (split-spoon) samples were collected in general accordance with ASTM: D1586. The ASTM test method consists of driving a 2-inch O.D. split-barrel sampler into the in-situ soil with a 140-pound hammer dropped from a height of 30 inches. The sampler is driven a total of 18 inches into the soil. After an initial set of 6 inches, the number of hammer blows to drive the sampler the final 12 inches is known as the standard penetration resistance or N-value.

A.2.2 Disturbed Samples (DS)/Spin-up Samples (SU)

Sample types described as “DS” or “SU” on the boring logs are disturbed samples, which are taken from the flights of the auger. Because the auger disturbs the samples, possible soil layering and contact depths should be considered approximate.

A.2.3 Sampling Limitations

Unless 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, and they may be present in the ground even if they are not noted on the boring logs.

Determining the thickness of “topsoil” layers is usually limited, due to variations in topsoil definition, sample recovery, and other factors. Visual-manual description often relies on color for determination, and transitioning changes can account for significant variation in thickness judgment. Accordingly, the topsoil thickness presented on the logs should not be the sole basis for calculating topsoil stripping depths and volumes. If more accurate information is needed relating to thickness and topsoil quality definition, alternate methods of sample retrieval and testing should be employed.

A.3 CLASSIFICATION METHODS

Soil descriptions 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 (sieve analysis or Atterberg Limits) have been performed, accurate classifications per ASTM: D2487 are possible. Otherwise, soil descriptions shown on the boring logs are visual-manual judgments. Charts are attached which provide information on the USC system, the descriptive terminology, and the symbols used on the boring logs.

Visual-manual judgment of the AASHTO Soil Group is also noted as a part of the soil description. A chart presenting details of the AASHTO Soil Classification System is also attached.

The boring logs include descriptions of apparent geology. The geologic depositional origin of each soil layer is interpreted primarily by observation of the soil samples, which can be limited. Observations of the surrounding topography, vegetation, and development can sometimes aid this judgment.

A.4 WATER LEVEL MEASUREMENTS

The groundwater level measurements are shown at the bottom of the boring logs. The following information appears under “Water Level Measurements” on the logs:

- ♦ 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 that the liquid in the borehole is drilling fluid

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

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A.5 LABORATORY TEST METHODS

A.5.1 Water Content Tests

Conducted per AET Procedure 01-LAB-010, which is performed in general accordance with ASTM: D2216 and AASHTO: T265.

A.5.2 Atterberg Limits Tests

Conducted per AET Procedure 01-LAB-030, which is performed in general accordance with ASTM: D4318 and AASHTO: T89, T90.

A.5.3 Sieve Analysis of Soils (thru #200 Sieve)

Conducted per AET Procedure 01-LAB-040, which is performed in general conformance with ASTM: D6913, Method A.

A.5.4 Particle Size Analysis of Soils (with hydrometer)

Conducted per AET Procedure 01-LAB-050, which is performed in general accordance with ASTM: D422 and AASHTO: T88.

A.5.5 Unconfined Compressive Strength of Cohesive Soil

Conducted per AET Procedure 01-LAB-080, which is performed in general accordance with ASTM: D2166 and AASHTO: T208.

A.5.6 Laboratory Soil Resistivity using the Wenner Four-Electrode Method

Conducted per AET Procedure 01-LAB-090, which is performed using Soil Box apparatus in the laboratory in general accordance with ASTM: G57

A.5.7 Organic Content Tests

Conducted per AET Procedure 20-SOI-010, which is performed in general accordance with ASTM D2974, Test Method C.

A.6 TEST STANDARD LIMITATIONS

Field and laboratory testing is done in general conformance with the described procedures. Compliance with any other standards referenced within the specified standard is neither inferred nor implied.

A.7 SAMPLE STORAGE

Unless notified to do otherwise, we routinely retain representative samples of the soils recovered from the borings for a period of 30 days.

Appendix B

Geotechnical Report Limitations and Guidelines for Use

Appendix B

Geotechnical Report Limitations and Guidelines for Use

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B.1 REFERENCE

This appendix provides information to help you manage your risks relating to subsurface problems which are caused by construction delays, cost overruns, claims, and disputes. This information was developed and provided by GBA¹, of which we are a member firm.

B.2 RISK MANAGEMENT INFORMATION

B.2.1 Understand the Geotechnical Engineering Services Provided for this Report

Geotechnical engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical engineering services is typically a geotechnical engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

B.2.2 Geotechnical Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared solely for the client.

Likewise, geotechnical engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. If you are the least bit uncertain about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

¹ Geoprosessional Business Association, 15800 Crabbs Branch Way, Suite 300, Rockville, MD 20855
Telephone: 301/565-2733: www.geoprosessional.org, 2019

Appendix B

Geotechnical Report Limitations and Guidelines for Use

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B.2.3 Read the Full Report

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. Read and refer to the report in full.

B.2.4 You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a rule, always inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

B.2.5 Most of the “Findings” Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed. The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

B.2.6 This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations only after observing actual subsurface conditions exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist do exist, the recommendations can be relied upon, assuming no other changes have occurred. The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.

B.2.7 This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

B.2.8 Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical engineering report, along with any attachments or appendices, with your contract documents, but be certain to note conspicuously that you've included the material for information purposes only. To avoid misunderstanding, you may also want to note that “informational purposes” means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the

Appendix B

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report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, only from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and be sure to allow enough time to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

B.2.9 Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled “limitations,” many of these provisions indicate where geotechnical engineers’ responsibilities begin and end, to help others recognize their own responsibilities and risks. Read these provisions closely. Ask questions. Your geotechnical engineer should respond fully and frankly.

B.2.10 Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a “phase-one” or “phase-two” environmental site assessment – differ significantly from those used to perform a geotechnical engineering study. For that reason, a geotechnical engineering report does not usually provide environmental findings, conclusions, or recommendations, e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Unanticipated subsurface environmental problems have led to project failures. If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

B.2.11 Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer’s services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, proper implementation of the geotechnical engineer’s recommendations will not in itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. Geotechnical engineers are not building-envelope or mold specialists.

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