# Geotechnical Evaluation Report

Former Ford Twin Cities Assembly Plant Redevelopment -
Infrastructure Phase
2192 Ford Parkway
St. Paul, Minnesota

*Prepared for*

## Ryan Companies US, Inc.

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

Joshua J. Van Abel, PE
Vice President, Principal Engineer
License Number: 45108
May 22, 2020

JOSHUA J. VAN ABEL
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STATE OF MINNESOTA

Project B1806527.00

Braun Intertec Corporation

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The Science You Build On.

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May 22, 2020

Project B1806527.00

Mr. Nick Koch
Ryan Companies US, Inc.
533 South 3rd Street, Suite 100
Minneapolis, MN 55415

Re: Geotechnical Evaluation
Former Ford Twin Cities Assembly Plant Redevelopment - Infrastructure Phase
2192 Ford Parkway
St. Paul, Minnesota

Dear Mr. Koch:

We are pleased to present this Geotechnical Evaluation Report for the Infrastructure Phase of the proposed redevelopment of the Former Ford Twin Cities Assembly Plant in St. Paul, Minnesota.

Thank you for making Braun Intertec your geotechnical consultant for this project. If you have questions about this report, or if there are other services that we can provide in support of our work to date, please contact Josh Van Abel at 952.995.2310 (jvanabel@braunintertec.com), Bob Janssen at 651.487.7017 (bjanssen@braunintertec.com) or Brandon Rounsville at 612.221.9007 (brounsville@braunintertec.com).

Sincerely,

BRAUN INTERTEC CORPORATION

Brandon S. Rounsville, EIT
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# A. Introduction

## A.1. Project Description and Ownership

This Geotechnical Evaluation Report addresses the geotechnical design and construction aspects associated with the infrastructure improvements for the redevelopment of the Former Ford Twin Cities Assembly Plant Site located at Ford Parkway and Mississippi River Boulevard (general site address of 2192 Ford Parkway) in St. Paul, Minnesota. The City of St. Paul has developed a master plan for redevelopment and Ford Motor Company has selected Ryan Companies US, Inc. (Ryan Companies) to develop the site. Ryan Companies, which has denoted the site as Project Paul, is currently developing project documents for the redevelopment of the site.

The master plan outlines a new "urban village" that encompasses a multi-use project that could bring more than 4,000 new residents, along with various commercial facilities and amenities, to the Highland Park neighborhood of St. Paul. Proposed development plans show a mix of one- to six-unit residential housing, multi-family residential housing, and commercial and mixed-use properties, along with supporting infrastructure improvements. The public infrastructure phase of the development will include streets, pedestrian bridges, sidewalks and paths, plaza areas, below-grade utilities, and various stormwater features. Figure 1 displays a potential Ryan Development Scenario rendering of the Ford Site.

**Figure 1. Proposed Rendering of Ryan's Development Scenario of the Ford Site**

Provided by Alternative Urban Areawide Review (AUAR) prepared by Kimley-Horn.

Table 1 displays the details of the Ryan Development Scenario, as well as the maximum use (density) allowed under the current regulating documents on all four parcels within the AUAR study area. Figure 2 displays the AUAR study area.

**Table 1. Development Scenarios**

| Land Use | Ryan Development Scenario* | Master Plan Maximum Development Scenario* |
|---|---|---|
| Residential (dwelling units) | 3,800 | 4,000 |
| Retail and Service (square feet of gross floor area) | 150,000 | 300,000 |
| Office and Employment (square feet of gross floor area) | 265,000 | 450,000 |
| Civic and Institutional (square feet of gross floor area) | 50,000 | 150,000 |

*Provided within AUAR.

**Figure 2. Project Area**


Provided within AUAR.

Figure A1, Appendix A (provided by Ryan Companies), shows an illustration of the current proposed site layout. The redevelopment is currently separated into a total of 36 individual blocks, 4 outlots, and 4 parks. Figure 3 (below) and Figure A2 (Appendix A) display the end ownership for the different portions of the redevelopment. Based on the provided plan, Ramsey County will be responsible for the right-of-way along Ford Parkway; private development will be responsible for Blocks 1 to 29, and 31 to 36; the City of St. Paul will be responsible for the public roadways, utilities (including stormwater facilities), and the 4 park locations; the master association will be responsible for the civic plaza, civic square, and the central water feature; and St. Paul Highland Ball will be responsible for Block 30.

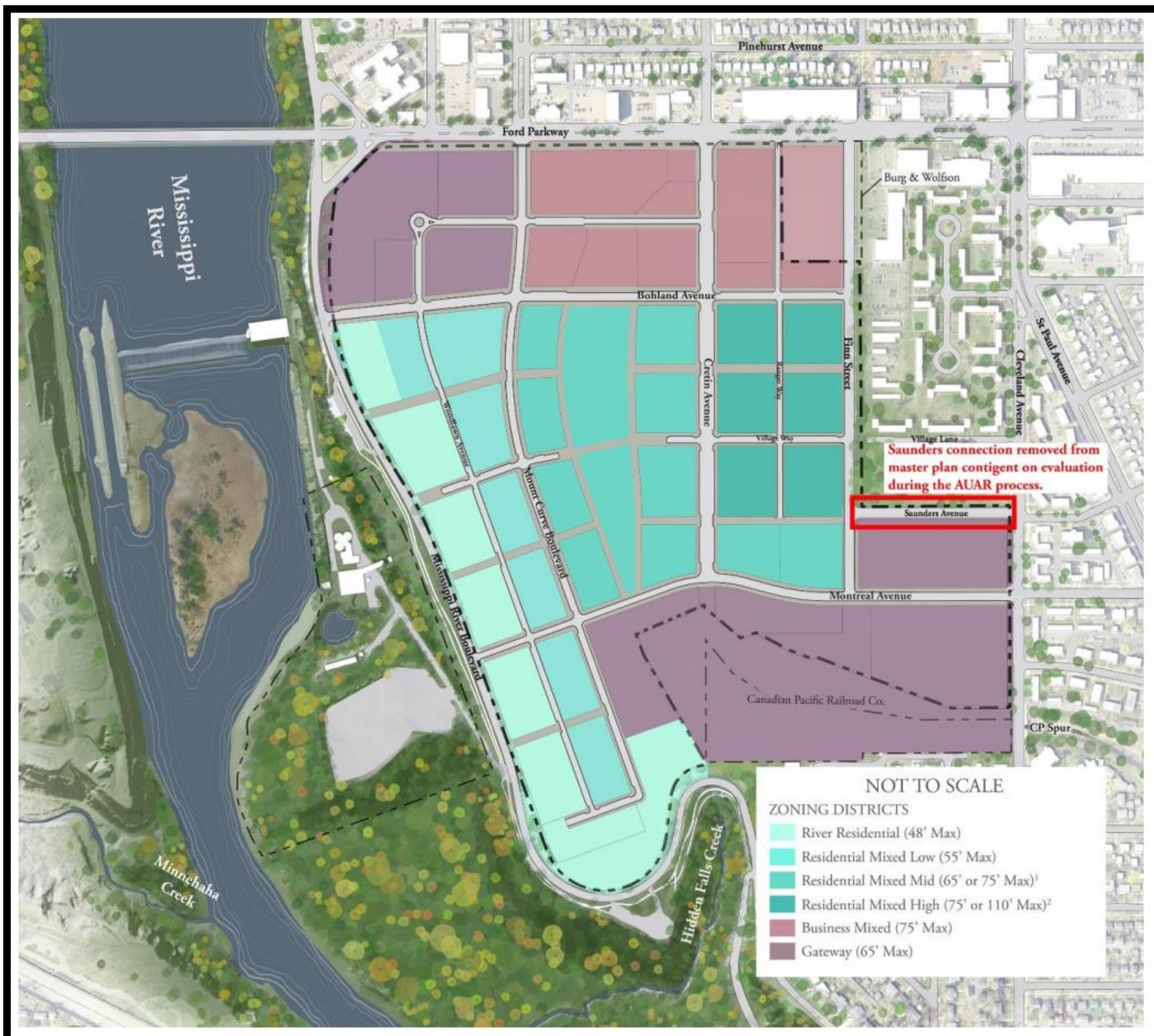
**Figure 3. Ownership Plan**


Provided by Ryan Companies.

## A.2. Development and Construction Schedule

From a planning standpoint, the northern portion of the site (along Ford Parkway) is planned for commercial and mixed-used development, eastern portions of the site (east of the Central Water Feature) are planned for multi-family development, and the western portions of the site (between the Central Water Feature and Mississippi River Boulevard) are planned for single-family housing. Figure 4 displays the current zoning map for the proposed redevelopment.

**Figure 4. Site Zoning and Public Realm Master Plan Zoning Map**




Provided within AUAR.

Most of the proposed mixed-use, commercial and multi-family buildings on the site will be three- to six-story structures with light to moderate foundation loads. Preliminary planning includes one level of underground parking for the multi-family housing, commercial, and mixed-use buildings and probable basements for the one- to six-unit residential housing. However, current development plans are conceptual and specific development on each block will be site dependent.

We understand construction of the infrastructure improvements is slated to begin in the spring of 2020. Ryan Companies provided us with a preliminary schedule as of September 26, 2019. A generalized overview of the schedule is listed below. Figure A4 in Appendix A, dated January 21, 2020, provides a visualization of the proposed construction completion schedule for the right-of-way improvements and private development.

- Mass grading to start May of 2020.
- Phase 1 of utilities to start May of 2020.
- Phase 1 of public right-of-way improvements to start late 2020.
- Central Water Feature: Retaining walls, below-grade storm systems and open air filtration basin to start July of 2020, with the remainder of the feature completed in 2021.
- Hidden Falls Headwater Creek Channel: Below-grade storm systems and open air filtration basin to start in mid-2020, with the remainder of the feature completed in 2021.
- Gateway Park: Storm pond and open air filtrations to start in fall of 2020.
- Civic Plaza: Below-grade storm system and retaining walls to start in 2020, remainder of the plaza completed in 2021.
- Neighborhood Park and City Park to start in summer of 2022.
- Phase 2 through 5 utilities and right-of-way to be completed from 2022 to 2026.

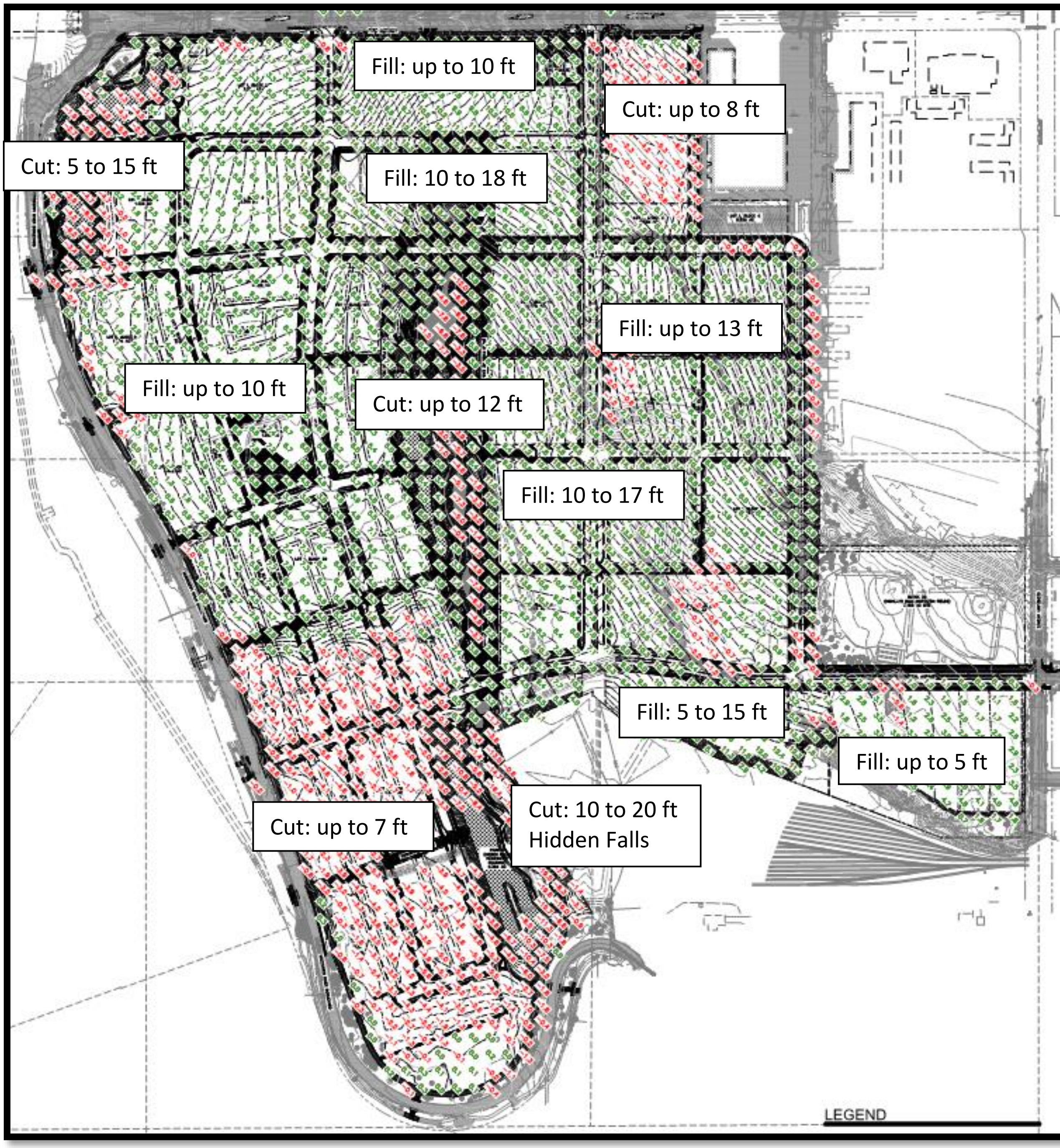
## A.3. Proposed Infrastructure Details

As depicted within the figures included in Appendix A, the public infrastructure phase of the development will include streets, pedestrian bridges, sidewalks and paths, plaza areas, below-grade utilities, and various stormwater features.

### A.3.a. Grade Changes

Based on the proposed grading plan provided by Ryan Companies, cuts up to 8 feet and fills up to 18 feet are expected to rough grade the site (excluding basements and stormwater features). Figure A3, Appendix A, and Figure 5, below, display the preliminary cut and fill plan for the project site. Cuts ups to approximately 20 feet below grade are anticipated for new stormwater ponds with the deepest cuts in the Hidden Falls Headwater Feature. The greatest fills are associated with the Civic Plaza area and east of the Central Water Feature.

**Figure 5. Preliminary Cut/Fill Illustration**



### A.3.b. Pavements

Initial development will include the construction of public streets, trails and sidewalks. Table 2 provides information regarding the new paved areas across the site.

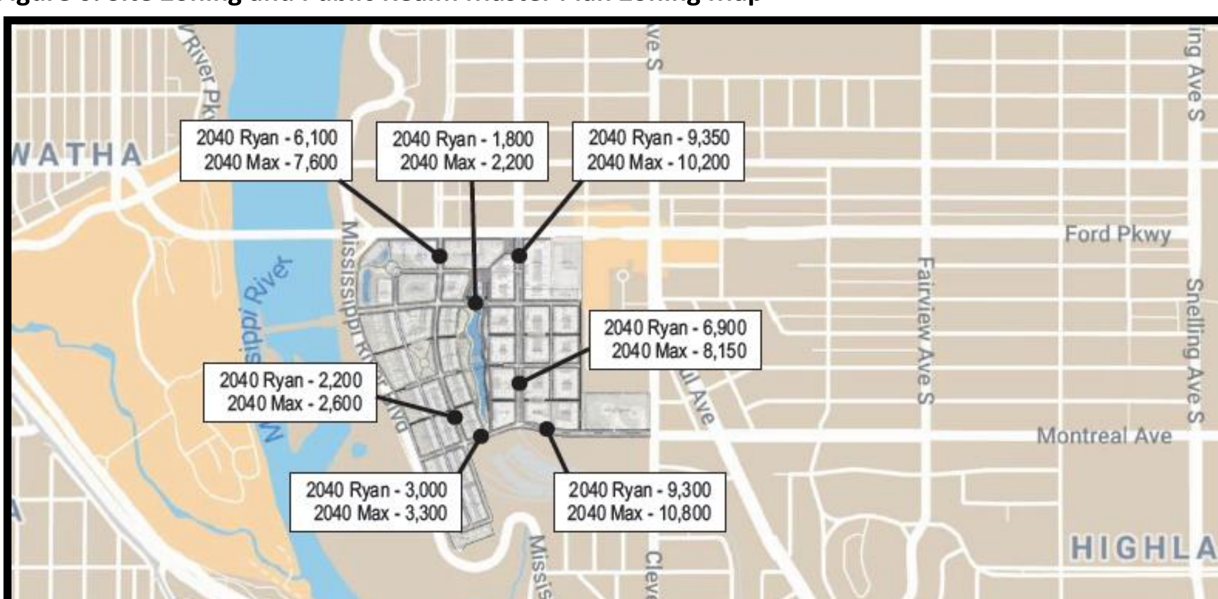
**Table 2. Proposed Roadway Improvements**

| Roadway Type | Name/Details |
|---|---|
| Primary Road | Cretin Avenue, Mount Curve Boulevard, Montreal Avenue, Bohland Avenue, Finn Street, Hillcrest Avenue, Woodlawn Avenue (STA. 102+73 to STA. 106+21), Village Way* (STA. 196+74 to STA. 201+46) and (STA. 206+36 to STA. 214+22) |
| Secondary Road | Ranger Way* (STA. 121+66 to STA. 129+47), Woodlawn Avenue (STA. 80+00 to STA. 102+73) |
| Shared Path | Beechwood Avenue, Village Way*, Ranger Way*, Saunders Avenue, Yorkshire Avenue |
| Bike Trail/Pedestrian-Use Only | Falls Passage (East and West), Mississippi River Boulevard Bike Trail, Ford Parkway Bike Trail, Sidewalks, and Various Park Trails |

*Portions of Village Way and Ranger Way will be either a Primary or Secondary Road with portions of the road being a Shared Path. Woodland Avenue will include Primary and Secondary Road segments.

Figure 6 denotes the anticipated 2040 traffic volumes for the new internal streets associated with the development. Table 3 provides the estimated 20-year design ESALs for the streets based on the anticipated traffic volumes (based on the potential maximum volumes).

**Figure 6. Site Zoning and Public Realm Master Plan Zoning Map**




Provided in AUAR.

**Table 3. Maximum Estimated 20-year Design ESALs[1]**

| Roadway/Structure Type | Design ESALs |
|---|---|
| Primary Road | 1,300,000 |
| Secondary Road | 250,000 |
| Shared Path | 50,000[2] |

[1] Equivalent 18,000-pound axle loads for flexible pavement design.

[2] Subject to occasional maintenance and emergency vehicle traffic.

In addition to the pavement areas defined above, development of the Civic Plaza and Square, Central Water Feature, and other green spaces will include paved (bituminous or concrete) sidewalk and plaza areas for pedestrian and public use. These pavements will generally not be subject to vehicle loads, with the exception of maintenance (including vac trucks) and emergency vehicles for select portions or segments of the pavements.

### A.3.c. Underground Utilities

Sanitary sewer lines serving the development will be installed below Woodlawn Avenue, Mount Curve Boulevard, Cretin Avenue, Montreal Avenue, Hillcrest Avenue, Bohland Avenue, Beechwood Avenue, Village Way, Saunders Avenue, and Yorkshire Avenue. All of the sanitary sewer lines for the project discharge to Saunders Avenue, which connects into the sanitary sewer on Mississippi River Boulevard. Table 4 displays the manhole structure heights and outlet elevations for the manholes on each of the streets that contain sanitary sewer lines. Figures 7 and 8 display the depth from proposed finished grades to the depth of the sanitary sewer lines and manholes for the entire development. In general, the sanitary sewer lines and manholes are anticipated be installed at depths ranging from about 8 to 28 feet below finished road elevations with elevations ranging from about 788 to 842 feet MSL. The exception will be a new sanitary sewer drop shaft west of Saunders Avenue that will connect the new system to the existing sanitary sewer system west of the site. The drop shaft will extend near elevation 751.

**Table 4. Sanitary Sewer Manhole Build Heights and Outlet Elevations**

| Street | Manhole Build Heights | | Manhole Pipe Outlet Elevation | |
|---|---|---|---|---|
| | Low (ft) | High (ft) | Low (ft MSL) | High (ft MSL) |
| Mount Curve Boulevard | 10.6 | 18.0 | 794.3 | 806.8 |
| Cretin Avenue | 10.2 | 18.6 | 798.8 | 832.8 |
| Woodlawn Avenue | 9.4 | 28.4 | 787.6 | 804.6 |
| Hillcrest Avenue | 8.0 | 18.0 | 805.1 | 829.4 |
| Bohland Avenue | 7.7 | 16.7 | 802.3 | 842.0 |
| Beechwood Avenue | 9.4 | 18.6 | 800.1 | 834.2 |
| Village Way | 8.5 | 19.9 | 798.1 | 834.3 |
| Saunders Avenue | 13.0 | 60.1* | 751.2* | 819.3 |
| Montreal Avenue | 8.7 | 18.6 | 789.5 | 824.8 |
| Yorkshire Avenue | 12.0 | 13.9 | 792.2 | 794.9 |

*Reflective of sanitary sewer drop shaft west of Saunders Avenue.

**Figure 7. Sanitary Sewer Lines and Manholes Depths from Proposed Grades (North)**

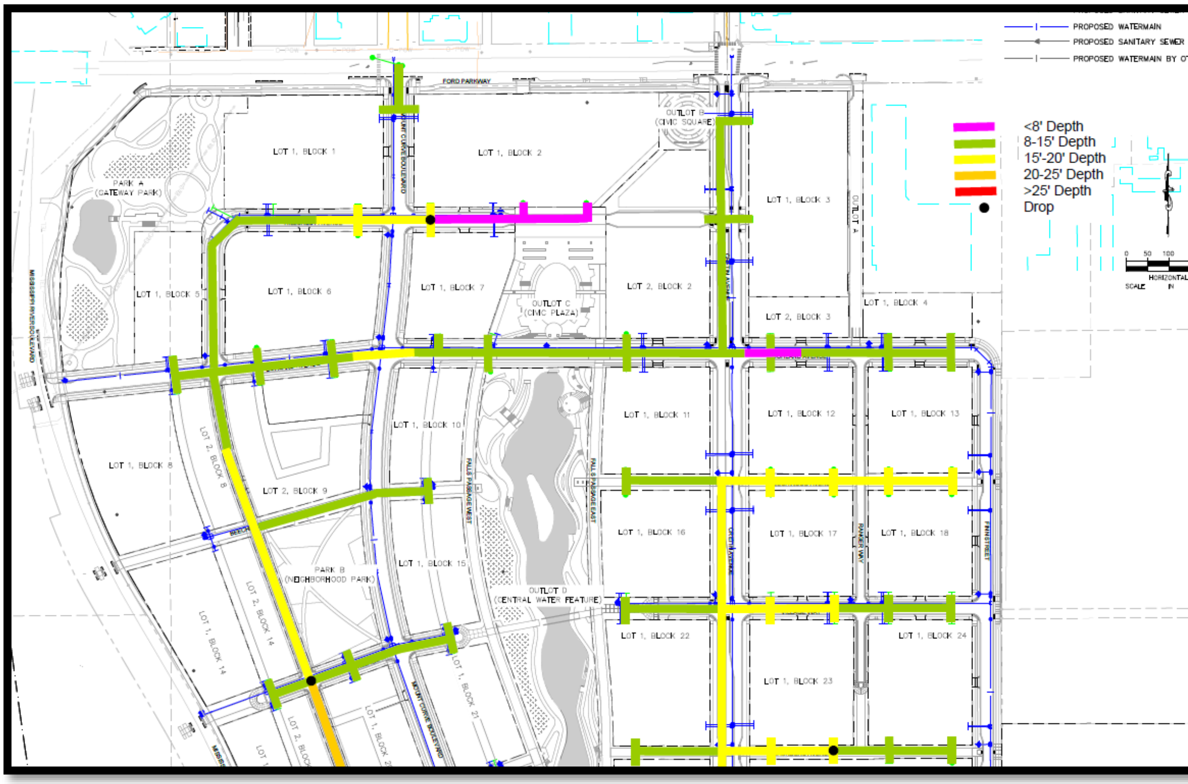
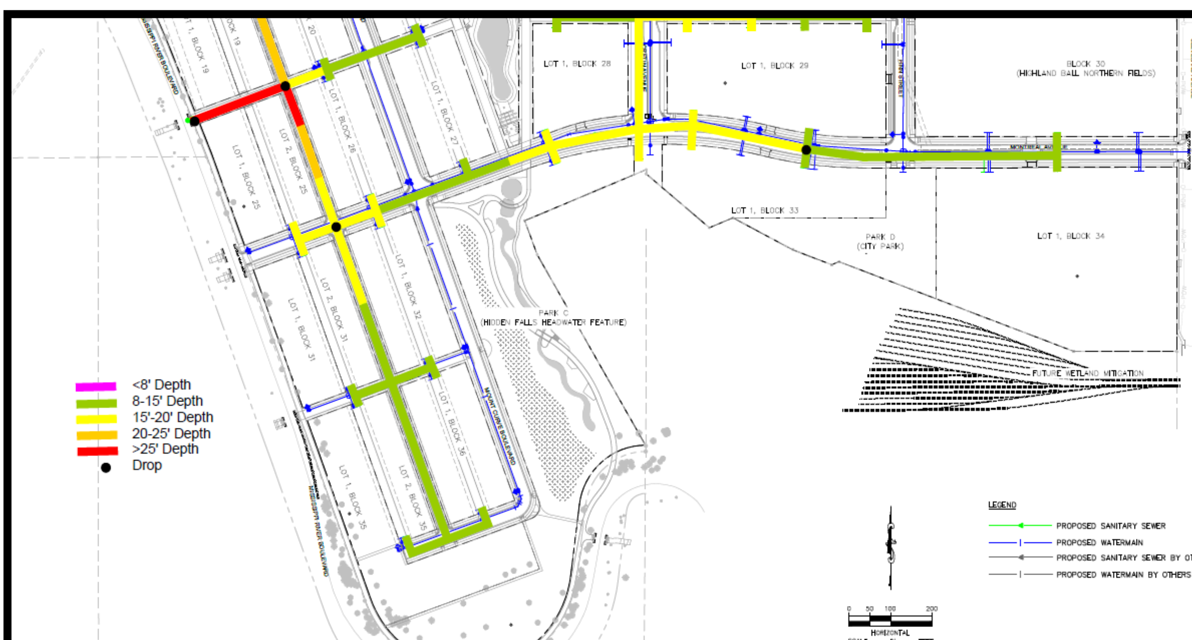



**Figure 8. Sanitary Sewer Lines and Manholes Depths from Proposed Grades (South)**



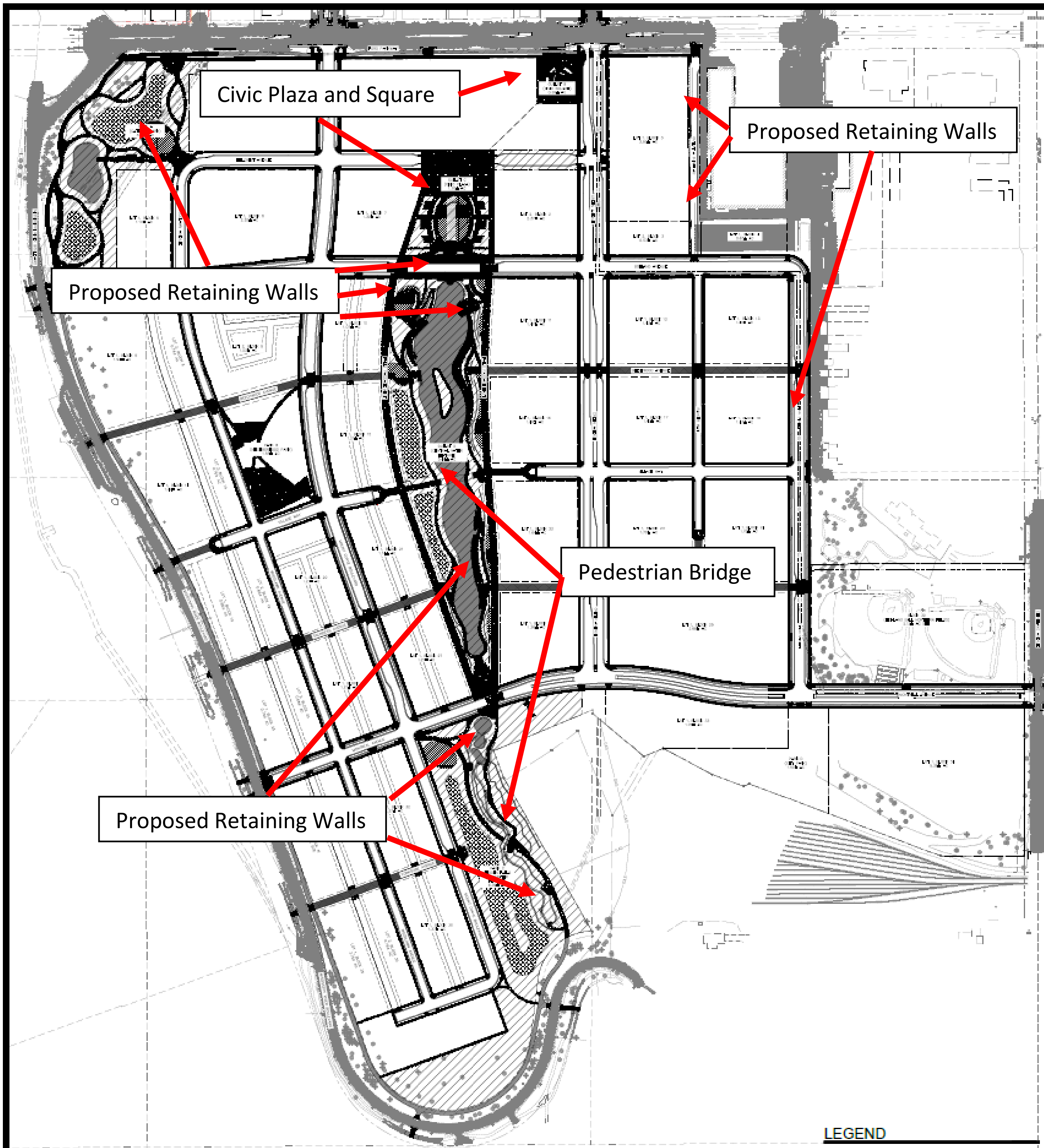
Water main lines serving the development are anticipated to be installed below Mount Curve Boulevard, Cretin Avenue, Montreal Avenue, Hillcrest Avenue, Bohland Avenue, Beechwood Avenue, Village Way, Saunders Avenue, Woodlawn Avenue, Finn Street, and Yorkshire Avenue. The water line installation depths are to be installed with minimum depths ranging from 6 1/2 to 8 feet below finished road elevations, with a majority of the water main lines to be installed at a depth of at least 8 feet below finished road elevations.

See Section A.3.e for proposed stormwater improvement details.

### A.3.d. Site Structure and Features

The infrastructure improvements for the site will include two pedestrian bridges. Proposed retaining walls are to be constructed as part of but not limited to Bohland Avenue, Gateway Park, the Central Water Feature, Hidden Falls Headwater Feature, in Outlot A, and along Finn Street. Figure 9 displays the locations of the proposed site structures and features.

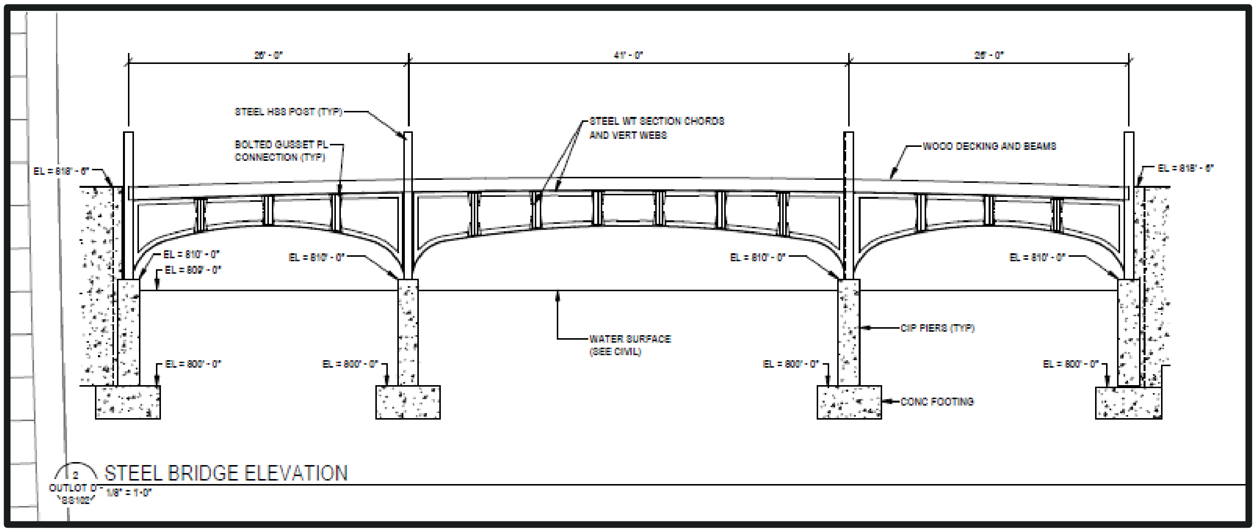
**Figure 9. Site Structures and Features**



### A.3.d.1. Pedestrian Bridges

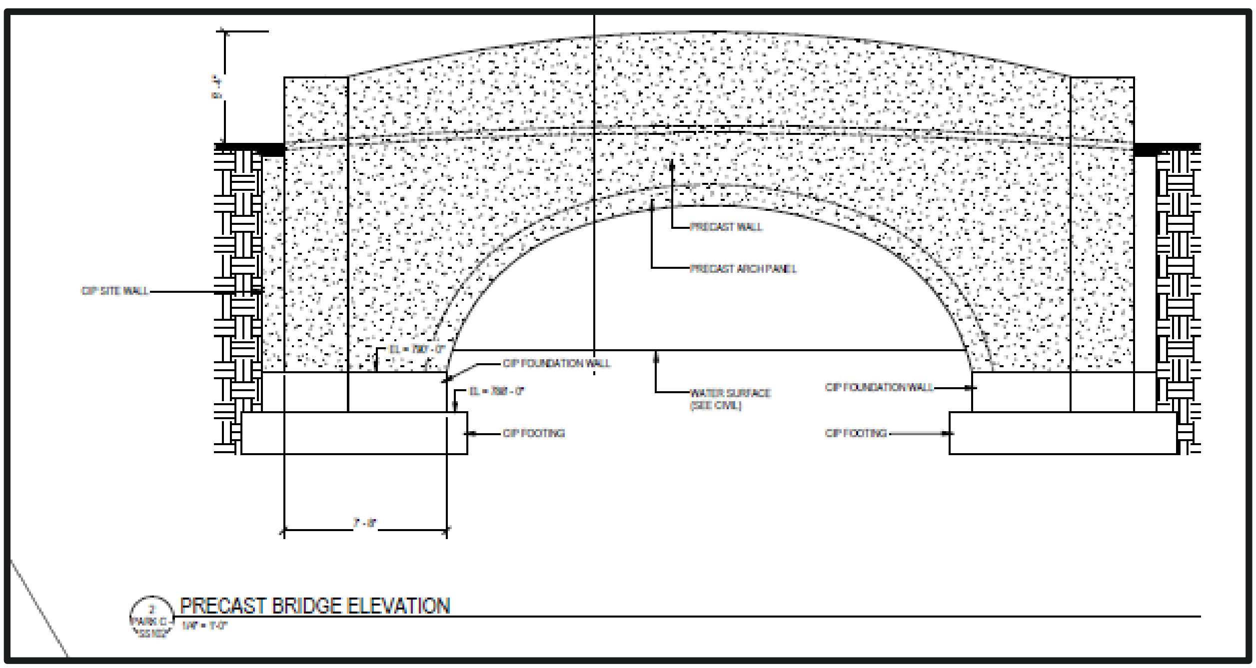
Two stand-alone pedestrian bridges will be constructed as part of the overall development. The bridges, as located in Figure 9 will be denoted as the Central Water Bridge and the Hidden Falls Bridge. The Central Water Bridge will be a streel structure and the Hidden Falls Bridge will consist of precast concrete. Both structures will be supported on cast-in-place concrete piers and footings.

**Figure 9A. Central Water Bridge Detail**




Plan from 60% Park Submittal Plan Set.

**Figure 9B. Hidden Falls Bridge**




Plan from 60% Park Submittal Plan Set

### A.3.d.2. Civic Plaza and Civic Square

The majority of Civic Plaza and Square will consist of concrete pavement and flatwork designed to support pedestrian activities, but also occasional event or maintenance vehicle traffic. The spaces will include the construction of benches and other amenities. Grades will be raised 10 to 15 feet in the Civic Plaza area.

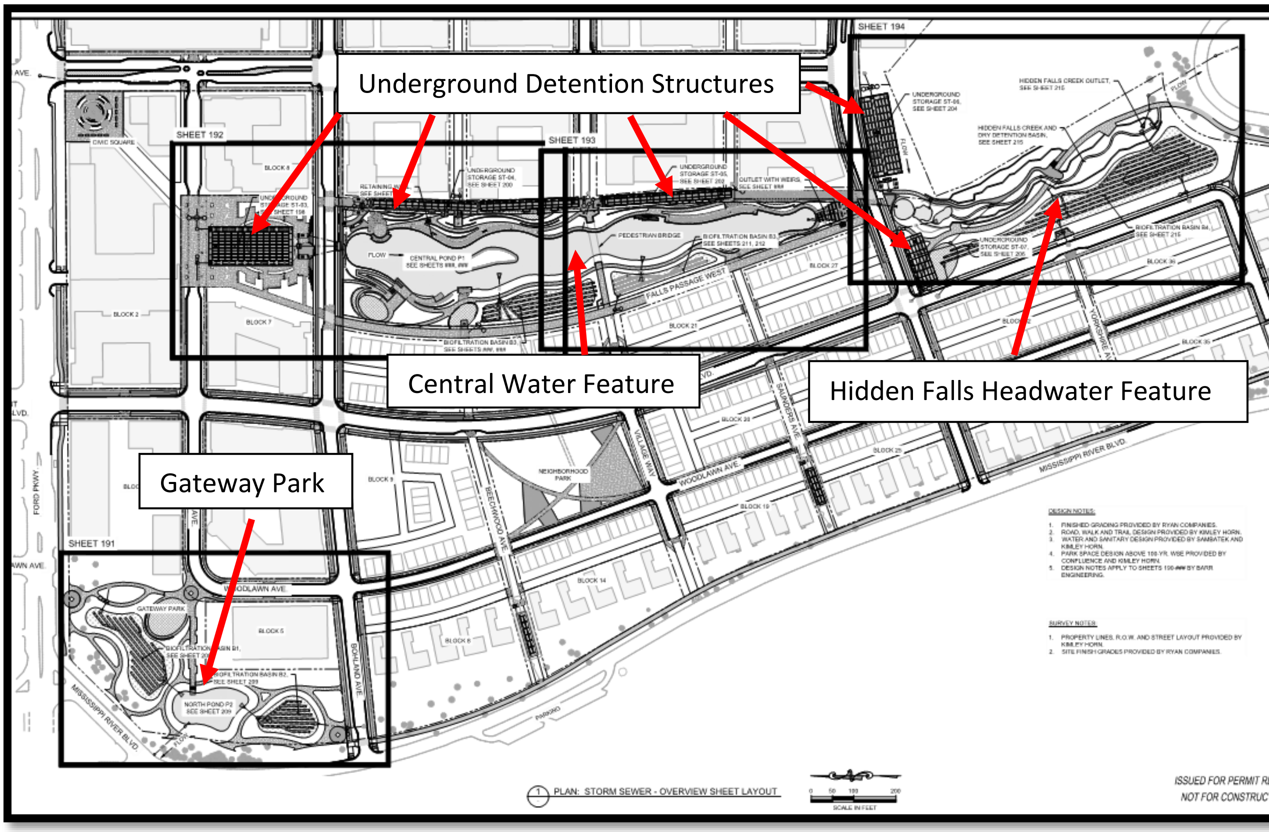
### A.3.d.3. Retaining Walls

The development of the site will include the construction of many site retaining walls. Figure 9 displays the general locations of the primary retaining walls; however, shallow walls associated with civic and park spaces are not all shown (or fully designed). The majority of these retaining walls will be cast-in-place concrete footings and walls. The majority of the walls will be less than 10 feet in height; the retaining wall along Bohland Avenue may exceed 20 feet in height.

### A.3.e. Proposed Stormwater Improvements and Water Features

Stormwater improvements will include the construction of two wet pond areas, four biofiltration basin areas, five underground detention (Stormtrap) systems, a creek and dry detention basin for stormwater management. Figure 10 displays the current layout of stormwater improvement and water features.

**Figure 10. Proposed Stormwater Layout**




Provided by Ryan Companies.

From a generalized standpoint, all of the features are designed to retain or treat stormwater and not infiltrate stormwater into the existing subgrade. Specifically, the Gateway Park Retention Pond and Central Water Feature Retention Pond are designed to hold water to specific elevation and will include a liner system.

Surface biofiltration basins will fluctuate from wet to dry, depending on stormwater flow, similar to the underground detention systems or structures. Biofiltration systems will include treatment media and also a liner system. Underground detention systems or structures will typically consist of precast concrete.

Variable water levels are anticipated within the Hidden Falls Creek Feature (and dry basin), although the creek and basin are not designed to maintain a specific water level, but they will also include a liner system.

Table 5 provides the approximate wet pond (permanent retention pond) elevations. The subsections below provide additional details.

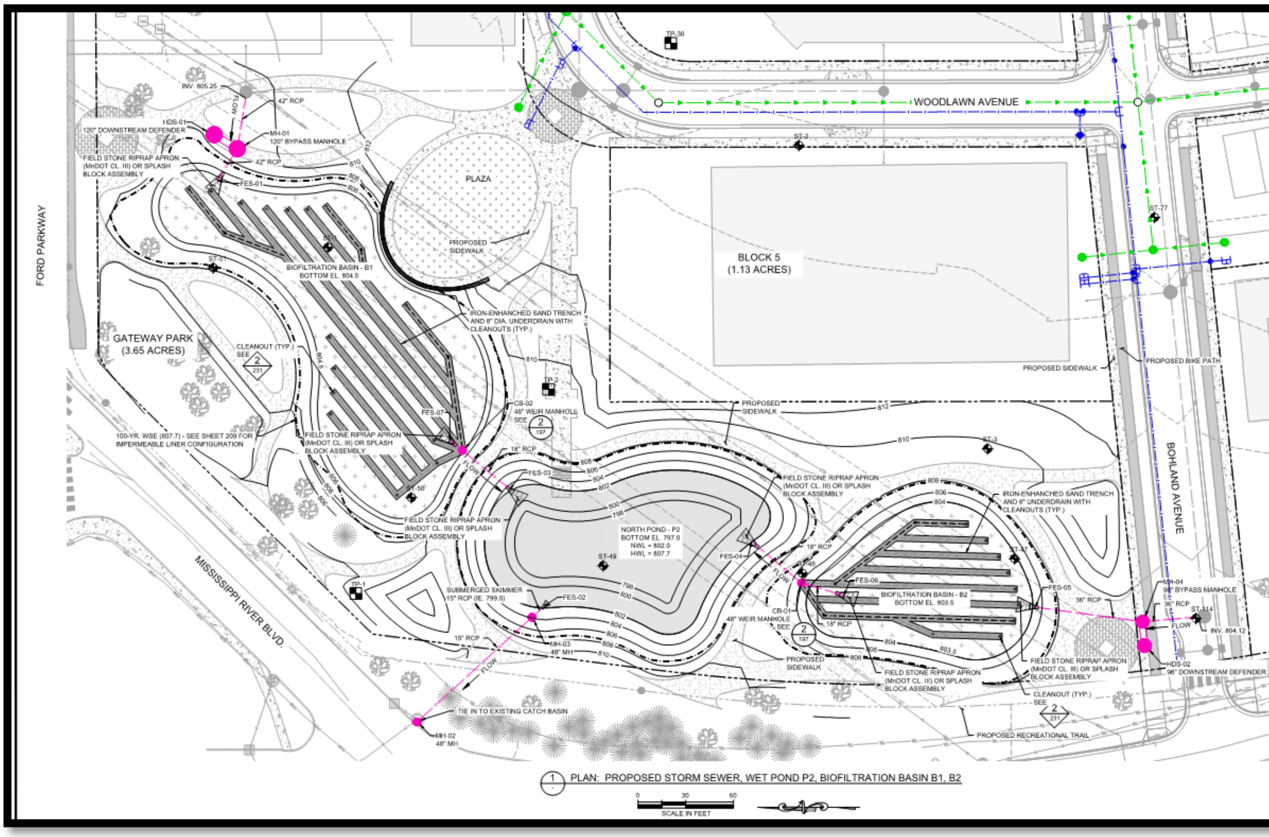
**Table 5. Permanent Stormwater Pond Summary**

| Pond Location | Design | Approximate Permanent Retention Pond/Creek Bottom Elevations (feet MSL) | Approximate Cuts to Reach Pond Bottom Elevations |
|---|---|---|---|
| Gateway Park | Wet pond | Bottom – 797.0<br>NWL – 802.0 | Up to 15 feet |
| Central Water Feature | Wet pond | Bottom – 802.0<br>NWL – 809.0 | Up to 12 feet<br>(north end only)<br>Up to 8 feet<br>(middle and south areas) |

### A.3.e.1. Gateway Park

The current layout of Gateway Park will consist of two biofiltration basins (B1 and B2) connected to a permanent retention pond (P2) between the basins. Figure 11 displays the preliminary stormwater layout for Gateway Park. Excluding surface runoff, stormwater will enter the biofiltration basins and flow into the permanent retention pond. The retention pond is to have a bottom elevation of 797 with a normal water elevation of 802. The pond is designed to handle a high water level of 807.7 and has an outlet in the northwest corner at an elevation of 802.

**Figure 11. Preliminary Stormwater Layout for Gateway Park**

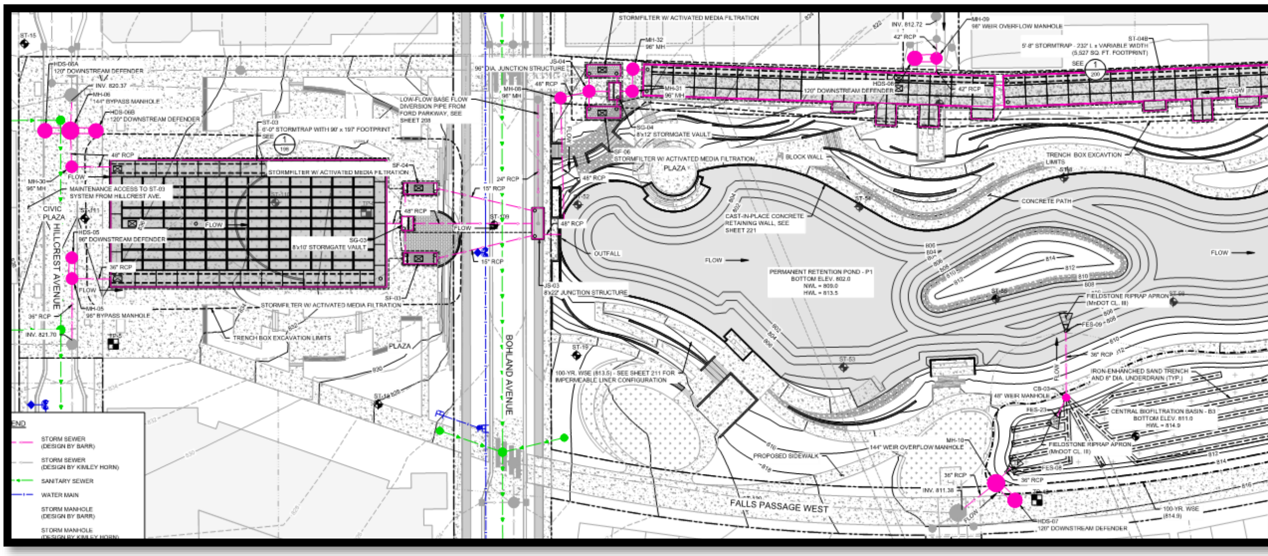



Provided by Ryan Companies.

## A.3.e.2. Central Water Feature

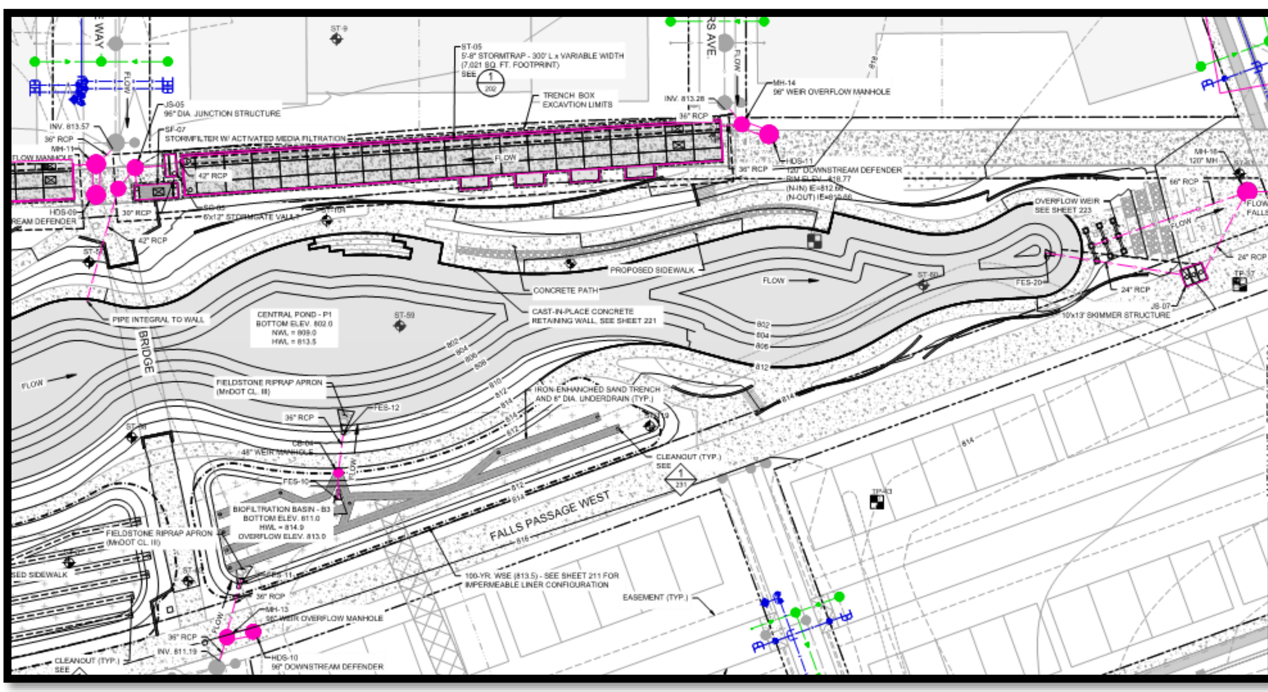
The current layout of the Central Water Feature will consist of a central permanent retention pond (P1), a biofiltration basin (B3) west of the pond, and three underground detention systems (one of the underground detention systems is part of Civic Plaza). Figures 12 and 13 display the preliminary stormwater layout for the north and south portions of the Central Water Feature. Excluding surface runoff, stormwater will enter the biofiltration basin B3 from the northwest and flow into the west side of the permanent retention pond at an elevation of 809 feet. The two underground water detention systems (one under Civic Plaza and one northeast of the retention pond) will filter stormwater flow into the retention pond on the north side. The southern underground water detention system will fill filter stormwater flow into the retention pond on the west side. The retention pond is to have a bottom elevation of 802 feet with a normal water elevation of 809 feet. The pond is designed to handle a high water level of 813.5 feet and has an outlet in the southernmost portion of the pond at an elevation of 806 feet and an overflow at 812.2 feet (60-foot weir).

**Figure 12. Preliminary Stormwater Layout for the Central Water Feature (North)**



Provided by Ryan Companies.

**Figure 13. Preliminary Stormwater Layout for the Central Water Feature (South)**

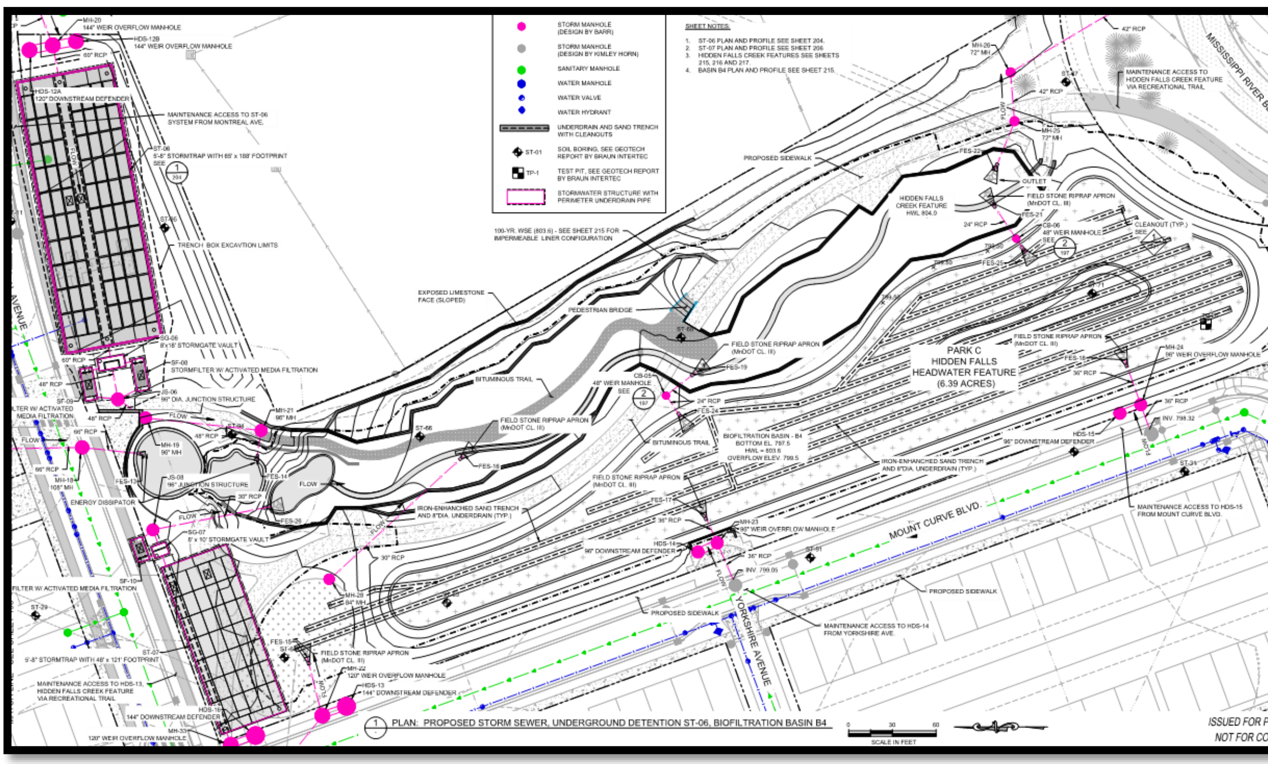


Provided by Ryan Companies.

### A.3.e.3. Hidden Falls Headwater Feature

The current layout of the Hidden Falls Headwater Feature will include a central creek feature and dry basin (reservoir) that will collect stormwater from a biofiltration basin (B4) to the west and underground detention systems to the northeast and northwest. Stormwater flow will also occur from the Central Water Feature (to the north). Excluding surface runoff, stormwater will enter the biofiltration basin from the northwest, west, and southwest, and flow into the creek in the northwest, west, and southwest. Stormwater from the Central Water Feature will have stormwater flow into the creek feature at an elevation of about 804 feet. The creek feature is to have a bottom elevation that will vary from about 793 to 788 feet. The creek feature has an outlet in the southernmost portion.

**Figure 14. Preliminary Stormwater Layout for Hidden Falls Headwater Feature**




Provided by Ryan Companies.

## A.4. Site Conditions and Historical Information

### A.4.a. General

The site is located on the southeast quadrant of the intersection of Ford Parkway and Mississippi River Boulevard in St. Paul, Minnesota. The site is located in a mixed industrial, commercial, and residential use area. The site is approximately 130 acres and bound to the west by the Mississippi River and Mississippi River Boulevard, to the north by Ford Parkway, to the east by South Cleveland Avenue and existing development, and to the south by Mississippi River Boulevard and former railroad tracks leading to the project site.

Modified by historic development, overall site grades slope downward from east to west (and the river beyond). The existing surface elevations range from approximately 810 to 855 feet, with the highest elevations along the northeastern property line. Matching the overall slope, site grades decrease about 10 to 15 feet from the former finished car parking lot (eastern boundary of the site) to the former paint building, and decrease another 10 to 15 feet between the paint building and former main assembly building (see Figure 15 below).

### A.4.b. Site History and Historical Photos

Although currently vacant, former Ford Assembly Plant operations at the project site consisted of the assembly and painting of cars and trucks, using parts manufactured off site. Assembly processes included welding, metal cleaning, painting and curing, windshield and trim installation, and preparation of the vehicles for final delivery. The primary production buildings consisted of the main assembly building, which also included a warehouse and a paint building (Figure 15).

**Figure 15. Former Ford Assembly Plant Layout**


Figure provided by Arcadis dated 2015.

Aerial photographs 1, 2, and 3 display the site conditions in 1923, 2011, and 2018, respectively. The red outline indicates the approximate location of the site. The main assembly building was constructed in 1923 with various building additions occurring between the 1960s and 1980s. The paint building was constructed in 1985. Assembly operations at the project site ceased in December of 2011. The aerial photograph of the site in 1923 displays what the site looked like prior to the construction of the Ford Plant. The aerial photograph of the site in 2011 displays the site prior to when operations ceased on site, and the photograph of the site in 2018 displays site post demolition.

**Photograph 1. Aerial Photograph of the Site in 1923**

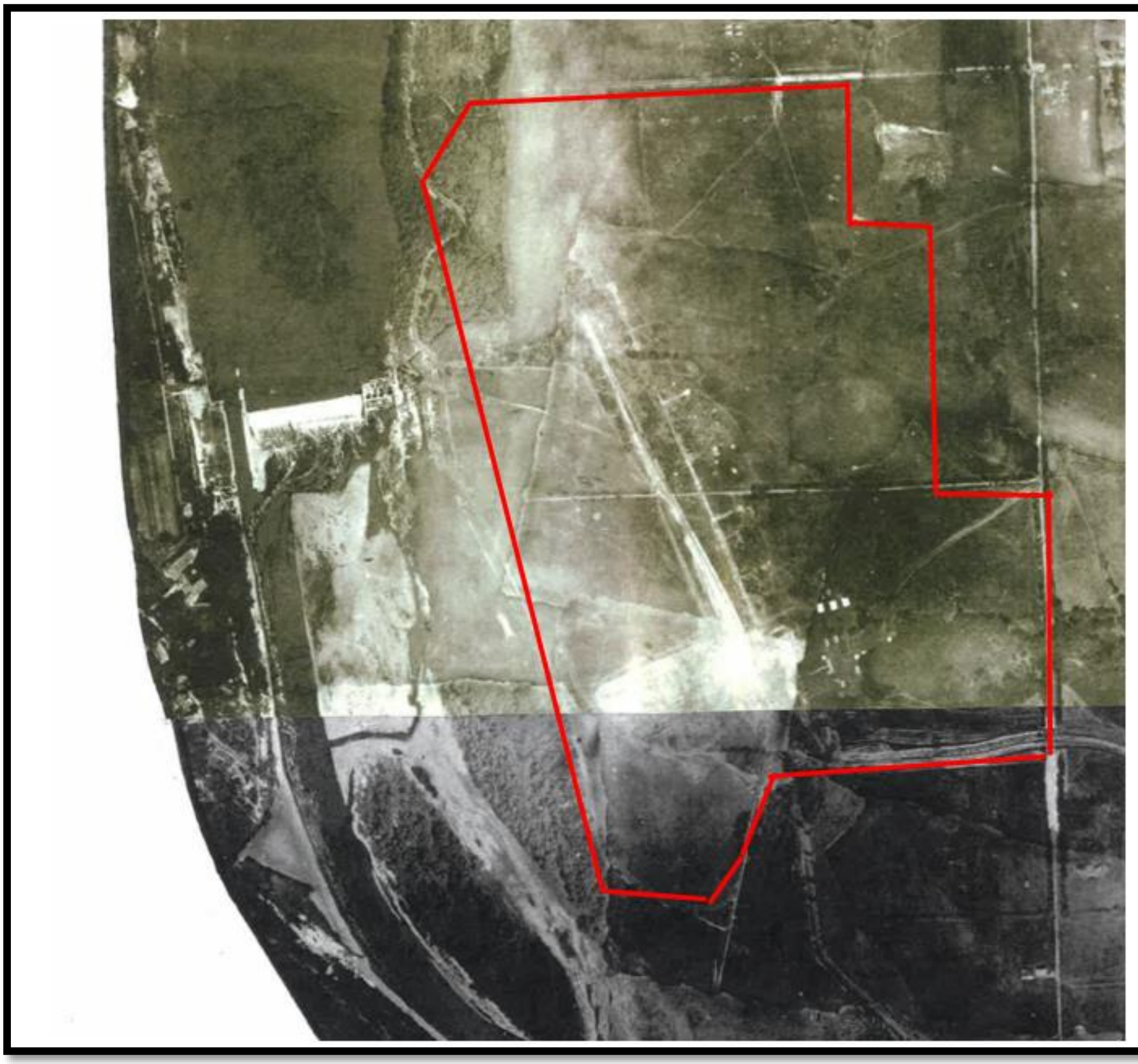


Photo provided by University of Minnesota, John R. Borchert Map Library Online.

**Photograph 2. Aerial Photograph of the Site in 2011**

Photograph provided by Ramsey County GIS.

**Photograph 3. Aerial Photograph of the Site in 2018**

Photograph provided by Ramsey County GIS.

### A.4.c. Environmental Remediation

The site was decommissioned in 2014 and 2015, including the demolition of buildings and the removal of a majority of the slabs and subsurface structures (including footings, pits, sumps, and utilities). However, Arcadis US, Inc. (Arcadis), Ford's environmental consultant for the site remediation, indicated that subsurface structures (tunnels, shafts, footings, slabs, etc.) that extended greater than 10 feet below the existing ground surface were cut off at that depth, bulk headed (for tunnels and shafts), and backfilled to the existing ground elevation. Figure F1 in Appendix F (provided by Arcadis) indicates the documented areas where known subsurface structures were left in place. Section A.4.c.2 provides additional information on the tunnels that were bulk-headed and left in place.

Based on the environmental investigation completed by Arcadis, select locations across the project site were excavated to remove the presence of environmentally-impacted soils. Figure B2 (Remedial Activities Completed Sketch) in Appendix B shows the areas excavated and identified by Arcadis (Arcadis's map is overlaid on our boring sketch); Arcadis identified these areas as Consolidated Impact Areas, Isolated Impact Areas, and SDRAP Addendums Areas. It is our understanding these impact areas were excavated to soils that were tested and indicated non-detect for environmental impacts or excavated to hard, unweathered bedrock. After the impacted soils were removed, they were backfilled with compacted soils.

### A.4.c.1. Previous Compaction Testing

Based on conversations with Carl Bolander & Sons Inc. (environmental remediation excavation contractor) and Arcadis, the impact areas were backfilled with either off-site sand fill or non-impacted soils from the project site. The backfilled soils were compacted in the excavations and periodically tested for compaction efforts. Figure F2 in Appendix F shows a location map of excavations and backfill and compaction testing.

Braun Intertec was contracted by Arcadis to complete periodic compaction testing on an on-call basis. We made approximately 25 visits to the site between December of 2014 and June of 2018 and approximately 190 compaction tests were completed using a nuclear density gauge. Additionally, we completed dynamic cone penetrometer (DCP) testing in areas where the nuclear density gauge tests could not give consistent results due to varying fill types or high amounts of coarse aggregate. Based on our review of the test reports, the fill soil types that were tested consisted of clayey sand (SC), silty sand (SM), poorly graded sand with silt (SP-SM), poorly graded sand (SP), poorly graded gravel (GP), and poorly graded gravel with silt (GP-GM). The test results indicate all tested fill met or exceeded 95 percent of standard Proctor density. Figure F2 in Appendix F, provided by Arcadis, shows the general compaction test locations in regards to their denoted environmental remediation areas (shown as IRAP, SDRAP, and NPL).

Note, Figure F2 does not include the location of tests performed between December of 2014 and August of 2015. These tests appear to be for the main assembly building and areas east of the main assembly building, which would be the areas labeled as MAB and AS-1/AS-5/FAB on Figure F2.

Our compaction testing scope of services did not include site observations or documentation of subgrade material or strength prior to fill placement. Furthermore, the fill we tested was directed to us by Arcadis, and it is not known whether all of the fill placed during remediation efforts was tested.

### A.4.c.2. Structures Left in Place

Seven documented tunnel systems were constructed in the subsurface below the former Ford Assembly Plant at various depths and configurations. Table 6 provides a summary of the known tunnel systems.

**Table 6. Summary of Existing Tunnel Systems**

| Tunnel System | Concrete Lined | Size (width x height; ft) | Elevation of Tunnel Invert (ft) | Geologic Condition at Invert | Demolished (Yes or No) |
|---|---|---|---|---|---|
| Traffic Tunnels | Fully | 10 x 11 | 711 to 718 | Sandstone | No |
| Gas Tunnel | Unlined | 8 x 6 | 731 | Sandstone | No |
| Cable Tunnel | Unlined | 3-6 x 6-7 | 691 to 741 | Sandstone | No |
| Oil Tunnel | Fully | 5 x 5 | 800 | Soil | Yes |
| Steam Tunnel | Fully | 13 x 10 | 798 | Soil | Yes |
| Sewer Tunnels | Partially | 2.5 x 6 | 756 to 760 | Limestone | No |
| Mined Sand Tunnels | Unlined | 15 x 15 | 725 | Sandstone | No |

Based on information provided by Ford, the shallow oil tunnel was completely removed and backfilled. Additionally, the steam tunnel was demolished and removed down to the bottom slab of the tunnel. The bottom slab of the steam tunnel was punctured to provide drainage and the tunnel area was backfilled with Class 5 fill material. The remaining tunnels were bulk-headed at the entrances and left in existing condition.

Elevator, air and other shafts that extended from the tunnels to the site buildings were excavated down at a depth of approximately 10 feet below existing surface grades and capped with reinforced concrete.

A detailed description of the tunnels is summarized within Appendix F in an attachment to the Application for Site Plan Review, Phases 1, 2, and 3, Large Site Demolition, Twin Cities Assembly Plant, St. Paul, Minnesota prepared by Devon Industrial Group c/o Ford TCAP dated November 9, 2012.

## A.5. Reference Information and Documents

Appendix F includes a list of the information and documents referenced in preparation of this report.

We have described our understanding of the proposed construction and site to the extent others reported it to us. Depending on the extent of available information, we may have made assumptions based on our experiences with similar projects. If we have not correctly recorded or interpreted the project details, the project team should notify us. New or changed information could require additional evaluation, analyses and/or recommendations.

## A.6. Scope of Services

### A.6.a. Purpose

The purpose of our geotechnical evaluation was to characterize and evaluate subsurface geologic conditions at selected exploration locations and provide geotechnical recommendations to support infrastructure development, design, and construction.

### A.6.b. Services

We performed our scope of services for the project in accordance with the Project Agreement between Braun Intertec and Ryan Companies dated June 29, 2018 (Contract Number 39585) and Change Order Number 3 dated August 21, 2019. The following list describes the geotechnical tasks completed thus far in accordance with our authorized scope of services.

- Reviewing the background information and reference documents previously cited.

- Staking and clearing the exploration locations of underground utilities. Terracon, along with our input, selected borings and test pits and we staked the exploration locations for the Preliminary Geotechnical Report. Ryan Companies and Braun Intertec selected and we staked the new exploration locations (ST-47 to ST-126). We acquired the surface elevations and locations with GPS technology using the State of Minnesota's permanent GPS base station network. The Soil Boring Location Sketch included in Appendix B shows the approximate locations of the borings.

- Performing 126 borings, denoted as ST-1 to ST-126, to nominal depths of 5 to 71 feet below current surface grades across the site using standard penetration test (SPT) and rock coring methods to collect soil and rock samples. Borings ST-47 to ST-126 were specifically performed for the infrastructure phase on the project.

- Performing 10 standard penetration test (SPT) borings for temporary wells, denoted as TW-1 to TW-10, to nominal depths of 5 to 20 feet below grade across the site.

- Observing the excavation of 46 test pits (excavated by Bolander), denoted as TP-1 to TP-46, to nominal depths of 5 to 15 feet below current surface grades across the site.

- Observing the excavation of 13 test pits (excavated by Bolander), denoted with an "ENV" prefix (i.e. ENV-TP-1), to nominal depths of 4 to 12 feet below current surface grades across the site at locations identified with anomalies during the GPR survey described below in Section C.2.e.

- Performing geotechnical laboratory testing on select samples to aid in soil classification and engineering analysis.

- Preparing this report containing an exploration location sketch and other supporting figures, logs of soil borings and test pits, a summary of the soils encountered and groundwater observations, results of laboratory tests, and recommendations to support site evaluation, grading and redevelopment, including:

  - Subgrade preparation for infrastructure improvements.

  - Placement and compaction of fill.

  - Design of pavements, below-grade utilities, retaining walls, and stormwater improvements.

Terracon is the environmental consultant for the project. Our scope of services did not include environmental testing, evaluation or consulting.

# B. Results

## B.1. Geologic Overview

Surficial geology and bedrock geology maps of Ramsey County show that the geology of the project site is comprised of stream sediments (alluvial or terrace deposits) consisting of sand and gravel and some clay and silt and then clayey glacial till beneath the stream sediments. The soils are underlain by shallow bedrock consisting of Decorah Shale, Platteville Limestone, Glenwood Shale, and St. Peter Sandstone (in descending order). Although not shown on the geologic maps, our review of the site specific data indicates that the site also contains varying amounts of undocumented fill from historic site development.

We based the geologic origins used in this report on the soil types, in-situ and laboratory testing, and available common knowledge of the geological history of the site. Because of the complex depositional history, geologic origins can be difficult to ascertain. We did not perform a detailed investigation of the geologic history for the site.

## B.2. Previous Geotechnical Information

Environmental evaluations started at the project site in the early 1990s, based on requests by the MPCA. Arcadis began work at the site for Ford in 2007 with the completion of a Phase I Environmental Site Assessment (ESA). Various phases of work were completed by Arcadis between 2007 and 2015 to evaluate environmental conditions at the project site, which included 1,320 soil borings (push-probe, roto-sonic, and hand auger). Additionally, 20 permanent monitoring wells were installed to evaluate groundwater conditions in the shallow perched zone and within the bedrock zones. Borings were drilled to depths ranging from approximately 3 feet (hand augers) to 150 feet (deep monitoring wells) below ground surface. Most soil borings were drilled at depths ranging from 8 to 20 feet below ground surface. The borings were terminated both in the overburden soil and in the upper bedrock. Because a push-probe type drill rig was used for the majority of the borings, penetration into the bedrock was minimal and most borings were stopped at practical refusal. Fill soils were not called out on the majority of the Arcadis boring logs. However, debris was noted in the fill soils, including construction materials, glass, metal, and ash. Our review of the boring logs also indicated buried asphalt, concrete, and ballast rock.

Where remediation efforts were performed, select areas across the site were excavated and backfilled (remediation fill) to remove environmentally-impacted soils. Impacted areas were excavated to depths and widths to remove the impacted soils and to provide documentation that the remaining soils left in place were below the required environmental regulatory levels. Additionally, many of the impacted areas were excavated to sound (unweathered) bedrock. Excavations within identified impact areas were documented to depths up to 22 feet below ground surface. It is our understanding that existing non-impacted soils, along with off-site sand fill materials, were used to backfill the excavated impacted areas. Arcadis indicated the remediation fill was occasionally mixed with crushed concrete that was approved for reuse. Furthermore, select areas were backfilled with concrete crushed to aggregate base specifications.

Related to construction of some of the previous Ford Plant facilities, we performed soil borings at this site in 1966, 1968, and 1977 for various locations across the existing plant in the areas of the main assembly building, the paint building, and the finished vehicle parking areas.

Approximately 250 boring logs were included within those available reports and we used that information to further assist us in the review of the site soil conditions; however, the majority of these borings likely do not represent current site conditions and are not included as reference documents in the Appendices of this report.

## B.3. Exploration Results

The following sections summarize the findings of our recent exploration program. Please refer to the Log of Boring sheets, Log of Coring sheets, and Test Pits in Appendix B, along with the Site Exploration Location Map (Figure B1), for additional details. Table E1 in Appendix E displays a subsurface profile summary for each of the borings and test pits across the site. The Descriptive Terminology sheet in Appendix B includes definitions of abbreviations used below.

### B.3.a. Surface Materials

Asphalt and concrete pavements were encountered in some of our borings and test pits, primarily in the north and eastern portions of the project site where pavements were left in place to support site decommissioning and cleanup efforts. Asphalt pavements ranged in thickness from about 2 to 9 inches and were generally underlain by about 2 to 12 inches of aggregate base. Concrete pavements ranged in thickness from 4 to 10 inches and were generally underlain by about 6 to 12 inches of aggregate base. We did not encounter aggregate base underneath the bituminous and/or concrete pavement in ST-72, ST-96, or ST-109. Much of the concrete pavement encountered was reinforced with steel.

Topsoil or identified topsoil fill was present in limited areas across the site. Where encountered, the thicknesses ranged from 0 to 4 feet, but were typically less than 1-foot thick. The topsoil material generally varied from dark brown to black with soil types varying from poorly graded sand with silt, silty sand, clayey sand, sandy lean clay, lean clay, sandy fat clay, organic clay, and weathered shale with varying amounts of organic material. Some of the topsoil contained debris (concrete and bituminous), gravel, or shale and limestone fragments.

### B.3.b. Fill Soils

Existing fill was the predominant material encountered overlying the bedrock. For simplicity, during our evaluation, we delineated the fill into: 1) undocumented fill, or fill associated with historic development on the site, and 2) remediation fill, which included fill placed during recent remediation efforts coordinated by Ford and Arcadis. Figure B2 in Appendix B displays our boring and test pit locations in relation to the remediation efforts completed on site. The following subsections provide additional details; however, it should be noted undocumented fill may be present below remediation fill and differentiation between the materials was not practical in these areas.

#### B.3.b.1. Undocumented Fill

The undocumented fill generally consisted of weathered shale, shale, organic silt, organic clay, fat clay, lean clay, sandy lean clay, clayey sand, silty sand, poorly graded sand with silt, and poorly graded sand. The fill contained varying amounts (and sometimes significant amounts) of gravel, shale and limestone fragments, organic soils (and layers) such as peat and organic clay, concrete, and bituminous debris. Additionally, we encountered larger sized building debris in the undocumented fill that included concrete fragments (footings, slabs, walls, etc.), clay pipes, rebar, metal, wood, PVC, and ash. Undocumented fill included material below existing buildings, pavement areas and landscaped or green areas.

The undocumented fill was encountered at depths up to approximately 17 feet below existing surface grades.

Penetration resistances within the undocumented fill ranged from 2 blows per foot (BPF) to 50 blows per 1/8 inch of penetration, indicating the soils were poorly (or uncompacted) to well compacted. Some of the higher penetration resistances could be the result of larger debris, gravel/cobbles/boulders, or bedrock chucks within the fill being encountered by the SPT sampler during drilling.

### B.3.b.2. Remediation Fill

Fill placed during recent remediation efforts coordinated by Ford and Arcadis was encountered to depths up to 22 feet below existing grade. The remediation fill primarily consisted of the following materials:

- **Imported sand fill (poorly graded sands).** The imported sand was fine- to medium-grained and contained varying amounts of gravel and silt with classifications ranging from poorly graded sand, poorly graded sand with silt, and silty sand. Although generally consistent, the sand occasionally contained layers of crushed concrete or other fill soils. The thickness of the sand fill ranged from about 4 to 14 feet.

- **On-site fill (generally lean clay, sandy lean clay, clayey sand and silty sand).** On-site soils that were determined to not have environmental impacts were reused as fill for remediation areas across the site. The on-site fill contained varying amounts of gravel, concrete and bituminous debris, and shale and limestone fragments. We also encountered traces of organic material or slightly organic layers. The thicknesses of the on-site fill ranged from about 1 to 8 feet. Additionally, the on-site fill was often used to cap the other remediation fill (sand or concrete) at the surface in less than 1-foot to 3-foot layers.

- **Crushed concrete fill.** On-site concrete, that was non-impacted, was crushed and placed as fill. Often this concrete appeared to be crushed similar to general aggregate base specifications (with a size of 2 inches or less). The thickness of the crushed concrete varied from about 1 1/2 to 12 feet. The crushed concrete was commonly covered at the surface by on-site fill soils ranging from silty sand to lean clay.

Penetration resistances within the remediation fill ranged from 2 to over 35 BPF, but generally ranged from 6 to 25 BPF. Overall the remediation fill appeared moderately to well compacted; however, the lower blow counts recorded within the borings also indicate layers or areas of low or minimal compaction are present.

### B.3.c. Native Soils

Native soils were generally encountered below the fill, but were most prevalent on the south and western portions of the site (in some areas weathered or sound bedrock was present directly below the fill soils). Native soils consisted of buried topsoil or swamp deposits, terrace (or alluvial) deposits, or glacial till.

A layer of organic topsoil or swamp deposited soil was common below the fill within the northeastern portion of the site, generally outside of previous building areas, but was also occasionally present throughout the entire site. Borings or test pits where buried organic soils were encountered included ST-8, ST-15, ST-18, ST-61, ST-73, ST-109, ST-110, TP-4 to TP-7, TP-20, TP-26, TP-35, ENV-TP-6, ENV-TP-58, ENV-TP-63, and ENV-TP-94. Organic soils consist of organic clay, sandy organic clay, peat, or slightly organic to organic sands and clays. The thicknesses of the organic soils was generally 4 feet or less.

Terrace or alluvial deposits were encountered at Borings ST-15, ST-43, ST-45, ST-49, ST-73, ST-78, ST-89, ST-98, ST-107, ST-108, ST-110, ST-111, ST-115, ST-117, ST-118, ST-124 and Test Pits TP-30, TP-31, TP-35, ENV-TP-4, ENV-TP-58, ENV-TP-63, and ENV-TP-94. These soils consisted of lean clay, lean clay with sand, clayey sand, silty sand, poorly graded sand with silt, and poorly graded sand and were generally in a loose/soft to very dense/hard condition.

Glacial till soils consisting of sandy lean clay, lean clay, clayey sand and silty sand were encountered in Borings ST-35, ST-36, ST-49, ST-59, ST-61, ST-77, ST-80, ST-82, ST-83, ST-88, ST-92, ST-93, ST-114, TW-7 and Test Pits TP-19, TP-20, TP-21, TP-22, TP-23, TP-27, TP-28, TP-30, TP-44, ENV-TP-6, ENV-TP-8, and ENV-TP-58. As indicated by the penetration resistances, the general consistency of the clayey soils ranged from soft to hard and the sandy soils from loose to medium dense.

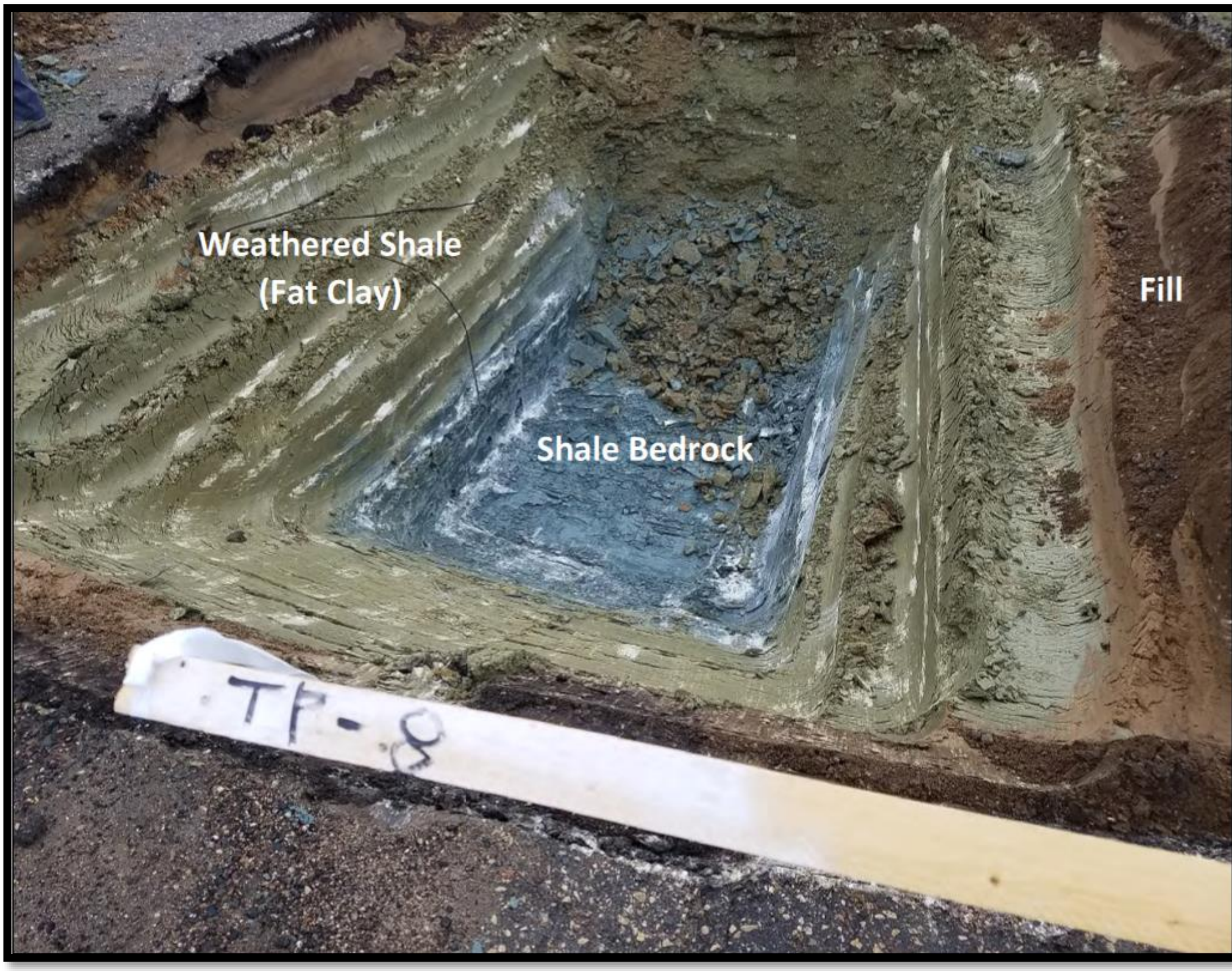
Terrace and glacial soils contained varying amounts of gravel, cobbles and potentially boulders, as well as shale and limestone fragments. Shale and limestone fragments were more prevalent closer to the bedrock interfaces.

### B.3.d. Bedrock

#### B.3.d.1. General

The on-site soils are underlain by shallow bedrock consisting of the Decorah Shale, Platteville Limestone, Glenwood Shale, and St. Peter Sandstone, in descending order. Decorah Shale was the most common bedrock encountered and was often present within 15 feet of existing surface grades. The Decorah Shale was generally present in two geologic conditions: highly weathered shale bedrock (shown on the boring and test pit logs as fat clay [CH] or lean clay [CL]) and shale bedrock (shown on the logs as Decorah Shale bedrock). The subsection below provides additional details. Photograph 4 shows the difference between the weathered shale (fat clay and lean clay) and shale bedrock (Decorah Shale) layer at TP-8.

**Photograph 4. Fat Clay and Shale Bedrock**



### B.3.d.2. Decorah Shale

Although shown as two distinct layers on the boring and test pit logs, the transition between the weathered shale (fat clay and lean clay) and less weathered shale bedrock was generally more gradual.

- **Highly Weathered Shale Bedrock (fat clay and lean clay)**. Based on our field logging and laboratory testing, the highly weathered shale bedrock was primarily a fat clay (CH) with lesser amounts of lean clay (CL). The fat clay and lean clay had varying amounts of sand, gravel, shale, and limestone fragments. The fat clay and lean clay were primarily a gray to greenish-gray and brown in color. The upper limits of the highly weathered shale bedrock were encountered at depths ranging from about 1 to 21 1/2 feet below ground surface (elevations 799 to 852 feet), with an average depth of about 7 feet. The thickness of the fat and lean clay varied from about 1 to 10 feet, but was more commonly 1 to 4 feet thick. In some remediation fill areas, the fat and lean clay was removed down to the underlying less weathered (massive) shale bedrock.

- **Decorah Shale Bedrock**. The shale bedrock was moderately to intensely fractured, fissile, and horizontally bedded, including areas of thin limestone interbedding. A layer of highly weathered shale bedrock (as described above) commonly overlaid the shale bedrock, although it some remediation areas the weathered shale (fat and lean clay) was removed. The shale bedrock was primarily gray to dark gray in color. The upper limits of the shale bedrock were encountered at depths ranging from 1 to 15 feet below ground surface (elevations 794 to 854 feet), but more commonly encountered at depths ranging from 7 to 12 feet below grade surface.

### B.3.d.3. Platteville Limestone

Platteville Limestone was encountered at elevations ranging from approximately 794 to 805 feet, but more commonly encountered at elevations ranging from 796 to 802 feet. Based on our review of available data, the Platteville Limestone is common at an elevation of about 800 feet or below. When intact, the overall thickness of the Platteville Limestone is generally about 30 feet, and in Boring ST-85, we encountered 33 feet of Platteville Limestone from coring. The limestone was slightly to very intensely fractured, and is commonly interbedded within the shale at the shale-limestone transition. In the test pits that encountered the moderately fractured limestone, the excavator could not excavate into the limestone and the test pit was stopped.

#### B.3.d.4. Glenwood Shale

The Glenwood Shale is typically present between the Platteville Limestone and St. Peter Sandstone. The typical thickness of the Glenwood Shale is 2 to 3 feet in the Twin Cities area, but the thickness can vary from 2 to 18 feet in thickness. The thickness of the Glenwood Shale increases as you move southward from the Twin Cities area to the Cannon Falls area, and then decreases in thickness as you move southward from the Cannon Falls area. In Boring ST-85, we encountered about 6 feet of the Glenwood Shale Formation. The last 3 feet of the Glenwood Shale we encountered was shaly sandstone, often a common occurrence in the transition zone between the shale and underlying sandstone.

#### B.3.d.5. St. Peter Sandstone

Based on review of the Arcadis borings, St. Peter Sandstone was encountered in the central and western portions of the project site (including AMW-01 to AMW-04) at depths ranging from 11 to 64 feet below ground surface. The sandstone was described primarily as a sand soil, fine-grained, well-grounded sand grains, trace silt and clay, and varying amounts of cementation. We encountered St. Peter Sandstone in Boring ST-85. The sandstone was encountered at a depth of about 50 feet below grade at an elevation of 763 1/2 feet. The sandstone was yellow, light brown to white in color, fine- to very fine-grained, and moderately to highly weathered.

## B.4. Groundwater

Groundwater was observed at varying depths within the undocumented fill, remediation fill, native soils, at the bedrock contact, and within the bedrock during our exploration; however, groundwater was also not present all exploration locations. In general, groundwater observations included the following:

- Observed depths to groundwater ranged from at the ground surface to approximately 16 1/2 feet below existing grade, with an average depth of about 6 feet.
- Observed groundwater elevations ranged from approximately 800 1/2 to 848 feet, with a general flow (trend) down to the west and south towards the river.
- Most commonly, the groundwater was perched above the low permeability weathered shale (fat clay or lean clay) or shale bedrock.
- Groundwater was also commonly observed perched or trapped within the clean sands and crushed rock/concrete (remediation fill) overlying the fat clay/shale bedrock. The shallowest observed groundwater depths were present within the sand fill, including at the ground surface.

- Horizontal bedding within the shale and limestone bedrock will promote lateral movement of groundwater within the bedrock.

- Water conditions observed within the borings and test pits are judged to be perched water conditions; perched water conditions will vary significantly based on annual and seasonal fluctuations, as well as subsurface conditions.

- Hydrostatic water levels exists within the underlying St. Peter Sandstone near elevation 700±.

- Although not observed, perched and trapped groundwater conditions may also be present within the Platteville Limestone, as the underlying Glenwood Shale can act as a confining layer.

Table E2 in Appendix E depicts the general observed groundwater elevations within the borings and test pits across the site.

## B.5. Karst Review

Karst is a landscape formed by the dissolution of a layer or layers of soluble bedrock. Geologic maps developed by Ramsey County and the Minnesota Department of Natural Resources (DNR) identify the Platteville Limestone and St. Peter Sandstone to have the potential for karst features, typically in the form of natural caves, sinkholes, or other landforms. During our geotechnical evaluations of the site, we did not observe karst-type features during on-site reconnaissance, review of historical information, or within the soil borings (or test pits) that were drilled into the limestone and sandstone. Figure F3 in Appendix F displays the known karst locations within a 1-mile radius. As displayed in Figure F3, there are no known karst locations at the site.

## B.6. Laboratory Test Results

The boring and test pit logs show the results of moisture content, percent passing the #200 sieve testing, Atterberg limits, and organic content tests we performed, next to the tested sample depth. Appendix B contains the results of these tests. Appendix D displays the results of the laboratory testing that was not included on the boring and test pit logs. Appendix D also includes the illustrations of the Atterberg Limits results for fill soils, alluvial or glacial till soils, weathered shale bedrock, and shale bedrock, sieve analysis, standard Proctor moisture-density relationship, hydraulic conductivity, and swell testing results. Laboratory testing was completed in general accordance with ASTM Standards.

### B.6.a. Existing Fill

#### B.6.a.1. Moisture Content

The moisture contents (ASTM D 2216) of the fine-grained fill soils (clayey sand, sandy lean clay, lean clay, fat clay, shale, and weathered shale) varied from approximately 5 to 60 percent, indicating the moisture contents of the tested clayey soils ranged from below to above their probable optimum moisture contents. The moisture contents of the sandy soils (poorly graded sand to silty sand, including crushed concrete) varied from approximately 1 to 27 percent, indicating the moisture contents of the tested sands were below to above their probable optimum moisture contents, likely varying in relation to the presence of perched groundwater.

#### B.6.a.2. Sieve Analysis

Our mechanical analyses (ASTM C 117) indicated that the sandy fill soil tested contained approximately 1 to 43 percent silt and clay by weight, indicating that the soil tested is classified as a poorly graded sand (SP) to a clayey or silty sand (SC or SM).

Our sieve analysis (ASTM D 6913) were completed on four samples of existing fill. The sieve analysis results determined the fill soils tested were generally poorly graded and contained 6 percent or less passing the #200 sieve. This would classify the soils as either poorly graded sand or poorly graded sand with silt.

#### B.6.a.3. Atterberg Limits

Atterberg limit tests (ASTM D 4318) were completed on four samples of existing fill. Liquid limits determined for the clayey soils tested ranged from 30 to 61 and plasticity indices ranged from 16 to 34. These results indicate that the clayey soils ranged from lean clay (CL) to fat clay (CH). Graphics depicting the results of the Atterberg limits tests is displayed in Appendix D.

#### B.6.a.4. Organic Content

Organic content tests (ASTM D 2974) were completed on 19 samples of existing fill and ranged from approximately 2 to 12 percent. The results indicated the tested fill soils were slightly to highly organic. Moisture contents of the organic soils ranged from 13 to 36 percent.

### B.6.b. Native Soil and Bedrock

#### B.6.b.1. Moisture Content

The moisture contents of the clayey soils (clayey sand, sandy lean clay, lean clay and fat clay) varied from approximately 10 to 40 percent, indicating the moisture contents of the tested soils were generally near to above their probable optimum moisture content. The moisture contents of samples of the weathered shale bedrock (fat clay and lean clay) and Decorah Shale Bedrock varied from approximately 6 to 39 percent. The moisture contents of the sandy soils (poorly graded sands to silty sands) varied from approximately 9 to 30 percent, indicating the moisture contents of the tested sands were generally near to above their probable optimum moisture contents.

#### B.6.b.2. Sieve Analysis

Our mechanical analyses indicated that the native soils (sandy and fine-grained soils) tested contained approximately 20 to 62 percent silt and clay by weight, indicating the soils were classified as a silty sand (SM), clayey sand (SC), or sandy lean clay (CL).

#### B.6.b.3. Organic Content

Organic content tests were completed on 11 samples of native soils (buried topsoil or swamp deposits) and the tests ranged from approximately 3 to 25 percent. The results indicate slightly to highly organic soils. Moisture contents of the native organic soils ranged from 17 to 36 percent.

#### B.6.b.4. Atterberg Limits

Atterberg limit tests were completed on three samples of native clay. Liquid limits determined for the clayey soils tested ranged from 20 to 39 and plasticity indices ranged from 8 to 20. These results indicate that the native clay ranges from clayey sand (SC) to lean clay (CL).

Atterberg limit tests were completed on 36 samples of weathered bedrock soils. Liquid limits determined for the weathered bedrock soils tested ranged from 40 to 79 and plasticity indices ranged from 20 to 52. These results indicate that the clay ranges from lean clay (CL) to fat clay (CH), with the majority of the highly weathered shale bedrock tested as fat clay.

Atterberg limit tests were completed on nine samples of Decorah Shale bedrock. Liquid limits determined for the bedrock tested ranged from 35 to 66 and plasticity indices ranged from 21 to 37. These results indicate that the bedrock ranges from lean clay (CL) to fat clay (CH), with the majority of the Decorah Shale bedrock tested as fat clay. Graphics depicting the results of the Atterberg limits tests are included within Appendix D.

#### B.6.b.5. Standard Proctor

Standard Proctor moisture-density relationship (ASTM D698) testing was completed on bag samples of fat clay (weathered shale bedrock) recovered from Borings ST-52 and ST-91. The standard Proctor tests yielded maximum dry densities of 91.8 and 102.3 pounds per cubic foot (pcf) with optimum moisture contents of 25 and 20 percent, respectively. The standard Proctor test results are displayed Appendix D.

#### B.6.b.6. Hydraulic Conductivity

Hydraulic conductivity testing (ASTM D 5084) was also completed on the bag samples from Borings ST-52 and ST-91. The samples were remolded to 95 percent of their respective maximum dry densities before the hydraulic conductivity testing was completed. The average hydraulic conductivity for sample ST-52 was 1.8E-08 cm/sec and for sample ST-91 was 6.8E-09 cm/sec. The hydraulic conductivity test results are displayed Appendix D.

#### B.6.b.7. Swell Testing

Swell testing (oedometer testing) was completed on three samples of Decorah Shale bedrock (in-situ condition). The results of the swell testing are displayed in Table 7. The swell testing results are displayed in Appendix D.

**Table 7. Consolidation-Swell (CS) Testing Results**

| Boring | Depth Below Surface Grade (feet) | Overburden Pressure Applied (tsf) | Swell Pressure (tsf) | Swell (%) |
|---|---|---|---|---|
| ST-52 | 10 1/2 | 0.08 | 1.5 | 0.4 |
| ST-73 | 12 | 0.08 | 0.8 | 0.6 |
| ST-94 | 9 1/2 | 0.08 | 1.4 | 2.2 |

Consolidation-swell (CS) and constant-volume (CV) swell tests performed to date for private development on the site yielded slightly lower results, with swell pressures ranging from 0.25 to 1 tsf and percent swell ranging from 0.5 to 1.1 percent.

### B.6.c. Swelling Potential Based on Laboratory Test Correlations

The liquid limit and plasticity index can be used to estimate the qualitative swelling potential of the clays and weathered shale. Swelling of the highly plastic clays can create engineering problems under foundations, structures, and pavements with changes in the moisture contents in the clay. Unweathered Decorah Shale is known to have a low to moderate swell potential. Table 8, adapted from the Geotechnical Reference by Holtz et al, 1969, provides general correlations of swelling potential related to common soil tests.

**Table 8. Correlation of Swelling Potential with Comment Soil Tests**

| Liquid Limit | Plasticity Index | Swelling Potential | Probable Expansion %* |
|---|---|---|---|
| <39 | <18 | Low | <1 |
| 39 to 50 | 15 to 26 | Medium | 1 to 5 |
| 50 to 63 | 25 to 41 | High | 3 to 10 |
| >63 | >35 | Very High | >10 |

*Percent volume change when subjected to a stress of 1 kip/sq. ft.

The majority of the weathered shale bedrock (fat clays) tested had liquid limits greater than 50 and plasticity index values greater than 25 indicating the potential for swelling. However, published data on the Decorah Shale states that it generally has a medium swell potential. Swelling potential increases when the soil is desiccated or dry and moisture is added. As stated above, the moisture contents of the fat clays tested ranged from about 9 to 39 percent. These recorded moisture contents are estimated to range from well below to slightly above the optimum moisture contents. The fat clay or shale with natural moisture contents below optimum will have the greatest swell potential.

# C. Geotechnical Design and Construction Discussion

## C.1. General Geology

The Ford Redevelopment Project has a complex subsurface profile that is unique to the region given the overall scale of the project. Subject to large-scale historic industrial development, and subsequent removal and remediation efforts, a cap of existing fill overlies a majority of the site. The fill is variable in regards to age, depth, composition, and in-place consistency. The fill often extends to the underlying bedrock, however, where native soil deposits were present below the fill, they were generally a combination of terrace (or alluvial) and glacial till. The native soils varied from sands to clays, were generally competent, and typical of deposits within the region. Localized layers of buried topsoil and other native organic soils were also present in select areas of the site.

Bedrock was prevalent throughout the site, often at a depth of 12 feet or less below the surface. The near surface bedrock is a combination of weathered shale and shale (Decorah Formation), and limestone (Platteville Formation), depending on location and elevation. In general, elevation 800± is the division between Decorah Shale (above) and Platteville Limestone (below). St. Peter Sandstone is also present at depth below the limestone. The shale, which often includes an upper zone of material weathered to a consistency of lean or fat clay, is considered potentially expansive. Although of limited impact to the project, a secondary shale formation (Glenwood) is also present between the Platteville Limestone and the St. Peter Sandstone.

Perched or trapped groundwater is common at relatively shallow depths below portions of the site, often where sandy fill is present over bedrock or other lower permeability soils.

Some physical remnants of the historic site development also remain, including utility tunnels, as well as caverns and tunnels within the sandstone from past mining operations.

The balance of the section of the report discusses impacts of the site geology to design and construction of the infrastructure phase of the project.

## C.2. Geotechnical Impacts

### C.2.a. Existing Fill

The existing fill is a combination of fill associated with historic development of the site (undocumented fill) and fill placed during recent environmental remediation efforts (remediation fill) as described in Section B.3. Fill soils were present to depths up to 22 feet below existing surface grade, but fill thicknesses generally ranged from 5 to 15 feet below current grades. Some of the fill consisted of clean sand and appears to be compacted; however, overall the fill was variable in composition and compaction. Some of the fill contained construction debris (mostly concrete, but also other debris), shale fragments, and organic material or soils. Crushed concrete was used as mass fill in limited remediation areas. The fill was also occasionally underlain by native organic soils or soft clayey soils.

Given the overall undocumented and variable composition of the fill, there is a risk of soil consolidation and subsequent settlement from additional loads associated with new fill placement and infrastructure improvements. The greatest risk exists where grades are raised 5 feet or more and/or where structures are placed, such as retaining walls and bridges (and future buildings).

Overall, it is our opinion the existing fill can generally be left in place below right-of-way areas, new pavements, exterior slabs, and similar infrastructure improvements. These structures are generally more tolerant of subgrade movement and the cost of removal and replacement of the fill is likely prohibitive, when compared to the performance benefit. Furthermore, the considerations and recommendations within Sections D.1 (subgrade preparation) and D.1.j. (construction delay) are provided to help reduce settlement risks through subgrade improvement and construction sequencing.

Alternatively, select removal of existing fill (and other unsuitable soils) may be required below infrastructure features less tolerant to movement and/or with higher subgrade loads, such as the pedestrian bridge and retaining walls.

### C.2.b. Bedrock

#### C.2.b.1. Removal

Bedrock will affect excavation and construction of 1) roads within the northeast and southern portions of the site, 2) all three stormwater basins (and the creek), 3) select below grade stormwater structures, and 4) utility pipes and structures throughout the site. Other features, such as bridge and retaining wall foundations, may also encounter bedrock. Generally, the upper bedrock layer on site is Decorah Shale, with the upper 1 to 4 feet typically being weathered to a consistency of fat or lean clay (rather than bedrock). Below approximate elevation 800 (+/-), Platteville Limestone may be present, although interbedded limestone seams and layers are also common within the lower portion of the Decorah Shale.

It has been our experience and from observing the test pit excavations that an excavator with a toothed bucket can often remove shale bedrock. However, larger equipment, pneumatic chisels or rippers may also be required to remove more competent shale bedrock or where limestone is interbedded. Alternate rock removal methods should also be assumed where massive limestone is present.

The shale and limestone is horizontally bedded. During removal, the bedrock will frequently break off at natural seams, fractures or bedding planes. As such, actual bedrock removal quantities can exceed the quantities established by the plans.

#### C.2.b.2. Support

In general, bedrock provides a high capacity bearing surface for pavements and structures; however, subcutting the bedrock below pavement, slabs, and utility pipes is typically required to reduce point loading and reflective cracking. Shale and weathered shale, while generally structurally competent, require additional precautions as outlined below related to expansive forces and volume changes.

### C.2.b.3. Shale and Expansive Clays

Weathered shale (generally fat clay), and more competent shale bedrock, can be expansive and subject to volume changes when exposed to moisture variations and when confining pressure is removed. Conversely, the material can also shrink if dried. If not properly managed, volume changes and associated expansive forces can be detrimental to footings, slabs, pavements, utilities or other items bearing on or above the shale. The shale with the greatest risk for volume change and expansion is where the material is partially weathered and/or its natural moisture content is dry of its optimum moisture content.

Methods for best managing the fat clay and shale include limiting their exposure to moisture variations by selective removal and sealing off exposed surfaces with other non-expansive, low permeability material (such as lean clay) and not leaving surfaces exposed for extended periods of time. Utilizing confining pressures that exceed the swell pressure of the fat clay and shale will also negate the expansive forces.

### C.2.c. Groundwater

Static groundwater is present at depth within the underlying sandstone bedrock; however, shallow perched (or trapped) groundwater was also present throughout the site. The observed perched groundwater depths were variable, likely indicative of the variable subsurface stratigraphy. Overall, the perched groundwater was typically present on top of the weathered shale/bedrock surface and where high permeability fill (clean sand, crushed rock or concrete) was present. Groundwater depths were shallowest where these conditions were present, including within the eastern and southern areas (where bedrock is shallow) and across the central portion of the site (where extensive sand fill was used for remediation efforts).

Groundwater impacts to infrastructure design and construction may include:

- Utility, pond, and other excavations approaching or intercepting the weathered shale or bedrock surface will likely encounter groundwater.

- The Central Water Feature and associated retaining walls, flatwork, below-grade stormwater basins, etc. will likely encounter substantial perched/trapped groundwater within the fill.

- Sumps and pumps may be suitable for groundwater control within low permeability soils; however, dewatering within high permeability sands may require wells, cut-off trenches, or other more extensive means. Dewatering should be in accordance with the approved environmental requirements for the project.

- Trenches excavated into the shale or limestone bedrock will likely become below-grade conduits for groundwater collection and transmission. Using clay fill to backfill trenches may be necessary to help control groundwater or to cut off water from entering future building excavations (or below-grade areas) and other areas such as the Central Water Feature.

- Pond liners may need to consider hydrostatic buoyancy forces.

## C.2.d. Existing Structures and Tunnels

### C.2.d.1. General

Provided records indicate subsurface structures (tunnels, shafts, footings, slabs, etc.) that extended greater than 10 feet below the existing ground surface were cut off at that depth, bulk-headed (for tunnels and shafts), and backfilled to the existing ground elevation. Figure F1 in Appendix F (provided by Arcadis) indicates the documented areas where subsurface structures were left in place. In addition, seven documented tunnel systems were constructed in the soil and bedrock below the former Ford Assembly Plant at various depths and configurations (see Appendix F). The documented tunnels include historic sand mining within the St. Peter Sandstone. Excluding the oil tunnel and steam tunnel (note, floor slab of the steam tunnel was left in place), the remaining tunnels were sealed at the entrances and left in existing condition. Elevator, air and other shafts that extended from the tunnels to the surface buildings were excavated down at a depth of approximately 10 feet and capped with reinforced concrete.

The majority of the tunnels that remain in place beneath the site were excavated in the sandstone at elevations ranging from 691 to 725. Based on proposed site grades, the existing tunnels will be approximately 55 to 100 feet below the lowest planned construction elevations and the Platteville Limestone will typically be in place over the tunnels.

The 2012 Mannik and Smith Group, Inc. report stated that based on the NTH inspection in 2007, the vast majority of the sand tunnels inspected were stable with only minor signs of deterioration. The 2012 report also states that the tunnels in the Platteville Limestone Formation and the St. Peter Sandstone are currently stable with an anticipated low risk of collapse in the sandstone and very low risk of collapse in the limestone. Finally, the 2012 report states that the hard limestone formation above the sandstone would likely provide a bridge that would mitigate ground subsidence at the surface.

Similar to the conclusions provided in the 2012 report, it is our opinion the risk for settlement or stability issues to the proposed infrastructure improvements related to the existing tunnels or structures is low.

### C.2.d.2. Removals

Ground Penetrating Radar Systems, LLC (GPRS) performed a ground penetrating radar (GPR) and electromagnetic induction (EMI) survey of the site to review the potential for underground storage tanks, near surface structures or other anomalies for Terracon (2018). Sixteen locations were identified for additional test pits to determine the source of the anomalies. The majority of the anomalies consisted of large pieces of concrete, existing column footings from former buildings, or other concrete structures.

It is likely other shallow structures are also present on site that are undocumented and undiscovered. However, unless in close proximity or in conflict with infrastructure features, we assume existing structures will have a negligible impact and can be left in place. The exception would be below retaining walls, bridges, or other structures with higher or more localized loads. Existing structures, including vertical shafts or utilities, should also be reviewed for impacts to stormwater features, specifically those designed to retain water.

### C.2.e. Frost Protection

The project will include extensive concrete pavement and sidewalk areas. Subgrade soils within these areas are generally anticipated to be controlled by engineered fill, although some areas may bear on existing soils depending on final site grades. Frost heave-related movement can affect surface grades, as well as pavement/slab performance and maintenance. Where frost-related movement is a concern, such as plazas and sidewalks, we recommend additional considerations such as a thickened layer of non-frost-susceptible sand backfill and drain tile be considered as outlined in Section C.6. Note, concrete pavements (such as concrete sidewalks) are considered rigid and will typically be more susceptible to differential frost-related movement and associated trip hazards at joints.

### C.2.f. Reuse of Existing Soil and Material

Soil reuse will significantly affect mass grading and infrastructure construction. Soil, bedrock and material reuse should consider the following:

- Organic soils containing greater than 5 percent organic content should not be reused as structural below pavements (or greater than 3 percent below structures).

- Large debris (greater than 6 inches in size), compressible debris (i.e. wood or organic material) or debris that cannot be properly compacted should be removed from structural or pavement fill prior to reuse.

- Remaining on-site concrete structures may be crushed and reused as structural fill, assuming the crushed product can be properly compacted for the intended use. Remaining bituminous pavement can be milled and reused as pavement base or subbase material depending on the gradation of the reclaimed material, but should not be used as general fill material and placed in building areas.

- On-site silty sands and clayey soils (SC, CL) are moisture sensitive and, in general, are at or above their estimated optimum moisture contents. Reuse of these soils should assume some moisture conditioning (drying or wetting) will be required to achieve required compaction levels.

- Fat clay or shale should not be reused as structural fill below structures, pavements, slabs, or adjacent to below-grade walls. Similarly, soils containing fat clay/shale fragments or chunks should not be reused as defined above unless these materials are removed or the percentage of these materials is low enough to not impact performance or add risk to the supported structure. Shale removed from utility trenches is not recommended for use as trench backfill. Fat clay may be considered for reuse as pond liner material, but should be reviewed for conformance with applicable stormwater design requirements. Shale should not be reused as pond liner. Moisture conditioning of fat clay (or crushed shale) to achieve compaction levels will be difficult. Chemical modification or stabilization of the fat clay or shale may be considered, but is likely not cost effective.

- Limestone bedrock may be crushed and reused as general site fill, stabilizing aggregate, or aggregate base, depending on the amount of processing.

- Reuse of all on-site soils should be in accordance with the approved environmental requirements for the project.

### C.2.g. Karst

Based on our understanding of the project and that site improvements and stormwater features will typically be designed to limit or prevent water infiltration into the existing bedrock, it is our opinion the potential for karst features or conditions is low on the project site. The potential for karst conditions or features developing can be further reduced by observation of soil and bedrock conditions by qualified engineering technicians, geotechnical engineers, or geologists during mass grading and construction.

## C.3. Structure/Feature Specific Commentary

### C.3.a. General Site Grading

As referenced in Figure A.3, Appendix A, a majority of the site will be subject to fill placement and increased site grades as part of the overall site grading, requiring substantial amounts of material to be imported to the site. The general exceptions where site grades will be lowered or cut includes the three primary stormwater basins/features, the extreme northeast corner of the site (Block 3), and the southern portion of the site (Blocks 25-27, 31, 32, 35 and 36).

Within fill areas, fill placement will generally allow for control of subgrade design, including materials and compaction levels, without removal of existing materials. However, as discussed in Section C.2.a, fill placement over the existing subgrade (including existing fill and native soils) will result in the risk of surface settlement related to the consolidation of the existing subgrade soils under the weight of the new fill.

### C.3.b. Public ROW, Pavements, and Exterior Slabs

Extensive new exterior pavements and slabs, including public roads, trails, plazas, sidewalks, etc., will be constructed as part of the infrastructure project. In addition to standard considerations for subgrade preparation, the following geotechnical factors or comments should be considered for pavement and exterior slab design and construction:

- Potentially expansive shale and fat clay, or fill containing these materials, may be present at subgrade elevations where grades will remain similar or be lowered. Provisions as outlined in Sections C.2.b and D.1 are recommended to mitigate the risks associated with expansive forces and volume changes.

- Frost heave-related movement will affect long-term performance and maintenance of pavements and exterior slabs. Section C.6 includes recommendations for reducing the risk of frost-related movement and its subsequent effects.

- Frost protection is recommended to include all sidewalks within ROW areas, and consider the impact of adjacent features (such as landscaping islands) that will allow water to enter the subgrade.

- The use of a construction delay or sequencing to allow for settlement related to fill consolidation (including fill consolidation of deep utility trench backfill) to generally occur prior to construction of pavements, sidewalks, etc.

### C.3.c. Central Plaza and Square

The Central Plaza and Square will be prominent site features that will include substantial grade raises (up to 16 feet), below-grade stormwater structures, and a large retaining wall on the south side of Bohland Avenue. Design and construction should include the following considerations:

- Substantial grade changes will increase the risk of settlement after fill placement related to consolidation of the existing soils, as well as consolidation of the fill under its own weight. We recommend construction of site features such as pavements/slabs, the retaining wall, and stormwater structures/pipes be staged or delayed to allow for the majority of this settlement to occur prior to construction.

- The use of non-frost-susceptible sands as fill within the Central Plaza Area, including as backfill behind the retaining wall on the south side of Bohland Avenue and around the stormwater structure, will reduce the risk of frost heave and also help reduce the risk of fill consolidation.

### C.3.d. Retaining Walls and Pedestrian Bridges

Several free-standing retaining walls are planned on site, including on the south side of Bohland Avenue, the east side of Finn Street, the east side of the Central Water Feature, within the Civic Plaza, and at other locations within the parks areas. Pedestrian bridges are also planned over the Central Water and Hidden Falls features. Although design is still preliminary, we recommend design and construction consider the following:

- If present, existing fill and soft/compressible soils should be removed below the proposed walls and bridge foundations to reduce the risk of settlement (and possibly to improve bearing capacity for support).

- If present, shale or fat clay should be partially subcut and capped with low-permeability fill below retaining wall and bridge foundations.

- The use of non-frost-susceptible sands as wall (and abutment) backfill will improve long-term performance, and reduce the lateral earth pressures used for wall design.

- Impact of groundwater, possibly stormwater (for the walls around the Central Water Feature), and potential saturated soil conditions on wall design and performance.

### C.3.e. Utilities

Extensive new below-grade utilities are planned throughout the site, including sanitary sewer pipes that will bear up to 28 feet below final grade and a deep drop shaft west of Saunders Avenue. Below-grade utility design and construction should consider the following geotechnical impacts:

- Groundwater will be encountered throughout the site and substantial dewatering and groundwater control should be anticipated, per Section C.2.c. Perched groundwater (above the bedrock) may also impact utility trench stability.
- Substantial bedrock removal is anticipated; weathered shale, shale, and fill containing shale should not be reused as utility trench backfill.
- Sequencing of utility construction in regards to general fill placement (and placement of other utilities) should be evaluated to reduce impacts to new utility pipes, as well as site features bearing within/over trench backfill zones, from settlement.
- Differential settlement between shallow utility pipes (bearing over fill) connected to deep structures bearing on bedrock (that will not be subject to settlement) should be reviewed.

### C.3.f. Stormwater Features

Stormwater features planned for the project include retention ponds, biofiltration basins, a creek channel, and below-grade systems and structures. The following should be considered for stormwater design and construction:

- Substantial bedrock removal is anticipated; shale and fill containing shale should not be reused as structural backfill.
- Limited additional subcutting of shale or fat clay may be required below structures or pipes.
- Exposed and unconfined shale or fat clay surfaces will expand over time.
- Bedrock surfaces (limestone and shale) should be reviewed for voids, cracks, anomalies, and existing structures (such as vertical shafts) that may impact stormwater feature performance.

- Fat clay (not shale bedrock) may be considered for reuse as low permeability pond liner material; however, fat clay is subject to volume changes with moisture variations. If this material is allowed to dry, it will be subject to shrinkage and cracking that may affect liner performance.

- Constructability of soil pond liners over slopes, and well as bedrock surfaces.

- Protection of soil pond liners during and after construction from erosion.

- Perched groundwater is prevalent throughout the central portion of the site where the Central Water Feature is planned; groundwater control should be planned to help reduce impacts to design and construction, including the potential for buoyancy forces on the liner.

# D. Geotechnical Recommendations

Recommendations provided within this section are intended to support development, design, and construction of the infrastructure improvements.

## D.1. Site Grading and Subgrade Preparation

### D.1.a. General Site Grading

We understand mass grading of the site may or may not include site-specific soil corrections for individual private buildings or blocks (i.e. pad ready); this report does not address block-specific private development. For areas where initial mass grading is limited to rough grading of the site and does not include performing additional below-grade soil corrections for individual private buildings or blocks, we recommend the following:

1. Strip vegetation, pavements, and other near surface structures.

2. Scarify, moisture condition and surface compact the subgrade with at least 5 passes of a large roller with a minimum drum diameter of 3 1/2 feet or as recommended by the geotechnical engineer.

3. Have a geotechnical representative observe the excavated subgrade to evaluate if additional subgrade improvements are necessary.

4. Place fill in accordance with Section D.1.m.

It should be noted that settlement may occur in areas where new fill will be placed on top of existing fill and/or underlying organic soils or compressible native soils. The amount and time rate of settlement will be dependent on the amount of fill placed and existing subgrade soils. Additional recommendations should be provided for private development of each individual block.

Road, pavement, structure and utility subgrades should be prepared in accordance with the recommendations provided in their respective sections below.

### D.1.b. Retaining Wall, Bridge, and Culvert (Structures) Subgrade Preparation

We recommend subgrade preparation below retaining walls, bridges, culverts and other structures associated with the infrastructure improvements include the steps outlined below. Recommendations for bridge foundations should be reviewed after design proceeds.

1. Excavate to the proposed structure subgrade elevation (in cut areas).

2. Remove unsuitable soils consisting of surficial topsoil or organic soils, vegetation, pavements/slabs, existing structures, uncontrolled or poorly compacted existing fill, and soft/unstable clayey or silty soils from below the structure and 1:1 lateral oversizing zone. If MSE walls are used, we recommend the lateral oversizing extend outward and downward from the back of the lateral reinforcement behind the wall.

3. Additional removal of bedrock (limestone, shale, weathered shale), fat clay (CH), and fill containing shale, weathered shale, or fat clay may be required if these materials are present at or near structure foundation/slab subgrades. These conditions should be reviewed on a case-by-case basis as design proceeds. For preliminary purposes, we recommend removal of shale bedrock, weathered shale, or fat clay (or fill containing these materials) within 12 inches of wall foundations or structure bearing depths.

4. Loose or unstable bedrock should be removed below foundations or structure inverts; bedrock bearing surfaces should be relatively level.

5. Have a geotechnical representative observe the excavated subgrade to evaluate if additional subgrade improvements are necessary.

6. Surface compact exposed subgrade as recommended by the geotechnical engineer. Surface compaction does not apply to exposed bedrock surfaces.

7. Place engineered fill to grade and compact in accordance with Section D.1.m (and Step 7 below). Fill placement should also include placement of non-frost-susceptible fill as applicable (see Section D.6).

8. If shale bedrock, weathered shale, or fat clay (or fill containing these materials) are present at the retaining wall foundation, they should be capped with a minimum of 12 inches of non-expansive clayey soil with a PI between 8 and 25. Other structures should be reviewed on a case-by-case basis.

Contractors should use techniques which would limit the disturbance. Provisions to subcut and replace soils with crushed aggregate base should be anticipated to provide a stable working platform.

We recommend fill be placed on level surfaces. Therefore, any fill placed on or against sloping ground should begin from the bottom of the slope where a level surface can be established and properly 'keyed' into the slope. Keys should consist of a level bench excavated to a convenient width for the equipment used. This will provide a more stable fill condition and reduce the potential for slip surface to occur along the existing soil/new fill interface.

### D.1.c. Public Street and Alley Subgrade Preparation

We recommend the following general steps for subgrade preparation of public streets and alleys.

1. Excavate to the proposed pavement section subgrade elevation (in cut areas).

2. Strip unsuitable soils consisting of surficial topsoil or organic soils, vegetation, pavements/slab, and existing near-surface structures to a minimum depth of 3 feet below pavement subgrades (defined as the bottom of aggregate base, or sand subbase if utilized).

3. If present, we recommend bedrock (limestone, shale, weathered shale), fat clay (CH), and fill containing shale, weathered shale, or fat clay be removed within and to a minimum depth of 12 inches below pavement subgrades (defined as the bottom of aggregate base, or sand subbase if utilized).

4. Have a geotechnical representative observe the excavated subgrade to evaluate if additional subgrade improvements are necessary.

5. Slope subgrade soils to areas of sand and drain tile to allow the removal of accumulating water.

6. Prior to filling or placement of new pavements, scarify, moisture condition and surface compact the exposed subgrade to at least 95 percent of standard Proctor density at depths deeper than 3 feet and to 100 percent of standard Proctor density within the upper 3 feet of the pavement subgrade. Scarification and surface compaction does not apply to exposed bedrock surfaces.

7. Place engineered fill to grade and compact in accordance with Section D.1.m to bottom of pavement (and Step 8 below). Fill placement should also include placement of non-frost-susceptible fill as applicable (see Section D.6).

8. Where shale bedrock, weathered shale, or fat clay (or fill containing these materials) are present at the pavement section subgrade (bottom of aggregate base, or sand subbase if utilized), they should be capped with a minimum of 12 inches of non-expansive clayey soil with a PI between 8 and 25.

9. Proofroll the pavement subgrades as described in Section D.1.i.

### D.1.d. Sidewalk and Trail Subgrade Preparation

We recommend sidewalk and trail subgrades be prepared in accordance with the general recommendations provided in Section D.1.c for pavement subgrades. For flatwork generally not subject to vehicle loads (such as sidewalks), the minimum compaction level for the upper 3 feet may be reduced to 95 percent of standard Proctor density.

### D.1.e. Civic Plaza and Square and Central Water Flatwork Subgrade Preparation

We recommend subgrades within the Civic Plaza and Square be prepared in accordance with the general recommendations provided in Section D.1.c for pavement subgrades.

For increased frost protection within these areas, we recommend the upper 4 feet of the subgrade (below the pavement section) consist of non-frost-susceptible fill in accordance with Sections D.1.m and D.6. This recommendations is also applicable for paved or flatwork areas around the Central Water Feature or other specific areas where reduced effects of frost heave are desired.

### D.1.f. Utility Pipe and Structure Subgrade Preparation

Soils present at utility pipe and structure invert elevations are anticipated to be a combination of bedrock, native soils, and fill. In general, we anticipate these materials will be directly suitable for pipe and structure support, although additional subcutting may be required as recommended below.

Earthwork activities associated with utility pipe and structure installations should adhere to the recommendations in Section D.1.b. In addition, we recommend the following for utility excavations (applies to pipes and structures):

- If bedrock (including limestone, shale, weathered shale) are present at or above the invert elevation, we recommend they be over-excavated a minimum of 12 inches beneath the invert to reduce the risk of point loads.

- If existing structures are present at or above the invert elevation, we recommend they be removed to a minimum depth of 12 inches beneath the invert to reduce the risk of point loads.

- If existing organic soils, unstable or soft clays or fill are present at or above the invert elevation, we recommend they be removed to a minimum of 12 inches beneath the invert and be backfilled with sand with less than 12 percent passing the #200 sieve (Select or Deep Structural Fill) or crushed aggregate to help provide a stable base for utility support.

We recommend selecting, placing and compacting utility fill in accordance with the recommendations provided above in Section D.1.m. Additional considerations pertaining to utility trench fill/backfill include the following:

- If settlement at or around utilities is a concern due to deep utility trench backfill, we recommend backfilling around the structure with sand with less than 12 percent passing the #200 sieve (Deep Structural Fill). Alternatively, project planning can include a construction delay between trench/structure backfill and construction of surface features, as discussed in Section D.1.m.

- As discussed in Section C.2, additional trench backfill considerations may be required within specific areas depending on the presence of perched/trapped groundwater and proximity of other below-grade structures. Low permeability backfill (non-expansive) may be required to reduce or impede groundwater flow along utility trenches into below-grade building areas, behind retaining wall, ponds, or other structures or features. These conditions should be reviewed on an individual basis.

- Pipe or structure bedding should be in accordance with manufacturer requirements.

- In general, capping of shale, weathered shale, or fat clay subgrades within utility trenches with low-permeability, non-expansive soil or material is not anticipated to be required due to the confining pressure of the overburden materials (or below grade structures). However, the exception would be shallow utility pipes or structures with insufficient confining pressure and where water subsurface may collect. These pipes and structures should be reviewed on an individual basis.

### D.1.g. Stormwater Pond and Basin Subgrade Preparation

In general, pond subgrades will not be subject to loading and we recommend they be prepared in accordance with Section D.1.a. However, additional removal of soil or material may be required if the subgrade is not stable enough to allow of proper construction of the pond liner as outlined below.

After excavation to the planned subgrade elevation, we recommend stormwater pond subgrades be reviewed by a geotechnical engineer or qualified engineering technician. Additional review may also be required by the stormwater designer. Exposed bedrock surfaces should be reviewed for voids, cracks, anomalies, and existing structures (such as vertical shafts) that may impact stormwater feature performance.

The stormwater design plans or submittal documents may provide additional subgrade preparation requirements.

Section D.5 provides additional commentary and recommendations pertaining to pond and basin liners.

### D.1.h. Additional Recommendations for Fat Clay and Shale Subgrades

Depending on site grades, fat clay or shale may be present at pavement, slab, structure, utility, or other site feature subgrades. As discussed, depending on the condition of the soil or bedrock, these materials have the potential for volume change and expansive forces. To reduce the risk for volume change and expansive force, we recommend the following general steps be taken to help manage the fat clay or shale exposed within or below subgrades that would be affected by volume changes or expansive forces.

- Subcutting these materials as defined within their respective subgrade preparation subsections for the various infrastructure improvements.

- Where exposed, seal off fat clay, weathered shale, or shale subgrades from moisture variations within 48 hours of exposure with low permeability clayey fill with a PI between 8 and 25 or lean fill. Chemical modification can also be considered for fat clay subgrades.

- Promptly remove water from fat clay or shale subgrades.

- Have a geotechnical representative observe the exposed subgrades to evaluate if additional subgrade improvements are necessary.

### D.1.i. Pavement Subgrade Proofroll

After preparing the subgrade as described above and prior to the placement of the aggregate base (or sand subbase, if utilized), we recommend proofrolling the subgrade soils with a fully loaded tandem-axle truck (minimum weight of load and truck of 50,000 pounds). We also recommend having a geotechnical representative observe the proofroll. Areas that fail the proofroll likely indicate soft or weak areas that will require additional soil correction work to support pavements.

The contractor should correct areas that display excessive yielding or rutting during the proofroll (generally defined as greater than 1 to 2 inches), as determined by the geotechnical representative. Possible options for subgrade correction include moisture conditioning and recompaction, subcutting and replacement with soil or crushed aggregate, chemical stabilization and/or geotextiles. We recommend performing a second proofroll after the aggregate base material is in place, and prior to placing bituminous or concrete pavement. Yielding or rutting during the proofroll of the aggregate base material should be negligible.

### D.1.j. Construction Delay

For preliminary design and planning, we recommend a construction delay between the completion of subgrade fill placement and the construction of infrastructure features (pavement, flatwork, utilities, structures, etc.) be utilized when the following conditions apply:

- New fill placement exceeds 5 feet over existing grades.

  AND

- Existing fill depth exceeds 5 feet, or
- Buried topsoil or organic soils are present at depth (and will be left in place), or
- Soft/loose native soils are present (and will be left in place).

The intent of the delay is to allow for all or a portion of the settlement of the existing soils from new fill loads to occur prior to placement of site features. We recommend a minimum delay of 4 weeks; however, the actual length of the construction delay will be dependent on the specific site feature and tolerance to potential settlement, amount and type of fill placement, and existing subgrade conditions.

### D.1.k. Excavated Slopes

Based on the borings, we anticipate on-site soils in excavations will vary from lean clay to poorly graded sand. These soils are typically considered Type B and C Soil under OSHA (Occupational Safety and Health Administration) guidelines. OSHA guidelines indicate unsupported excavations in Type C soils should have a gradient no steeper than 1.5H:1V. Slopes constructed in this manner may still exhibit surface sloughing, especially where wet or saturated soils are present. Excavations within competent bedrock may be excavated as a vertical face; however, loose or highly fractured zones may require additional removal. OSHA requires an engineer to evaluate slopes or excavations over 20 feet in depth.

An OSHA-approved qualified person should review the soil classification in the field. Excavations must comply with the requirements of OSHA 29 CFR, Part 1926, Subpart P, “Excavations and Trenches.” This document states excavation safety is the responsibility of the contractor. The project specifications should reference these OSHA requirements.

### D.1.l. Excavation Dewatering

Where present, we recommend removing groundwater from the excavations as promptly as possible. Allowing water to pond on subgrades for extended periods will cause them to become saturated and make them more susceptible to disturbance and strength loss during construction, or swelling (for shale and fat clay subgrades). We recommend the contractor develop and submit a dewatering plan for review and approval to the design team prior to construction.

### D.1.m. Engineered Fill Materials and Compaction

Table 9 below contains our recommendations for engineered fill materials for the infrastructure phase of the project. All prospective fill materials should be reviewed by the geotechnical engineer.

**Table 9. Recommended Engineered Fill Materials[1]**

| Locations To Be Used | Engineered Fill Classification | Possible Soil Type Descriptions | Gradation | Additional Requirements |
|---|---|---|---|---|
| ▪ General site fill<br>▪ Below retaining walls and site structures<br>▪ Pavements, exterior slabs, flatwork, trails | ▪ Structural fill<br>▪ Pavement fill | SP, SP-SM, SM, SC, CL (excludes ML, MH, CH, Shale) | 100% passing 3-inch sieve (within upper 3 feet of subgrade)<br>100% passing 6-inch sieve (below 3 feet of subgrade) | < 3% Organic Content (OC) below structures<br>< 5% OC below pavements, exterior slabs, etc.<br>Plasticity Index (PI) < 20% |
| ▪ Deep structural fill (fill placed more than 10 feet below proposed structures or site features where settlement is a concern)[2]<br>▪ Pavement subbase<br>▪ Behind retaining walls and below-grade walls, beyond drainage layer[3] | ▪ Select or deep structural fill[2]<br>▪ Pavement subbase<br>▪ Retained fill[3] | GP, GW, SP, SW, SP-SM | 100% passing 2-inch sieve<br>< 50% passing #40 sieve<br>< 12% passing #200 sieve | < 3% OC |
| ▪ Drainage layer<br>▪ Non-frost-susceptible | ▪ Free-draining<br>▪ Non-frost-susceptible fill | GP, GW, SP, SW, SP-SM | 100% passing 1-inch sieve<br>< 50% passing #40 sieve<br>< 7% passing #200 sieve | < 3% OC |
| Below landscaped surfaces, where subsidence is not a concern | Non-structural fill | --- | 100% passing 6-inch sieve | < 10% OC |
| Pond liner[4] | Pond liner[4] | CL, CH | 100% passing 2-inch sieve | Hydraulic Conductivity < $1 \times 10^{-7}$ cm/sec |
| Low permeability fill to cap shale or fat clay subgrades | Non-expansive clay fill | CL | 100% passing 2-inch sieve | PI between 8 and 25 |

[1] Reuse of all on-site soils should be in accordance with the approved environmental requirements for the project.
[2] Recommended to limit the risk of settlement associated with fill consolidation under its own weight.
[3] Should be in accordance with retaining wall design wall design plans and specifications.
[4] Should be in accordance with any applicable stormwater design requirements and requirements of design engineer.

We recommend spreading engineered fill in loose lifts of approximately 8 inches thick. We recommend compacting engineered fill in accordance with the criteria presented below in Table 10. The project documents should specify relative compaction of engineered fill, based on the structure located above the engineered fill, and vertical proximity to that structure.

**Table 10. Minimum Compaction Recommendations Summary**

| Reference | Relative Compaction, percent (ASTM D698 – Standard Proctor) | Moisture Content Variance from Optimum, percentage points | |
|---|---|---|---|
| | | < 12% Passing #200 Sieve (typically SP, SP-SM) | > 12% Passing #200 Sieve (typically CL, SC, ML, SM) |
| Below structure foundations or slabs (includes stormwater/utility structures) | 98 | ±3 | -1 to +3 |
| Below public streets/roads and other pavements/slabs subject to regular vehicle traffic (upper 3 feet of subgrade, only) | 100 | ±3 | -2 to +1 |
| Below public streets/roads (below upper 3 feet of subgrade) | 95 | ±3 | ±3 |
| Below sidewalks, trails, and exterior slabs not subject to regular vehicle loading | 95 | ±3 | ±3 |
| Below landscaped surface (see Section D.5 for pond liners) | 90 | ±5 | -3 to +5 |
| Behind/adjacent to retaining or below-grade walls | 95[1] | ±3 | -1 to +3 |
| General utilities | 95[1] | ±3 | -1 to +3 |
| Pond liners[2] | 95 | --- | 0 to +3 |

[1] Increase compaction requirement to meet compaction required for structure supported by this engineered fill.
[2] Recommendations should be in accordance with any applicable stormwater design requirements and requirements of design engineer.

The project documents should not allow the contractor to use frozen material as engineered fill or to place engineered fill on frozen material. Frost should not penetrate under foundations during construction.

We recommend performing density tests in engineered fill to evaluate if the contractors are effectively compacting the soil and meeting project requirements.

## D.2. Structures

### D.2.a. Retaining Walls

The following comments and recommendations may be used in retaining wall design and construction, however, final design responsibility will rest with the wall design engineer. Retaining wall designers should be informed of site features and utilities that would influence their design. Our scope of services did not include global stability analysis. If desired, we can provide global stability analysis of the proposed walls.

### D.2.a.1. Subgrade Support and Net Allowable Bearing Pressure

We recommend the retaining walls bear in soils prepared as described in Section D.1.b; however, further direction regarding soil correction depths and suitable subgrade soils should be provided by the retaining wall designer. For walls with reinforced fill, we recommend the lateral oversizing extend outward and downward from the back of the fill reinforcement.

We anticipate foundations for the proposed retaining walls will bear on engineered fill placed for this project, or suitable native glacial soils or bedrock. However, depending on final design, retaining walls may be constructed within engineered fill placed during mass grading over areas of existing fill. Areas where walls are placed on existing fill should be expected to have greater amount of post-construction settlement, both differential and total settlements. Usually retaining walls can accommodate this movement, however, if potential wall settlement is not acceptable, existing fill should be removed from below wall foundations and reinforced zones. When soil conditions allow, surface compaction with the largest practical compactor will improve subgrade uniformity and strength.

For preliminary wall design purposes, we recommend foundations bearing on these soils be designed to exert an allowable soil bearing pressure up to 2,000 pounds per square foot (psf). The Boland Avenue retaining wall may bear on or near limestone bedrock. If retaining wall foundations bear directly on competent limestone bedrock, the bearing capacity may be increased to 10,000 psf.

All foundation subgrades should be reviewed by a geotechnical engineer. We anticipate total settlement of the wall will not exceed 1 inch; however, we recommend additional settlement analysis be performed as part of final wall design.

### D.2.a.2. Drainage

Drainage behind the walls is critical. Unless a drainage composite is placed against the backs of the retaining walls, we recommend that fill placed within 2 horizontal feet of the walls consist of free-draining sand or gravel in accordance with Table 9, Section D.1.m. If “clear” gravel only (such as MnDOT

3149.2H Coarse Filter Aggregate) is used for drainage, a fabric separator may be needed to keep sand from washing into the gravel. Water within this zone should be removed and routed away from the wall and its foundation zone.

Wall fill not capped with slabs or pavement should be capped with a low-permeability soil to limit the infiltration of surface drainage into the fill. Grades should also be sloped to divert water away from the walls and the reinforced zone. We recommend the wall designer be consulted if water is introduced to the area of the wall.

Walls around the Central Water Feature may require more robust subsurface drainage systems depending on final grades, locations, and subsurface conditions. We recommend these walls be further reviewed as the park plans are further developed.

### D.2.a.3. Lateral Design Parameters

Free-standing retaining wall design can use active earth pressure conditions, assuming the walls can rotate slightly. If the wall design cannot tolerate rotation, then design should use at-rest earth pressure conditions. Rotation up to 0.002 times the wall height is generally required for walls supporting sand. Rotation up to 0.02 times the wall height is required when the wall supports clay.

To improve long-term performance and for ease of backfilling and compaction, we recommend the retaining walls be backfilled with sand with less than 12 percent passing the #200 sieve (per Table 9, Section D.1.m). Table 11 below provides recommended design values for the retaining walls. Alternate design values are also provided if the project team and wall designer use other on-site or imported material for retaining wall backfill.

**Table 11. Recommended Retaining Wall/Below-Grade Wall Design Parameters – Drained Conditions**

| Retained Soil[1] | Wet Unit Weight (pcf) | Friction Angle (degrees) | Active Equivalent Fluid Pressure[2] (pcf) | At-Rest Equivalent Fluid Pressure[2] (pcf) | Passive Equivalent Fluid Pressure[2] (pcf) |
|---|---|---|---|---|---|
| Sand with less than 12% fines (SP, SP-SM) | 120 | 32 | 35 | 55 | 320 |
| Other structural fill (SM, SC, CL) | 125 | 26 | 50 | 70 | 320 |

[1] Per Table 9, Section D.1.m.
[2] Based on Rankine model for soils in a region behind the wall extending at least 2 horizontal feet beyond the bottom outer edges of the wall footings and then rising up and away from the wall at an angle no steeper than 60 degrees from horizontal.

Consideration needs to be given for sloping fill or other dead or live loads that are placed within a horizontal distance behind the walls that is equal to the height of the walls. Our design values also assume that the walls are drained so that water cannot accumulate behind the walls (not saturated conditions).

Resistance to lateral earth pressures will be provided by passive resistance along the base of the wall and reinforced zone, and by sliding resistance along the bottoms of the wall footings. We recommend assuming a sliding coefficient equal to 0.4. These values are unfactored.

#### D.2.a.4. Global Factor of Safety

In addition to other applicable stability and performance demonstrations, we recommend retaining wall design documents or submittals contain demonstrations of global stability with a minimum factor of safety against global failure of 1.5 or greater.

### D.2.b. Pedestrian Bridges

#### D.2.b.1. Design

We were provided with the axial service loads listed in Table 12 for each bridge structure by Ericksen-Roed and Associates (ERA). ERA indicated the lateral loads on the bridge foundations were minimal.

We used LRFD methodology for design of the anticipated bridge foundations supported on shallow foundations. Resistance factors were obtained from the current edition of the American Association of State Highway and Transportation Officials (AASHTO) LRFD Bridge Design Specifications. For the service limit state, we applied a resistance factor of 1.0. We assume a maximum settlement of 1-inch will be specified for each bridge. For evaluation of the strength limit state, we applied a resistance factor of 0.45 per Table 10.5.5.2.2-1 of the AASHTO LRFD Bridge Design Specifications.

#### D.2.b.2. Bearing Capacity and Settlement

Our recommended bridge foundation design parameters are provided within Table 12 below. If lateral pressure values are required for abutment design, we recommend utilizing the values provided in Table 11, Section D.2.a.3.

**Table 12. Pedestrian Bridge Foundation Recommendations**

| Structure | Foundation Element | Service Load (kips) | Bearing Elevation | Referenced Boring(s) | Anticipated Subgrade Material | Recommended Design Bearing Capacity[1] (psf) |
|---|---|---|---|---|---|---|
| Central Water Bridge | Abutments | 50 | 806 | ST-57, ST-58 | Fill[2] | 2000 |
| | Central Piers | 110 | 797 | | Limestone Bedrock[3] | 10000 |
| Hidden Falls Bridge | Abutments | 220 | 786 | ST-68 | Limestone Bedrock[3] | 10000 |

[1]Recommended design (factored) bearing resistance is for both strength and service limit states.
[2]Remove unstable or organic fill and replace with select structural fill per Section D.1.m, Tables 9 and 10.
[3]Remove any remaining shale to expose limestone bedrock

## D.3. Pavement

### D.3.a. Subgrade Design

After site grading and subgrade preparation per Section D.1, we anticipate the pavement subgrade soils will be variable, consisting of both sands and clays. Given the anticipated subgrades and experience with similar soils, we recommend designing pavements for a composite clayey and silty sand (SM/SC) subgrade and using an assumed R-value of 20 for flexible pavement design. We recommend rigid (concrete) pavements be designed for a modulus of subgrade reaction (k) of 150 pci.

### D.3.b. Public Street Pavement Sections

Table 13 includes our recommended minimum pavement sections for the public streets based on the anticipated subgrade soils and provided traffic loads.

**Table 13. Recommended Minimum Bituminous Pavement Sections**

| Use | Primary Roads[1] | Secondary Roads | Shared Paths | Pedestrian/Bike/ Park Trails[2] |
|---|---|---|---|---|
| Feature | Cretin Ave., Mount Curve Blvd., Montreal Ave., Bohland Ave., Finn St., Hillcrest Ave., Woodlawn Ave.[3] (STA. 102+73 to STA. 106+21), Village Way[3] (STA. 196+74 to STA. 201+46 and STA. 206+35 to STA. 214+22) | Ranger Way[3], Woodlawn Ave.[3] (STA. 80+00 to STA. 102+73) | Beechwood Ave., Village Way[3], Ranger Way[3], Saunders Ave., Yorkshire Ave. | Falls Passage (East and West), Mississippi River Blvd. and Ford Parkway Bike Trail, Various Park Trails |
| Minimum asphalt thickness (inches) | 5 | 4 | 4 | 3.5 |
| Minimum aggregate base thickness (inches) | 12 | 10 | 6 | 8 |
| Minimum sand subbase thickness (inches) | 18 | 18 | 12 | --- |

[1] Bituminous section thickened to support construction traffic.
[2] Design includes additional 2 inches of aggregate base to meet support requirements for maintenance vehicles and vac-trucks.
[3] Portions of Village Way and Ranger Way will be either a Primary or Secondary Road with portions of the road being a Shared Path. Woodlawn Avenue will include both Primary and Secondary Road segments.

### D.3.c. Bituminous Pavement Materials

We recommend specifying crushed aggregate base meeting the requirements of Minnesota Department of Transportation (MnDOT) Specification 3138 for Class 5. We recommend that the bituminous wear and non-wear courses meet the requirements of Specifications 2360, with the following designations:

- Wear: SPWEA340C
- Non-wear: SPNWB330C

If increased protection against thermal cracking and rutting is desired, we recommend using a PG Grade “F” oil.

We recommend compacting the aggregate base to meet the requirements of MnDOT Specification 2211.3.D.2.c (Penetration Index Method for the dynamic cone penetrometer [DCP]). We recommend compacting bituminous pavements to an average of at least 92 percent of their maximum theoretical (Rice) density with no individual result less than 90 percent.

### D.3.d. Concrete Pavements

Table 14 includes our recommended minimum pavement sections for the exterior concrete pavements; most of the public streets will consist of bituminous pavement.

**Table 14. Recommended Minimum Concrete Pavement Sections**

| Use | Pavement Subject to Vehicle Loads[2] | Sidewalks |
|---|---|---|
| Minimum concrete thickness (inches) | 6 | 4 |
| Minimum aggregate base thickness (inches) | 6 | 4 |
| Minimum sand subbase thickness (inches) | ---[1] | ---[1] |

[1] Dependent on desired frost protection and area.
[2] Designed to include Falls Passage East and West, and concrete pavement areas subject to maintenance, vac-truck and other vehicle traffic.

We recommend specifying concrete for pavements that have a minimum 28-day compressive strength of 4,500 psi, and a modulus of rupture ($M_r$) of at least 600 psi. We also recommend Type I cement meeting the requirements of ASTM C 150. We recommend specifying 5 to 8.5 percent entrained air for exposed concrete to provide resistance to freeze-thaw deterioration. We also recommend using a water/cement ratio of 0.45 or less for concrete exposed to deicers.

### D.3.e. Subgrade Drainage

We recommend installing perforated drainpipes throughout pavement areas at low points and around catch basins and along the perimeter of pavement areas where adjacent surface grades will promote drainage towards the pavement. Additional drain tile should be installed along the full length of road/pavement subgrades where shale, fat clay, or soils with low permeability are present at the pavement section subgrade.

The drainpipes should be placed in small trenches slightly below the bottom of the aggregate base material or sand subbase, where present.

### D.3.f. Performance and Maintenance

We based the above pavement designs on a 20-year performance life for bituminous and a 30-year life for concrete. This is the amount of time before we anticipate the pavement will require reconstruction. This performance life assumes routine maintenance, such as seal coating and crack sealing. The actual pavement life will vary depending on variations in weather, traffic conditions and maintenance.

It is common to place the non-wear course of bituminous and then delay placement of wear course. For this situation, we recommend evaluating if the reduced pavement section will have sufficient structure to support traffic (including construction traffic).

Many conditions affect the overall performance of the exterior slabs and pavements. Some of these conditions include the environment, loading conditions and the level of ongoing maintenance. With regard to bituminous pavements in particular, it is common to have thermal cracking develop within the first few years of placement, and continue throughout the life of the pavement. We recommend developing a regular maintenance plan for filling cracks in exterior slabs and pavements to lessen the potential impacts for cold weather distress due to frost heave or warm weather distress due to wetting and softening of the subgrade.

## D.4. Below Grade Utilities and Structures

### D.4.a. Pipe Design and Support

Soils present at utility pipe and structure invert elevations are anticipated to be a combination of bedrock, native soils, and fill. In general, we anticipate these materials will be directly suitable for pipe and structure support, although additional subcutting may be required as recommended below. Reference Section D.1.f for subgrade preparation and trench fill recommendations.

In general, we recommend project design and construction not place utilities within the 1H:1V oversizing of foundations (including future private structures). However, for structures supported on bedrock, this influence zone may be reduced and should be reviewed on a case-by-case basis.

The on-site soils varied from sand to clay. Based on our experience, the clayey soils encountered by the borings are moderately corrosive to metallic conduits, but only marginally corrosive to concrete. We recommend specifying non-corrosive materials or providing corrosion protection, unless project planning chooses to perform additional tests to demonstrate the soils are not corrosive.

### D.4.b. Sanitary Sewer Drop Shaft

The new sanitary sewer system will include a vertical drop shaft west of Saunders Avenue and then tie into the existing sanitary sewer system via a horizontal connection. Boring ST-85 was extended to an approximate elevation of 742 utilizing rock coring to provide additional subsurface information for the drop shaft (note, the drop shaft was originally located west of Village Way).

Only preliminary design and construction details were provided, but we understand installation will be achieved with a cased, drilled shaft and the structure will consist of precast concrete. We also understand the annulus between the concrete structure and shaft walls will be fully grouted upon completion. We recommend shaft design and construction consider the following:

- Variable overburden soils and perched groundwater may be present on top of the bedrock.

- Perched groundwater may be present within the Platteville Limestone. The Glenwood Shale can act as a confining layer and trap substantial amounts of water within the lower bounds of the limestone. The perched water can adversely affect installation and construction.

- Shaft installation will likely penetrate four bedrock formations, including two layers of shale.

- The shaft and structure will ultimately bear within St. Peter Sandstone, which is considered to have a high bearing capacity, but is susceptible to disturbance, strength loss, and weathering if left exposed.

- Settlement of the material around the outside drop shaft may affect connecting horizontal pipes and surface features.

## D.5. Stormwater Ponds and Basins

Final design of the stormwater ponds, basins, and features, and associated liner systems, is the responsibility of the stormwater design engineer. Recommendations within this section are provided to aid design.

To aid design and construction, we recommend the following for liners intended to retain or hold water:

- If soil is desired for use a liner, we recommend a minimum of 2 feet of soil meeting the requirements outlined in Table 9, Section D.1.m. The minimum thickness should be increased in slope areas to accommodate constructability and loss of material through contamination with the existing subgrade during placement.

- On-site soils meeting these requirements will largely consist of fat clays; fat clays are considered expansive and subject to volume changes with moisture fluctuations. The clay pond liner should be protected from drying during construction and until filled to reduce the risk of shrinkage and cracking. The shrinkage cracks may not seal when the pond is filled and would serve as conduits for water loss. After filling, the water level should be maintained to prevent shrinkage and cracking of the clay liner.

- Within ponds (or portions of ponds) subject to water level fluctuations or designed to occasionally be dry, we recommend the pond liner include a stand-alone synthetic liner or a similar liner in-conjunction with a clay liner. The minimum clay layer thickness could potentially be reduced when used in conjunction with a synthetic liner.

- Design of synthetic liners should consider on-site debris, crushed concrete fill, and presence of bedrock.

- Where soil (not bedrock) is present at the pond subgrade, prior to liner placement, the subgrade should be scarified to a minimum depth of 18 inches and recompacted to break up any sand seams or layers.

The clay liner fill should be placed in maximum 8-inch lifts and be thoroughly compacted to minimum of 95 percent of standard Proctor density, unless otherwise specified by the design engineer. We recommend soil placed as fill be placed at a moisture content ranging from optimum moisture to 3 percentage points above its optimum moisture content. Fill should be compacted with a large self-propelled sheepsfoot compactor.

## D.6. Frost Protection

### D.6.a. General

The project will include extensive areas of pavements and exterior slabs that will be subject to freeze-thaw conditions. The subgrade soils are highly variable, but in general we consider the on-site silty and clayey soils (including weathered bedrock) to be moderately to highly frost susceptible. Soils of this type can retain moisture and heave upon freezing. In general, this characteristic is not an issue unless these soils become saturated due to surface runoff or infiltration or are excessively wet in-situ. Once frozen, unfavorable amounts of general and isolated heaving of the soils and the surface structures supported on them could develop. This type of heaving could impact design drainage patterns and the performance of exterior slabs, sidewalks, and pavements, as well as any isolated exterior footings and piers. To address most of the heave related issues, we recommend that general site grades and grades for exterior surface features be set to direct surface drainage away from buildings, across large paved areas and away from walkways and plazas to limit the potential for saturation of the subgrade and any subsequent heaving. General grades should also have enough “slope” to tolerate potential larger areas of heave which may not fully settle when thawed.

It should be noted that general runoff and infiltration from precipitation are not the only sources of water that can saturate subgrade soils and contribute to frost heave. Roof drainage, stormwater features, and the irrigation of landscaped areas in close proximity to exterior slabs, pavements, and isolated footings and piers, contribute as well.

We recommend subgrade details for landscaping within boulevard and ROW areas be reviewed to help reduce subgrade water flow into the subgrades of the adjacent pavements and exterior slabs (sidewalks).

### D.6.b. Additional Mitigation

One method to help limit the potential for heaving to occur is to remove frost-susceptible soils present below the overlying slab or pavement area down to the desired frost protection depth, and replace the excavated material with non-frost-susceptible, engineered fill. Non-frost-susceptible fill as defined in Table 9 as sand with less than 7 percent passing the #200 sieve and less than 50 percent passing the #40 sieve. If free draining sands are not present at the base of the subcut, we recommend providing drainage, as well as gradual transitions from this subcut (3H:1V or flatter gradient).

As discussed with the project team, Table 15 provides the recommended minimum removal and replacement depths for placing non-frost susceptible sand for increased frost protection for select features.

**Table 15. Recommended Minimum Removal and Replacement Depths for Frost Protection**

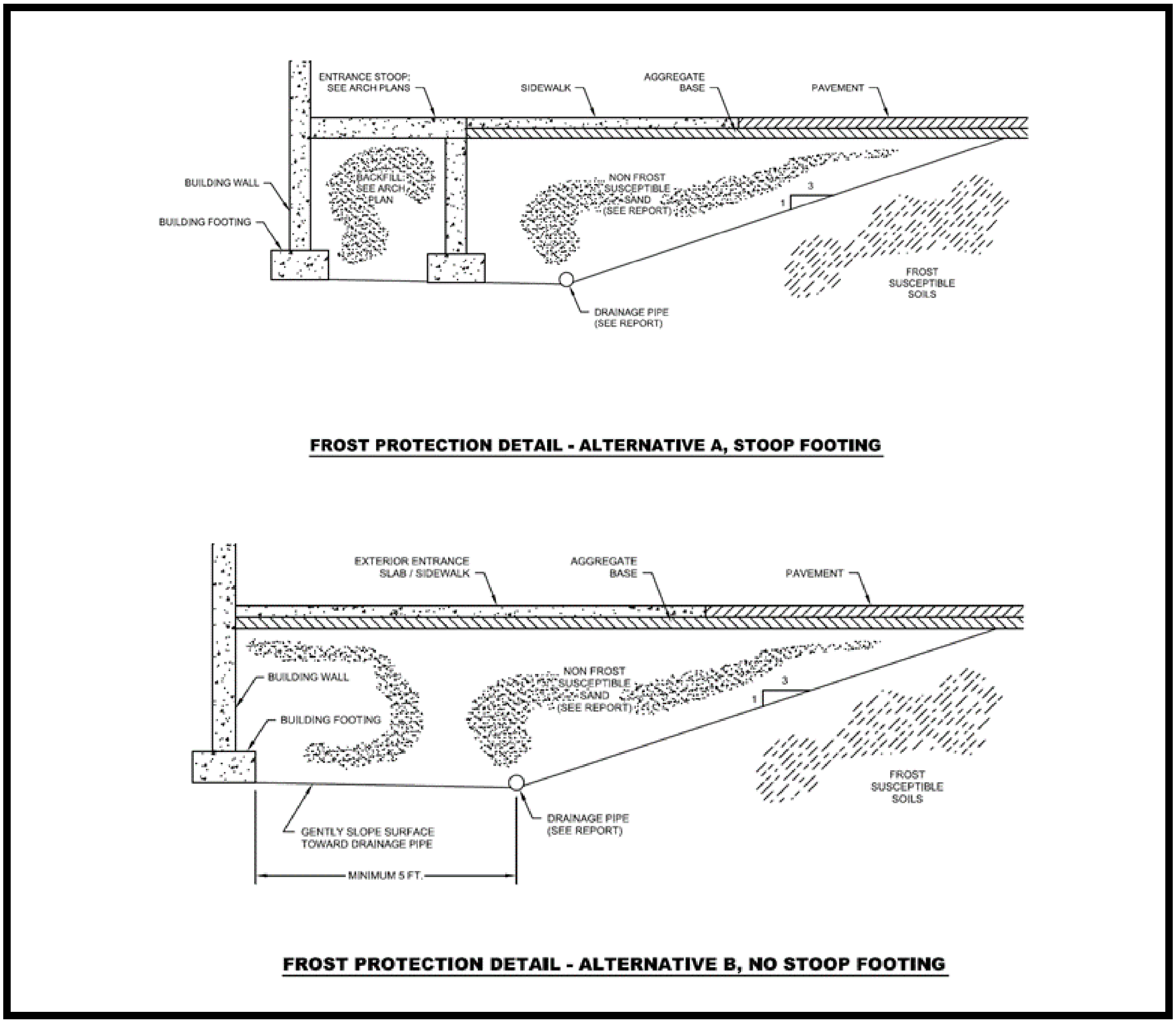
| Feature | Minimum Depth (feet) |
|---|---|
| Central Plaza and Square | 4 |
| Plazas and walkways around Central Water Feature | 4 |
| Sidewalks and exterior slabs adjacent to public streets | Match sand subbase of adjacent road* |

*Depths may need to be increased or transition zones may be required for stoops and flatwork for adjacent buildings or other areas of increased frost protection.

Another option is to limit frost heave in critical areas, such as doorways and entrances, via frost-depth footings or localized excavations with sloped transitions between frost-susceptible and non-frost-susceptible soils, as described above.

Figure 16 shows an illustration summarizing some of the recommendations above.

**Figure 16. Frost Protection Geometry Illustration**



#### D.6.c. Maintenance

Over the life of slabs and pavements, cracks will develop and joints will open up, which will expose the subgrade and allow water to enter from the surface and either saturate or perch atop the subgrade soils. This water intrusion increases the potential for frost heave or moisture-related distress near the crack or joint. Therefore, we recommend implementing a detailed maintenance program to seal and/or fill any cracks and joints. The maintenance program should give special attention to areas where dissimilar materials abut one another, where construction joints occur and where shrinkage cracks develop.

### D.7. Testing and Quality Control

We recommend sampling and testing of materials for this project in accordance with the State-Aid for Local Transportation (SALT) 2019 Schedule of Materials Control- Local Government Agency; while following the specification requirements set forth in this Geotechnical Evaluation Report, the City of St. Paul Standard Supplemental Specifications for Construction, and the Minnesota Department of Transportation's Standard Specification for Construction 2018 Edition.

## E. Procedures

### E.1. Penetration Test Borings

We drilled the penetration test borings with a truck-mounted core and auger drill equipped with hollow-stem auger. We performed the borings in general accordance with ASTM D6151 taking penetration test samples at continuous, 2 1/2- or 5-foot intervals in general accordance to ASTM D1586. We collected thin-walled tube samples in general accordance with ASTM D1587 at selected depths. The boring logs show the actual sample intervals and corresponding depths. We also collected bulk samples of auger cuttings at selected locations for laboratory testing.

We sealed penetration test boreholes meeting the Minnesota Department of Health (MDH) Environmental Borehole criteria with an MDH-approved grout. We will forward sealing records for those boreholes to the Minnesota Department of Health Well Management Section.

## E.2. Rock Cores

We performed rock cores with an NQ-3 core barrel. First, we lowered the bit and casing to the bottom of the previously advanced borehole. Then we lowered the core barrel into the casing with a wire line, and locked into place. We advanced the bit and barrel by rotating the assembly while applying crowd pressure. We used bentonite-drilling mud to cool the bit and wash cuttings to the surface. Our drillers noted bit pressure, rate of advance, fluid pressure and fluid return as coring progressed. They also noted intervals with a rapid rate of advance, a sudden loss of fluid pressure or return and intervals with a loss of bit pressure.

After completing each 5-foot core run, the drillers unlocked the core barrel from the bit and brought the barrel to the surface. They then extruded the split inner tube from the barrel and opened the tube to reveal the core sample. After field classification and logging, the drillers packed the core into a cardboard storage box, arranged into 2-foot long sections.

## E.3. Exploratory Test Pits

Bolander excavated the test pits with a 345 excavator, under the direction and observation of our staff. We prepared Test Pit Logs by visually examining the sidewalls of the test pits and classifying the materials brought to the surface by the excavator bucket. We measured strata boundary depths with a metal tape and generally rounded to the nearest 1/2 foot.

## E.4. Exploration Logs

### E.4.a. Log of Boring Sheets

Appendix A includes Log of Boring sheets for our penetration test borings. The logs identify and describe the penetrated geologic materials, and present the results of penetration resistance and other in-situ tests performed. The logs also present the results of laboratory tests performed on penetration test samples, and groundwater measurements.

We inferred strata boundaries from changes in the penetration test samples and the auger cuttings. Because we did not perform continuous sampling, the strata boundary depths are only approximate. The boundary depths likely vary away from the boring locations, and the boundaries themselves may occur as gradual rather than abrupt transitions.

### E.4.b. Geologic Origins

We assigned geologic origins to the materials shown on the logs and referenced within this report, based on: (1) a review of the background information and reference documents cited above, (2) visual classification of the various geologic material samples retrieved during the course of our subsurface exploration, (3) penetration resistance and other in-situ testing performed for the project, (4) laboratory test results, and (5) available common knowledge of the geologic processes and environments that have impacted the site and surrounding area in the past.

## E.5. Material Classification and Testing

### E.5.a. Visual and Manual Classification

We visually and manually classified the geologic materials encountered based on ASTM D2488. When we performed laboratory classification tests, we used the results to classify the geologic materials in accordance with ASTM D2487. The Appendix includes a chart explaining the classification system we used.

### E.5.b. Laboratory Testing

The exploration logs in the Appendix note most of the results of the laboratory tests performed on geologic material samples. The remaining laboratory test results follow the exploration logs. We performed the tests in general accordance with ASTM or AASHTO procedures.

## E.6. Groundwater Measurements

The drillers checked for groundwater while advancing the penetration test borings, and again after auger withdrawal. We then filled the boreholes or allowed them to remain open for an extended period of observation, as noted on the boring logs.

# F. Qualifications

## F.1. Variations in Subsurface Conditions

### F.1.a. Material Strata

We developed our evaluation, analyses and recommendations from a limited amount of site and subsurface information. It is not standard engineering practice to retrieve material samples from exploration locations continuously with depth. Therefore, we must infer strata boundaries and thicknesses to some extent. Strata boundaries may also be gradual transitions, and project planning should expect the strata to vary in depth, elevation and thickness, away from the exploration locations.

Variations in subsurface conditions present between exploration locations may not be revealed until performing additional exploration work, or starting construction. If future activity for this project reveals any such variations, you should notify us so that we may reevaluate our recommendations. Such variations could increase construction costs, and we recommend including a contingency to accommodate them.

### F.1.b. Groundwater Levels

We made groundwater measurements under the conditions reported herein and shown on the exploration logs, and interpreted in the text of this report. Note that the observation periods were relatively short, and project planning can expect groundwater levels to fluctuate in response to rainfall, flooding, irrigation, seasonal freezing and thawing, surface drainage modifications and other seasonal and annual factors.

## F.2. Continuity of Professional Responsibility

### F.2.a. Plan Review

We based this report on a limited amount of information, and we made a number of assumptions to help us develop our recommendations. We should be retained to review the geotechnical aspects of the designs and specifications. This review will allow us to evaluate whether we anticipated the design correctly, if any design changes affect the validity of our recommendations, and if the design and specifications correctly interpret and implement our recommendations.

### F.2.b. Construction Observations and Testing

We recommend retaining us to perform the required observations and testing during construction as part of the ongoing geotechnical evaluation. This will allow us to correlate the subsurface conditions exposed during construction with those encountered by the borings and provide professional continuity from the design phase to the construction phase. If we do not perform observations and testing during construction, it becomes the responsibility of others to validate the assumption made during the preparation of this report and to accept the construction-related geotechnical engineer-of-record responsibilities.

## F.3. Use of Report

This report is for the exclusive use of the addressed parties. Without written approval, we assume no responsibility to other parties regarding this report. Our evaluation, analyses and recommendations may not be appropriate for other parties or projects.

## F.4. Standard of Care

In performing its services, Braun Intertec used that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession currently practicing in the same locality. No warranty, express or implied, is made.

# Appendix B

# Borings and Test Pits

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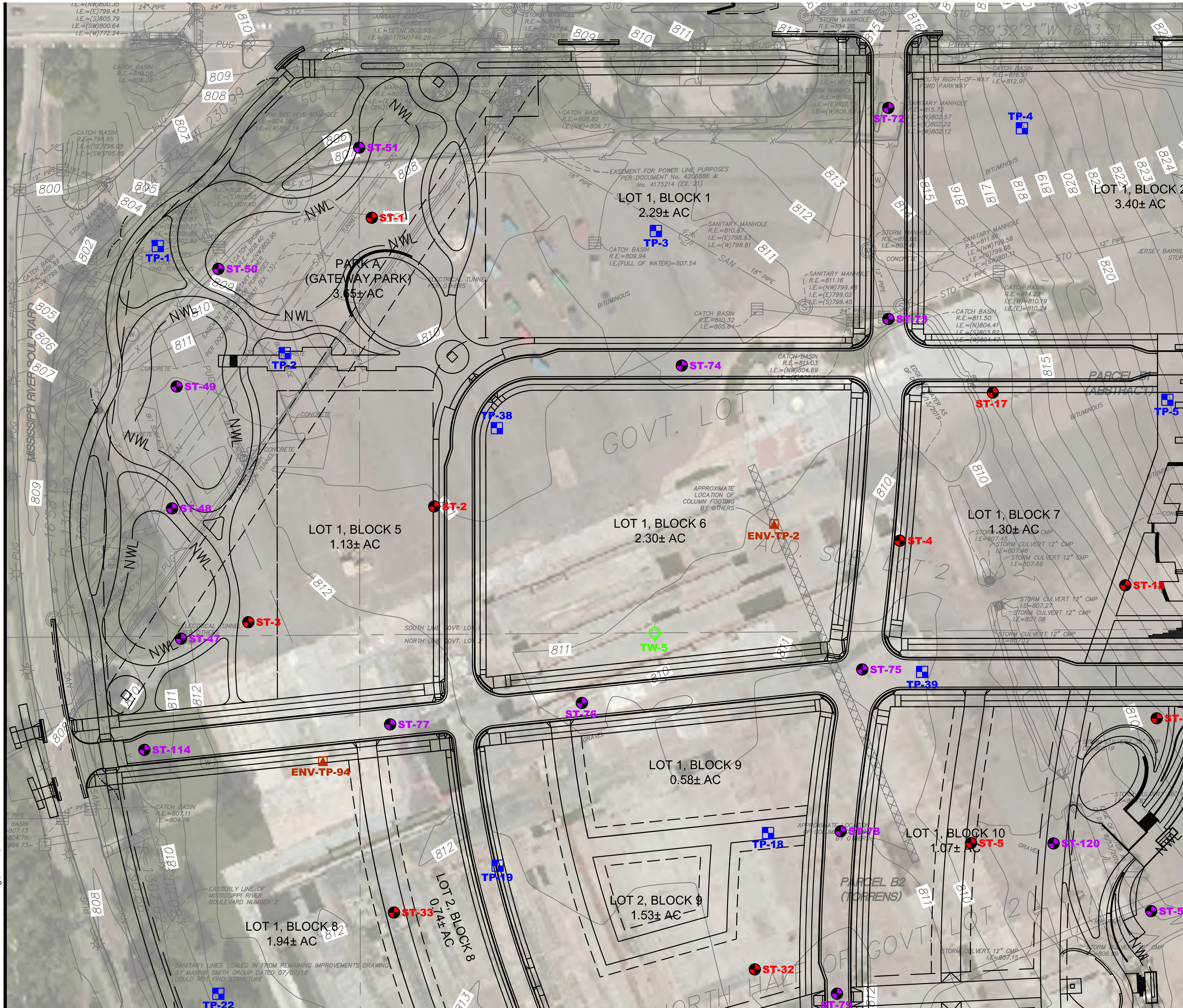


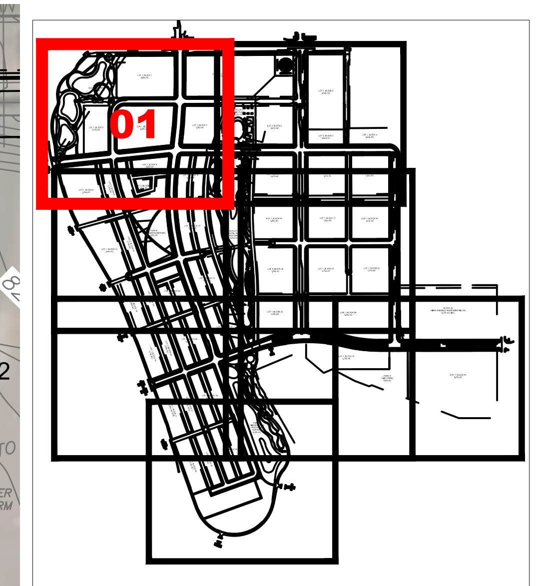

SHEET LOCATION

DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING (BRAUN PROJECT NUMBER B1806527.00)

DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING (BRAUN PROJECT NUMBER B1806527)

DENOTES APPROXIMATE LOCATION OF TEST PIT

DENOTES APPROXIMATE LOCATION OF TEMPORARY WELL

DENOTES APPROXIMATE LOCATION OF ENVIRONMENTAL TEST PIT

N

50' 0 100'

SCALE: 1" = 100'


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Drawing Information

Project No: B1806527.00

Drawing No: B1806527-00

Drawn By: BJB

Date Drawn: 7/30/19

Checked By: JJV

Last Modified: 4/3/20

Project Information

Project Paul
Infrastructure Phase

966 Mississippi River Boulevard South

Saint Paul, Minnesota

**Figure B1**

**Site Plan**

Sheet: 01 of 08

Fig:

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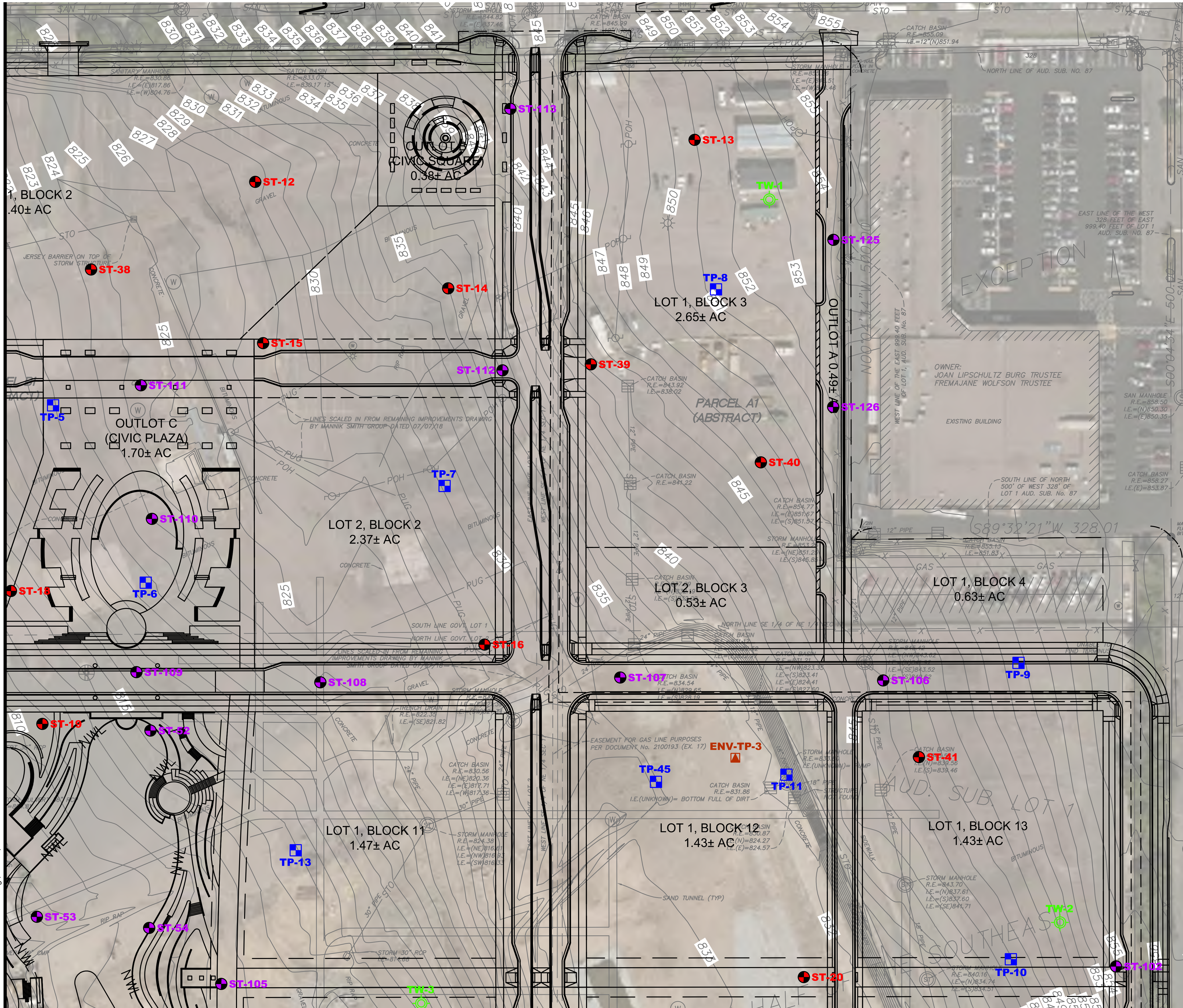


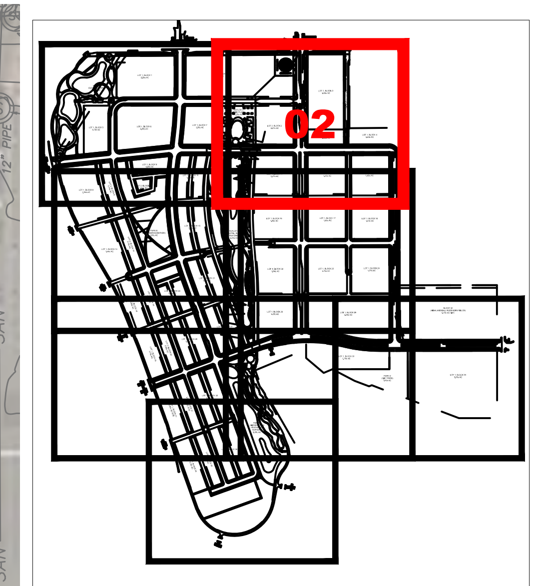


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- DENOTES APPROXIMATE LOCATION OF TEST PIT
- DENOTES APPROXIMATE LOCATION OF TEMPORARY WELL
- DENOTES APPROXIMATE LOCATION OF ENVIRONMENTAL TEST PIT

N

50' 0 100'

SCALE: 1" = 100'


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Project No: B1806527.00

Drawing No: B1806527-00

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| Drawn By: | BJB |
| Date Drawn: | 7/30/19 |
| Checked By: | JJV |
| Last Modified: | 4/3/20 |

Project Information

Project Paul
Infrastructure Phase

966 Mississippi River Boulevard South

Saint Paul, Minnesota

**Figure B1**

Site Plan

Sheet: 02 of 08

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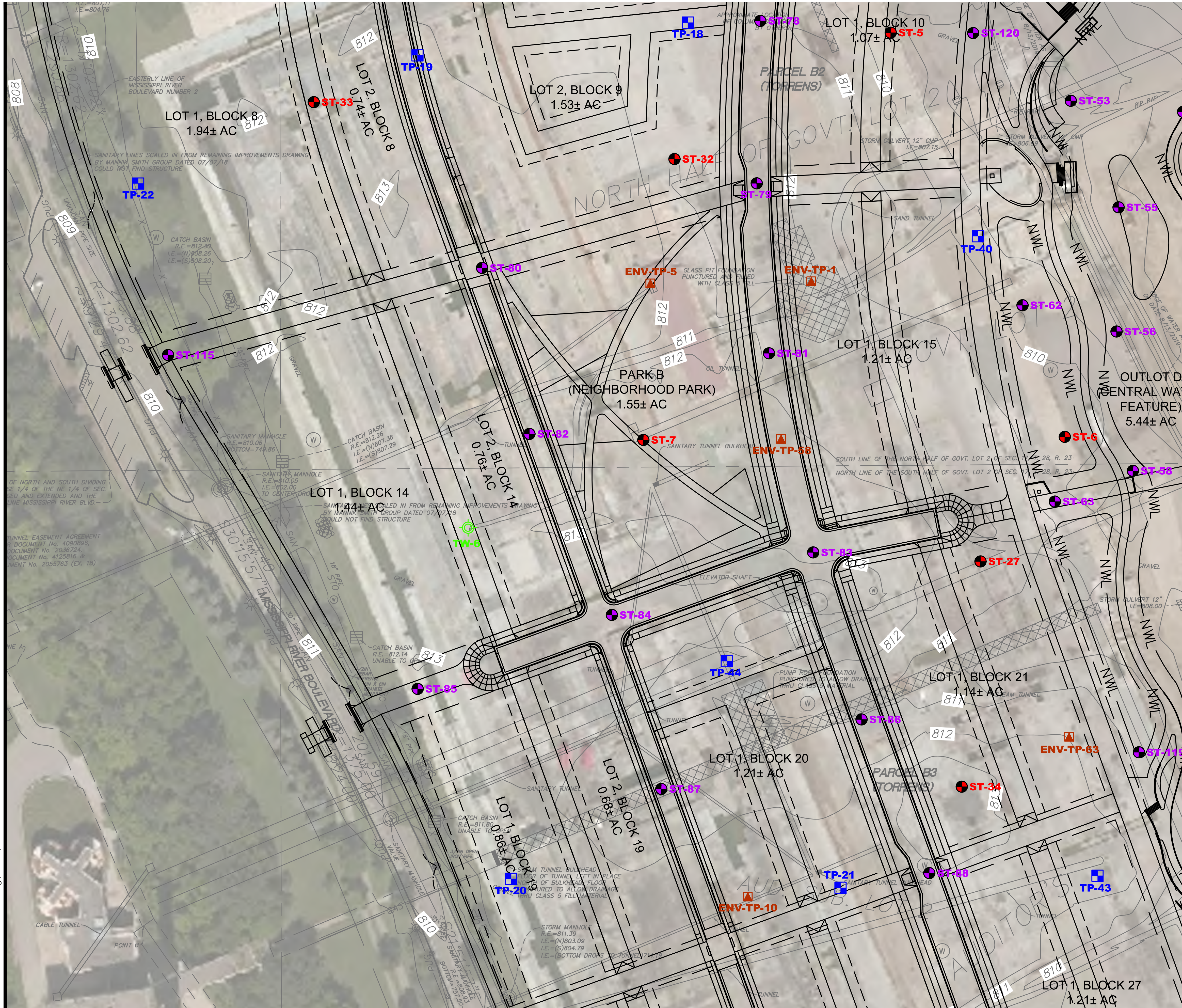


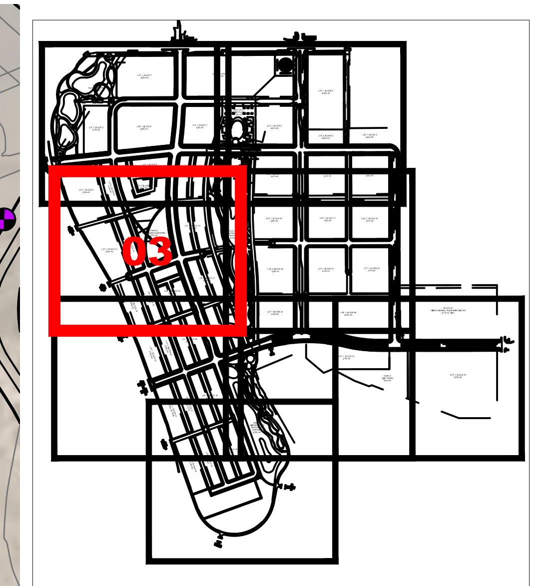


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- DENOTES APPROXIMATE LOCATION OF ENVIRONMENTAL TEST PIT

N

50' 0 100'

SCALE: 1" = 100'

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Project Information

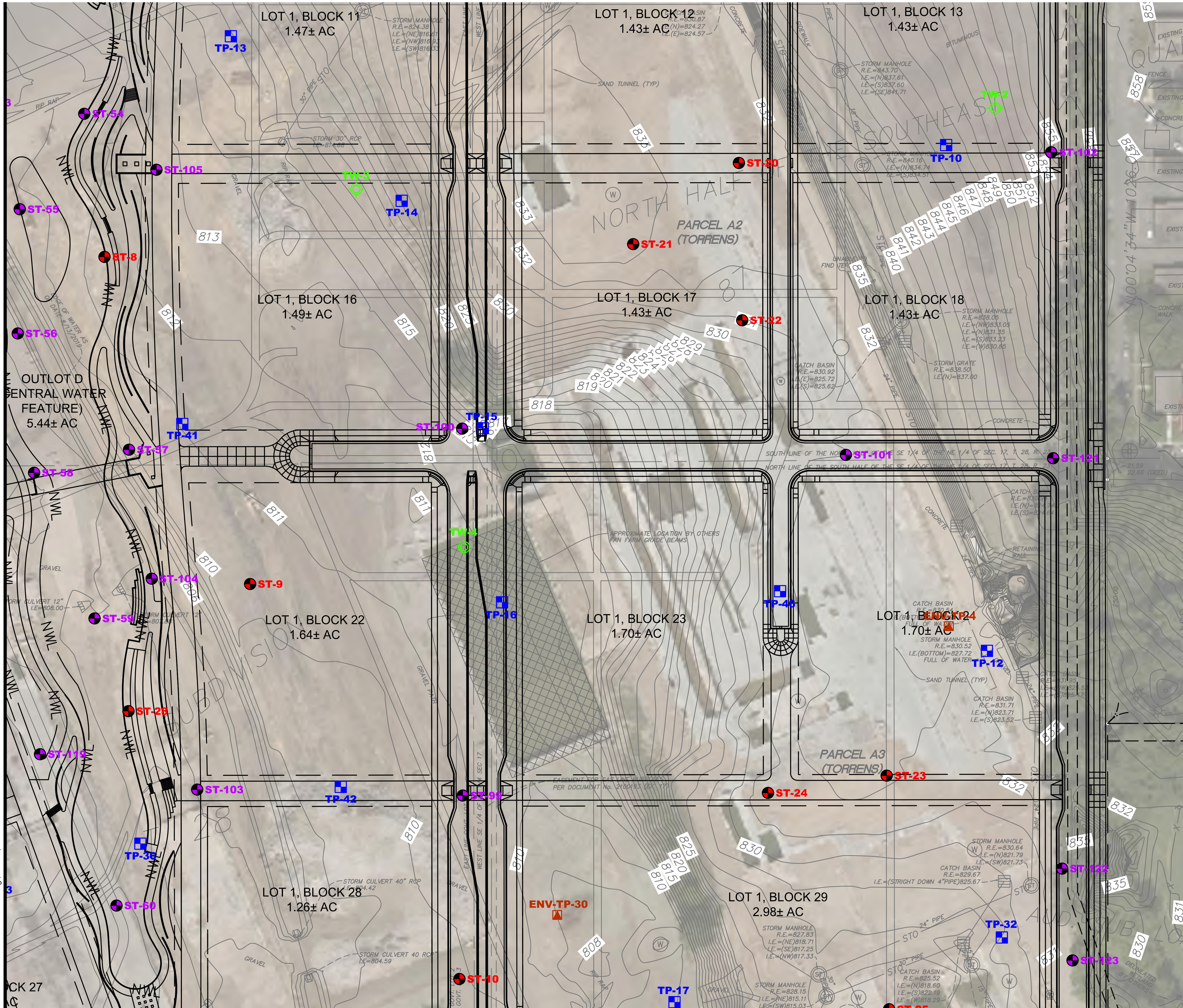
Project Paul
Infrastructure Phase

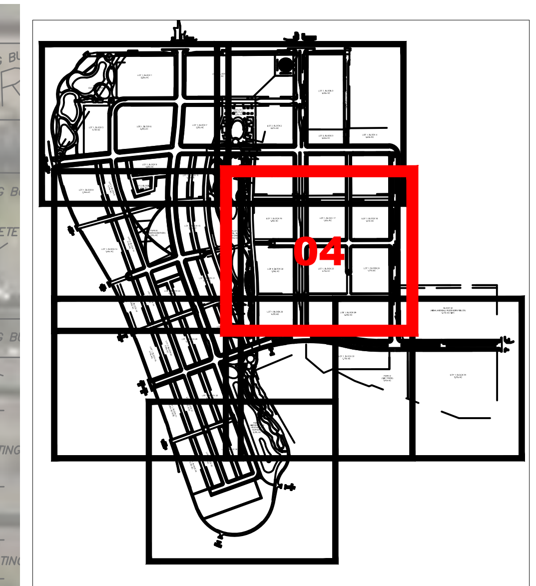
966 Mississippi River
Boulevard South

Saint Paul, Minnesota

**Figure B1**

**Site Plan**



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50' 0 100'

SCALE: 1" = 100'

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Drawing No: B1806527-00
Drawn By: BJB
Date Drawn: 7/30/19
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Last Modified: 4/3/20

Project Information

Project Paul
Infrastructure Phase

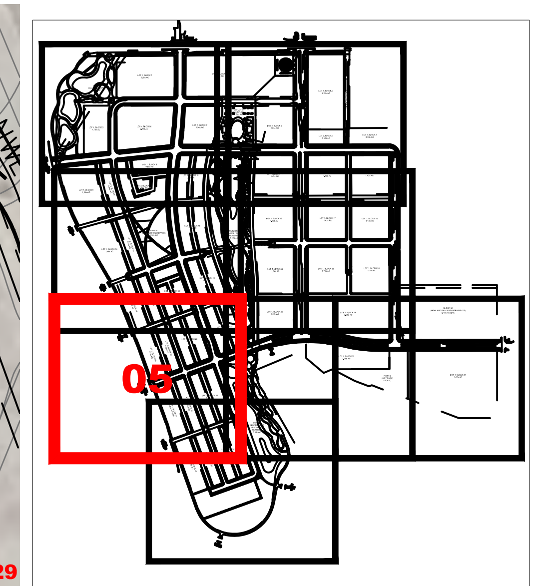
966 Mississippi River Boulevard South

Saint Paul, Minnesota

**Figure B1**

**Site Plan**

Sheet: 04 of 08
Fig: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DENOTES APPROXIMATE LOCATION OF TEST PIT

DENOTES APPROXIMATE LOCATION OF TEMPORARY WELL

DENOTES APPROXIMATE LOCATION OF ENVIRONMENTAL TEST PIT

50' 0 100'

SCALE: 1" = 100'

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Last Modified: 4/3/20

Project Information

Project Paul
Infrastructure Phase

966 Mississippi River
Boulevard South

Saint Paul, Minnesota

**Figure B1**

**Site Plan**

Sheet: 05 of 08

Fig:

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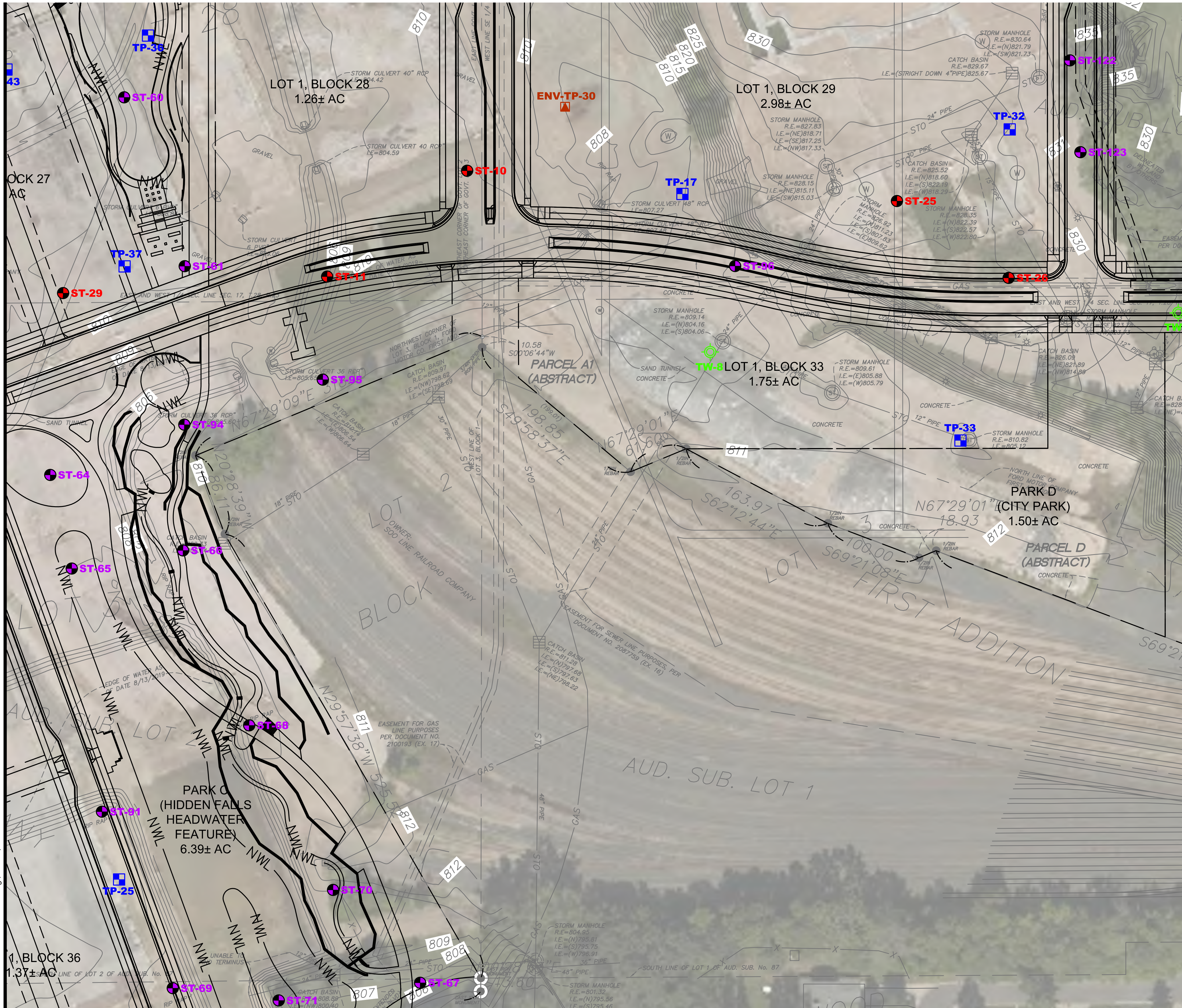


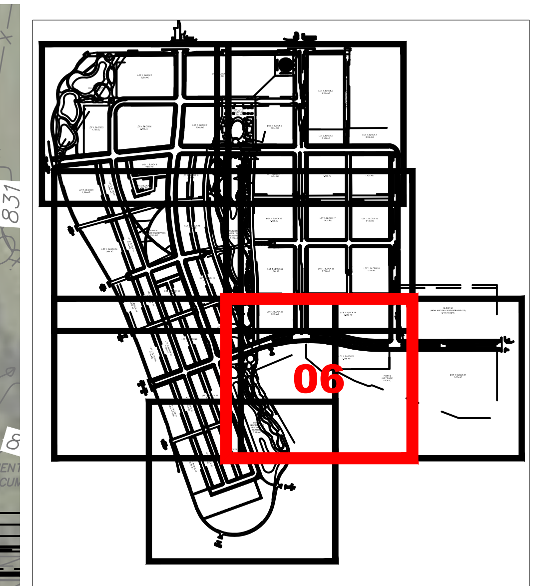


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- DENOTES APPROXIMATE LOCATION OF TEST PIT
- DENOTES APPROXIMATE LOCATION OF TEMPORARY WELL
- DENOTES APPROXIMATE LOCATION OF ENVIRONMENTAL TEST PIT

N

50' 0 100'

SCALE: 1" = 100'

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Project Information

Project Paul
Infrastructure Phase

966 Mississippi River
Boulevard South

Saint Paul, Minnesota

**Figure B1**

**Site Plan**

Sheet: 06 of 08 Fig:

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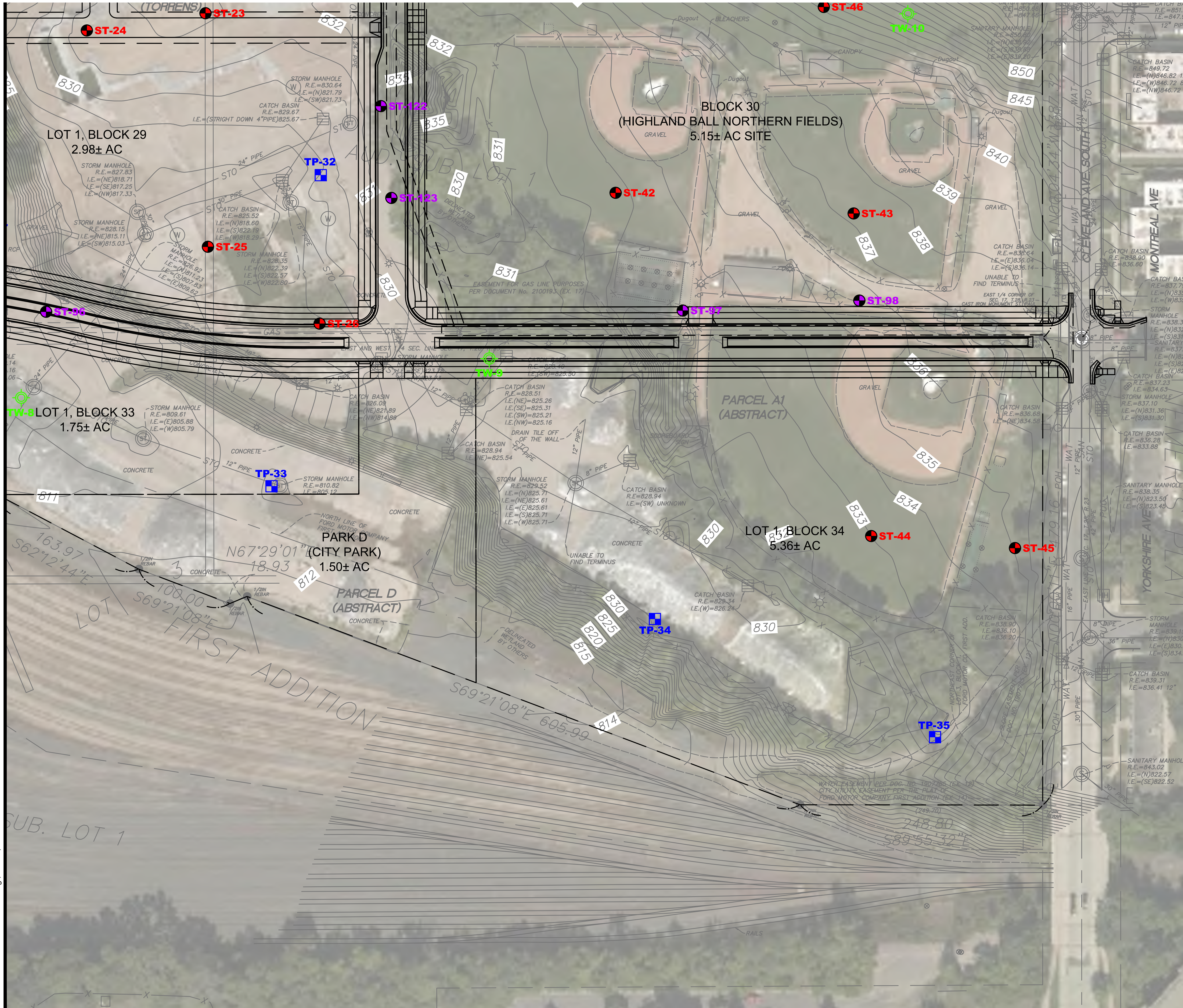


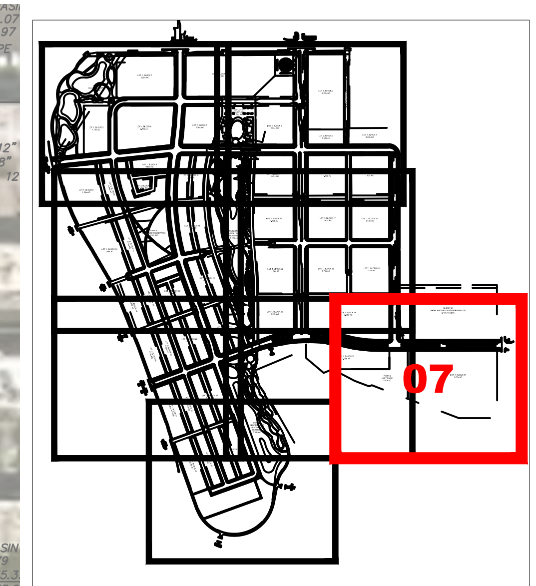


SHEET LOCATION

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**DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING (BRAUN PROJECT NUMBER B1806527)**

**DENOTES APPROXIMATE LOCATION OF TEST PIT**

**DENOTES APPROXIMATE LOCATION OF TEMPORARY WELL**

**DENOTES APPROXIMATE LOCATION OF ENVIRONMENTAL TEST PIT**

50' 0 100'

SCALE: 1" = 100'


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Project Information

Project Paul
Infrastructure Phase

966 Mississippi River Boulevard South

Saint Paul, Minnesota

# Figure B1

## Site Plan

Sheet: 07 of 08

Fig:

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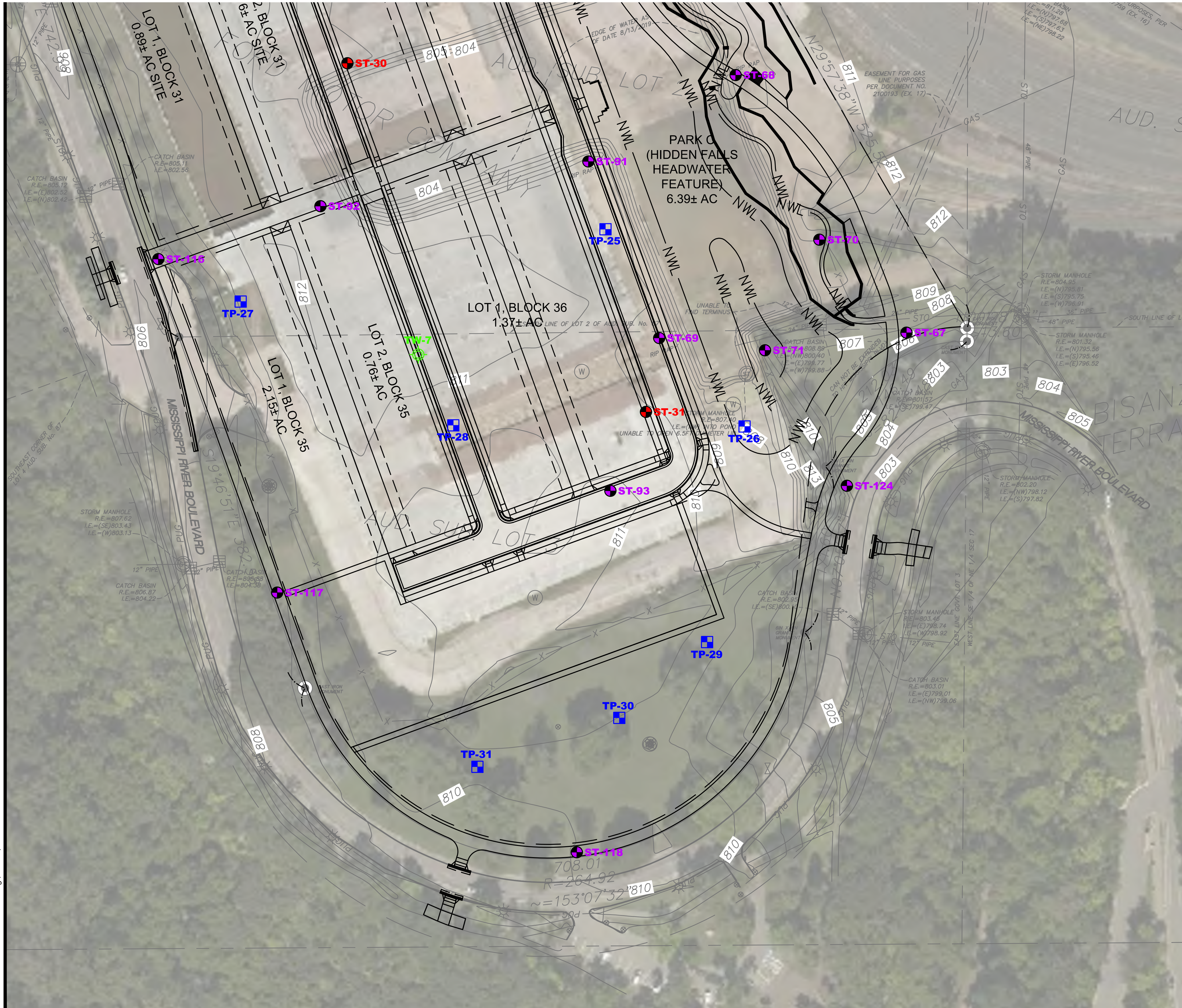


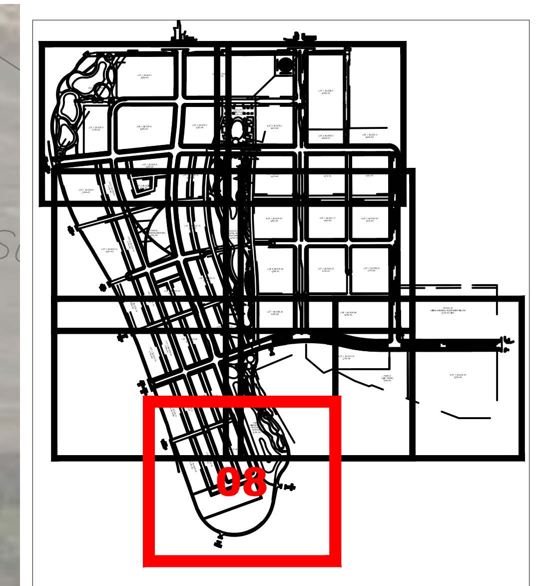

SHEET LOCATION

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- DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING (BRAUN PROJECT NUMBER B1806527)
- DENOTES APPROXIMATE LOCATION OF TEST PIT
- DENOTES APPROXIMATE LOCATION OF TEMPORARY WELL
- DENOTES APPROXIMATE LOCATION OF ENVIRONMENTAL TEST PIT

50' 0 100'

SCALE: 1" = 100'


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B1806527-00

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| Checked By: | JJV |
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Project Information

Project Paul
Infrastructure Phase

966 Mississippi River Boulevard South

Saint Paul, Minnesota

**Figure B1**

**Site Plan**

Sheet: 08 of 08

Fig:

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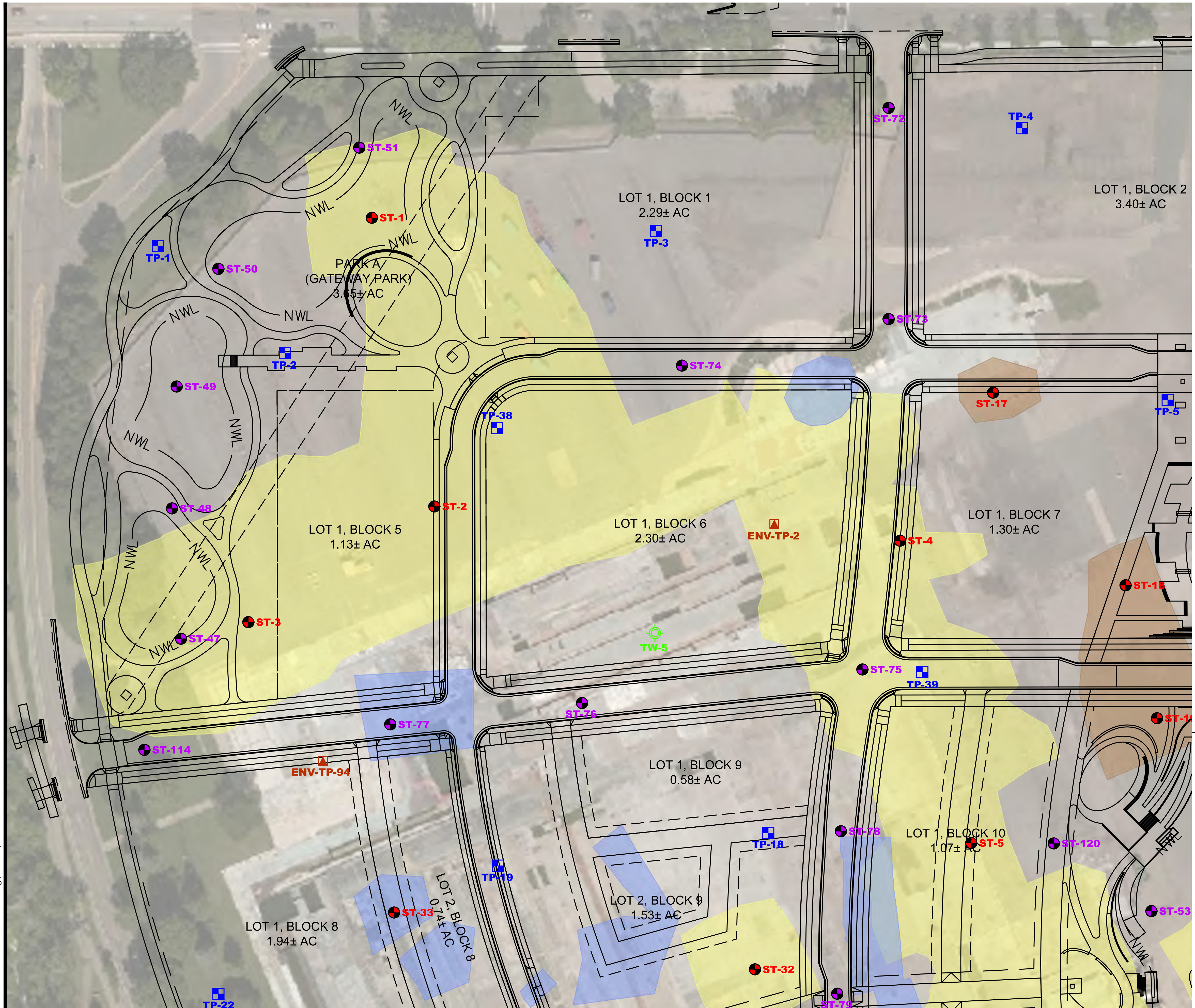


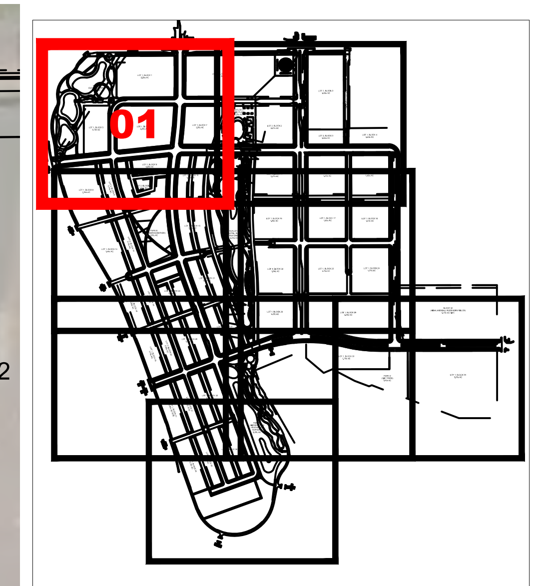


SHEET LOCATION

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**DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING (BRAUN PROJECT NUMBER B1806527)**

**DENOTES APPROXIMATE LOCATION OF TEST PIT**

**DENOTES APPROXIMATE LOCATION OF TEMPORARY WELL**

**DENOTES APPROXIMATE LOCATION OF ENVIRONMENTAL TEST PIT**

CONSOLIDATED IMPACT AREAS

ISOLATED IMPACT AREAS

SDRAP ADDENDUMS

N

50' 0 100'

SCALE: 1" = 100'

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Drawing No: B1806527-00

Drawn By: BJB

Date Drawn: 7/30/19

Checked By: JJV

Last Modified: 4/3/20

Project Information

Project Paul
Infrastructure Phase

966 Mississippi River Boulevard South

Saint Paul, Minnesota

**Figure B2**

**Remedial Activities Completed**

Sheet: 01 of 08

Fig:

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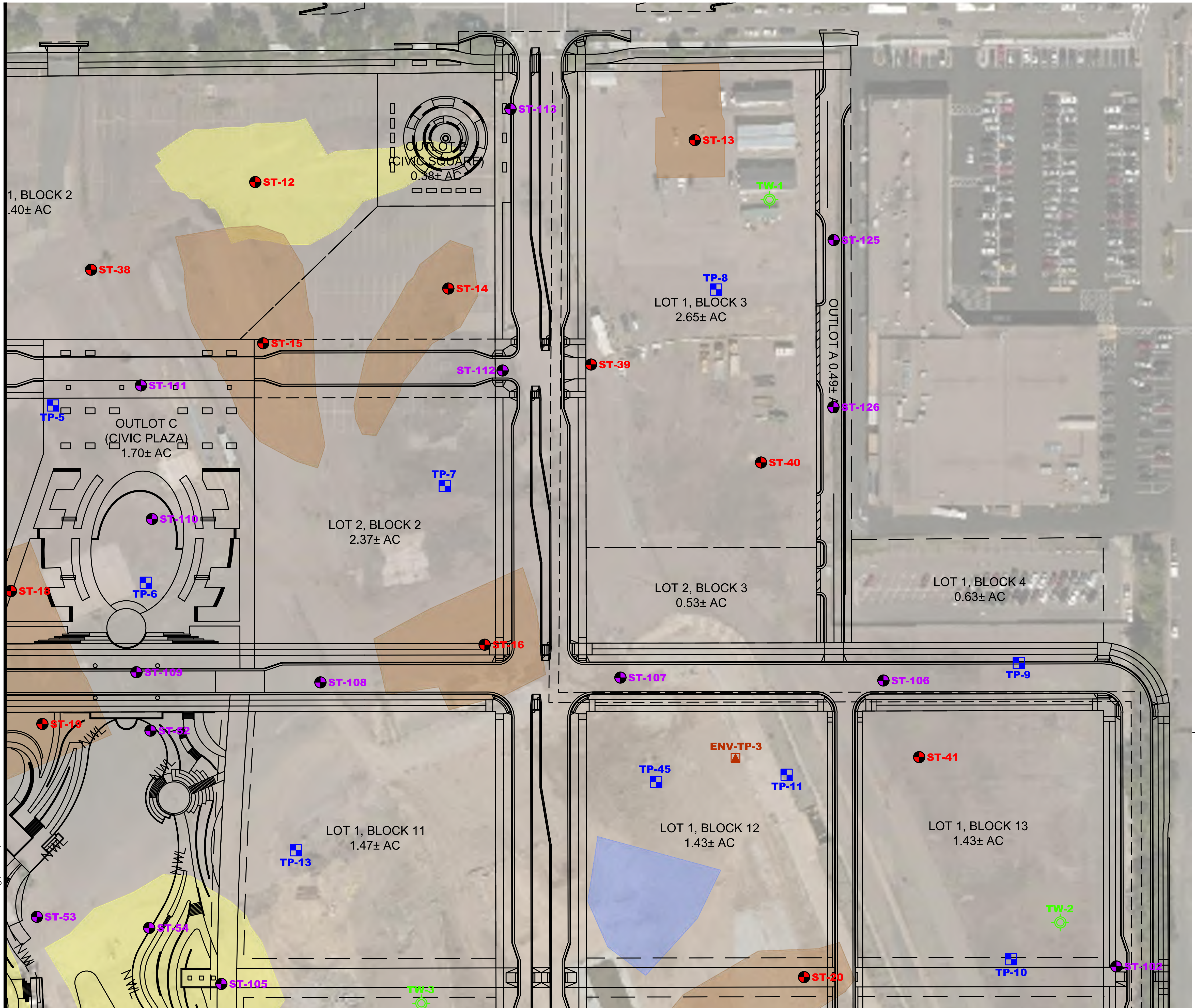


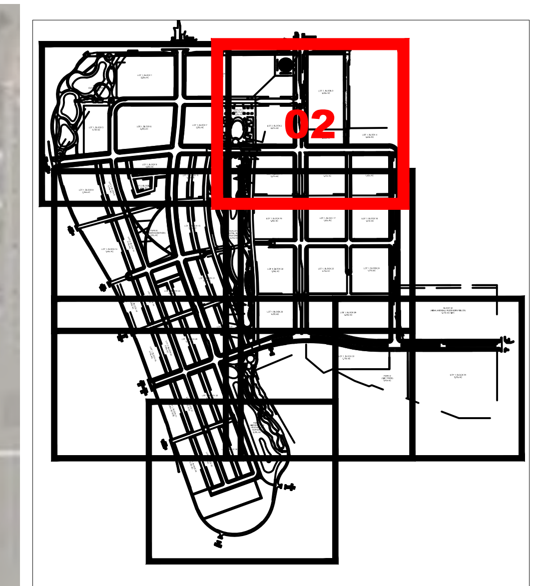

SHEET LOCATION

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DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING (BRAUN PROJECT NUMBER B1806527)

DENOTES APPROXIMATE LOCATION OF TEST PIT

DENOTES APPROXIMATE LOCATION OF TEMPORARY WELL

DENOTES APPROXIMATE LOCATION OF ENVIRONMENTAL TEST PIT

CONSOLIDATED IMPACT AREAS

ISOLATED IMPACT AREAS

SDRAP ADDENDUMS

50' 0 100'

SCALE: 1" = 100'


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Drawing Information

Project No: B1806527.00

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| Checked By: | JJV |
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Project Information

Project Paul
Infrastructure Phase

966 Mississippi River Boulevard South

Saint Paul, Minnesota

**Figure B2**

**Remedial Activities Completed**

Sheet: 02 of 08 Fig:

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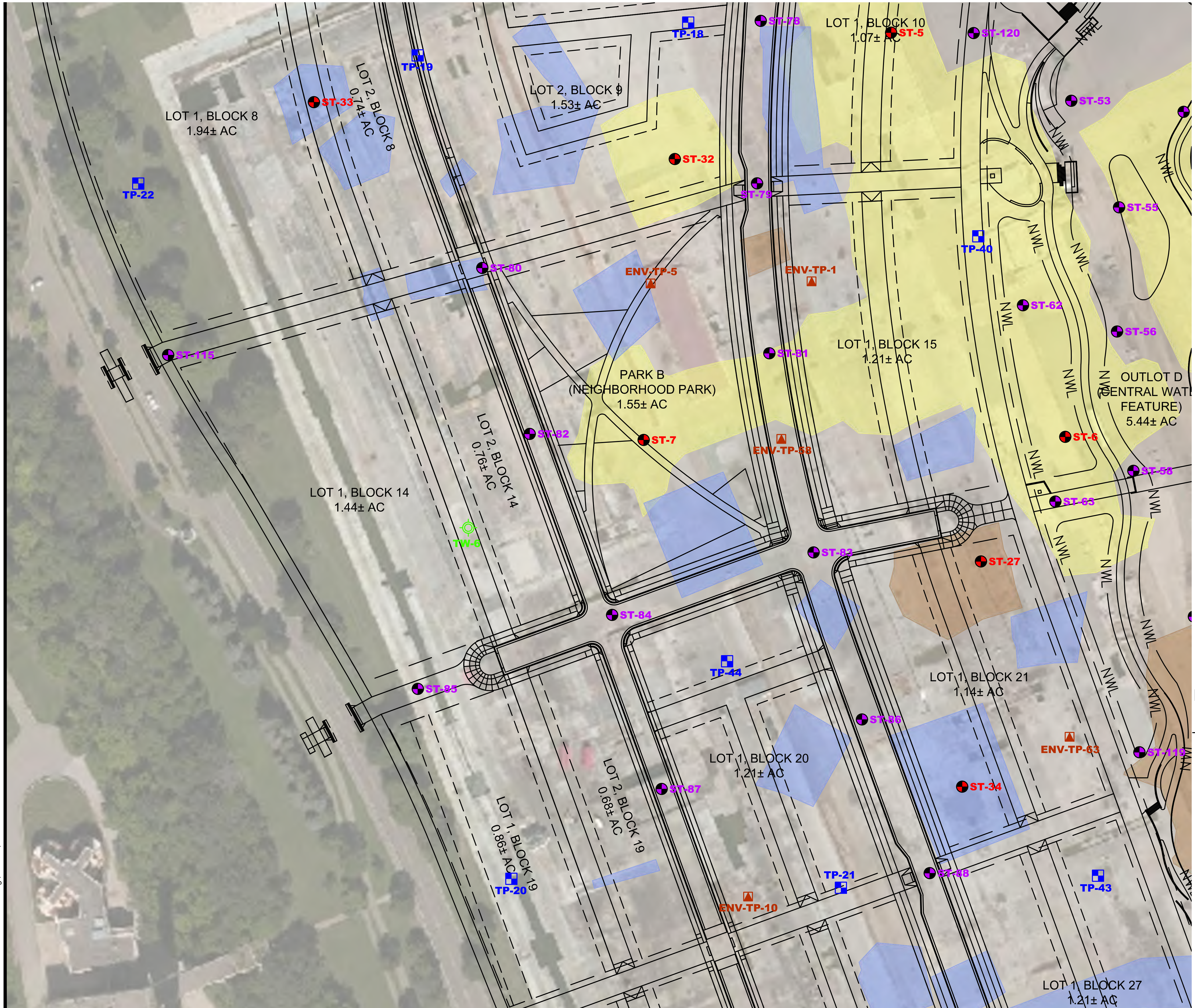


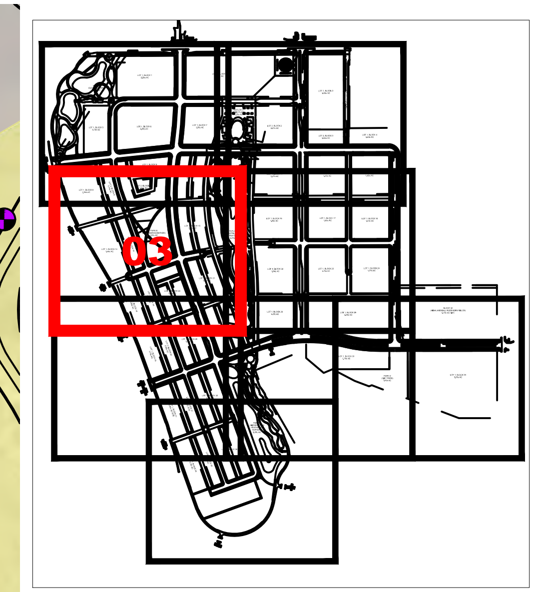


SHEET LOCATION

- DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING (BRAUN PROJECT NUMBER B1806527.00)
- DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING (BRAUN PROJECT NUMBER B1806527)
- DENOTES APPROXIMATE LOCATION OF TEST PIT
- DENOTES APPROXIMATE LOCATION OF TEMPORARY WELL
- DENOTES APPROXIMATE LOCATION OF ENVIRONMENTAL TEST PIT
- CONSOLIDATED IMPACT AREAS
- ISOLATED IMPACT AREAS
- SDRAP ADDENDUMS

N

50' 0 100'

SCALE: 1" = 100'

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| Drawn By: | BJB |
| Date Drawn: | 7/30/19 |
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Project Information

Project Paul
Infrastructure Phase

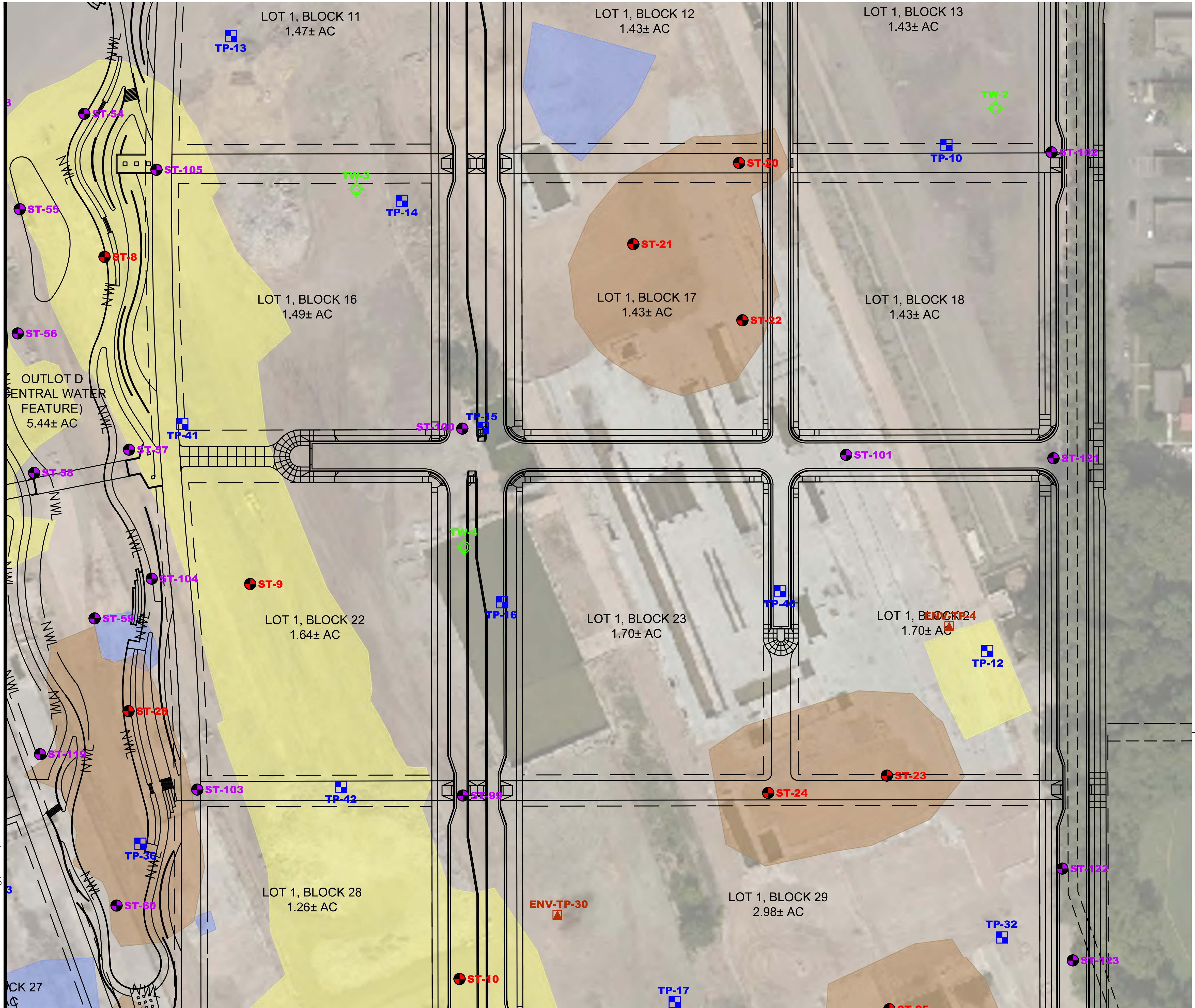
966 Mississippi River
Boulevard South

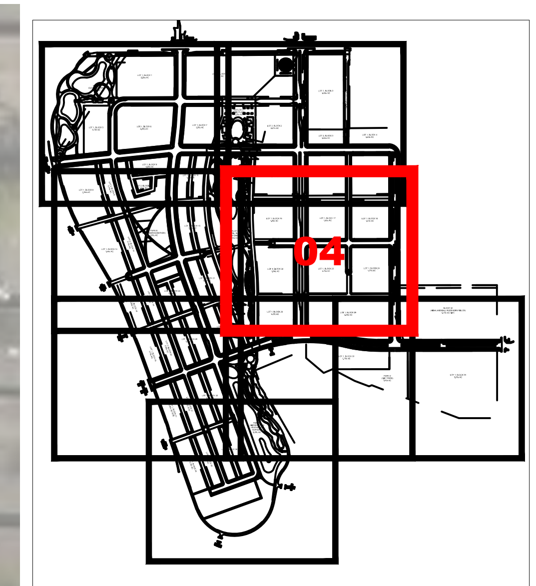
Saint Paul, Minnesota

**Figure B2**

**Remedial Activities Completed**

Sheet: 03 of 08 | Fig:

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DENOTES APPROXIMATE LOCATION OF ENVIRONMENTAL TEST PIT

CONSOLIDATED IMPACT AREAS

ISOLATED IMPACT AREAS

SDRAP ADDENDUMS

50' 0 100'

SCALE: 1" = 100'

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Project Information

Project Paul
Infrastructure Phase

966 Mississippi River
Boulevard South

Saint Paul, Minnesota

**Figure B2**

**Remedial Activities Completed**

Sheet: 04 of 08

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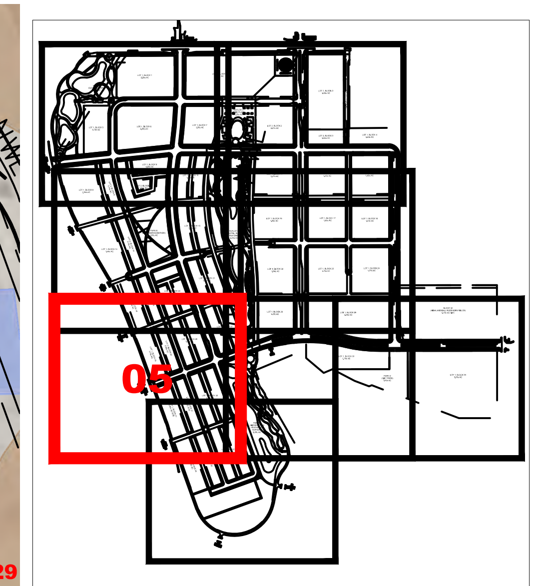


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CONSOLIDATED IMPACT AREAS

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SDRAP ADDENDUMS

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Project Information

Project Paul
Infrastructure Phase

966 Mississippi River Boulevard South

Saint Paul, Minnesota

**Figure B2**

**Remedial Activities Completed**

Sheet: 05 of 08

Fig:

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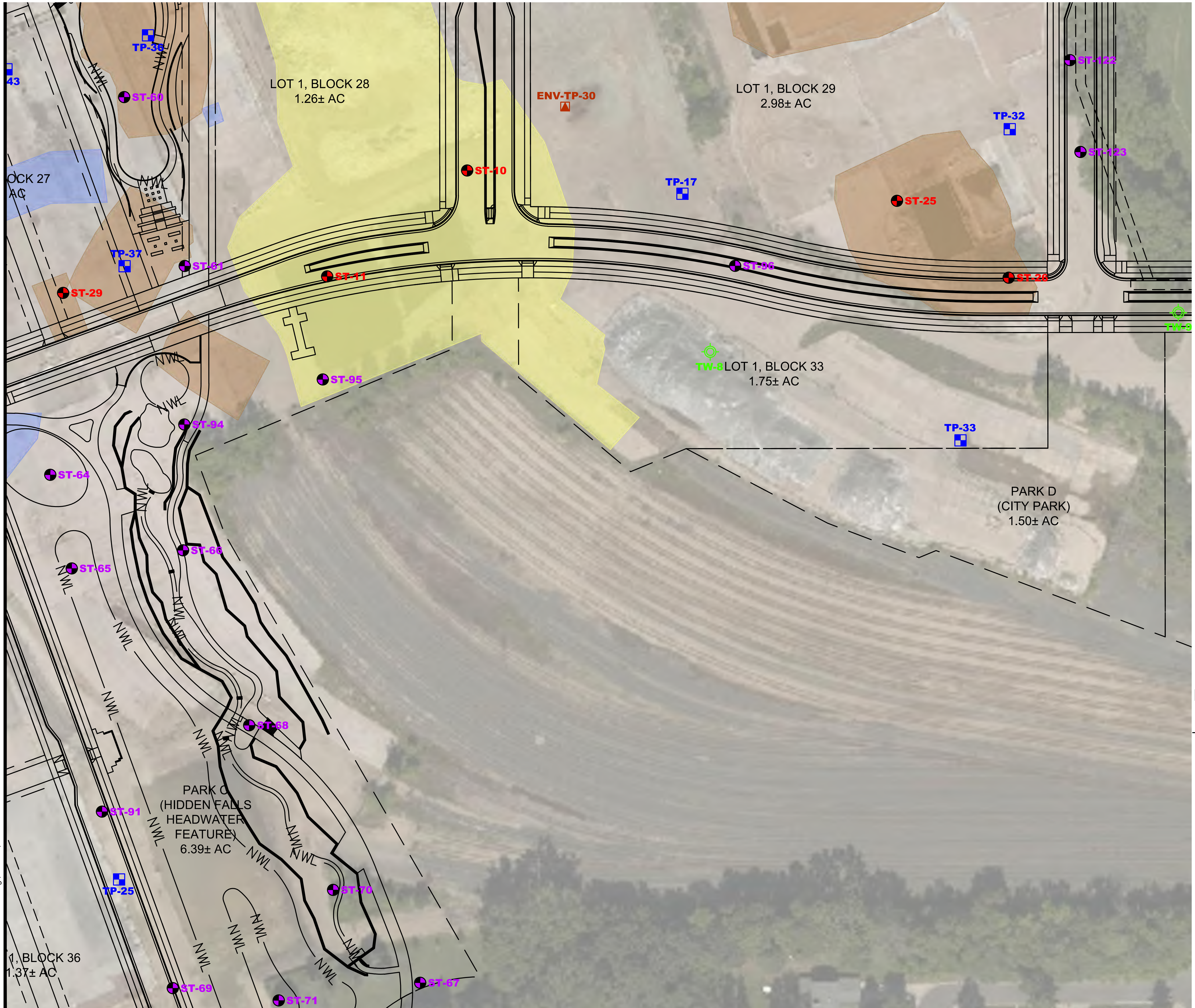


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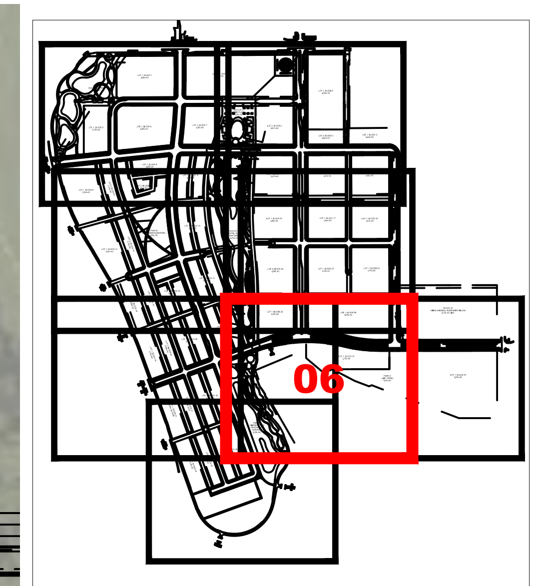


SHEET LOCATION

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**DENOTES APPROXIMATE LOCATION OF TEMPORARY WELL**

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CONSOLIDATED IMPACT AREAS

ISOLATED IMPACT AREAS

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Project Information

Project Paul
Infrastructure Phase

966 Mississippi River
Boulevard South

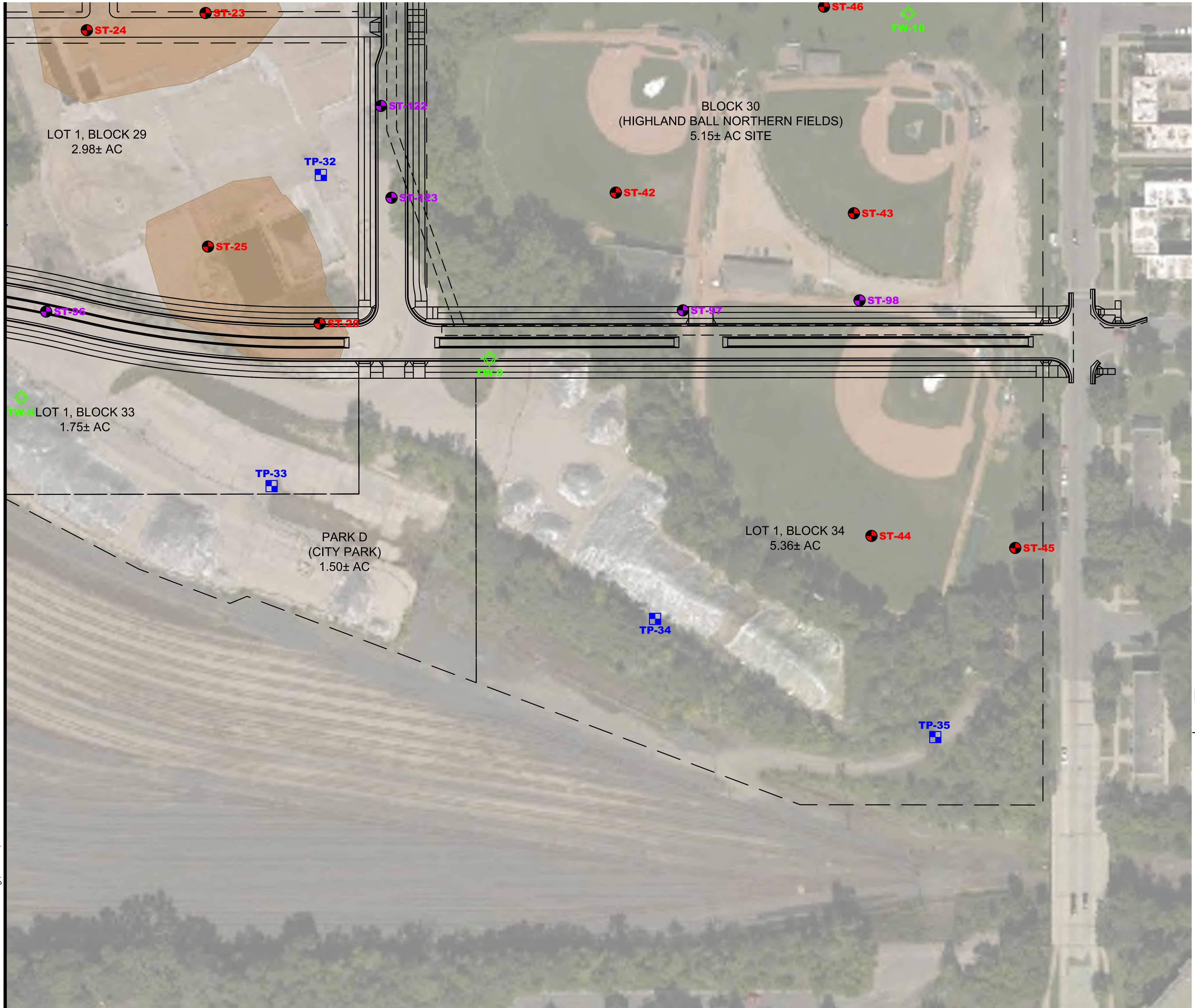
Saint Paul, Minnesota

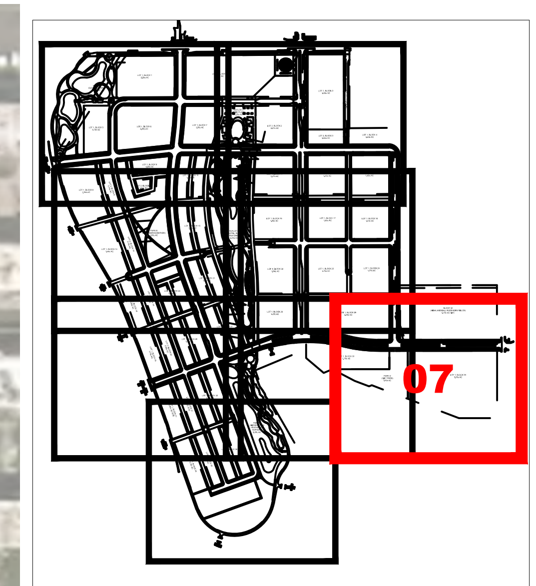
**Figure B2**

**Remedial Activities Completed**

Sheet: 06 of 08

Fig:




SHEET LOCATION

DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING (BRAUN PROJECT NUMBER B1806527.00)

DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING (BRAUN PROJECT NUMBER B1806527)

DENOTES APPROXIMATE LOCATION OF TEST PIT

DENOTES APPROXIMATE LOCATION OF TEMPORARY WELL

DENOTES APPROXIMATE LOCATION OF ENVIRONMENTAL TEST PIT

CONSOLIDATED IMPACT AREAS

ISOLATED IMPACT AREAS

SDRAP ADDENDUMS

50' 0 100'

SCALE: 1" = 100'


BRAUN INTERTEC
The Science You Build On.
11001 Hampshire Avenue S
Minneapolis, MN 55438
952.995.2000
braunintertec.com


Drawing Information

Project No: B1806527.00

Drawing No: B1806527-00

| | |
|---|---|
| Drawn By: | BJB |
| Date Drawn: | 7/30/19 |
| Checked By: | JJV |
| Last Modified: | 4/3/20 |

Project Information

Project Paul
Infrastructure Phase

966 Mississippi River
Boulevard South

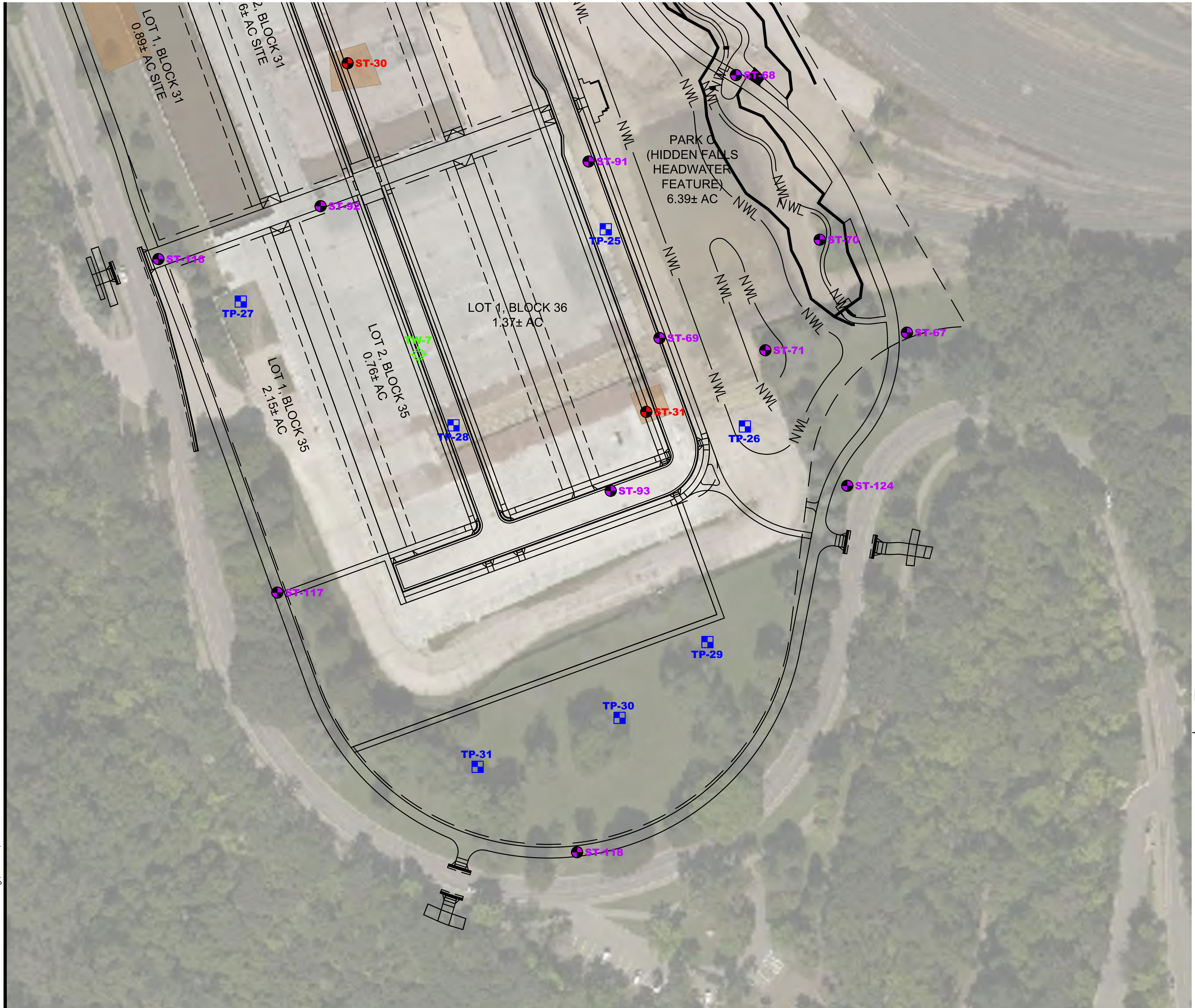
Saint Paul, Minnesota

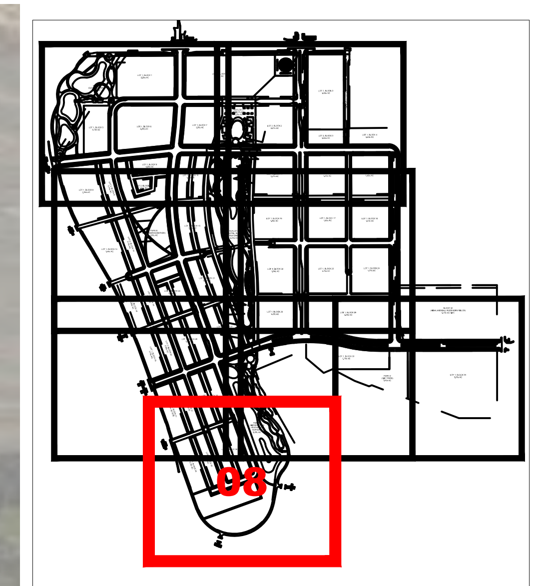
**Figure B2**

**Remedial Activities Completed**

Sheet: 07 of 08

Fig:




SHEET LOCATION

**DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING (BRAUN PROJECT NUMBER B1806527.00)**

**DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING (BRAUN PROJECT NUMBER B1806527)**

**DENOTES APPROXIMATE LOCATION OF TEST PIT**

**DENOTES APPROXIMATE LOCATION OF TEMPORARY WELL**

**DENOTES APPROXIMATE LOCATION OF ENVIRONMENTAL TEST PIT**

CONSOLIDATED IMPACT AREAS

ISOLATED IMPACT AREAS

SDRAP ADDENDUMS

N

50' 0 100'

SCALE: 1" = 100'

BRAUN INTERTEC
The Science You Build On.
11001 Hampshire Avenue S
Minneapolis, MN 55438
952.995.2000
braunintertec.com

Drawing Information

Project No: B1806527.00

Drawing No: B1806527-00

Drawn By: BJB

Date Drawn: 7/30/19

Checked By: JJV

Last Modified: 4/3/20

Project Information

Project Paul
Infrastructure Phase

966 Mississippi River Boulevard South

Saint Paul, Minnesota

**Figure B2**

**Remedial Activities Completed**

Sheet: 08 of 08

Fig:

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BRAUN℠ INTERTEC

# LOG OF BORING

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | BORING: **ST-1**<br>LOCATION: N: 146067.173 E: 548132.949. See attached sketch. |
|---|---|

| DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/17/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 809.5 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 809.2 | 0.3 | FILL | FILL: Lean Clay, trace Sand, Gravel and roots, dark brown, moist. (Topsoil Fill) | 5 | | |
| | | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, brown, moist. | 7 | | |
| | | | Wet at 4 feet. | 9 | ▽ | An open triangle in the water level (WL) column indicates the depth at which groundwater was observed while drilling. Groundwater levels fluctuate. |
| | | | | 14 | | |
| 800.5 | 9.0 | | | * | | *50 to set 1" |
| | | | END OF BORING.<br><br>Water observed at 4 feet with 2 feet of hollow-stem auger in the ground.<br><br>Water observed at 9 feet with 8 feet of hollow-stem auger in the ground.<br><br>Water not observed to cave-in depth of 8 feet immediately after withdrawal of auger.<br><br>Boring then backfilled. | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:26

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | BORING: **ST-2**<br>LOCATION: N: 145771.076 E: 548197.005. See attached sketch. |
|---|---|
| DRILLER: K. Miller / METHOD: 3 1/4" HSA, Autohammer | DATE: **7/17/18** / SCALE: **1" = 4'** |

| Elev. feet 811.6 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| | | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, with Gravel, brown, moist. | 5 | | | | |
| | | | | 14 | | | | |
| | | | Moist to wet from 4 to 6 feet. | 17 | | | | |
| 805.6 | 6.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, brown and gray, moist. | 18 | | 13 | 16 | |
| 803.6 | 8.0 | FILL | FILL: Poorly Graded Sand, fine- to coarse-grained, gravel, brown, wet. | 8 | ∇ | | | |
| 800.6 | 11.0 | | | * | | | | *100 to set 1" |
| | | | END OF BORING.<br><br>Auger met refusal at the 11-foot depth.<br><br>Water observed at 8 feet with 7 feet of hollow-stem auger in the ground.<br><br>Water not observed to cave-in depth of 3 feet immediately after withdrawal of auger.<br><br>Boring then backfilled. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:26

BRAUN INTERTEC

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-3**

LOCATION: N: 145652.445 E: 548006.387. See attached sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/17/18** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 812.9 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| | | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, trace Gravel, brown, moist. | 3 | | |
| | | | | 8 | | |
| | | | | 13 | | |
| 806.9 | 6.0 | FILL | FILL: Crushed concrete, trace brick and wood debris, brown and gray, wet. | 23 | | |
| | | | | 38 | ▽ | |
| 802.9 | 10.0 | FILL | FILL: Poorly Graded Sand, fine- to coarse-grained, with Gravel, brown, wet. | 13 | | |
| 800.9 | 12.0 | LS | LIMESTONE, weathered, gray. (Limestone Bedrock) | * | | *100 to set 2" |
| 800.8 | 12.1 | | END OF BORING. | | | |

Water observed at 9 feet with 10 feet of hollow-stem auger in the ground.

Water not observed to cave-in depth of 3 1/2 feet immediately after withdrawal of auger

Boring then backfilled.

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:47

# BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-4**

LOCATION: N: 145735.964 E: 548674.352. See attached sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/17/18** | SCALE: **1" = 4'**

| Elev. feet 810.2 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 809.8 | 0.4 | FILL | FILL: Lean Clay with Sand, dark brown, moist. | | | | | |
| 808.2 | 2.0 | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, trace Gravel, brown, moist. | 9 | | | | |
| 806.2 | 4.0 | FILL | FILL: Clayey Sand, with Gravel and Lean Clay nodules, dark brown and gray, moist. | 7 | ∇ | 14 | 26 | |
| 804.2 | 6.0 | FILL | FILL: Clayey Gravel, brown and gray, moist. | 10 | | | | |
| 802.2 | 8.0 | FILL | FILL: Lean Clay with Sand, with Gravel, trace concrete debris, brown and gray, wet. | 8 | | | | |
| 800.2 | 10.0 | CH | FAT CLAY, gray and brown, moist, stiff. (Weathered Shale Bedrock) | 9 | | 32 | | LL=79, PL=27, PI=52 |
| 799.2 | 11.0 | LS | LIMESTONE, weathered, gray. (Limestone Bedrock) | * | | | | *100 to set 5 1/2" |

END OF BORING.

Water observed at 3 1/2 feet with 6 feet of hollow-stem auger in the ground.

Water not observed to cave-in depth of 3 feet immediately after withdrawal of auger.

Boring then backfilled.

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

# LOG OF BORING

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | BORING: ST-5<br>LOCATION: N: 145425.888 E: 548747.403. See attached sketch. |
|---|---|
| DRILLER: K. Miller   METHOD: 3 1/4" HSA, Autohammer | DATE: 7/18/18   SCALE: 1" = 4' |

| Elev. feet 809.2 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| | | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, trace Gravel, brown, moist. | 8 | | | | |
| | | | | 13 | ▽ | 9 | 3 | |
| | | | Wet at 4 feet. | 6 | | | | |
| | | | | 7 | | | | |
| 801.2 | 8.0 | FILL | FILL: Poorly Graded Gravel, fine- to coarse-grained, with Gravel, brown, wet. | 94/6" | | | | |
| 799.2 | 10.0 | CH | FAT CLAY, layer of Poorly Graded Sand with Gravel at 10 1/2 feet, gray, wet, very stiff. (Weathered Shale Bedrock) | 18 | | | | |
| 797.2 | 12.0 | SH | SHALE, gray, moist. (Decorah Shale Bedrock) | * | | | | *100 to set 2 1/2" |
| 796.2 | 13.0 | | END OF BORING.<br><br>Water observed at 3 feet with 4 feet of hollow-stem auger in the ground.<br><br>Boring then backfilled. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:26

BRAUN INTERTEC

# LOG OF BORING

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | BORING: ST-6<br>LOCATION: N: 145011.442 E: 548925.873. See attached sketch. |
|---|---|
| DRILLER: K. Miller / METHOD: 3 1/4" HSA, Autohammer | DATE: 7/17/18 / SCALE: 1" = 4' |

| Elev. feet 810.6 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 810.1 | 0.5 | FILL | FILL: Lean Clay with Sand, with Gravel, gray, moist. | | | | |
| | | FILL | FILL: Poorly Graded Sand, fine- to coarse-grained, with Gravel, brown, moist. | 6 | | | |
| | | | | 10 | | | |
| | | | | 14 | | | |
| | | | | 9 | ▽ | | |
| | | | Wet at 7 1/2 feet. | 16 | | | |
| 800.6 | 10.0 | CH | FAT CLAY, trace Sand, gray, wet, medium to hard. (Weathered Shale Bedrock) | 5 | | 31 | LL=59, PL=23, PI=36 |
| 797.6 | 13.0 | | | * | | | *100 to set 1" |
| | | | END OF BORING.<br><br>Water observed at 7 1/2 feet with 10 feet of hollow-stem auger in the ground.<br><br>Water not observed with 12 feet of hollow-stem auger in the ground.<br><br>Boring then backfilled. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:26

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | BORING: ST-7<br>LOCATION: N: 145008.298 E: 548579.370. See attached sketch. |
|---|---|

| DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: 7/16/18 | SCALE: 1" = 4' |
|---|---|---|---|

| Elev. feet 812.5 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 811.5 | 1.0 | FILL | FILL: Lean Clay with Sand, with Gravel, gray, moist. | | | | | |
| | | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, trace Gravel and Cobbles to 3 feet, brown, moist. | 21 | | | | |
| | | | | 10 | | | | |
| | | | | 13 | | 4 | 3 | |
| | | | | 14 | | | | |
| | | | Wet at 8 feet. | 11 | ▽ | | | |
| 801.5 | 11.0 | | | * | | | | *100 to set 3" |
| 801.2 | 11.3 | SH | SHALE, gray, wet. (Decorah Shale Bedrock) | | | | | |
| | | | END OF BORING.<br><br>Water observed at 8 feet with 10 feet of hollow-stem auger in the ground.<br><br>Boring then backfilled. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:26

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-8**

LOCATION: N: 145197.903 E: 549067.949. See attached sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/17/18** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 811.9 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| | | FILL | FILL: Lean Clay with Sand, trace Gravel and Limestone fragments, gray, moist. | 8 | | | |
| | | | | 4 | | | |
| 808.4 | 3.5 | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, trace Gravel, Limestone fragments, brown, moist. | 10 | | | |
| | | | Wet at 7 feet. | 7 | ▽ | | |
| 802.9 | 9.0 | OL | ORGANIC CLAY, trace Sand, Gravel, black, wet. (Swamp Deposit/Topsoil) | 3 | | 31 | OC=6% |
| 801.9 | 10.0 | CH | FAT CLAY, fractured Limestone layer from 11 to 12 feet, black to gray, wet, very stiff. (Weathered Shale Bedrock) | 28 | | 28 | LL=52, PL=18, PI=34 |
| 799.9 | 12.0 | SH | SHALE, weathered layers of Fat Clay, dark gray, moist to wet. (Decorah Shale Bedrock) | 16 | | | |
| 797.4 | 14.5 | | END OF BORING. | * | | | *100 to set 5" |

Water observed at 7 feet with 8 feet of hollow-stem auger in the ground.

Boring then backfilled.

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-9**

LOCATION: N: 144862.522 E: 549217.303. See attached sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/17/18** | SCALE: **1" = 4'**

| Elev. feet 810.8 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 809.8 | 1.0 | FILL | FILL: Lean Clay with Sand, gray, moist. | 4 | | | | |
| | | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, with Gravel, brown, moist. | 28 | | 3 | 3 | |
| | | | | 8 | | | | |
| | | | Wet at 7 feet. | 3 | ▽ | | | |
| 801.8 | 9.0 | | | 1 | | 27 | | LL=45, PL=14, PI=31 |
| | | CL | LEAN CLAY, black to gray, moist, very soft to hard. (Weathered Shale Bedrock) | 6 | | | | |
| 797.7 | 13.1 | | | * | | | | *100 to set 2" |
| | | | END OF BORING.<br><br>Water observed at 7 feet with 8 feet of hollow-stem auger in the ground.<br><br>Boring then backfilled. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

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**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-10**

LOCATION: N: 144457.589 E: 549431.812. See attached sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/17/18** | SCALE: **1" = 4'**

| Elev. feet 810.1 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 809.6 | 0.5 | FILL | FILL: Lean Clay with Sand, trace Gravel, dark brown, moist. | | | |
| | | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, with Gravel, brown, moist. | 6 | | |
| | | | | 15 | | |
| | | | | 14 | ▽ | |
| | | | Wet at 6 feet. | 7 | | |
| | | | | 6 | | |
| 799.1 | 11.0 | SH | SHALE, gray, moist. (Decorah Shale Bedrock) | * | | *100 to set 1" |
| 798.6 | 11.5 | | END OF BORING. | | | |

Water observed at 7 1/2 feet with 8 feet of hollow-stem auger in the ground.

Water observed at 6 feet with 10 feet of hollow-stem auger in the ground.

Boring then backfilled.

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-11**

LOCATION: N: 144349.077 E: 549288.377. See attached sketch.

DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/20/18** | SCALE: **1" = 4'**

| Elev. feet 805.9 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 805.4 | 0.5 | FILL | FILL: Lean Clay, trace Gravel and Limestone fragments, gray and brown, moist. | | | | | |
| | | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, trace Gravel, brown, moist. | 7 | | | | |
| | | | | 13 | | | | |
| | | | Wet at 5 feet. | 17 | ▽ | 7 | 4 | |
| | | | | 9 | | | | |
| | | | | 11 | | | | |
| 793.9 | 12.0 | | | 13 | | | | |
| 792.9 | 13.0 | LS | LIMESTONE, weathered, light brown, moist. (Platteville Limestone) | 50/6" | | | | |
| | | | END OF BORING. | | | | | |
| | | | Water observed at 5 feet with 4 feet of hollow-stem auger in the ground. | | | | | |
| | | | Water observed at 6 feet with 12 feet of hollow-stem auger in the ground. | | | | | |
| | | | Water not observed to cave-in depth of 10 feet. | | | | | |
| | | | Boring then backfilled. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:27

BRAUN INTERTEC

# LOG OF BORING

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | BORING: ST-12<br>LOCATION: N: 146109.658 E: 549155.979. See attached sketch. |
|---|---|

| DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: 7/19/18 | SCALE: 1" = 4' |
|---|---|---|---|

| Elev. feet 828.9 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| | | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, trace Gravel, brown, moist to wet. | 6 | | | |
| | | | | 18 | ▽ | | |
| | | | | 9 | | | |
| | | | | 7 | | | |
| 820.9 | 8.0 | CH | FAT CLAY, trace Gravel, gray, moist, hard. (Weathered Shale Bedrock) | 38 | | 15 | LL=53, PI=25, PI=28 |
| | | | | 75 | | | |
| 816.9 | 12.0 | | END OF BORING.<br><br>Water observed at 3 1/2 feet with 6 feet of hollow-stem auger in the ground.<br><br>Water not observed to cave-in depth of 2 feet immediately after withdrawal of auger.<br><br>Boring then backfilled. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:27

BRAUN℠ INTERTEC

# LOG OF BORING

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | BORING: ST-13<br>LOCATION: N: 146152.676 E: 549606.522. See attached sketch. |
|---|---|

| DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: 7/20/18 | SCALE: 1" = 4' |
|---|---|---|---|

| Elev. feet 851.1 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 848.1 | 3.0 | FILL | FILL: Poorly Graded Sand with Silt, fine- to medium-grained, trace Gravel and concrete debris, brown, moist. | 19<br>28 | | |
| 845.1 | 6.0 | SH | SHALE, gray, moist. (Decorah Shale Bedrock) | 72 | | |
| | | | END OF BORING.<br><br>Water not observed with 4 feet of hollow-stem auger in the ground.<br><br>Boring then backfilled. | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-14**

LOCATION: N: 146000.488 E: 549353.854. See attached sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/19/18** | SCALE: **1" = 4'**

| Elev. feet 834.2 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| | | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, brown, moist. | 8 | | | | |
| | | | | 14 | | | | |
| 828.7 | 5.5 | | | 4 | | | | |
| 828.2 | 6.0 | FILL | FILL: Fat Clay, with weathered Shale fragments, brown and gray, moist. | | | | | |
| 826.2 | 8.0 | FILL | FILL: Poorly Graded Sand with Silt, fine- to coarse-grained, with Gravel, Clay nodules, Shale and Limestone fragments, brown, moist to wet. | 16 | ▽ | 12 | 8 | |
| | | CH | FAT CLAY, gray, moist, hard. (Weathered Shale Bedrock) | 33 | | 22 | | LL=53, PL=26, PI=27 |
| 822.2 | 12.0 | | | 36 | | | | |

END OF BORING.

Water observed at 7 feet with 6 feet of hollow-stem auger in the ground.

Water not observed with 10 feet of hollow-stem auger in the ground.

Boring then backfilled.

(See Descriptive Terminology sheet for explanation of abbreviations)

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# BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-15**

LOCATION: N: 145944.315 E: 549164.112. See attached sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/19/18** | SCALE: **1" = 4'**

| Elev. feet 827.7 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 824.2 | 3.5 | FILL | FILL: Silty Sand, fine- to coarse-grained, with Gravel and concrete fragments, brown, moist. | 17<br>5 | | <br>27 | <br>OC=4% |
| 823.7 | 4.0 | OL | ORGANIC CLAY, black, moist. (Swamp Deposit/Buried Topsoil) | | | | |
| 822.2 | 5.5 | CL | LEAN CLAY, trace fibers, light gray, moist, medium. (Alluvium) | 5 | | | |
| 820.7 | 7.0 | SM | SILTY SAND, fine- to medium-grained, gray, moist to wet, loose. (Alluvium) | 5 | ▽ | 30 | LL=65, PL=29, PI=36 |
| 817.7 | 10.0 | CH | FAT CLAY, olive to gray, moist to wet, medium to very stiff. (Weathered Shale Bedrock) | 19 | | | |
| 815.7 | 12.0 | SH | SHALE, gray, moist, hard. (Decorah Shale Bedrock) | 56 | | | |

END OF BORING.

Water observed at 6 1/2 feet with 8 feet of hollow-stem auger in the ground.

Water not observed with 10 feet of hollow-stem auger in the ground.

Boring immediately backfilled.

(See Descriptive Terminology sheet for explanation of abbreviations)

# LOG OF BORING

BRAUN INTERTEC

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-16**

LOCATION: N: 145635.171 E: 549391.095. See attached sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/18/18** | SCALE: **1" = 4'**

| Elev. feet 827.9 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| | | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, with Silty Sand layers, brown, moist. | 24 | | | |
| | | | | 12 | | | |
| 824.4 | 3.5 | FILL | FILL: Lean Clay with Sand, with Limestone fragments, black and gray, moist. | 7 | | 21 | LL=46, PL=20, PI=26 |
| | | | | 6 | | | |
| 819.4 | 8.5 | CH | FAT CLAY, dark gray, moist, medium to hard. (Weathered Shale Bedrock) | 6 | | | |
| | | | | 32 | | | |
| 815.9 | 12.0 | SH | SHALE, gray, moist. (Decorah Shale Bedrock) | * | | | *100 to set 3" |
| 814.4 | 13.5 | | END OF BORING. | | | | |

Water not observed to cave-in depth of 9 feet immediately after withdrawal of auger.

Water not observed to cave-in depth of 12 feet immediately after withdrawal of auger.

Boring then backfilled.

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-17**

LOCATION: N: 145887.877 E: 548769.723. See attached sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/19/18** | SCALE: **1" = 4'**

| Elev. feet 812.5 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| | | FILL | FILL: Crushed concrete, brown and gray, moist. | 19 | | | |
| | | | | 34 | | | |
| | | | | 20 | | | |
| 806.5 | 6.0 | CH | FAT CLAY, olive to gray, moist, medium. (Weathered Shale Bedrock) | 7 | | 23 | LL=62, PI=20, PI=42 |
| 804.0 | 8.5 | SH | SHALE, gray, moist. (Decorah Shale Bedrock) | 43 | | | |
| 802.5 | 10.0 | | END OF BORING. | | | | |
| | | | Water not observed with 8 feet of hollow-stem auger in the ground. | | | | |
| | | | Boring then backfilled. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-18**

LOCATION: N: 145690.228 E: 548905.548. See attached sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/19/18** | SCALE: **1" = 4'**

| Elev. feet 813.5 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 812.5 | 1.0 | FILL | FILL: Silty Sand, fine- to coarse-grained, with Gravel, brown, moist. | 18 | | | | |
| 809.0 | 4.5 | FILL | FILL: Poorly Graded Sand with Silt, fine- to medium-grained, with Gravel, brown, moist. | 12 | | 6 | 6 | |
| 807.0 | 6.5 | CL | SANDY LEAN CLAY, trace Gravel, slightly organic, black, moist. (Swamp Deposit/Buried Topsoil) | 4 | ∇ | 20 | | OC=4% |
| 805.0 | 8.5 | CH | FAT CLAY, gray, moist, stiff. (Weathered Shale Bedrock) | 14 | | | | |
| 803.5 | 10.0 | SH | SHALE, gray, moist. (Decorah Shale Bedrock) | 33 | | | | |

END OF BORING.

Water observed at 5 1/2 feet with 6 feet of hollow-stem auger in the ground.

Water not observed with 8 feet of hollow-stem auger in the ground.

Boring immediately backfilled.

(See Descriptive Terminology sheet for explanation of abbreviations)

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# BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-19**

LOCATION: N: 145547.839 E: 548940.659. See attached sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/19/18** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 810.9 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 809.9 | 1.0 | FILL | FILL: Silty Sand, fine- to medium-grained, trace gravel, dark brown, moist. | 35 | | | |
| 804.9 | 6.0 | FILL | FILL: Poorly Graded Sand, fine- to coarse-grained, trace Gravel, brown, moist to wet. | 13 | | | |
| | | | | 9 | ▽ | | |
| 802.4 | 8.5 | CH | FAT CLAY, with Silty Sand lenses, tan to greenish gray, moist, very stiff. (Weathered Shale Bedrock) | 22 | | 22 | LL=59, PL=23, PI=36 |
| 800.9 | 10.0 | SH | SHALE, gray, moist. (Decorah Shale Bedrock) | 107 | | | |
| | | | END OF BORING.<br><br>Water observed at 5 feet with 6 feet of hollow-stem auger in the ground.<br><br>Water not observed with 8 feet of hollow-stem auger in the ground.<br><br>Boring immediately backfilled. | | | | |

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BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-20**

LOCATION: N: 145294.282 E: 549718.451. See attached sketch.

DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/19/18** | SCALE: **1" = 4'**

| Elev. feet 833.0 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 831.0 | 2.0 | FILL | FILL: Silty Sand, fine- to medium-grained, trace Gravel and Clay nodules, brown, moist. | 3 | | | |
| 827.0 | 6.0 | FILL | FILL: Crushed concrete, trace Clay, gray and brown, moist. | 20<br>15 | | | |
| 823.0 | 10.0 | CH | FAT CLAY, trace Gravel, black to gray, moist, stiff to very stiff. (Weathered Shale Bedrock) | 14<br>22 | | 29 | LL=67, PL=30, PI=37 |
| 821.0 | 12.0 | SH | SHALE, gray, moist. (Decorah Shale Bedrock) | 57 | | | |
| | | | END OF BORING.<br><br>Water not observed with 10 feet of hollow-stem auger in the ground.<br><br>Water not observed to cave-in depth of 10 feet.<br><br>Boring then backfilled. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN℠ INTERTEC

# LOG OF BORING

| **Braun Project B1806527**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul**<br>**966 Mississippi River Boulevard S**<br>**St. Paul, Minnesota** | BORING: **ST-21**<br>LOCATION: N: 145210.999 E: 549610.013. See attached sketch. |
|---|---|
| DRILLER: K. Miller   METHOD: 3 1/4" HSA, Autohammer | DATE: **7/19/18**   SCALE: **1" = 4'** |

| Elev. feet 833.6 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| | | FILL | FILL: Sandy Lean Clay, trace Gravel and concrete, bituminous fragments, dark brown and brown, moist. | 4 | | | |
| | | | | 32 | | | |
| 830.1 | 3.5 | | With Cobbles and concrete at 3 1/2 feet. | | | | |
| | | FILL | FILL: Lean Clay, mixed with Sand, dark brown and gray, moist. | 7 | | 17 | LL=30, PL=14, PI=16 |
| | | | With Shale fragments from 6 to 8 feet. | 8 | | | |
| 825.6 | 8.0 | FILL | FILL: Crushed concrete, brownish gray, moist. | 18 | | | |
| | | | | 10 | | | |
| | | | | 26 | | | |
| | | | | 15 | | | |
| | | | | 23 | ∇ | | |
| | | | | 10 | | | |
| | | | | 15 | | | |
| 812.1 | 21.5 | CH | FAT CLAY, trace Gravel, green to gray, moist, stiff. (Weathered Shale Bedrock) | | | | |
| 811.1 | 22.5 | SH | SHALE, gray, moist. (Decorah Shale Bedrock) | 69 | | | |
| 809.6 | 24.0 | | END OF BORING. | | | | |
| | | | Water observed at 19 feet with 20 feet of hollow-stem auger in the ground. | | | | |
| | | | Water observed at 16 1/2 feet with cave-in depth of 18 1/2 feet immediately after withdrawal of auger. | | | | |
| | | | Boring immediately backfilled with bentonite grout. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

# LOG OF BORING

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | BORING: ST-22<br>LOCATION: N: 145132.963 E: 549721.803. See attached sketch. |
|---|---|

| DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: 7/19/18 | SCALE: 1" = 4' |
|---|---|---|---|

| Elev. feet 831.8 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 830.8 | 1.0 | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, trace Gravel, brown, moist. | 2 | | | |
| 825.8 | 6.0 | FILL | FILL: Lean Clay with Sand, trace Gravel and weathered Shale fragments, gray, moist. | 7 | | 19 | LL=33, PL=14, PI=19 |
| | | | | 10 | | | |
| 820.8 | 11.0 | FILL | FILL: Crushed concrete, trace Clay, brown and gray, moist. | 12 | | | |
| | | | | 9 | | | |
| | | | | 7 | | | |
| 817.8 | 14.0 | SH | SHALE, gray, moist. (Decorah Shale Bedrock) | 50 | | | |
| | | | END OF BORING.<br><br>Water not observed with 12 feet of hollow-stem auger in the ground.<br><br>Boring then backfilled. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-23**

LOCATION: N: 144666.078 E: 549869.913. See attached sketch.

DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/19/18** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 832.4 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 828.4 | 4.0 | FILL | FILL: Clayey Sand, fine-grained, with Gravel and Shale fragments, brown and gray, moist. | 15 | | | |
| | | | | 16 | | 15 | |
| 820.4 | 12.0 | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, Gravel, brown, moist. | 8 | | | |
| | | | | 2 | | | |
| | | | Wet at 9 feet. | 2 | ▽ | | |
| | | | | 2 | | | |
| 818.9 | 13.5 | CH | FAT CLAY, trace Limestone fragments, gray, wet, hard. (Weathered Shale Bedrock) | * | | | *50 to set 3" |

END OF BORING.

Water observed at 9 feet with 8 feet of hollow-stem auger in the ground.

Water observed at 11 feet with 13 feet of hollow-stem auger in the ground.

Water not observed to cave-in depth of 10 feet immediately after withdrawal of auger.

Boring then backfilled.

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-24**

LOCATION: N: 144648.358 E: 549748.241. See attached sketch.

DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/19/18** | SCALE: **1" = 4'**

| Elev. feet 831.9 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| | | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel and Shale fragments, trace concrete debris, brown, moist. | 12 | | | | |
| | | | | 15 | | | | |
| 827.9 | 4.0 | | | | | | | |
| | | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, Gravel, brown, moist. | 10 | | 2 | 5 | |
| | | | | 16 | | | | |
| | | | Wet at 9 feet. | 10 | ▽ | | | |
| | | | | 23 | | | | |
| | | | | 11 | | | | |
| 817.9 | 14.0 | CH | FAT CLAY, gray, wet, hard. (Weathered Shale Bedrock) | * | | | | *50 to set 2" |
| 817.1 | 14.8 | | END OF BORING. | | | | | |

Water observed at 9 feet with 8 feet of hollow-stem auger in the ground.

Water observed at 10 1/2 feet with 14 feet of hollow-stem auger in the ground.

Water not observed to cave-in depth of 10 feet immediately after withdrawal of auger.

Boring then backfilled.

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC

# LOG OF BORING

| **Braun Project B1806527**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul**<br>**966 Mississippi River Boulevard S**<br>**St. Paul, Minnesota** | BORING: **ST-25**<br>LOCATION: N: 144426.547 E: 549872.413. See attached sketch. |
|---|---|
| DRILLER: J. Chermak \| METHOD: 3 1/4" HSA, Autohammer | DATE: **7/20/18** \| SCALE: **1" = 4'** |

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 826.6 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 825.6 | 1.0 | FILL | FILL: Lean Clay with Sand, gray, moist. | 10 | | |
| | | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, Gravel, brown, moist. | 12 | | |
| | | | | 12 | | |
| | | | Wet at 7 feet. | 12 | ∇ | |
| 817.1 | 9.5 | | | 12 | | |
| 816.6 | 10.0 | CH | FAT CLAY, trace Sand, gray, wet. (Weathered Shale Bedrock) | | | |

END OF BORING.

Water observed at 7 feet with 6 feet of hollow-stem auger in the ground.

Water observed at 7 feet with 8 feet of hollow-stem auger in the ground.

Water not observed to cave-in depth of 7 1/2 feet immediately after withdrawal of auger.

Boring then backfilled.

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**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-26**

LOCATION: N: 144347.704 E: 549986.940. See attached sketch.

DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/20/18** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 828.0 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 827.5 | 0.5 | FILL | FILL: Lean Clay, trace Sand and Shale fragments, gray, moist. | | | | |
| | | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, trace Gravel, brown, moist. | 6 | | | |
| | | | | 15 | | | |
| | | | | 26 | | | |
| | | | Wet at 7 feet. | 3 | ∇ | | |
| 819.0 | 9.0 | | | 2 | | | |
| | | CL | LEAN CLAY, with Shale fragments, gray, wet, soft to stiff. (Weathered Shale Bedrock) | | | | |
| | | | | 12 | | 16 | LL=49, PI=19, PI=30 |
| 816.0 | 12.0 | | END OF BORING. | | | | |

Water observed at 7 feet with 6 feet of hollow-stem auger in the ground.

Water observed at 7 feet with 10 feet of hollow-stem auger in the ground.

Water not observed to cave-in depth of 7 1/2 immediately after withdrawal of auger.

Boring then backfilled.

# LOG OF BORING

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-27**

LOCATION: N: 144883.732 E: 548839.431. See attached sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/18/18** | SCALE: **1" = 4'**

| Elev. feet 812.2 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 811.7 | 0.5 | FILL | FILL: Lean Clay with Sand, with Gravel, dark brown, moist. | | | |
| 803.7 | 8.5 | FILL | FILL: Crushed concrete debris, trace Sand and Clay, moist. | 28<br>32<br>25<br>19 | | |
| 802.2 | 10.0 | SH | SHALE, gray, moist to dry. (Decorah Shale Bedrock) | 92/6" | | |
| | | | END OF BORING.<br><br>Water not observed with 8 feet of hollow-stem auger in the ground.<br><br>Boring then backfilled. | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

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# LOG OF BORING

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-28**

LOCATION: N: 144732.196 E: 549092.530. See attached sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/12/18** | SCALE: **1" = 4'**

| Elev. feet 808.2 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 804.2 | 4.0 | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, trace Gravel, brown, moist. Wet at 3 feet. | 3<br>12 | ▽ | | | |
| 802.7 | 5.5 | FILL | FILL: Organic Clay, trace Sand, black, wet. | 12 | | 48 | | OC=15% |
| 799.2 | 9.0 | FILL | FILL: Clayey Sand, gray, wet. Lens of Gravel at 8 feet. | 10<br>10 | | 14 | 19 | |
| 798.0 | 10.2 | CH | FAT CLAY, with Gravel and Shale fragments, gray and brown, wet, stiff to hard. (Weathered Shale Bedrock) | * | | | | *100 to set 2 1/2" |

END OF BORING.

Water observed at 3 feet with 6 feet of hollow-stem auger in the ground.

Boring then backfilled.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:27

BRAUN℠ INTERTEC

# LOG OF BORING

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-29**

LOCATION: N: 144332.110 E: 549017.678. See attached sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/17/18** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 810.8 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| | | FILL | FILL: Clayey Sand, fine-grained, trace Gravel, Clay nodules and concrete debris, brown and gray, moist. | 10 | | | | |
| | | | | 9 | | 11 | | |
| 806.8 | 4.0 | | | | | | | |
| | | FILL | FILL: Clayey Sand, trace Gravel, brown and gray, moist. | 5 | | 16 | 27 | |
| 803.8 | 7.0 | | | 20 | | | | |
| | | SH | SHALE, Limestone fragments, dark gray, moist. (Decorah Shale Bedrock) | | | | | |
| 801.8 | 9.0 | | | * | | | | *100 to set 1 1/2" |
| | | | END OF BORING. | | | | | |
| | | | Water not observed with 8 feet of hollow-stem auger in the ground. | | | | | |
| | | | Boring then backfilled. | | | | | |

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| Braun Project B1806527 GEOTECHNICAL EVALUATION Project Paul 966 Mississippi River Boulevard S St. Paul, Minnesota | BORING: ST-30 LOCATION: N: 143901.005 E: 548810.369. See attached sketch. |
|---|---|

| DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: 7/16/18 | SCALE: 1" = 4' |
|---|---|---|---|

| Elev. feet 809.7 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| | | FILL | FILL: Lean Clay, trace Gravel, with Sand, brown, moist. | 3 | | |
| | | | Poorly Graded Sand layer and concrete debris at 2 1/2 feet. | 10 | | |
| | | | | 16 | | |
| 803.7 | 6.0 | | Limestone fragments at 6 feet. | | | |
| | | CH | FAT CLAY, with Shale layers, gray, moist, stiff to hard. (Weathered Shale Bedrock) | * | | *100 to set 4" |
| | | | | 9 | | |
| 799.2 | 10.5 | SH | SHALE, gray, moist. (Decorah Shale Bedrock) | * | | *100 to set 0" |
| 798.7 | 11.0 | | END OF BORING. | | | |
| | | | Water not observed with 10 feet of hollow-stem auger in the ground. | | | |
| | | | Boring then backfilled. | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

# LOG OF BORING

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | BORING: ST-31<br>LOCATION: N: 143543.481 E: 549116.547. See attached sketch. |
|---|---|

| DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: 7/16/18 | SCALE: 1" = 4' |
|---|---|---|---|

| Elev. feet 810.7 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 810.4 | 0.3 | FILL | FILL: Silty Sand, fine- to medium-grained, Gravel, roots, brown, moist. (Topsoil Fill) | 25 | | |
| | | FILL | FILL: Crushed concrete, with Limestone fragments, trace Clay, brown and gray, moist to wet at 3 feet. | 17 | ▽ | |
| | | | | 8 | | |
| 804.7 | 6.0 | SH | SHALE, gray, moist. (Decorah Shale Bedrock) | 70/9" | | |
| 803.2 | 7.5 | | END OF BORING.<br><br>Auger met refusal at the 6-foot depth.<br><br>Water observed at 3 1/2 feet with 2 feet of hollow-stem auger in the ground.<br><br>Water observed at 3 feet with 6 feet of hollow-stem auger in the ground.<br><br>Water not observed to cave-in depth of 3 feet immediately after withdrawal of auger.<br><br>Boring then backfilled. | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

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**BRAUN INTERTEC**

# LOG OF BORING

(See Descriptive Terminology sheet for explanation of abbreviations)

| | |
|---|---|
| **Braun Project B1806527**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul**<br>**966 Mississippi River Boulevard S**<br>**St. Paul, Minnesota** | BORING: **ST-32**<br>LOCATION: N: 145296.326 E: 548525.611. See attached sketch. |

| DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/17/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 812.2 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| | | FILL | FILL: Clayey Sand, fine- to medium-grained, trace Gravel, roots and concrete debris, dark brown, moist. | 6 | | | |
| | | | | 14 | | 18 | OC=3% |
| 808.2 | 4.0 | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, trace Gravel, brown, moist. | 15 | | | |
| | | | Wet at 7 feet. | 11 | ∇ | | |
| | | | | 13 | | | |
| | | | | 7 | | | |
| 799.7 | 12.5 | | END OF BORING.<br>Water observed at 7 feet with 6 feet of hollow-stem auger in the ground.<br>Water observed at 10 1/2 feet with 12 feet of hand auger in the ground.<br>Water not observed to cave-in depth of 10 feet immediately after withdrawal of auger.<br>Boring then backfilled. | | | | |

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# LOG OF BORING

BRAUN INTERTEC

| Braun Project B1806527 | BORING: ST-33 |
|---|---|
| GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | LOCATION: N: 145354.679 E: 548155.728. See attached sketch. |

| DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: 7/16/18 | SCALE: 1" = 4' |
|---|---|---|---|

| Elev. feet 812.5 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| | | FILL | FILL: Crushed concrete, trace Gravel, Clay and Limestone fragments, brown and gray, moist. | 15 | | |
| | | | | 35 | | |
| | | | | 47 | | |
| | | | | 22 | ∇ | |
| | | | Wet at 7 1/2 feet. | 8 | | |
| | | | | 13 | | |
| 800.5 | 12.0 | | END OF BORING.<br><br>Water observed at 7 1/2 feet with 10 feet of hand auger in the ground.<br><br>Water not observed to cave-in depth of 3 feet immediately after withdrawal of auger.<br><br>Boring then backfilled. | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

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# LOG OF BORING

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-34**

LOCATION: N: 144652.821 E: 548820.192. See attached sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/18/18** | SCALE: **1" = 4'**

| Elev. feet 814.2 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 812.2 | 2.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, trace concrete debris, brown, moist. | 11 | | | |
| 810.2 | 4.0 | FILL | FILL: Lean Clay with Sand, with Gravel, trace organic debris, brown and gray, moist. | 8 | | 16 | |
| 802.2 | 12.0 | FILL | FILL: Crushed concrete, trace Lean Clay, gray, wet. | 11, 18, 23, 17 | ∇ | | |
| 802.1 | 12.1 | SH | SHALE, gray, moist. (Decorah Shale Bedrock) | * | | | *100 to set 1" |

END OF BORING.

Water observed at 7 1/2 feet with 8 feet of hollow-stem auger in the ground.

Water not observed to cave-in depth of 4 1/2 feet immediately after withdrawal of auger.

Boring then backfilled.

(See Descriptive Terminology sheet for explanation of abbreviations)

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(See Descriptive Terminology sheet for explanation of abbreviations)

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|---|---|
| **Braun Project B1806527**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul**<br>**966 Mississippi River Boulevard S**<br>**St. Paul, Minnesota** | BORING: **ST-35**<br>LOCATION: N: 144379.795 E: 548832.583. See attached sketch. |

| DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/16/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 813.0 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 812.0 | 1.0 | FILL | FILL: Lean Clay with Sand, with Gravel, gray, moist. | 13 | | | | |
| 809.0 | 4.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, trace Shale and Limestone fragments, brown and gray, moist. | 23 | ▽ | 9 | 21 | |
| 806.0 | 7.0 | FILL | FILL: Poorly Graded Gravel, fine- to coarse-grained, with Clay nodules, brown, wet. | 45<br>43 | | | | |
| 801.5 | 11.5 | SC | CLAYEY SAND, fine- to medium-grained, gray, wet, soft to hard. (Glacial Till)<br>Weathered Shale at 11 1/2 feet in sampler. | 12<br>* | | 11 | | *100 to set 1" |
| | | | END OF BORING.<br><br>Water observed at 4 feet with 4 feet of hollow-stem auger in the ground.<br><br>Water observed at 4 1/2 feet with 10 feet of hollow-stem auger in the ground.<br><br>Boring then backfilled. | | | | | |

# BRAUN INTERTEC

# LOG OF BORING

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | BORING: **ST-36**<br>LOCATION: N: 144267.332 E: 548606.426. See attached sketch. |
|---|---|

| DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/17/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 812.4 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| | | FILL | FILL: Silty Sand, fine- to medium-grained, trace Clay nodules and fibers, brown, moist. | 7 | | | | |
| 809.4 | 3.0 | | | 12 | | 13 | 42 | |
| 808.4 | 4.0 | SM | SILTY SAND, fine- to medium-grained, trace Shale fragments and Gravel, brown, moist. (Glacial Till) | | | | | |
| | | SC | CLAYEY SAND, fine-grained, gray, moist, stiff. (Glacial Till) | 12 | | 13 | | |
| 805.4 | 7.0 | | | 14 | | | | |
| | | SH | SHALE, moderately to highly weathered, gray, moist. (Decorah Shale Bedrock) | 29 | | | | |
| 801.3 | 11.1 | | | * | | | | *100 to set 2" |
| | | | END OF BORING.<br><br>Water not observed with 10 feet of hollow-stem auger in the ground.<br><br>Boring then backfilled. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

# LOG OF BORING

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| **Braun Project B1806527**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul**<br>**966 Mississippi River Boulevard S**<br>**St. Paul, Minnesota** | BORING: **ST-37**<br>LOCATION: N: 144134.207 E: 548498.820. See attached sketch. |

| DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/16/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 811.4 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 811.1 | 0.3 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, roots, dark brown, moist. (Topsoil Fill) | 5 | | | | |
| | | FILL | FILL: Crushed concrete fragments, trace Limestone fragments, Clay and Gravel, brown and gray, moist. | 26 | | | | |
| | | | | 44 | | | | |
| 805.4 | 6.0 | FILL | FILL: Silty Sand, fine- to medium-grained, trace Gravel and Limestone fragments, dark brown, moist. | 20 | | 13 | | OC=2% |
| | | | | 22 | | | | |
| 801.4 | 10.0 | FILL | FILL: Poorly Graded Sand with Silt, fine- to medium-grained, trace Gravel, dark brown, wet at 11 feet. | 12 | ▽ | 15 | 10 | |
| 800.4 | 11.0 | CH | FAT CLAY, gray, wet, stiff. (Weathered Shale Bedrock) | | | | | |
| 799.4 | 12.0 | | END OF BORING. | | | | | |

Water observed at 11 feet with 10 feet of hollow-stem auger in the ground.

Water not observed to cave-in depth of 10 feet.

Boring then backfilled.

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠ INTERTEC

# LOG OF BORING

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-38**

LOCATION: N: 146019.771 E: 548987.632. See attached sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/19/18** | SCALE: **1" = 4'**

| Elev. feet 823.7 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 822.4 | 1.3 | PAV | 3 inches of bituminous over 11 1/2 inches of aggregate base. | AS | | | |
| 819.7 | 4.0 | FILL | FILL: Lean Clay, with Gravel and Silty Sand, dark brown and brown, moist. | 40 | | | |
| 815.7 | 8.0 | CH | FAT CLAY, with Lean Clay Sand seams, olive, moist, stiff to very stiff. (Weathered Shale Bedrock) | 16 | | 17 | LL=52, PL=24, PI=28 |
| | | | | 32 | | | |
| 813.7 | 10.0 | SH | SHALE, gray, moist, (Decorah Shale Bedrock) | 39 | | | |
| | | | END OF BORING. Water not observed with 8 feet of hollow-stem auger in the ground. Boring immediately backfilled. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

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# LOG OF BORING

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|---|---|
| **Braun Project B1806527**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul**<br>**966 Mississippi River Boulevard S**<br>**St. Paul, Minnesota** | BORING: **ST-39**<br>LOCATION: N: 145922.513 E: 549500.149. See attached sketch. |

| DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/20/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 844.2 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 843.8 | 0.3 | BIT | 4 inches of bituminous. | | | |
| 842.2 | 2.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, brown, moist. | 13 | | |
| 838.2 | 6.0 | CH | FAT CLAY, trace Gravel, gray, moist, medium. (Weathered Shale Bedrock) | 7<br>6 | | |
| | | | END OF BORING.<br><br>Water not observed with 4 feet of hollow-stem auger in the ground.<br><br>Boring then backfilled. | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

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# LOG OF BORING

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-40**

LOCATION: N: 145822.058 E: 549674.388. See attached sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/20/18** | SCALE: **1" = 4'**

| Elev. feet 847.5 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 845.5 | 2.0 | FILL | FILL: Silty Sand, fine- to medium-grained, trace Gravel, Clay nodules and bituminous, brown, moist. | 18 | | | |
| 843.5 | 4.0 | CH | FAT CLAY, light gray, moist, very stiff. (Weathered Shale Bedrock) | 19 | | 24 | LL=62, PL=29, PI=33 |
| 841.5 | 6.0 | SH | SHALE, dark gray, moist. (Decorah Shale Bedrock) | 55 | | | |
| | | | END OF BORING. | | | | |
| | | | Water not observed with 4 feet of hollow-stem auger in the ground. | | | | |
| | | | Boring then backfilled. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

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# LOG OF BORING

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-41**

LOCATION: N: 145519.881 E: 549836.449. See attached sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/18/18** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 848.5 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 847.0 | 1.5 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, moist. | 8 | | | |
| 844.5 | 4.0 | CH | FAT CLAY, trace Sand, gray, moist, very stiff. (Weathered Shale Bedrock) | 19 | | 24 | LL=61, PL=28, PI=33 |
| 836.5 | 12.0 | SH | SHALE, gray, moist. (Decorah Shale Bedrock) | 52<br>39<br>47<br>61 | | | |
| | | | END OF BORING.<br><br>Water not observed with 10 feet of hollow-stem auger in the ground.<br><br>Boring then backfilled. | | | | |

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# LOG OF BORING

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-42**

LOCATION: N: 144481.918 E: 550290.430. See attached sketch.

| DRILLER: M. Barber | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/10/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 833.0 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 831.0 | 2.0 | FILL | FILL: Silty Sand, fine- to medium-grained, trace roots, black, moist. (Topsoil Fill) | 3 | | |
| 829.5 | 3.5 | FILL | FILL: Poorly Graded Sand with Silt, fine- to coarse-grained, trace Gravel, brown, moist. | 12 | | |
| 826.5 | 6.5 | CH | FAT CLAY, interbedded Limestone from 4 1/2 to 5 1/2 feet, greenish brown, moist, stiff to hard. (Weathered Shale Bedrock) | 15 | | |
| | | | | * | | *50 to set 3" |

END OF BORING.

Auger met refusal at the 6 1/2-foot depth.

Water not observed with 6 1/2 feet of hollow-stem auger in the ground.

Boring then backfilled.

(See Descriptive Terminology sheet for explanation of abbreviations)

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# LOG OF BORING

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**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-43**

LOCATION: N: 144460.674 E: 550534.468. See attached sketch.

DRILLER: M. Barber | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/10/18** | SCALE: **1" = 4'**

| Elev. feet 837.7 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 833.7 | 4.0 | FILL | FILL: Silty Sand, fine- to medium-grained, trace roots, trace Gravel, dark brown, moist. (Topsoil Fill) Weathered Shale fragments at 1 1/2 feet. | 7<br>3 | | |
| 831.7 | 6.0 | FILL | FILL: Poorly Graded Sand with Silt, fine- to medium-grained, trace Gravel, brown, moist. | 19 | | |
| 828.7 | 9.0 | SP | POORLY GRADED SAND, fine- to medium-grained, trace Gravel, weathered Shale fragments, trace Limestone fragments, brown, moist, dense to very dense. (Terrace Deposit) | 43<br>55 | | |
| | | | END OF BORING.<br><br>Auger met refusal at the 9-foot depth.<br><br>Water not observed with 9 feet of hollow-stem auger in the ground.<br><br>Boring then backfilled. | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-44**

LOCATION: N: 144129.830 E: 550552.496. See attached sketch.

DRILLER: M. Barber | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/10/18** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 833.2 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 831.2 | 2.0 | FILL | FILL: Silty Sand, fine- to medium-grained, trace Clay, trace roots, trace Gravel, black, moist. (Topsoil Fill) | 3 | | |
| 829.7 | 3.5 | FILL | FILL: Poorly Graded Sand with Silt, fine- to medium-grained, Gravel, brown, moist. | 6 | | |
| 828.7 | 4.5 | CH | FAT CLAY, trace Gravel, green gray, moist. (Weathered Shale Bedrock) | | | |
| 826.2 | 7.0 | SH | SHALE, thin interbeds of Limestone, green gray, moist. (Decorah Shale Bedrock) | 16 | | |
| | | | | * | | *92 to set 11" |
| | | | END OF BORING. | | | |
| | | | Auger met refusal at the 7-foot depth. | | | |
| | | | Water not observed with 7 feet of hollow-stem auger in the ground. | | | |
| | | | Boring then backfilled. | | | |

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| | |
|---|---|
| **Braun Project B1806527**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul**<br>**966 Mississippi River Boulevard S**<br>**St. Paul, Minnesota** | BORING: **ST-45**<br>LOCATION: N: 144117.516 E: 550699.935. See attached sketch. |

| DRILLER: M. Barber | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/10/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 835.0 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 834.2 | 0.8 | TS | SILTY SAND, fine- to medium-grained, roots, dark brown, moist. (Topsoil) | 10 | | |
| | | SP | POORLY GRADED SAND, fine- to medium-grained, trace Clay inclusions, trace Gravel, brown, moist, medium dense to very dense. (Terrace Deposit) | 10 | | |
| | | | | 17 | | |
| | | | | 22 | | |
| | | | Fractured Limestone from 8 to 12 feet. | 41 | | |
| 823.0 | 12.0 | | | 59 | | |
| | | CL | LEAN CLAY, with Sand, Gravel, fractured Limestone, brown and green gray, moist, very stiff to hard. (Interbedded weathered Shale and Limestone Bedrock) | 33 | ▽ | |
| | | | Wet at 14 feet. | 45 | | |
| | | | | 82 | | |
| 816.5 | 18.5 | | | * | | *50 to set 4" |
| | | | END OF BORING.<br><br>Auger met refusal at the 18 1/2-foot depth.<br><br>Water observed at 14 feet with 12 feet of hollow-stem auger in the ground.<br><br>Water observed at 18 feet with 18 feet of hollow-stem auger in the ground.<br><br>Water observed at 13 1/2 feet immediately after withdrawal of auger.<br><br>Water not observed to cave-in depth of 17 feet.<br><br>Boring then backfilled with bentonite grout. | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **ST-46**

LOCATION: N: 144672.550 E: 550503.906. See attached sketch.

DRILLER: M. Barber | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/10/18** | SCALE: **1" = 4'**

| Elev. feet 844.2 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 841.2 | 3.0 | FILL | FILL: Silty Sand, fine- to medium-grained, trace roots, dark brown, moist. (Topsoil Fill) | 2 | | |
| | | | | 7 | | |
| 830.2 | 14.0 | CH | FAT CLAY, trace Sand, trace Gravel, thin interbedded Limestone, green brown, moist. (Weathered Shale Bedrock) | 57 | | |
| | | | | 39 | | |
| | | | | 26 | | |
| | | | | 28 | | |
| | | | | 41 | | |

END OF BORING.

Auger met refusal at the 14-foot depth.

Water not observed with 14 feet of hollow-stem auger in the ground.

Boring then backfilled.

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-47**

LOCATION: N: 145635.523 E: 547937.290. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **10/1/19** | SCALE: **1" = 4'**

| Elev. feet 812.0 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 811.5 | 0.5 | FILL | FILL: Silty Sand, fine- to medium-grained, with roots, dark brown, moist. (Topsoil Fill) | | | | | |
| 805.5 | 6.5 | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, with Gravel, trace Lean Clay inclusions, brown, moist to wet. | 13 | | 8 | 5 | |
| | | | | 7 | | | | |
| 803.0 | 9.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, trace concrete pieces, dark brown, moist. | 32 | | 14 | | |
| 800.5 | 11.5 | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, with Gravel, trace Lean Clay lenses, brown, wet. | 11 | ▽ | | | |
| 798.0 | 14.0 | SH | SHALE, gray, moist, hard. (Decorah Shale Bedrock) | 60 | | 19 | | |
| 794.9 | 17.1 | LS | LIMESTONE, Carimona Member, trace Shale fragments, gray, wet, very dense. (Platteville Formation) | 50/2"* | | | | *2-inch recovery |
| | | | | 50/2"* | | | | *2-inch recovery |

END OF BORING.

Water observed at 9 feet with 10 feet of hollow-stem auger in the ground.

Water observed at 11 feet with 17 feet of hollow-stem auger in the ground.

Water observed at 9 feet immediately after withdrawal of auger.

Boring immediately backfilled with cement.

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-48**

LOCATION: N: 145769.045 E: 547928.172. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **9/30/19** | SCALE: **1" = 4'**

| Elev. feet 811.7 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 811.2 | 0.5 | FILL | FILL: Clayey Sand, with roots and Gravel, dark brown, moist. (Topsoil Fill) | | | | |
| 807.7 | 4.0 | FILL | FILL: Fat Clay, non- to slightly organic, trace Gravel, with Shale fragments, gray and black, moist. | 11 | | | |
| 805.2 | 6.5 | FILL | FILL: Silty Sand, fine-grained, with weathered Shale layers, trace Limestone fragments, dark brown to brown, moist. | 20 | | 17 | Possible chemical odor from 5 to 10 feet. |
| 802.7 | 9.0 | FILL | FILL: Poorly Graded Sand with Silt, fine- to medium-grained, with Shale fragments, trace Limestone fragments, gray, wet. | 5 | ▽ | | |
| 800.7 | 11.0 | FILL | FILL: Sandy Lean Clay, with Sand seams and Shale fragments, trace Limestone fragments, gray, wet. | 56/9" | | 14 | |
| 798.3 | 13.4 | SH | SHALE, gray, moist, hard. (Decorah Shale Bedrock) | 91/11" | | 19 | |

END OF BORING.

Water observed at 7 feet with 7 feet of hollow-stem auger in the ground.

Water observed at 9 feet with 12 feet of hollow-stem auger in the ground.

Water observed at 7 feet with a cave-in depth of 7 feet immediately after withdrawal of auger.

Boring immediately backfilled with grout.

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-49**

LOCATION: N: 145894.098 E: 547932.893. See attached sketch

DRILLER: M. Barber | METHOD: 3 1/4" HSA, Autohammer | DATE: 9/20/19 | SCALE: 1" = 4'

| Elev. feet 810.9 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 810.6 | 0.3 | FILL | FILL: Silty Sand, fine- to coarse-grained, with roots, bituminous pieces and Gravel, black, moist. (Topsoil Fill) | | | | | |
| 806.9 | 4.0 | FILL | FILL: Silty Sand, fine- to medium-grained, dark brown, moist. | 17 | | 13 | 27 | |
| 803.9 | 7.0 | SC | CLAYEY SAND, trace fibers, gray and brown, moist, soft. (Alluvium) | 4 | | 17 | | |
| 801.9 | 9.0 | SC | CLAYEY SAND, trace Gravel, brown, moist, medium. (Glacial Till) | 7 | | 15 | | |
| 800.8 | 10.1 | CL | SANDY LEAN CLAY, trace Gravel and Silt lenses, with Shale fragments, brown and gray, moist. (Glacial Till) | 50/2" | | 19 | | |
| 793.9 | 17.0 | LS | LIMESTONE, Carimona Member, dark gray to light gray, moderately to highly weathered, soft to hard, thin bedded, highly to intensely fractured, with 3-inch Shale layer at 11 feet and 2-inch Shale layer at 15.3 feet. (Platteville Formation) | | | | | Run 1 Switched to coring at 10.1 feet. See Log of Coring for additional information. Run 2 |
| 790.9 | 20.0 | LS | LIMESTONE, Magnolia Member, light gray, slightly to moderately weathered, moderately hard to hard, thick bedded, highly to intensely fractured, vuggy. (Platteville Formation) | | | | | |

END OF BORING.

Auger met refusal at 10.1 feet.

Switched to coring at 10.1 feet.

Water not observed while drilling.

Boring immediately backfilled with cement.

(See Descriptive Terminology sheet for explanation of abbreviations)

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-49 (cont.)**

LOCATION: N: 145894.098 E: 547932.893. See attached sketch

DATE: **9/20/19** SCALE: **1" = 1'**

| Elev. feet 800.8 | Depth feet 10.1 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 800.8 | 10.1 | LIMESTONE, Carimona Member, dark gray to light gray, moderately to highly weathered, soft to hard, thin bedded, highly to intensely fractured, with 3-inch Shale layer at 11 feet and 2-inch Shale layer at 15.3 feet. (Platteville Formation) | 4,650 | 2 3/4 | 500 | 100 | 56 | 0 | Run 1 Carimona Member |
| | | | | 4 | | | | | |
| | | | | 6 3/4 | | | | | |
| | | | | 3 1/4 | | | | | |
| | | | | 2 1/2 | | | | | |

*Continued Next Page*

NOTES:

BRAUN INTERTEC

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-49 (cont.)**

LOCATION: N: 145894.098 E: 547932.893. See attached sketch

DATE: **9/20/19** SCALE: **1" = 1'**

| Elev. feet 795.8 | Depth feet 15.1 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | LIMESTONE, Carimona Member, dark gray to light gray, moderately to highly weathered, soft to hard, thin bedded, highly to intensely fractured, with 3-inch Shale layer at 11 feet and 2-inch Shale layer at 15.3 feet. (Platteville Formation) *(continued)* | 4,650 | 5 3/4 | 500 | 100 | 93 | 34 | Run 2 |
| | | | | 3 1/4 | | | | | |
| 793.9 | 17.0 | LIMESTONE, Magnolia Member, light gray, slightly to moderately weathered, moderately hard to hard, thick bedded, highly to intensely fractured, vuggy. (Platteville Formation) | | 3 | | | | | Magnolia Member |
| | | | | 1 1/2 | | | | | |
| | | | | 1 3/4 | | | | | |
| 790.9 | 20.0 | END OF CORING. | | | | | | | |

BRAUN INTERTEC

NOTES:

LOG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN_V8_(See Descriptive Terminology sheet for explanation of abbreviations)

Photograph of Rock Cores
Project Paul
B1806527.00

# ST-49


NOTE: Cores run from left to right and top to bottom. Each row is 24 inches long.

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-50**

LOCATION: N: 146014.770 E: 547975.611. See attached sketch

DRILLER: M. Barber | METHOD: 3 1/4" HSA, Autohammer | DATE: **9/20/19** | SCALE: **1" = 4'**

| Elev. feet 809.3 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 807.3 | 2.0 | FILL | FILL: Silty Sand, fine- to coarse-grained, Gravelly, with Limestone fragments, brown, dry. | | | | |
| 800.3 | 9.0 | FILL | FILL: Shale, with non- to slightly organic Silty Sand and Lean Clay seams, with Sand lenses, trace Limestone fragments, black and brown, moist. | 9 | | 22 | OC=2% |
| | | | | 10 | | 22 | |
| | | | | 12 | | 23 | |
| 797.3 | 12.0 | SH | SHALE, gray, dry, hard. (Decorah Shale Bedrock) | 56 | | 16 | |
| | | | | 50/2" | | | |
| 793.8 | 15.5 | LS | LIMESTONE, Carimona Member, dark gray, moderately to highly weathered, moderately hard to hard, thin bedded, highly to intensely fractured. (Platteville Formation) | | | | Run 1 Switched to coring at 12 1/2 feet. See Log of Coring for additional information. |
| 791.8 | 17.5 | LS | LIMESTONE, Magnolia Member, light gray, slightly to moderately weathered, moderately hard to hard, thick bedded, moderately to highly fractured, vuggy. (Platteville Formation) | | | | |

END OF BORING.

Auger met refusal at 12 1/2 feet.

Switched to coring at 12 1/2 feet.

Water not observed while drilling.

Boring immediately backfilled with cement.

(See Descriptive Terminology sheet for explanation of abbreviations)

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# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-50 (cont.)**

LOCATION: N: 146014.770 E: 547975.611. See attached sketch

DATE: **9/20/19** SCALE: **1" = 1'**

| Elev. feet 796.8 | Depth feet 12.5 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | LIMESTONE, Carimona Member, dark gray, moderately to highly weathered, moderately hard to hard, thin bedded, highly to intensely fractured. (Platteville Formation) *(continued)* | 4,650 | 4 | 500 | 100 | 80 | 43 | Run 1 Carimona Member |
| | | | | 3 1/2 | | | | | |
| | | | | 3 3/4 | | | | | |
| 793.8 | 15.5 | LIMESTONE, Magnolia Member, light gray, slightly to moderately weathered, moderately hard to hard, thick bedded, moderately to highly fractured, vuggy. (Platteville Formation) | | 4 | | | | | Magnolia Member |
| | | | | 1 3/4 | | | | | |
| 791.8 | 17.5 | END OF CORING. | | | | | | | |

BRAUN INTERTEC

NOTES:

Photograph of Rock Cores
Project Paul
B1806527.00

# ST-50

12.5


17.5

NOTE: Cores run from left to right and top to bottom. Each row is 24 inches long.

BRAUN℠ INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-51**

LOCATION: N: 146139.098 E: 548120.065. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **10/1/19** | SCALE: **1" = 4'**

| Elev. feet 806.2 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 805.7 | 0.5 | FILL | FILL: Weathered Shale, mixed with Fat Clay and Shale, with roots, trace Limestone fragments, dark brown and gray, moist. (Topsoil Fill) | | | | | |
| | | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, with Gravel, brown, wet. | 3 | | 15 | 4 | |
| | | | | 11 | | | | |
| 799.7 | 6.5 | CH | FAT CLAY, with Limestone layers, gray, wet, very stiff. (Weathered Shale Bedrock) | 26 | | | | Slight chemical odor. |
| 796.2 | 10.0 | LS | WEATHERED LIMESTONE, trace Shale inclusions, gray, wet, very dense. | 50/5" | | 14 | | |
| 794.1 | 12.1 | | END OF BORING. | 50/2"* | | | | *2-inch recovery |

Water observed at surface.

Boring immediately backfilled.

# BRAUN INTERTEC

# LOG OF BORING

| Braun Project B1806527.00<br>GEOTECHNICAL EVALUATION<br>Project Paul - Infrastructure Phase<br>966 Mississippi River Boulevard South<br>Saint Paul, Minnesota | BORING: ST-52<br>LOCATION: N: 145547.002 E: 549048.612. See attached sketch |
|---|---|

| DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: 8/6/19 | SCALE: 1" = 4' |
|---|---|---|---|

| Elev. feet 815.7 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 814.6 | 1.1 | PAV | 5 inches of bituminous over 8 inches of aggregate base. | | | | |
| 812.7 | 3.0 | FILL | FILL: Lean Clay, slightly organic, trace Gravel and Limestone fragments, black, moist. | 6 | | 20 | OC=4% |
| 806.7 | 9.0 | CH | FAT CLAY, trace fibers, brown and gray, moist, medium to very stiff. (Weathered Shale Bedrock) | 5 | | 36 | $q_p$=1 1/4 tsf<br>LL=77, PL=28, PI=49 |
| | | | | 24 | | 26 | |
| 796.7 | 19.0 | SH | SHALE, gray, moist, hard. (Decorah Shale Bedrock) | 48 | | 19 | LL=55, PL=24, PI=31 |
| | | | | 80 | | 15 | A bag sample was collected from 3 to 9 feet, and California tube samples were taken from 10 to 12 feet from the offset borehole completed for lab testing. See appendix for test results. |
| | | | | 81 | | | |
| | | | | 87/11" | | | |
| 795.7 | 20.0 | LS | WEATHERED LIMESTONE, gray, dry, very dense. | 50/1" | | | |
| | | | END OF BORING.<br>Water not observed to cave-in depth of 19 feet.<br>Boring immediately backfilled with bentonite grout. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

# LOG OF BORING

| Braun Project B1806527.00<br>GEOTECHNICAL EVALUATION<br>Project Paul - Infrastructure Phase<br>966 Mississippi River Boulevard South<br>Saint Paul, Minnesota | BORING: ST-53<br>LOCATION: N: 145356.091 E: 548932.044. See attached sketch |
|---|---|

| DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: 8/7/19 | SCALE: 1" = 4' |
|---|---|---|---|

| Elev. feet 808.0 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 807.0 | 1.0 | FILL | FILL: Silty Sand, fine-grained, trace Gravel, dark brown, moist. | | | | | |
| | | FILL | FILL: Poorly Graded Sand, fine- to coarse-grained, trace Gravel to with Gravel, brown, moist to wet. | | ▽ | | | |
| | | | | 7 | | | | |
| | | | | 8 | | 14 | 5 | |
| | | | | 50 | | | | |
| 798.5 | 9.5 | SH | SHALE, gray, moist, hard. (Decorah Shale) | 50/5" | | 20 | | |
| 795.9 | 12.1 | | With Limestone fragments at 12 feet. | 50/1" | | | | |

END OF BORING.

Water observed at 2 feet with 2 feet of hollow-stem auger in the ground.

Water not observed with 12 feet of hollow-stem auger in the ground.

Water observed at 1 1/2 feet with cave-in depth of 5 feet immediately after withdrawal of auger.

Boring immediately backfilled.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

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INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-54**

LOCATION: N: 145344.725 E: 549047.219. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/7/19** | SCALE: **1" = 4'**

| Elev. feet 810.3 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 809.8 | 0.5 | FILL | SILTY SAND, fine- to medium-grained, mixed with Shale fragments, brown and gray, moist. | | | | | |
| 806.3 | 4.0 | FILL | FILL: Poorly Graded Sand with Silt, fine- to coarse-grained, trace Gravel to with Gravel, brown, moist. | 18 | | 9 | 9 | |
| 801.3 | 9.0 | FILL | FILL: Poorly Graded Sand, fine- to coarse-grained, trace Gravel to with Gravel, brown, moist to wet. | 8 | ▽ | | | |
| | | | | 7 | | 11 | 5 | |
| 799.3 | 11.0 | FILL | FILL: Poorly Graded Sand with Silt, fine- to coarse-grained, little Gravel, brown, wet. | 50/5" | | | | See appendix for sieve analysis results. |
| 795.7 | 14.6 | SH | SHALE, gray, dry, hard. (Decorah Shale) | 75/9" | | 18 | | |
| | | | With Limestone fragments at 14 1/2 feet. | 50/1" | | | | |

END OF BORING.

Water observed at 6 feet with 7 feet of hollow-stem auger in the ground.

Water observed at 6 1/2 feet with 14 1/2 feet of hollow-stem auger in the ground.

Water observed at 5 feet with cave-in depth of 14 feet immediately after withdrawal of auger.

Boring immediately backfilled with bentonite grout.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 12/5/19 13:45

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-55**

LOCATION: N: 145246.833 E: 548981.028. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/7/19** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 810.4 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 809.9 | 0.5 | FILL | FILL: Weathered Shale, gray, dry. | | | | | |
| 806.4 | 4.0 | FILL | FILL: Poorly Graded Sand, fine- to coarse-grained, trace Gravel, brown, moist. | 5 | | 7 | 4 | |
| 803.4 | 7.0 | FILL | FILL: Poorly Graded Sand with Silt, fine- to coarse-grained, little Gravel, brown, wet. | 6 | ▽ | | | See appendix for sieve analysis results. |
| 798.4 | 12.0 | FILL | FILL: Poorly Graded Sand, fine- to coarse-grained, trace Gravel, brown, wet. | 17<br>4 | | | | |
| 795.8 | 14.6 | SH | SHALE, gray, moist, hard. (Decorah Shale)<br>With Limestone fragments at 14 1/2 feet. | 54/8"<br>50/1" | | 25 | | |

END OF BORING.

Water observed at 4 1/2 feet with 4 1/2 feet of hollow-stem auger in the ground.

Water observed at 6 feet with 14 1/2 feet of hollow-stem auger in the ground.

Water observed at 5 feet with cave-in depth of 5 feet immediately after withdrawal of auger.

Boring immediately backfilled with bentonite grout.

**BRAUN INTERTEC**

# LOG OF BORING

| Braun Project B1806527.00<br>GEOTECHNICAL EVALUATION<br>Project Paul - Infrastructure Phase<br>966 Mississippi River Boulevard South<br>Saint Paul, Minnesota | BORING: **ST-56**<br>LOCATION: N: 145119.469 E: 548979.003. See attached sketch |
|---|---|

| DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/8/19** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 808.7 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 804.2 | 4.5 | FILL | FILL: Weathered Shale, mixed with Fat Clay and Shale, brown and gray, dry to moist. | 2 | ▽ | 5<br>17 | | |
| 796.7 | 12.0 | FILL | FILL: Poorly Graded Sand, fine- to coarse-grained, trace Gravel, brown, wet. | 3<br>5<br>4 | | 16 | 2 | |
| 794.1 | 14.6 | LS | WEATHERED LIMESTONE, gray, dry, very dense. (Platteville Formation) | 50/1"<br>50/1" | | | | |
| | | | END OF BORING.<br><br>Water observed at 4 feet with 4 1/2 feet of hollow-stem auger in the ground.<br><br>Water observed at 5 1/2 feet with 14 1/2 feet of hollow-stem auger in the ground.<br><br>Water not observed to cave-in depth of 5 immediately after withdrawal of auger.<br><br>Boring immediately backfilled with bentonite grout. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

# LOG OF BORING

BRAUN INTERTEC

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-57**

LOCATION: N: 145000.249 E: 549093.127. See attached sketch

DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/23/19** | SCALE: **1" = 4'**

| Elev. feet 810.3 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 809.6 | 0.7 | FILL | FILL: Sandy Lean Clay, trace roots, with Gravel and Shale fragments, dark brown, moist. (Topsoil Fill) | | | | | |
| 807.3 | 3.0 | FILL | FILL: Sandy Lean Clay, with Gravel and Shale fragments, dark brown, moist. | 8 | ▽ | 13 | | |
| | | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, with Gravel, trace Shale lenses, brown, wet. | | | | | |
| | | | | 6 | | | | See appendix for sieve analysis results. |
| | | | | 4 | | 15 | 3 | |
| | | | With a 2-inch Lean Clay layer at 10 feet. | 4 | | | | |
| 797.6 | 12.7 | | | 50/1/8" | | | | |
| | | | END OF BORING. | | | | | |

Auger met refusal at 12.7 feet.

Water observed at 3 feet with 3 feet of hollow-stem auger in the ground.

Water observed at 8 feet with 13 feet of hollow-stem auger in the ground.

Water observed at 3 feet with a cave-in depth of 3 feet immediately after withdrawal of auger.

Boring immediately backfilled.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-58**

LOCATION: N: 144976.635 E: 548995.755. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/8/19** | SCALE: **1" = 4'**

| Elev. feet 810.2 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 809.2 | 1.0 | FILL | FILL: Silty Sand, fine-grained, trace Gravel and Shale fragments, brown, dry. | | | 1 | |
| 806.2 | 4.0 | FILL | FILL: Silty Sand, fine- to coarse-grained, with Gravel, dark brown and brown, moist. | 13 | | 7 | |
| 803.2 | 7.0 | FILL | FILL: Organic Silt, black, moist. | 7 | | 25 | OC=7% |
| 801.2 | 9.0 | FILL | FILL: Silty Sand, fine- to medium-grained, brown and gray, wet. | 3 | ▽ | 19 | |
| 798.2 | 12.0 | FILL | FILL: Clayey Sand, with Gravel, Limestone fragments and wood, brown and gray, wet. | 10 | | | |
| 796.2 | 14.0 | SH | SHALE, gray, dry to moist, hard. (Decorah Shale) | 50/1" | | | |
| 795.6 | 14.6 | LS | WEATHERED LIMESTONE, gray, wet, very dense. (Platteville Formation) | 50/1" | | | |

END OF BORING.

Water observed at 7 1/2 feet with 7 1/2 feet of hollow-stem auger in the ground.

Water not observed with 14 1/2 feet of hollow-stem auger in the ground.

Water observed at 7 feet with cave-in depth of 9 feet immediately after withdrawal of auger.

Boring immediately backfilled with bentonite grout.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

BRAUN INTERTEC

# LOG OF BORING

| Braun Project B1806527.00<br>GEOTECHNICAL EVALUATION<br>Project Paul - Infrastructure Phase<br>966 Mississippi River Boulevard South<br>Saint Paul, Minnesota | BORING: ST-59<br>LOCATION: N: 144827.227 E: 549057.742. See attached sketch |
|---|---|

| DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: 8/8/19 | SCALE: 1" = 4' |
|---|---|---|---|

| Elev. feet 809.1 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| | | FILL | FILL: Silty Sand, fine- to coarse-grained, trace Gravel to with Gravel, brown and dark brown, moist to wet. | 6 | | 13 | 16 | |
| | | | | | ▽ | | | |
| | | | | 3* | | | | *Only Gravel recovery |
| 802.1 | 7.0 | SC | CLAYEY SAND, with Gravel and Limestone fragments, brown and gray, wet, very stiff. (Glacial Till) | 17 | | 13 | | |
| 799.1 | 10.0 | CH | FAT CLAY, with Silt lenses and Shale seams, gray, moist, stiff. (Weathered Shale Bedrock) | 10 | | 30 | | LL=68 , PL=28, PI=40 |
| 797.1 | 12.0 | LS | WEATHERED LIMESTONE, gray, wet, very dense. (Platteville Formation) | 50/3" | | | | |
| 794.3 | 14.8 | | END OF BORING.<br><br>Water observed at 4 feet with 4 1/2 feet of hollow-stem auger in the ground.<br><br>Water observed at 7 feet with 14 1/2 feet of hollow-stem auger in the ground.<br><br>Boring immediately backfilled with bentonite grout. | 50/3" | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-60**

LOCATION: N: 144535.867 E: 549080.29. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/12/19** | SCALE: **1" = 4'**

| Elev. feet 810.5 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 810.3 | 0.2 | FILL | FILL: Silty Sand, fine- to medium-grained, with roots, trace Gravel, brown, moist. (Topsoil Fill) | | | | | |
| | | FILL | FILL: Poorly Graded Sand with Silt, fine- to medium-grained, with Gravel, trace to with Lean Clay inclusions, brown, wet. | 17 | | 10 | | |
| | | | | 8 | | 10 | 9 | |
| 803.5 | 7.0 | FILL | FILL: Lean Clay, non- to slightly organic, with Shale lenses and layers, black and gray, moist. | 5 | | 23 | | OC=2% |
| | | | | 2* | | | | *No recovery |
| 798.5 | 12.0 | SH | SHALE, gray, moist, hard. (Decorah Shale Bedrock) | 50/3"* | | 13 | | *3-inch recovery |
| 796.5 | 14.0 | | | | | | | |
| 795.9 | 14.6 | LS | WEATHERED LIMESTONE, dark gray, dry, very dense. (Platteville Formation) | 50/1"* | | | | *1-inch recovery |
| | | | END OF BORING. Water not observed while drilling. Water not observed to cave-in depth of 13 feet. Boring immediately backfilled with bentonite grout. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-61**

LOCATION: N: 144359.739 E: 549142.338. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/9/19** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 810.5 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 808.5 | 2.0 | FILL | FILL: Silty Sand, fine- to coarse-grained, with Gravel, brown, dry. | | | | |
| 806.5 | 4.0 | FILL | FILL: Sandy Lean Clay, non- to slightly organic, with Gravel and Limestone fragments, dark brown to black, moist. | 16 | | 16 | OC=2% |
| 803.5 | 7.0 | OL | ORGANIC CLAY, with fibers, black, moist. (Buried Topsoil/Swamp Deposit) | 3 | | 33 | |
| 802.5 | 8.0 | SC | CLAYEY SAND, with Limestone fragments, brown, moist, very stiff. (Glacial Till) | 19 | | 36 | $q_p$=3/4 tsf |
| 799.0 | 11.5 | CH | FAT CLAY, with Silt lenses, gray and brown, moist, stiff. (Weathered Shale Bedrock) | 13 | ∇ | 34 | $q_p$=2 tsf |
| 798.4 | 12.1 | SH | SHALE, gray, moist, hard. (Decorah Shale Bedrock) | 50/1" | | 8 | |
| 795.3 | 15.2 | LS | LIMESTONE, Carimona Member, dark gray, moderately to highly weathered, moderately hard to hard, thick bedded, highly to intensely fractured, with 3-inch Gravel layer. (Platteville Formation) | | | | Run 1 Switched to coring at 12.1 feet. See Log of Coring for additional information. |
| 790.5 | 20.0 | LS | LIMESTONE, Magnolia Member, light gray, slightly to moderately weathered, moderately hard to hard, massive bedded, moderately to highly fractured, vuggy. (Platteville Formation) | | | | Run 2 |

END OF BORING.

Auger met refusal at 12 feet.

Switched to coring at 12 feet.

Water observed at 10 feet with 10 feet of hollow-stem auger in the ground.

Boring immediately backfilled with bentonite grout.

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-61 (cont.)**

LOCATION: N: 144359.739 E: 549142.338. See attached sketch

DATE: **8/9/19** SCALE: **1" = 1'**

| Elev. feet 798.4 | Depth feet 12.1 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 798.4 | 12.1 | LIMESTONE, Carimona Member, dark gray, moderately to highly weathered, moderately hard to hard, thick bedded, highly to intensely fractured, with 3-inch Gravel layer. (Platteville Formation) | 4,650 | 2 | | | 99 | 0 | Run 1 Carimona Member |
| | | | | 3 1/4 | | | | | |
| | | | | 6 1/4 | | | | | |
| 795.3 | 15.2 | LIMESTONE, Magnolia Member, light gray, slightly to moderately weathered, moderately hard to hard, massive bedded, moderately to highly fractured, vuggy. (Platteville Formation) | | 11 3/4 | | | | | Magnolia Member |
| | | | 4,650 | 1 1/2 | | | 98 | 73 | Run 2 |

*Continued Next Page*

NOTES:

BRAUN INTERTEC

LOG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN_V8_CURRENT.GDT 11/27/19 13:40 (See Descriptive Terminology sheet for explanation of abbreviations)

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-61 (cont.)**

LOCATION: N: 144359.739 E: 549142.338. See attached sketch

DATE: **8/9/19** SCALE: **1" = 1'**

| Elev. feet 793.4 | Depth feet 17.1 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | LIMESTONE, Magnolia Member, light gray, slightly to moderately weathered, moderately hard to hard, massive bedded, moderately to highly fractured, vuggy. (Platteville Formation) *(continued)* | 4,650 | 1 1/2 | | | 98 | 73 | |
| | | | | 1 1/2 | | | | | |
| | | | | 1 1/2 | | | | | |
| 790.5 | 20.0 | END OF CORING. | | | | | | | |

LOG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN_V8_CURRENT.GDT 11/27/19 14:10 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC

NOTES:

**Photograph of Rock Cores**
**Project Paul**
**B1806527.00**

# ST-61


NOTE: Cores run from left to right and top to bottom. Each row is 60 inches long.

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-62**

LOCATION: N: 145146.417 E: 548882.559. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/7/19** | SCALE: **1" = 4'**

| Elev. feet 809.7 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 809.2 | 0.5 | FILL | FILL: Weathered Shale fragments, gray, dry. | | | | | |
| | | FILL | FILL: Poorly Graded Sand, fine- to coarse-grained, trace Gravel, brown, moist to wet. | | | | | |
| | | | | 6 | | 11 | 3 | |
| | | | | | ▽ | | | |
| | | | | 13 | | | | |
| | | | | 20 | | | | |
| 798.7 | 11.0 | | | 8 | | | | |

END OF BORING.

Water observed at 4 feet with 4 1/2 feet of hollow-stem auger in the ground.

Water observed at 7 feet with 9 1/2 feet of hollow-stem auger in the ground.

Water not observed to cave-in depth of 4 feet immediately after withdrawal of auger.

Boring immediately backfilled.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-63**

LOCATION: N: 144945.152 E: 548915.713. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/8/19** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 810.9 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 810.4 | 0.5 | FILL | FILL: Silty Sand, fine- to medium-grained, mixed with Shale fragments, brown and gray, dry. | | | | | |
| | | FILL | FILL: Poorly Graded Sand, fine- to coarse-grained, trace Gravel, brown, moist to wet. | 11 | | | | |
| | | | | | ▽ | | | |
| | | | | 14 | | 13 | 4 | |
| | | | | 3 | | | | |
| 799.9 | 11.0 | | | 11 | | | | |
| | | | END OF BORING. | | | | | |
| | | | Water observed at 4 1/2 feet with 4 1/2 feet of hollow-stem auger in the ground. | | | | | |
| | | | Water observed at 7 feet with 9 1/2 feet of hollow-stem auger in the ground. | | | | | |
| | | | Water not observed to cave-in depth of 4 feet immediately after withdrawal of auger. | | | | | |
| | | | Boring immediately backfilled. | | | | | |

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-64**

LOCATION: N: 144161.156 E: 548988.986. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/29/19** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 808.9 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 807.9 | 1.0 | FILL | CLAYEY SAND, with roots and Gravel, dark brown, moist. (Topsoil Fill) | | | | |
| 804.9 | 4.0 | CH | FAT CLAY, with Silt lenses, gray and brown, moist, stiff. (Weathered Shale Bedrock) | 13 | | 23 | |
| 796.9 | 12.0 | SH | SHALE, with Limestone fragments, gray, dry, hard. (Decorah Shale Bedrock) | 40 | | 14 | |
| | | | | 50/0"* | | | *Sampler only encountered Limestone. 1-inch recovery |
| | | | | 50/3"* | | 7 | *3-inch recovery |
| 794.9 | 14.0 | LS | LIMESTONE, Carimona Member, dark gray, very dense. (Platteville Formation) | 50/3"* | | | *3-inch recovery |
| 789.9 | 19.0 | LS | LIMESTONE, Magnolia Member, light gray, slightly to moderately weathered, hard, massive bedded, intensely to moderately fractured, vuggy. (Platteville Formation) | | | | Run 1 Switched to coring at 14 feet. See Log of Coring for additional information |

END OF BORING.

Auger met refusal at 14 feet.

Switched to coring at 14 feet.

Water not observed while drilling.

Boring immediately backfilled with cement.

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-64 (cont.)**

LOCATION: N: 144161.156 E: 548988.986. See attached sketch

DATE: **8/29/19** SCALE: **1" = 1'**

| Elev. feet 794.9 | Depth feet 14.0 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 794.9 | 14.0 | LIMESTONE, Magnolia Member, light gray, slightly to moderately weathered, hard, massive bedded, intensely to moderately fractured, vuggy. (Platteville Formation) | 4,650 | 2 1/4 | | 100 | 99 | 71 | Run 1 Magnolia Member |
| | | | | 1 3/4 | | | | | |
| | | | | 1 3/4 | | | | | |
| | | | | 1 3/4 | | | | | |
| | | | | 1 3/4 | | | | | |
| 789.9 | 19.0 | END OF CORING AT 19 FEET. | | | | | | | |

NOTES:

BRAUN INTERTEC

LOG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN_V8_CURRENT.GDT 11/27/19 13:49 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC
The Science You Build On.

**Photograph of Rock Cores**
**Project Paul**
**B1806527.00**

# ST-64

14.0

19.0

NOTE: Cores run from left to right and top to bottom. Each row is 24 inches long.

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-65**

LOCATION: N: 144049.645 E: 549026.485. See attached sketch

DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/30/19** | SCALE: **1" = 4'**

| Elev. feet 807.8 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 807.1 | 0.7 | FILL | FILL: Silty Sand, fine- to medium-grained, trace Gravel, with Lean Clay inclusions and roots, moist. (Topsoil Fill) | | | | |
| 803.8 | 4.0 | CH | FAT CLAY, gray and brown, moist, stiff. (Weathered Shale Bedrock) | 12 | | 23 | |
| 800.8 | 7.0 | SH | SHALE, gray, dry, hard. (Decorah Shale Bedrock) Limestone layer at 6 feet. | 44 | | 16 | |
| 797.8 | 10.0 | SH | SHALE, gray, slightly weathered, very soft to soft, thin bedded, intensely fractured. (Decorah Shale Formation) | | | | Run 1 Switched to coring at 7 feet. See Log of Coring for additional information. |
| 793.8 | 14.0 | LS | LIMESTONE, Carimona Member, slightly to moderately weathered, moderately hard to hard, thin bedded, moderately to intensely fractured, vuggy. (Platteville Formation) | | | | Run 2 |
| 785.8 | 22.0 | LS | LIMESTONE, Magnolia Member, slightly weathered, moderately hard to hard, thin to massive bedded, moderately to highly fractured, vuggy. (Platteville Formation) | | | | Run 3 |

END OF BORING.

Auger met refusal at 6 1/2 feet.

Switched to coring at 7 feet.

Water not observed while drilling.

Boring immediately backfilled with bentonite grout.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-65 (cont.)**

LOCATION: N: 144049.645 E: 549026.485. See attached sketch

DATE: **8/30/19** SCALE: **1" = 1'**

| Elev. feet 800.8 | Depth feet 7.0 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 800.8 | 7.0 | SHALE, gray, slightly weathered, very soft to soft, thin bedded, intensely fractured. (Decorah Shale Formation) | 2,325 | 3/4 | 120 | 100 | 82 | 36 | Run 1 Core barrel dropped 6-8 inches. |
| | | | 3,720 | 2 | | | | | |
| | | | | 2 | | | | | |
| 797.8 | 10.0 | LIMESTONE, Carimona Member, slightly to moderately weathered, moderately hard to hard, thin bedded, moderately to intensely fractured, vuggy. (Platteville Formation) | | 2 | | | | | Core barrel dropped 2-4 inches. |
| | | | | 1 3/4 | | | | | |

**BRAUN INTERTEC**

*Continued Next Page*

NOTES:

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-65 (cont.)**

LOCATION: N: 144049.645 E: 549026.485. See attached sketch

DATE: **8/30/19** SCALE: **1" = 1'**

| Elev. feet | Depth feet | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 795.8 | 12.0 | LIMESTONE, Carimona Member, slightly to moderately weathered, moderately hard to hard, thin bedded, moderately to intensely fractured, vuggy. (Platteville Formation) *(continued)* | 4,185 | 2 1/2 | 120 | 100 | 100 | 65 | Run 2 |
| | | | | 2 | | | | | |
| 793.8 | 14.0 | LIMESTONE, Magnolia Member, slightly weathered, moderately hard to hard, thin to massive bedded, moderately to highly fractured, vuggy. (Platteville Formation) | | 2 | | | | | |
| | | | | 1 3/4 | | | | | |
| | | | | 2 1/4 | | | | | |

*Continued Next Page*

NOTES:

BRAUN INTERTEC

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-65 (cont.)**

LOCATION: N: 144049.645 E: 549026.485. See attached sketch

DATE: **8/30/19** SCALE: **1" = 1'**

| Elev. feet 790.8 | Depth feet 17.0 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | LIMESTONE, Magnolia Member, slightly weathered, moderately hard to hard, thin to massive bedded, moderately to highly fractured, vuggy. (Platteville Formation) *(continued)* | 4,650 | 2 1/4 | 110 | 100 | 92 | 84 | Run 3 |
| | | | | | 130 | | | | |
| | | | | 1 3/4 | | | | | |
| | | | | 2 | | | | | |
| | | | | 1 1/2 | | | | | |
| 785.8 | 22.0 | END OF CORING. | | | | | | | |

NOTES:

BRAUN INTERTEC

LOG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN_V8_CURRENT.GDT 11/27/19 14:10

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC
The Science You Build On.

**Photograph of Rock Cores**
**Project Paul**
**B1806527.00**

# ST-65


NOTE: Cores run from left to right and bottom to top. Each row is 60 inches long.

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-66**

LOCATION: N: 144068.163 E: 549140.621. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/27/19** | SCALE: **1" = 4'**

| Elev. feet 809.1 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 808.9 | 0.2 | FILL | FILL: Silty Sand, fine- to medium-grained, trace roots and Gravel, brown, moist. (Topsoil Fill) | | | | | |
| 805.1 | 4.0 | FILL | FILL: Silty Sand, fine- to medium-grained, trace Gravel, dark brown to black, wet. | 4 | ▽ | 16 | 12 | |
| 802.1 | 7.0 | CH | FAT CLAY, gray and brown, moist, soft. (Weathered Shale Bedrock) | 4 | | 27 | | |
| 797.1 | 12.0 | SH | SHALE, gray, moist, hard. (Decorah Shale Bedrock) | 42 | | 16 | | |
| | | | | 50/3"* | | 6 | | *3-inch recovery |
| 792.1 | 17.0 | LS | LIMESTONE, Carimona Member, dark gray, very dense. (Platteville Formation) | 50/2"* | | | | *2-inch recovery |
| | | | | 50/3"* | | | | *3-inch recovery |
| 789.4 | 19.7 | LS | LIMESTONE, Magnolia Member, light gray, very dense. (Platteville Formation) | 50/3" | | | | *3-inch recovery |
| | | | END OF BORING. | 50/3"* | | | | *3-inch recovery |

END OF BORING.

Water observed at 2 feet with 2 feet of hollow-stem auger in the ground.

Water observed at 14 feet with 20 feet of hollow-stem auger in the ground.

Water observed at 2 feet with a cave-in depth of 14 feet immediately after withdrawal of auger.

Boring immediately backfilled with cement.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-67**

LOCATION: N: 143624.770 E: 549383.713. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **9/19/19** | SCALE: **1" = 4'**

| Elev. feet 806.7 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 805.7 | 1.0 | FILL | FILL: Sandy Lean Clay, trace Gravel and roots, dark brown, moist. (Topsoil Fill) | | | | |
| 802.7 | 4.0 | FILL | FILL: Organic Clay, with fibers, black, moist. | 5 | | 28 | OC=6% |
| 799.7 | 7.0 | FILL | FILL: Silty Sand, fine- to medium-grained, slightly organic, with Gravel, dark brown and black, moist. | 8 | | 12 | |
| 797.7 | 9.0 | FILL | FILL: Organic Clay, trace Gravel, black and brown, moist. | 22 | | 29 | OC=7% |
| 794.7 | 12.0 | LS | LIMESTONE, Carimona Member, dark gray, moist, very dense. (Platteville Formation) | 50/2"* | | | *1-inch recovery |
| 789.6 | 17.1 | LS | LIMESTONE, Magnolia Member, light gray, dry, very dense, trace vugs. (Platteville Formation) | 50/3"* | | | *1-inch recovery |
| | | | | 50/2"* | | | *1-inch recovery |
| | | | END OF BORING. | 50/1"* | | | *2-inch recovery |
| | | | Water not observed while drilling. | | | | |
| | | | Boring immediately backfilled with bentonite grout. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

# BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-68**

LOCATION: N: 143888.803 E: 549208.443. See attached sketch

| DRILLER: | B. Kammermeier | METHOD: | 3 1/4" HSA, Autohammer | DATE: | **8/27/19** | SCALE: | **1" = 4'** |
|---|---|---|---|---|---|---|---|

| Elev. feet 808.6 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 807.6 | 1.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with roots, dark brown, moist. (Topsoil Fill) | | | | |
| 804.6 | 4.0 | FILL | FILL: Organic Clay, black and gray, moist. | 6 | | 34 | OC=8% |
| 801.6 | 7.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with Lean Clay inclusions, trace Gravel, brown to dark brown, moist. | 10 | | 15 | |
| 799.6 | 9.0 | CH | FAT CLAY, with Silt lenses, gray and brown, moist, stiff. (Weathered Shale Bedrock) | 15 | | 25 | |
| 794.6 | 14.0 | LS | LIMESTONE, Carimona Member, gray, dry, very dense. (Platteville Formation) | 50/2"* | | | *Sampler only encountered Limestone at 9 1/2 feet. 1-inch recovery |
| | | | | 50/1"* | | | *No recovery |
| 789.6 | 19.0 | LS | LIMESTONE, Magnolia Member, light gray, slightly weathered, moderately hard to hard, massive bedded, intensely to moderately fractured, vuggy, large vug at 15 1/2 feet. (Platteville Formation) | | | | Run 1 Switched to coring at 14 feet. See Log of Coring for additional information. |

END OF BORING.

Auger met refusal at 14 feet.

Switched to coring at 14 feet.

Water not observed while drilling.

Boring immediately backfilled with cement.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-68 (cont.)**

LOCATION: N: 143888.803 E: 549208.443. See attached sketch

DATE: **8/28/19** SCALE: **1" = 1'**

| Elev. feet 794.6 | Depth feet 14.0 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 794.6 | 14.0 | LIMESTONE, Magnolia Member, light gray, slightly weathered, moderately hard to hard, massive bedded, intensely to moderately fractured, vuggy, large vug at 15 1/2 feet. (Platteville Formation) | 4,650 | 2 1/4 | | 100 | 100 | 80 | Run 1 Magnolia Member |
| | | | | 1 1/2 | | | | | |
| | | | | 1 1/2 | | | | | |
| | | | | 1 3/4 | | | | | |
| | | | | 2 1/4 | | | | | |
| 789.6 | 19.0 | END OF CORING AT 19 FEET. | | | | | | | |

NOTES:

BRAUN INTERTEC

LOG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN_V8_(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC
The Science You Build On.

**Photograph of Rock Cores**
**Project Paul**
**B1806527.00**

# ST-68


NOTE: Cores run from left to right and top to bottom. Each row is 24 inches long.

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-69**

LOCATION: N: 143619.235 E: 549130.145. See attached sketch

DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/26/19** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 809.8 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 809.3 | 0.5 | FILL | FILL: Sandy Lean Clay, trace roots and Gravel, with Silty Sand inclusions and Silt lenses, dark brown, moist. (Topsoil Fill) | | | | |
| 807.8 | 2.0 | FILL | FILL: Sandy Lean Clay, trace Gravel, with Silty Sand inclusions, dark brown, moist. | 8 | | 25 | LL=59, PL=18, PI=41 |
| 800.8 | 9.0 | CH | FAT CLAY, with occasional Silt lenses, with Limestone fragments, gray and brown, moist, very stiff to hard. (Weathered Shale Bedrock) | 18 | | 17 | |
| | | | With Silty Sand seams at 7 feet. | 50/2" | | | |
| 799.0 | 10.8 | SH | SHALE, with Limestone fragments, gray and brown, dry, hard. (Decorah Shale Bedrock) | 88 | | 17 | |
| 795.8 | 14.0 | LS | LIMESTONE, Carimona Member, light gray to gray, slightly to moderately weathered, moderately hard to hard, medium to thin bedded, highly to intensely fractured, vuggy. (Platteville Formation) | | | | Run 1 Switched to coring at 10.8 feet. See Log of Coring for additional information. |
| 794.0 | 15.8 | LS | LIMESTONE, Magnolia Member, light gray, slightly weathered, moderately hard to hard, thick bedded, intensely to moderately fractured, vuggy. (Platteville Formation) | | | | |

END OF BORING.

Auger met refusal at 10.8 feet.

Switched to coring at 10.8 feet.

Water not observed while drilling.

Boring immediately backfilled with bentonite grout.

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-69 (cont.)**

LOCATION: N: 143619.235 E: 549130.145. See attached sketch

DATE: **8/29/19** SCALE: **1" = 1'**

| Elev. feet 799.0 | Depth feet 10.8 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 799.0 | 10.8 | LIMESTONE, Carimona Member, light gray to gray, slightly to moderately weathered, moderately hard to hard, medium to thin bedded, highly to intensely fractured, vuggy. (Platteville Formation) | 4.185 | 1 3/4 | 110 | 100 | 100 | 81 | Run 1 Carimona Member |
| | | | | 1 3/4 | | | | | |
| | | | | 2 1/2 | | | | | |
| 795.8 | 14.0 | LIMESTONE, Magnolia Member, light gray, slightly weathered, moderately hard to hard, thick bedded, intensely to moderately fractured, vuggy. (Platteville Formation) | | 1 3/4 | | | | | Magnolia Member |
| | | | | 2 1/4 | | | | | |
| 794.0 | 15.8 | END OF CORING. | | | | | | | Core barrel dropped last 3 inches. |

NOTES:

BRAUN INTERTEC

LOG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN_V8_(See Descriptive Terminology sheet for explanation of abbreviations)

The Science You Build On.

**Photograph of Rock Cores**
**Project Paul**
**B1806527.00**

# ST-69

10.8

15.8

NOTE: Core runs from left to right. The row is 60 inches long.

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-70**

LOCATION: N: 143720.035 E: 549294.415. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/28/19** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 810.2 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 810.0 | 0.2 | FILL | FILL: Poorly Graded Sand with Silt, fine- to medium-grained, with roots and Gravel, dark brown, moist. (Topsoil Fill) | | | | | |
| 806.2 | 4.0 | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, with Gravel and Lean Clay inclusions, brown, moist. | 3 | | 5 | | |
| 803.2 | 7.0 | FILL | FILL: Silty Sand, fine-grained, dark brown, moist. | 7 | | 17 | 19 | |
| 800.2 | 10.0 | CH | FAT CLAY, with Silt lenses, gray and brown, moist, soft to hard. (Weathered Shale Bedrock) | 3 | | 28 | | $q_p$=1 3/4 tsf |
| 791.2 | 19.0 | LS | LIMESTONE, Carimona Member, dark gray, very dense. (Platteville Formation) | 50/7" | | 23 | | |
| | | | | 50/1"* | | | | *Sampler only encountered Limestone. 1-inch recovery |
| | | | | 50/1"* | | | | *1-inch recovery |
| | | | | 50/3" | | | | *3-inch recovery |
| 790.5 | 19.7 | LS | LIMESTONE, Magnolia Member, light gray, very dense. (Platteville Formation) | 50/3"* | | | | *3-inch recovery |

END OF BORING.

Water not observed while drilling.

Boring immediately backfilled with cement.

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-71**

LOCATION: N: 143606.685 E: 549238.665. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **9/19/19** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 808.0 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 806.9 | 1.1 | FILL | FILL: Organic Clay, trace roots and Shale fragments, black to dark brown, moist. (Topsoil Fill) | | | | |
| 804.0 | 4.0 | FILL | FILL: Organic Clay, trace Shale fragments, black to dark brown, moist. | 24* | | | *No recovery |
| 799.5 | 8.5 | CH | FAT CLAY, olive and brown, moist, stiff to very stiff. (Weathered Shale Bedrock) | 10 | | 28 | LL=71, PL=22, PI=49 |
| | | | | 18 | | 28 | |
| 794.0 | 14.0 | LS | LIMESTONE, Carimona Member, dark gray, dry, very dense. (Platteville Formation) | 50/1"* | | | *1-inch recovery |
| | | | | 50/2"* | | | *2-inch recovery |
| 790.9 | 17.1 | LS | LIMESTONE, Magnolia Member, light gray, dry, very dense, trace vugs. (Platteville Formation) | 50/1"* | | | *1-inch recovery |
| | | | END OF BORING. | 50/1"* | | | *1-inch recovery |
| | | | Water not observed to cave-in depth of 12 feet immediately after withdrawal of auger. | | | | |
| | | | Boring immediately backfilled with bentonite grout. | | | | |

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

# LOG OF BORING

BRAUN INTERTEC

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-72**

LOCATION: N: 146179.868 E: 548662.640. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **9/19/19** | SCALE: **1" = 4'**

| Elev. feet 814.7 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 813.7 | 1.0 | PAV | 2 inches of bituminous over 4 inches of Shale over 6 inches of concrete. | | | | | |
| 812.7 | 2.0 | FILL | FILL: Organic Clay, trace Gravel, black, moist. | | | | | |
| 810.7 | 4.0 | FILL | FILL: Poorly Graded Sand with Silt, fine- to medium-grained, with Gravel, brown, moist. | 24 | | 7 | 11 | |
| 807.7 | 7.0 | CH | FAT CLAY, gray and brown, moist, very stiff. (Weathered Shale Bedrock) | 22 | | 26 | | |
| 799.7 | 15.0 | SH | SHALE, gray, dry, hard. (Decorah Shale Bedrock) | 47 | | 19 | | |
| | | | | 80 | | | | |
| | | | | 50/6" | | 10 | | |
| 795.1 | 19.6 | LS | LIMESTONE, Carimona Member, dark gray, dry, very dense. (Platteville Formation) | 50/6" | | 10 | | |
| | | | END OF BORING. | 50/1"* | | | | *1-inch recovery |
| | | | Water not observed while drilling. | | | | | |
| | | | Water not observed to cave-in depth of 6 feet immediately after withdrawal of auger. | | | | | |
| | | | Boring immediately backfilled with bentonite grout. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

BRAUN INTERTEC

| **Braun Project B1806527.00**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul - Infrastructure Phase**<br>**966 Mississippi River Boulevard South**<br>**Saint Paul, Minnesota** | BORING: **ST-73**<br>LOCATION: N: 145963.377 E: 548662.647. See attached sketch |
|---|---|
| DRILLER: B. Kammermeier / METHOD: 3 1/4" HSA, Autohammer | DATE: **8/20/19** / SCALE: **1" = 4'** |

| Elev. feet 812.2 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 812.0 | 0.2 | FILL | FILL: Sandy Lean Clay, with Silty Sand inclusions, dark brown to black, moist. (Topsoil Fill) | | | | | |
| | | OL | ORGANIC CLAY, black, moist. (Buried Topsoil/Swamp Deposit) | 7 | | 23 | | OC=7% |
| 808.2 | 4.0 | CL | SANDY LEAN CLAY, fine-grained, with Silty Sand lenses, dark brown, moist, soft. (Alluvium) | 4 | | 23 | 62 | |
| 805.2 | 7.0 | CH | FAT CLAY, with Silty Sand lenses, brown and gray, moist, stiff. (Weathered Shale Bedrock) | 15 | | 19 | | |
| 803.2 | 9.0 | SH | SHALE, gray, dry, hard. (Decorah Shale Bedrock) | 50/6" | | 15 | | |
| | | | | 50/5" | | | | LL=53, PL=21, PI=32<br>California tube samples were taken from 10 to 12 1/2 feet from the offset borehole completed for lab testing. See appendix for test results. |
| | | | With Limestone layers at 15 feet. | 50/5" | | 16 | | |
| 795.2 | 17.0 | LS | LIMESTONE, Carimona Member, dark gray, very dense. (Platteville Formation) | 50/1" | | | | |
| 792.6 | 19.6 | LS | LIMESTONE, Magnolia Member, light gray, very dense. (Platteville Formation) | 50/1" | | | | |
| | | | | 50/3" | | | | |
| 788.9 | 23.3 | | END OF BORING.<br>Water not observed while drilling.<br>Boring immediately backfilled with bentonite grout. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

BRAUN[SM] INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-74**

LOCATION: N: 145915.57 E: 548450.78. See attached sketch

DRILLER: J. Tatro | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/12/19** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 811.5 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 810.9 | 0.6 | PAV | 2 inches of bituminous over 5 inches of aggregate base. | | | | | |
| | | FILL | FILL: Clayey Sand, non- to slightly organic, with Limestone fragments, with Gravel, black, brown, and dark brown, moist. | 8 | | 14 | 31 | OC=2% |
| | | | | 9* | | | | *1-inch recovery |
| 803.5 | 8.0 | | | 8 | | 16 | | $q_p$=2 1/4 tsf |
| | | CH | FAT CLAY, with Silt lenses, gray and brown, moist, medium to stiff. (Weathered Shale Bedrock) | 10 | | 28 | | $q_p$=2 1/4 tsf |
| | | | Limestone layer at 12 feet. | 50/1" | | | | |
| 796.4 | 15.1 | | | | | | | |
| | | LS | LIMESTONE, Carimona Member, dark gray to gray, moderately to highly weathered, moderately hard to hard, thin to medium bedded, highly to intensely fractured. (Platteville Formation) Shale seam at 15.6 feet. | | | | | Run 1 Switched to coring at 15.1 feet. See Log of Coring for additional information. Run 2 |
| 793.1 | 18.4 | | | | | | | |
| | | LS | LIMESTONE, Magnolia Member, light gray, slightly to moderately weathered, moderately hard to hard, thick to massive bedded, moderately to intensely fractured, vuggy. (Platteville Formation) | | | | | |
| 789.4 | 22.1 | | | | | | | |
| | | | END OF BORING.<br>Auger met refusal at 15.1 feet.<br>Switched to coring at 15.1 feet.<br>Water not observed while drilling.<br>Boring then grouted. | | | | | |

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-74 (cont.)**

LOCATION: N: 145915.570 E: 548450.780. See attached sketch

DATE: **8/12/19** SCALE: **1" = 1'**

| Elev. feet 796.4 | Depth feet 15.1 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | LIMESTONE, dark gray to gray, moderately to highly weathered, moderately hard to hard, thin to medium bedded, highly to intensely fractured. (Platteville Formation) *(continued)* Shale seam at 15.6 feet. | 4,185 | 2 1/4 | 100 | 95 | 75 | 46 | Run 1 Carimona Member |
| | | | | 1 1/2 | 50-100 | | | | |
| | | | 4,650 | 2 | 50-70 | 95 | 92 | 57 | Run 2 |
| | | | | 1 3/4 | 70-100 | | | | |
| 793.1 | 18.4 | LIMESTONE, light gray, slightly to moderately weathered, moderately hard to hard, thick to massive bedded, moderately to intensely fractured, vuggy. (Platteville Formation) | | | | | | | Magnolia Member |
| | | | | 2 | 100 | | | | |

*Continued Next Page*

NOTES:

BRAUN INTERTEC

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-74 (cont.)**

LOCATION: N: 145915.570 E: 548450.780. See attached sketch

DATE: **8/12/19** SCALE: **1" = 1'**

| Elev. feet 791.4 | Depth feet 20.1 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | LIMESTONE, light gray, slightly to moderately weathered, moderately hard to hard, thick to massive bedded, moderately to intensely fractured, vuggy. (Platteville Formation) *(continued)* | 4,650 | 2 | 80-110 | 95 | 92 | 57 | |
| | | | | 1 3/4 | 90-110 | | | | |
| 789.4 | 22.1 | END OF CORING. | | | | | | | |



(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC

NOTES:

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The Science You Build On.

**Photograph of Rock Cores**
**Project Paul**
**B1806527.00**

# ST-74


NOTE: Cores run from left to right and top to bottom. Each row is 24 inches long.

**BRAUN INTERTEC**

# LOG OF BORING

| | |
|---|---|
| **Braun Project B1806527.00**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul - Infrastructure Phase**<br>**966 Mississippi River Boulevard South**<br>**Saint Paul, Minnesota** | BORING: **ST-75**<br>LOCATION: N: 145603.902 E: 548635.796. See attached sketch |

DRILLER: J. Tatro | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/9/19** | SCALE: **1" = 4'**

| Elev. feet 810.8 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 810.6 | 0.2 | FILL | FILL: Silty Sand, fine- to medium-grained, trace Gravel, with roots, dark brown, moist. (Topsoil Fill) | | | | | |
| | | FILL | FILL: Poorly Graded Sand, fine- to coarse-grained, trace Gravel, brown, wet. | 8 | | 10 | | |
| | | | | 9 | ▽ | | | |
| | | | | 9 | | 18 | 2 | |
| | | | | 18 | | | | |
| 798.3 | 12.5 | CH | FAT CLAY, gray and brown, moist, stiff. (Weathered Shale Bedrock) | 12 | | 39 | | $q_p$=1 tsf<br>LL=76, PL=28, PI=48 |
| 797.4 | 13.4 | LS | LIMESTONE, Carimona Member, dark gray to gray, slightly to moderately weathered, soft to hard, medium to thin bedded, highly to intensely fractured. (Platteville Formation)<br><br>3-inch Shale layer at 16.2 feet. | 50/1" | | | | Run 1<br>Switched to coring at 14.2 feet. See Log of Coring for additional information. |
| 792.9 | 17.9 | LS | LIMESTONE, Magnolia Member, light gray, unweathered to slightly weathered, moderately hard to hard, massive bedded, moderately to intensely fractured, vuggy. (Platteville Formation) | | | | | Run 2<br><br>Run 3 |
| 786.3 | 24.5 | LS | LIMESTONE, Hidden Falls Member, dark gray to gray, unweathered to slightly weathered, moderately hard to hard, thin to thick bedded, moderately to highly fractured. (Platteville Formation) | | | | | |
| 783.2 | 27.6 | | END OF BORING.<br><br>Auger met refusal at 14.2 feet.<br><br>Switched to coring at 14.2 feet.<br><br>Water observed at 7 feet with 7 feet of hollow-stem auger in the ground.* | | | | | *Boring immediately backfilled with bentonite grout. |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-75 (cont.)**

LOCATION: N: 145603.902 E: 548635.796. See attached sketch

DATE: **8/9/19** SCALE: **1" = 1'**

| Elev. feet 796.6 | Depth feet 14.2 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | LIMESTONE, dark gray to gray, slightly to moderately weathered, soft to hard, medium to thin bedded, highly to intensely fractured. (Platteville Formation) *(continued)* | 3,720 | 3 | 100 | 100 | 97 | 45 | Run 1 Carimona Member |
| | | | 4,650 | 1 1/2 | 50-80 | | | | |
| | | 3-inch Shale layer at 16.2 feet. | 4,185 | 4 3/4 | 40 | | | | |
| | | | | 2 1/2 | | | | | |
| | | | 4,650 | 4 1/4 | 50-100 | 40 | 99 | 69 | Run 2 |
| 792.9 | 17.9 | LIMESTONE, light gray, unweathered to slightly weathered, moderately hard to hard, massive bedded, moderately to intensely fractured, vuggy. (Platteville Formation) | | | | | | | Magnolia Member |
| | | | | 4 1/2 | 80-100 | 80 | | | |

*Continued Next Page*

NOTES:

BRAUN INTERTEC

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-75 (cont.)**

LOCATION: N: 145603.902 E: 548635.796. See attached sketch

DATE: **8/9/19** SCALE: **1" = 1'**

| Elev. feet 791.6 | Depth feet 19.2 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | LIMESTONE, light gray, unweathered to slightly weathered, moderately hard to hard, massive bedded, moderately to intensely fractured, vuggy. (Platteville Formation) *(continued)* | 4,650 | 4 1/2 | 80-100 | 80 | 99 | 69 | |
| | | | | 3 | 70-100 | | | | |
| | | | | 1 3/4 | 90-100 | | | | |
| | | | | 1 3/4 | 100 | | | | |
| | | | 4,650 | 1 1/4 | 80-100 | 75 | 99 | 88 | Run 3 |
| | | | | 1 1/2 | | 90 | | | |

BRAUN INTERTEC

*Continued Next Page*

NOTES:

LOG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN_V8_CURRENT.GDT 11/27/19 11:10 (See Descriptive Terminology sheet for explanation of abbreviations)

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-75 (cont.)**

LOCATION: N: 145603.902 E: 548635.796. See attached sketch

DATE: **8/9/19** SCALE: **1" = 1'**

| Elev. feet 786.6 | Depth feet 24.2 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 786.3 | 24.5 | | 4,650 | 1 1/2 | 80-100 | 90 | 99 | 88 | |
| | | LIMESTONE, dark gray to gray, unweathered to slightly weathered, moderately hard to hard, thin to thick bedded, moderately to highly fractured. (Platteville Formation) | | 1 1/4 | | | | | Hidden Falls Member |
| | | | | 1 1/4 | | | | | |
| 783.2 | 27.6 | | | 1 1/2 | 80-110 | | | | |
| | | END OF CORING. | | | | | | | |

NOTES:

BRAUN INTERTEC

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**Photograph of Rock Cores**
**Project Paul**
**B1806527.00**

# ST-75


Column 1 Column 2

NOTE: Cores run from left to right and top to bottom in each column. Each row is 24 inches long.

BRAUN℠ INTERTEC

# LOG OF BORING

| Braun Project B1806527.00<br>GEOTECHNICAL EVALUATION<br>Project Paul - Infrastructure Phase<br>966 Mississippi River Boulevard South<br>Saint Paul, Minnesota | BORING: ST-76<br>LOCATION: N: 145569.517 E: 548348.374. See attached sketch |
|---|---|

| DRILLER: J. Tatro | METHOD: 3 1/4" HSA, Autohammer | DATE: 8/8/19 | SCALE: 1" = 4' |
|---|---|---|---|

| Elev. feet 811.2 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 810.2 | 1.0 | FILL | FILL: Silty Sand, fine-grained, black, dry. (Topsoil Fill) | | | | | |
| 806.2 | 5.0 | FILL | FILL: Silty Sand, fine- to coarse-grained, trace Gravel, occasional Clayey Sand seams, dark brown, moist. | 10 | | 11 | 19 | |
| 801.7 | 9.5 | CH | FAT CLAY, trace Gravel, light brown to gray, moist, medium to stiff. (Weathered Shale Bedrock) | 6 | | 26 | | $q_p$=2 tsf<br>LL=65, PI=41, PL=24 |
| | | | | 9 | ▽ | 25 | | $q_p$=2 tsf |
| 800.2 | 11.0 | CH | FAT CLAY, with Shale fragments, gray and green, moist, stiff. (Weathered Shale Bedrock) | 10 | | 26 | | LL=53, PI=29, PL=24 |
| 799.6 | 11.6 | LS | WEATHERED LIMESTONE, light gray, dry, very dense. (Platteville Formation) | 50/2" | | | | |

END OF BORING.

Auger met refusal at 11.6 feet.

Water observed at 8 1/2 feet with 9 1/2 feet of hollow-stem auger in the ground.

Water not observed with 11.6 feet of hollow-stem auger in the ground.

Boring immediately backfilled.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

# LOG OF BORING

BRAUN INTERTEC

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-77**

LOCATION: N: 145547.577 E: 548151.82. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/16/19** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 812.9 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 812.4 | 0.5 | FILL | FILL: Silty Sand, fine-grained, with roots, trace Gravel, dark brown and black, wet. (Topsoil Fill) | | | | | |
| | | FILL | FILL: Silty Sand, fine- to medium-grained, trace Gravel, brown, wet. | 6 | | 12 | 12 | |
| 808.9 | 4.0 | CL | SANDY LEAN CLAY, with Gravel, brown and gray, stiff. (Glacial Till) With Silty Sand lenses at 5 feet. | 12 | | 17 | | |
| | | | With Shale layer at 8 feet. | 14 | | 17 | 51 | |
| | | | Gray at 10 1/2 feet. | 11 | | 10 | | |
| | | | With 1-inch weathered Limestone layer at 12 feet. | 50/1"* | | | | *1-inch recovery |
| 798.9 | 14.0 | SH | SHALE, with Limestone fragments, gray, dry, hard. (Decorah Shale Bedrock) | 50/2"* | | 16 | | *2-inch recovery |
| 795.8 | 17.1 | | END OF BORING. Water not observed while drilling. Boring immediately backfilled with bentonite grout. | 50/2"* | | | | *2-inch recovery |

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

# LOG OF BORING

| | |
|---|---|
| **Braun Project B1806527.00**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul - Infrastructure Phase**<br>**966 Mississippi River Boulevard South**<br>**Saint Paul, Minnesota** | BORING: **ST-78**<br>LOCATION: N: 145437.994 E: 548613.698. See attached sketch |

| DRILLER: J. Tatro | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/8/19** | SCALE: **1" = 4'** |
|---|---|---|---|

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 811.6 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 811.1 | 0.5 | FILL | FILL: Silty Sand, fine- to medium-grained, dark brown, dry. | | | | | |
| 807.6 | 4.0 | FILL | FILL: Poorly Graded Sand with Silt, fine- to medium-grained, trace Gravel, brown, moist. | 22 | | 8 | 10 | |
| 805.6 | 6.0 | FILL | FILL: Clayey Sand, trace Gravel, dark brown and brown, moist. | 8 | | 14 | | |
| 802.6 | 9.0 | FILL | FILL: Lean Clay, slightly organic, black, moist. (Buried Topsoil) | 3 | | 27 | | OC=4% |
| 799.6 | 12.0 | CL | LEAN CLAY with SAND, with Silty Sand seams, gray to brown, moist, soft. (Alluvium) | 4 | | 22 | | |
| 798.1 | 13.5 | SH | SHALE, with Limestone fragments, gray, dry to moist, hard. (Decorah Shale Bedrock) | 36 | | 13 | | |
| | | | END OF BORING.<br><br>Water not observed with 12 feet of hollow-stem auger in the ground.<br><br>Boring immediately backfilled. | | | | | |

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

BRAUN INTERTEC

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-79**

LOCATION: N: 145271.425 E: 548609.949. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/19/19** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 812.6 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 812.1 | 0.5 | FILL | FILL: Silty Sand, fine- to medium-grained, with concrete pieces and roots, dark brown, moist. | | | | |
| | | FILL | FILL: Crushed concrete (gravel-sized), with Sand and Shale fragments, brown, moist. | 40 | | | |
| | | | | 10 | | 13 | |
| 805.6 | 7.0 | CH | FAT CLAY, with Silt lenses at 7 1/2 feet, trace Limestone fragments, brown and gray to 10 feet then gray, moist, stiff to very stiff. (Weathered Shale Bedrock) | 15 | | 21 | |
| | | | | 24 | | 20 | |
| 800.6 | 12.0 | SH | SHALE, gray, dry, hard. (Decorah Shale Bedrock) | 50/5" | | 17 | |
| | | | | 50/3" | | 17 | LL=55, PL=26, PI=29 |
| 795.6 | 17.0 | LS | LIMESTONE, Carimona Member, dark gray, very dense. (Platteville Formation) | 50/1" | | | |
| | | | | 50/2" | | | |
| 790.0 | 22.6 | | END OF BORING. | 50/1" | | | |

Water not observed while drilling.

Boring immediately backfilled with bentonite grout.

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

**BRAUN℠ INTERTEC**

# LOG OF BORING

| Braun Project B1806527.00<br>GEOTECHNICAL EVALUATION<br>Project Paul - Infrastructure Phase<br>966 Mississippi River Boulevard South<br>Saint Paul, Minnesota | BORING: **ST-80**<br>LOCATION: N: 145184.635 E: 548328.304. See attached sketch |
|---|---|

| DRILLER: J. Tatro | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/8/19** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 813.2 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 813.0 | 0.2 | FILL | FILL: Silty Sand, fine- to medium-grained, trace Gravel, with roots, dark brown, moist. (Topsoil Fill) | | | | | |
| | | FILL | FILL: Clayey Sand, trace fibers and Shale fragments, with Gravel, dark brown and black, wet. | 14 | | 9 | | |
| | | | With waterbearing Sand seam at 5 feet. | 21 | ▽ | 13 | | |
| 806.2 | 7.0 | SC | CLAYEY SAND, with Gravel, gray, wet to moist, stiff. (Glacial Till) | 10 | | 14 | | |
| | | | | 12 | | 11 | 38 | $q_p$=2 1/2 tsf |
| 801.2<br>801.1 | 12.0<br>12.1 | LS | LIMESTONE, gray, dry, very dense. (Platteville Formation) | 50/1"* | | | | *1-inch recovery |
| | | | END OF BORING.<br><br>Water observed at 5 feet while drilling.<br><br>Boring immediately backfilled. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

| Braun Project B1806527.00<br>GEOTECHNICAL EVALUATION<br>Project Paul - Infrastructure Phase<br>966 Mississippi River Boulevard South<br>Saint Paul, Minnesota | BORING: ST-81<br>LOCATION: N: 145097.157 E: 548622.584. See attached sketch |
|---|---|

| DRILLER: J. Tatro | METHOD: 3 1/4" HSA, Autohammer | DATE: 8/8/19 | SCALE: 1" = 4' |
|---|---|---|---|

| Elev. feet 812.2 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 811.7 | 0.5 | FILL | FILL: Silty Sand, fine- to coarse-grained, trace roots and Gravel, dark brown, dry. | | | | |
| 808.2 | 4.0 | FILL | FILL: Poorly Graded Sand with Silt, fine- to coarse-grained, with Gravel and Cobbles, occasional Clay inclusions, brown, dry to moist. | 21 | | 7 | |
| 805.1 | 7.1 | FILL | FILL: Silty Sand, fine- to coarse-grained, with Gravel and Cobbles, dark brown and brown, moist. | 12* | | | *No sample recovery |
| | | | With Limestone fragments at 7 feet. | 50/1" | | | |
| | | | END OF BORING.<br><br>Auger met refusal at 7.1 feet.<br><br>Water not observed with 7.1 feet of hollow-stem auger in the ground.<br><br>Boring immediately backfilled. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

**BRAUN INTERTEC**

# LOG OF BORING

| **Braun Project B1806527.00**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul - Infrastructure Phase**<br>**966 Mississippi River Boulevard South**<br>**Saint Paul, Minnesota** | BORING: **ST-82**<br>LOCATION: N: 145014.498 E: 548376.889. See attached sketch |
|---|---|

| DRILLER: J. Tatro | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/8/19** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 813.2 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 811.2 | 2.0 | FILL | FILL: Silty Sand, fine- to coarse-grained, with Gravel, brown, dry. | | | | | |
| | | SC | CLAYEY SAND, trace Gravel, brown to 8 feet then gray, moist, medium to stiff. (Glacial Till) | 9 | | 12 | | $q_p$=1 1/2 tsf |
| | | | | 10 | | 14 | | $q_p$=2 tsf |
| | | | | 7 | | 14 | 42 | $q_p$=1 1/2 tsf |
| | | | | 9 | | | | |
| 801.0 | 12.2 | | With Limestone fragments at 12 feet. | 50/2" | | | | |
| | | | END OF BORING.<br><br>Auger met refusal at 12.2 feet.<br><br>Water not observed with 12.2 feet of hollow-stem auger in the ground.<br><br>Boring immediately backfilled. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

# BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-83**

LOCATION: N: 144892.991 E: 548667.923. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/19/19** | SCALE: **1" = 4'**

| Elev. feet 813.1 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 812.9 | 0.2 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, trace concrete pieces and roots, dark brown, moist. (Topsoil Fill) | | | | | |
| | | SC | CLAYEY SAND, with Shale fragments, brown to 7 feet then gray, moist to wet, medium to very stiff. (Glacial Till) | 20 | | 14 | | |
| | | | | 18 | | 12 | | |
| | | | | 17 | | 13 | | $q_p$=1 3/4 tsf |
| | | | | 8 | | 12 | 34 | |
| 801.1 | 12.0 | LS | LIMESTONE, Carimona Member, gray, very dense. (Platteville Formation) | 50/1" | | | | |
| | | | | 50/4" | | | | |
| | | | With Shale lenses at 17 1/2 feet. | 50/5" | | | | |
| | | | | 50/2" | | | | |
| 791.1 | 22.0 | LS | LIMESTONE, Magnolia Member, light gray, very dense. (Platteville Formation) | 50/1" | | | | |
| | | | | 50/2" | | | | |
| 785.5 | 27.6 | | END OF BORING. | 50/2" | | | | |
| | | | Water not observed while drilling. | | | | | |
| | | | Boring immediately backfilled with bentonite grout. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-84**

LOCATION: N: 144828.851 E: 548461.419. See attached sketch

DRILLER: J. Tatro | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/13/19** | SCALE: **1" = 4'**

| Elev. feet 812.6 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 812.4 | 0.2 | FILL | FILL: Silty Sand, fine-grained, Gravelly, with roots, dark brown, moist. (Topsoil Fill) | | | | | |
| 808.6 | 4.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, dark brown, moist. | 11 | | 3 | | |
| 805.6 | 7.0 | FILL | FILL: Poorly Graded Sand with Silt, fine- to medium-grained, trace Gravel and Lean Clay inclusions, brown, wet. | 10 | ▽ | 7 | 7 | |
| 802.4 | 10.2 | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, with Gravel, trace Shale fragments, Limestone fragments in tip of sampler, brown, wet. | 10 | | | | |
| | | | END OF BORING. | 55/2" | | | | |

Auger met refusal at 10.2 feet.

Water observed at 7 feet with 7 feet of hollow-stem auger in the ground.

Water not observed to cave-in depth of 4 1/2 feet immediately after withdrawal of auger.

Boring immediately backfilled.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-85**

LOCATION: N: 144753.088 E: 548262.265. See attached sketch

DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/20/19** | SCALE: **1" = 4'**

| Elev. feet 813.2 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 812.6 | 0.6 | FILL | FILL: Poorly Graded Sand with Silt, fine- to medium-grained, trace Gravel and Lean Clay inclusions, brown, moist. (Topsoil Fill) | | | | |
| 806.2 | 7.0 | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, with Gravel, trace Silty Sand seams, brown, moist. | 12 | ▽ | | |
| | | | | 20 | | 13 | |
| 804.2 | 9.0 | CL | LEAN CLAY, trace Limestone fragments, brown and gray, moist, very stiff. (Weathered Shale Bedrock) | 24 | | 23 | LL=43, PL=18, PI=25 |
| 802.2 | 11.0 | SH | SHALE, gray, moist, hard. (Decorah Shale Bedrock) | 68 | | 11 | |
| 795.6 | 17.6 | LS | LIMESTONE, Carimona Member, light gray to gray, slightly to moderately weathered, very soft to hard, thin to medium bedded, moderately to intensely fractured, Shale layer from 11.4 to 13.8 feet. (Platteville Formation) | | | | Run 1<br>Switched to coring at 11 feet. See Log of Coring for additional information.<br><br>Void - core barrel dropped last 4 inches.<br>Run 2 |
| 787.3 | 25.9 | LS | LIMESTONE, Magnolia Member, light gray, slightly to moderately weathered, moderately hard to hard, thin to massive bedded, moderately to intensely fractured, vuggy. (Platteville Formation) | | | | Run 3 |
| 781.8 | 31.4 | LS | LIMESTONE, Hidden Falls Member, gray, slightly to unweathered, hard, thin to thick bedded, moderately to highly fractured. (Platteville Formation) | | | | Run 4<br><br>Run 5 |
| | | LS | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

# LOG OF BORING

BRAUN INTERTEC

| | |
|---|---|
| **Braun Project B1806527.00**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul - Infrastructure Phase**<br>**966 Mississippi River Boulevard South**<br>**Saint Paul, Minnesota** | BORING: **ST-85 (cont.)**<br>LOCATION: N: 144753.088 E: 548262.265. See attached sketch |

| DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/20/19** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 781.2 | Depth feet 32.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| | | | LIMESTONE, Mifflin Member, light gray, unweathered to slightly weathered, hard, thin bedded, slightly to intensely fractured. (Platteville Formation) *(continued)* | | | | Run 6<br>Run 7 |
| 770.0 | 43.2 | LS | LIMESTONE, Pecatonica Member, gray, unweathered, hard, medium bedded, moderately fractured, vuggy. (Platteville Formation) | | | | |
| 769.2 | 44.0 | SH | SHALE, gray, slightly to highly weathered, very soft to soft, thin bedded, highly to intensely fractured. (Glenwood Formation)<br>Shaly Sandstone at 47 feet. | | | | Run 8<br>Run 9 |
| 763.5 | 49.7 | SS | SANDSTONE, yellow, light brown to white, moderately to highly weathered, very soft, fine- to very fine-grained, highly to intensely fractured. (St. Peter Sandstone Formation) | | | | Run 10<br>Run 11<br>Run 12 |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

| Braun Project B1806527.00<br>GEOTECHNICAL EVALUATION<br>Project Paul - Infrastructure Phase<br>966 Mississippi River Boulevard South<br>Saint Paul, Minnesota | BORING: ST-85 (cont.)<br>LOCATION: N: 144753.088 E: 548262.265. See attached sketch |
|---|---|

| DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: 8/20/19 | SCALE: 1" = 4' |
|---|---|---|---|

| Elev. feet 749.2 | Depth feet 64.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 742.2 | 71.0 | | SANDSTONE, yellow, light brown to white, moderately to highly weathered, very soft, fine- to very fine-grained, highly to intensely fractured. (St. Peter Sandstone Formation) *(continued)* | | | | Run 13 |
| | | | END OF BORING.<br><br>Auger met refusal at 11 feet.<br><br>Switched to coring at 11 feet.<br><br>Water observed at 4 1/2 feet with 7 1/2 feet of hollow-stem auger in the ground.<br><br>Water observed at 6 feet with 11 feet of hollow-stem auger in the ground.<br><br>Boring immediately backfilled with bentonite grout. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-85 (cont.)**

LOCATION: N: 144753.088 E: 548262.265. See attached sketch

DATE: **8/20/19** SCALE: **1" = 1'**

| Elev. feet 802.2 | Depth feet 11.0 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 802.2 | 11.0 | LIMESTONE, Carimona Member, light gray to gray, slightly to moderately weathered, very soft to hard, thin to medium bedded, moderately to intensely fractured, Shale layer from 11.4 to 13.8 feet. (Platteville Formation) | 3,720 | 1 3/4 | 120 | 100 | 100 | 52 | Run 1 Carimona Member |
| | | | | 1 3/4 | | | | | |
| | | | | 1 3/4 | | | | | |
| | | | | | 160 | | | | |
| | | | | 1 3/4 | | | | | |
| | | | | 1 3/4 | | | | | Core barrel dropped last 4 inches. |

BRAUN INTERTEC

*Continued Next Page*

NOTES:

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-85 (cont.)**

LOCATION: N: 144753.088 E: 548262.265. See attached sketch

DATE: **8/20/19** SCALE: **1" = 1'**

| Elev. feet 797.2 | Depth feet 16.0 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | LIMESTONE, Carimona Member, light gray to gray, slightly to moderately weathered, very soft to hard, thin to medium bedded, moderately to intensely fractured, Shale layer from 11.4 to 13.8 feet. (Platteville Formation) *(continued)* | 3,720 | 2 1/2 | 120 | 100 | 95 | 81 | Run 2 |
| | | | | | 160 | | | | |
| | | | | 2 1/4 | | | | | |
| 795.6 | 17.6 | LIMESTONE, Magnolia Member, light gray, slightly to moderately weathered, moderately hard to hard, thin to massive bedded, moderately to intensely fractured, vuggy. (Platteville Formation) | | | | | | | Magnolia Member |
| | | | | 2 1/4 | | | | | |
| | | | | 2 1/4 | | | | | |
| | | | | 2 1/4 | | | | | |

BRAUN INTERTEC

*Continued Next Page*

NOTES:

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-85 (cont.)**

LOCATION: N: 144753.088 E: 548262.265. See attached sketch

DATE: **8/20/19** SCALE: **1" = 1'**

| Elev. feet 792.2 | Depth feet 21.0 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | LIMESTONE, Magnolia Member, light gray, slightly to moderately weathered, moderately hard to hard, thin to massive bedded, moderately to intensely fractured, vuggy. (Platteville Formation) *(continued)* | 3,720 | 2 1/4 | 120 | 100 | 100 | 80 | Run 3 |
| | | | | 2 1/4 | | | | | |
| | | | | 2 | | | | | |
| | | | | 2 | | | | | |
| | | | | 1 1/2 | | | | | |
| 787.3 | 25.9 | | | | | | | | |

*Continued Next Page*

NOTES:

BRAUN INTERTEC

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-85 (cont.)**

LOCATION: N: 144753.088 E: 548262.265. See attached sketch

DATE: **8/20/19** SCALE: **1" = 1'**

| Elev. feet 787.2 | Depth feet 26.0 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | LIMESTONE, Hidden Falls Member, gray, slightly to unweathered, hard, thin to thick bedded, moderately to highly fractured. (Platteville Formation) *(continued)* | 3,720 | 2 1/4 | 120 | 100 | 100 | 81 | Run 4 Hidden Falls Member |
| | | | | | 140 | | | | |
| | | | | 2 1/2 | | | | | |
| | | | | 3 | | | | | |
| | | | | 2 1/2 | | | | | |
| | | | | 2 | | | | | |

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BRAUN INTERTEC

LOG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN_V8 (See Descriptive Terminology sheet for explanation of abbreviations)

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-85 (cont.)**

LOCATION: N: 144753.088 E: 548262.265. See attached sketch

DATE: **8/20/19** SCALE: **1" = 1'**

| Elev. feet 782.2 | Depth feet 31.0 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | | 3,720 | 2 1/2 | 120 | 100 | 100 | 93 | Run 5 |
| 781.8 | 31.4 | LIMESTONE, Mifflin Member, light gray, unweathered to slightly weathered, hard, thin bedded, slightly to intensely fractured. (Platteville Formation) | | | 160 | | | | Mifflin Member |
| | | | | 3 | | | | | |
| | | | | 2 1/2 | | | | | |
| | | | | 2 3/4 | | | | | |
| | | | | 2 1/4 | | | | | |

*Continued Next Page*

NOTES:

BRAUN INTERTEC

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-85 (cont.)**

LOCATION: N: 144753.088 E: 548262.265. See attached sketch

DATE: **8/20/19** SCALE: **1" = 1'**

| Elev. feet 777.2 | Depth feet 36.0 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | LIMESTONE, Mifflin Member, light gray, unweathered to slightly weathered, hard, thin bedded, slightly to intensely fractured. (Platteville Formation) *(continued)* | 3,720 | 2 3/4 | 120 | 100 | 98 | 90 | Run 6 |
| | | | | | 160 | | | | |
| | | | | 2 3/4 | | | | | |
| | | | | 2 3/4 | | | | | |
| | | | | 2 3/4 | | | | | |
| | | | | 2 1/2 | | | | | |

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NOTES:

BRAUN INTERTEC

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-85 (cont.)**

LOCATION: N: 144753.088 E: 548262.265. See attached sketch

DATE: **8/20/19** SCALE: **1" = 1'**

| Elev. feet 772.2 | Depth feet 41.0 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | LIMESTONE, Mifflin Member, light gray, unweathered to slightly weathered, hard, thin bedded, slightly to intensely fractured. (Platteville Formation) *(continued)* | 3,720 | 1 3/4 | 120 | 100 | 100 | 65 | Run 7 |
| | | | | | 160 | | | | |
| | | | | 2 1/4 | | | | | |
| | | | | 2 1/2 | | | | | |
| 770.0 | 43.2 | LIMESTONE, Pecatonica Member, gray, unweathered, hard, medium bedded, moderately fractured, vuggy. (Platteville Formation) | | | | | | | Pecatonica Member |
| 769.2 | 44.0 | SHALE, gray, slightly to highly weathered, very soft to soft, thin bedded, highly to intensely fractured. (Glenwood Formation) | | 2 1/2 | | | | | |
| | | | | 1 3/4 | | | | | |

*Continued Next Page*

NOTES:

BRAUN INTERTEC

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-85 (cont.)**

LOCATION: N: 144753.088 E: 548262.265. See attached sketch

DATE: **8/20/19** SCALE: **1" = 1'**

| Elev. feet 767.2 | Depth feet 46.0 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | SHALE, gray, slightly to highly weathered, very soft to soft, thin bedded, highly to intensely fractured. (Glenwood Formation) *(continued)* | 3,720 | 2 1/4 | 120 | 100 | 72 | 25 | Run 8 |
| | | | | | 160 | | | | |
| | | Shaly Sandstone at 47 feet. | | 1/4 | | | | | |
| | | | | | | | | | Run 9 |
| | | | | 1 3/4 | | | | | |
| | | | | 1/2 | | | | | |
| 763.5 | 49.7 | | | | | | | | |
| | | SANDSTONE, yellow, light brown to white, moderately to highly weathered, very soft, fine- to very fine-grained, highly to intensely fractured. (St. Peter Sandstone Formation) | | 1/2 | | | | | |

*Continued Next Page*

NOTES:

BRAUN INTERTEC

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-85 (cont.)**

LOCATION: N: 144753.088 E: 548262.265. See attached sketch

DATE: **8/20/19** SCALE: **1" = 1'**

| Elev. feet 762.2 | Depth feet 51.0 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | SANDSTONE, yellow, light brown to white, moderately to highly weathered, very soft, fine- to very fine-grained, highly to intensely fractured. (St. Peter Sandstone Formation) *(continued)* | 2,325 | 1/2 | 120 | 100 | 93 | 7 | Run 10 |
| | | | | 1/2 | | | | | |
| | | | | 1/2 | | | | | |
| | | | | 1/2 | | | | | |
| | | | | 3/4 | | | | | |

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NOTES:

BRAUN INTERTEC

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN_V8_CURRENT.GDT 11/27/19 13:45

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-85 (cont.)**

LOCATION: N: 144753.088 E: 548262.265. See attached sketch

DATE: **8/20/19** SCALE: **1" = 1'**

| Elev. feet 757.2 | Depth feet 56.0 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | SANDSTONE, yellow, light brown to white, moderately to highly weathered, very soft, fine- to very fine-grained, highly to intensely fractured. (St. Peter Sandstone Formation) *(continued)* | 2,325 | 1 1/4 | 120 | 100 | 90 | 8 | Run 11 |
| | | | | 3/4 | | | | | |
| | | | | 1/2 | | | | | |
| | | | | 12 | | | | | |
| | | | | 3/4 | | | | | |

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NOTES:

BRAUN INTERTEC

LOG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN_V8_CURRENT.GDT 11/27/19 14:19

(See Descriptive Terminology sheet for explanation of abbreviations)

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-85 (cont.)**

LOCATION: N: 144753.088 E: 548262.265. See attached sketch

DATE: **8/20/19** SCALE: **1" = 1'**

| Elev. feet 752.2 | Depth feet 61.0 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | SANDSTONE, yellow, light brown to white, moderately to highly weathered, very soft, fine- to very fine-grained, highly to intensely fractured. (St. Peter Sandstone Formation) *(continued)* | 2,325 | 1 1/4 | 120 | 100 | 92 | 8 | Run 12 |
| | | | | 1 1/2 | | | | | |
| | | | | 1 1/4 | | | 100 | | |
| | | | | 3/4 | | | | | |
| | | | | 2 | | | | | |

*Continued Next Page*

NOTES:

BRAUN INTERTEC

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-85 (cont.)**

LOCATION: N: 144753.088 E: 548262.265. See attached sketch

DATE: **8/20/19** SCALE: **1" = 1'**

| Elev. feet 747.2 | Depth feet 66.0 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | SANDSTONE, yellow, light brown to white, moderately to highly weathered, very soft, fine- to very fine-grained, highly to intensely fractured. (St. Peter Sandstone Formation) *(continued)* | 2,325 | 1 | 140 | 100 | 75 | 14 | Run 13 |
| | | | | 3/4 | | | | | |
| | | | | 1 1/4 | | | | | |
| | | | | 1 1/4 | | | | | |
| | | | | 3/4 | | | | | |
| 742.2 | 71.0 | END OF CORING AT 71 feet. | | | | | | | |

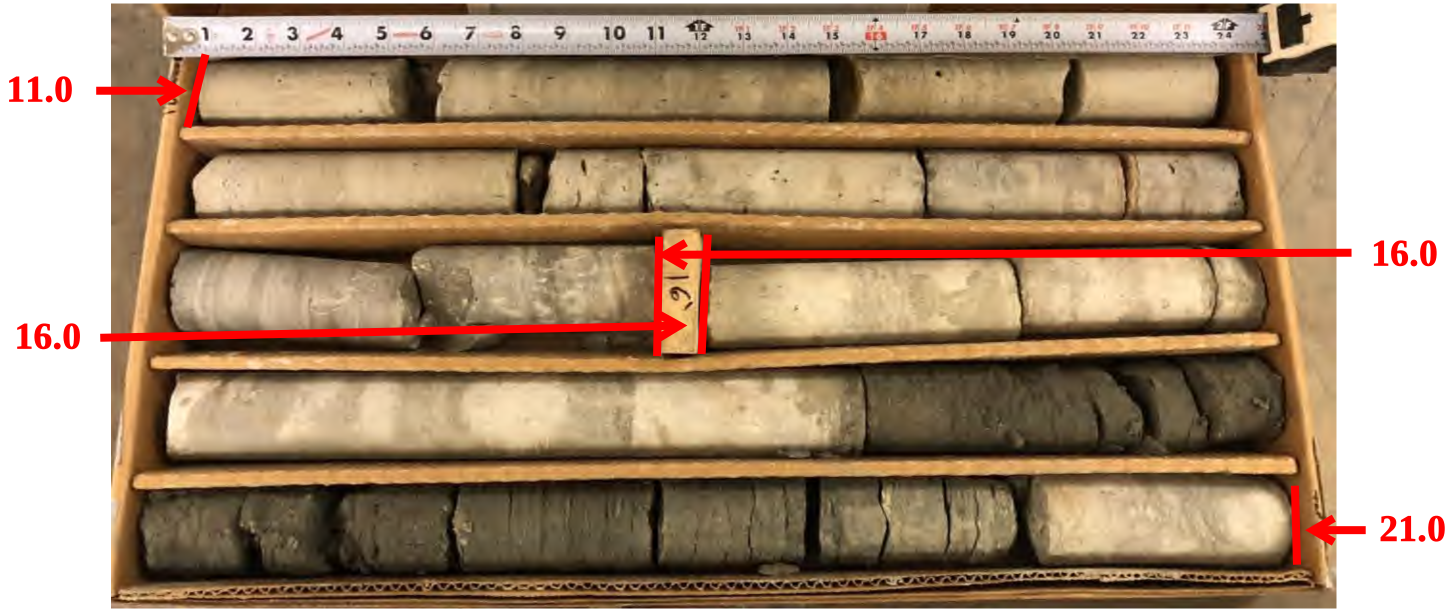
BRAUN INTERTEC

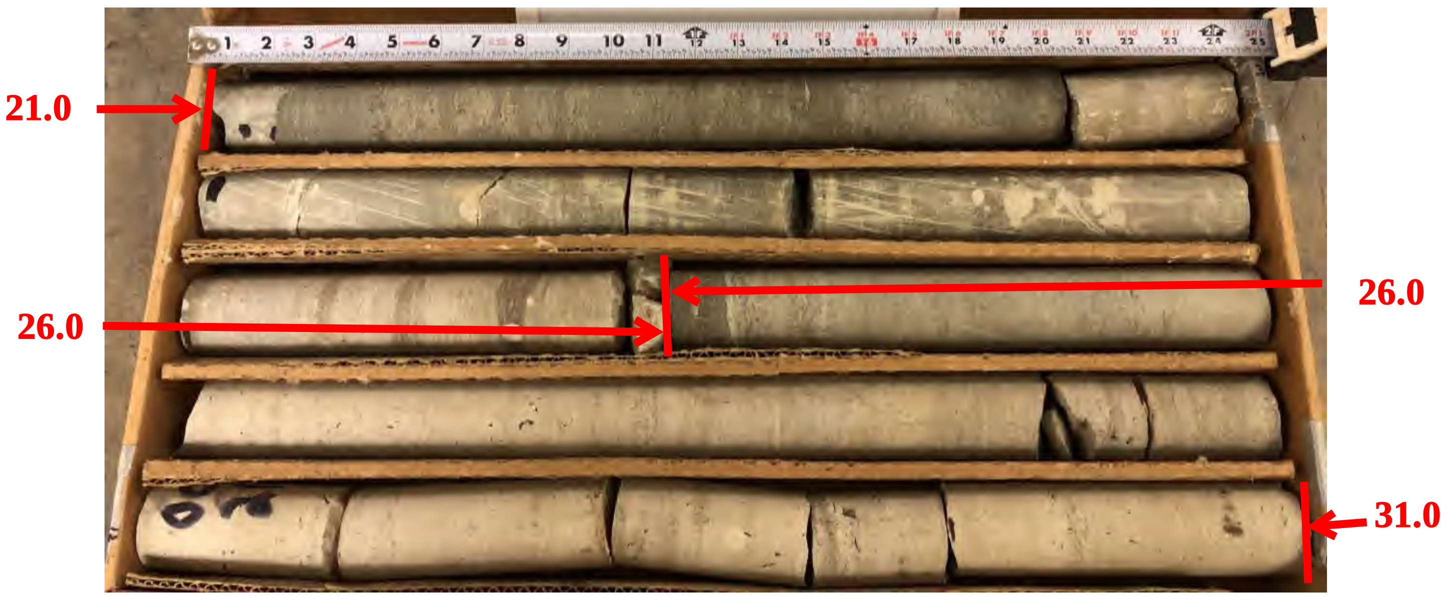
NOTES:

BRAUN INTERTEC
The Science You Build On.

# Photograph of Rock Cores
# Project Paul
# B1806527.00

## ST-85




NOTE: Cores run from left to right and top to bottom. Each row is 24 inches long.

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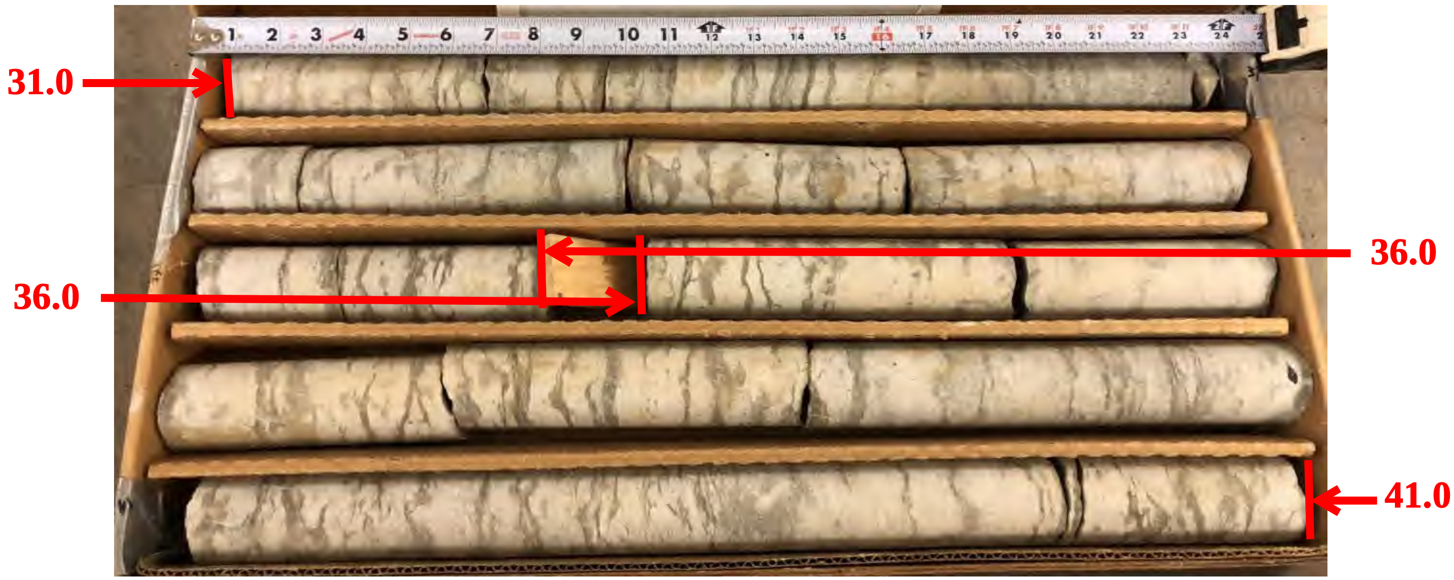
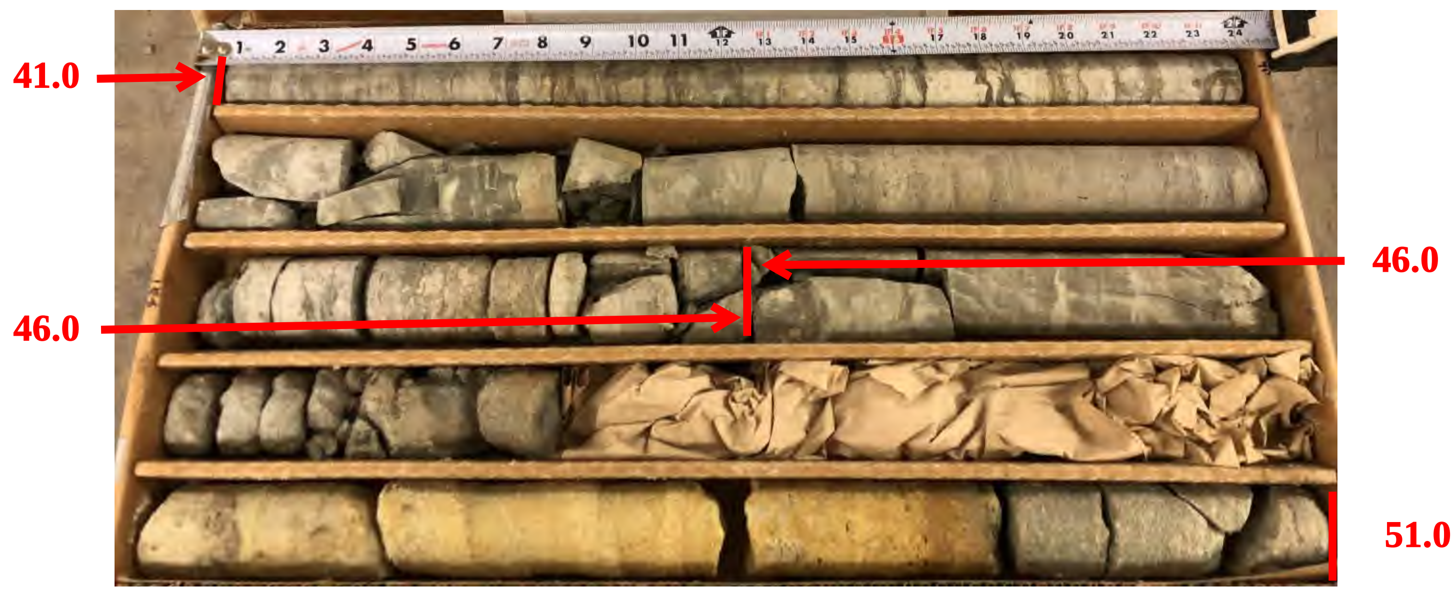
The Science You Build On.

**Photograph of Rock Cores**
**Project Paul**
**B1806527.00**

# ST-85




NOTE: Cores run from left to right and top to bottom. Each row is 24 inches long.

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The Science You Build On.

**Photograph of Rock Cores**
**Project Paul**
**B1806527.00**

# ST-85


NOTE: Cores run from left to right and top to bottom. Each row is 60 inches long.

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-86**

LOCATION: N: 144721.698 E: 548717.464. See attached sketch

DRILLER: J. Tatro | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/13/19** | SCALE: **1" = 4'**

| Elev. feet 811.3 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 811.0 | 0.3 | FILL | FILL: Silty Sand, fine- to medium-grained, with roots, trace Gravel, dark brown, moist. (Topsoil Fill) | | | | |
| | | FILL | FILL: Clayey Sand, trace roots and Limestone fragments, with Shale inclusions and Gravel, dark brown, moist. | 19 | | 12 | |
| | | | | 10 | | 10 | |
| | | | | 10* | | | *No recovery |
| 802.3 | 9.0 | LS | WEATHERED LIMESTONE, gray, dry, very dense. (Platteville Formation) | 50/2" | | | *3-inch recovery |
| 801.6 | 9.7 | | END OF BORING.<br><br>Auger met refusal at 9.7 feet.<br><br>Water not observed while drilling.<br><br>Boring immediately backfilled. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-87**

LOCATION: N: 144650.44 E: 548512.173. See attached sketch

| DRILLER: J. Tatro | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/13/19** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 811.9 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 811.6 | 0.3 | FILL | FILL: Silty Sand, fine- to medium-grained, trace Gravel, concrete pieces and Shale inclusions, with roots, dark brown, moist. (Topsoil Fill) | | | | |
| 807.9 | 4.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with Limestone fragments and concrete pieces, trace Shale inclusions, brown, moist. | 18 | | 10 | |
| 804.9 | 7.0 | FILL | FILL: Sandy Lean Clay, with Shale fragments, trace Gravel, non- to slightly organic, brown, dark brown and black, moist. | 11 | | 18 | |
| 802.9 | 9.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, trace Shale inclusions and pieces of concrete, brown and dark brown, moist. | 15 | | 12 | |
| | | FILL | FILL: Sandy Lean Clay, with Shale fragments and Gravel, non- to slightly organic, brown, gray and black, moist. | 17 | | 14 | |
| | | | Concrete chunks at 13 feet. | 20 | | 15 | |
| 796.3 | 15.6 | | | 52/7" | | 23 | |
| | | | END OF BORING.<br>Auger met refusal at 15.6 feet.<br>Water not observed while drilling.<br>Boring immediately backfilled with bentonite grout. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-88**

LOCATION: N: 144564.137 E: 548787.011. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/23/19** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 812.8 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 812.6 | 0.2 | FILL | FILL: Silty Sand, fine- to medium-grained, with roots and Gravel, brown, dry. (Topsoil Fill) | | | | | |
| 808.8 | 4.0 | FILL | FILL: Silty Sand, Gravelly, brown, wet. | 32 | | 8 | 12 | |
| 805.8 | 7.0 | FILL | FILL: Poorly Graded Gravel, with Cobbles, brown, wet. | 24* | ▽ | | | *6-inch recovery |
| 803.8 | 9.0 | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, brown, wet. | 14* | | | | *1-inch recovery |
| 800.8 | 12.0 | CL | LEAN CLAY, with Shale seams, trace Sand lenses, gray, moist, medium. (Glacial Till) | 7 | | 13 | | |
| 799.8 | 13.0 | CH | FAT CLAY, gray, moist, stiff. (Weathered Shale Bedrock) | 14 | | 20 | | |
| 795.8 | 17.0 | SH | SHALE, gray, moist, hard. (Decorah Shale Bedrock) With Limestone fragments at 14 1/2 feet. | 50/1"* | | | | *1-inch recovery |
| 793.3 | 19.5 | LS | LIMESTONE, Carimona Member, trace Shale lenses, dark gray, very dense. (Platteville Formation) | 50/1"* | | | | *1-inch recovery |
| 789.7 | 23.1 | LS | LIMESTONE, Magnolia Member, light gray, very dense. (Platteville Formation) | 50/1"* | | | | *1-inch recovery |
| | | | | 50/2"* | | | | *7-inch recovery |

END OF BORING.

Water observed at 6 feet with 7 feet of hollow-stem auger in the ground.

Water not observed with 22 feet of hollow-stem auger in the ground.

Boring immediately backfilled with cement.

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-89**

LOCATION: N: 144224.243 E: 548906.711. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/12/19** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 810.3 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 809.8 | 0.5 | FILL | FILL: Silty Sand, fine- to medium-grained, with roots and Gravel, dark brown, moist. (Topsoil Fill) | | | | | |
| 803.3 | 7.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, with Shale and Fat Clay layers and seams, dark brown, brown and gray, moist. | 8 | | 12 | | |
| | | | | 5 | | 14 | 26 | |
| 802.3 | 8.0 | SP | POORLY GRADED SAND, fine- to coarse-grained, with Gravel, brown, wet, loose. (Terrace Deposit) | 9 | | 19 | | |
| 801.0 | 9.3 | CH | FAT CLAY, with Gravel, gray, wet. (Weathered Shale Bedrock) 4-inch Limestone layer at 9 feet. | | | | | Run 1 Switched to coring at 9 feet. See Log of Coring for additional information. |
| 798.5 | 11.8 | SH | SHALE, gray and olive, unweathered to slightly weathered, soft, thin bedded, intensely fractured. (Decorah Shale Formation) | | | | | |
| 795.1 | 15.2 | LS | LIMESTONE, Carimona Member, gray to dark gray, moderately to highly weathered, soft to hard, highly to intensely fractured. (Platteville Formation) With 4-inch Gravel and Shale layer at 13.2 feet. | | | | | Run 2 |
| 788.8 | 21.5 | LS | LIMESTONE, Magnolia Member, light gray, slightly to highly weathered, moderately hard to hard, thick to massive bedded, moderately to intensely fractured, vuggy. (Platteville Formation) | | | | | Run 3 |
| 786.3 | 24.0 | LS | LIMESTONE, Hidden Falls Member, gray to dark gray, slightly to moderately weathered, moderately hard to hard, thin to medium bedded, moderately to intensely fractured. (Platteville Formation) | | | | | |
| | | | END OF BORING. Auger met refusal at 9 feet. Switched to coring at 9 feet. Water not observed while drilling. Boring immediately backfilled with bentonite grout. | | | | | |

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-89 (cont.)**

LOCATION: N: 144224.243 E: 548906.711. See attached sketch

DATE: **8/12/19** SCALE: **1" = 1'**

| Elev. feet 801.3 | Depth feet 9.0 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 801.0 | 9.3 | FAT CLAY, with Gravel, gray, wet. (Weathered Shale Bedrock) *(continued)* 4-inch Limestone layer at 9 feet. | 4,650 | 2 1/2 | | | 92 | 0 | Run 1 |
| | | SHALE, gray and olive, unweathered to slightly weathered, soft, thin bedded, intensely fractured. (Decorah Shale Formation) | | 2 3/4 | | | | | |
| | | | | 2 1/4 | | | | | |
| 798.5 | 11.8 | LIMESTONE, gray to dark gray, moderately to highly weathered, soft to hard, highly to intensely fractured. (Platteville Formation) | | 2 1/2 | | | | | Carimona Member |
| | | With 4-inch Gravel and Shale layer at 13.2 feet. | | 2 1/2 | | | | | |

*Continued Next Page*

NOTES:

BRAUN INTERTEC

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-89 (cont.)**

LOCATION: N: 144224.243 E: 548906.711. See attached sketch

DATE: **8/12/19** SCALE: **1" = 1'**

| Elev. feet 796.3 | Depth feet 14.0 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | LIMESTONE, gray to dark gray, moderately to highly weathered, soft to hard, highly to intensely fractured. (Platteville Formation) *(continued)* | 4.650 | 3 3/4 | | | 93 | 59 | Run 2 |
| 795.1 | 15.2 | | | 4 | | | | | |
| | | LIMESTONE, light gray, slightly to highly weathered, moderately hard to hard, thick to massive bedded, moderately to intensely fractured, vuggy. (Platteville Formation) | | | | | | | Magnolia Member |
| | | | | 1 | | | | | |
| | | | | 1 | | | | | |
| | | | | 1 | | | | | |

LOG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN_V8_CURRENT.GDT 10/31/19 14:16

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC

*Continued Next Page*

NOTES:

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-89 (cont.)**

LOCATION: N: 144224.243 E: 548906.711. See attached sketch

DATE: **8/12/19** SCALE: **1" = 1'**

| Elev. feet 791.3 | Depth feet 19.0 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | LIMESTONE, light gray, slightly to highly weathered, moderately hard to hard, thick to massive bedded, moderately to intensely fractured, vuggy. (Platteville Formation) *(continued)* | 4,650 | 1 3/4 | | | 100 | 79 | Run 3 |
| | | | | 1 3/4 | | | | | |
| | | | | 1 3/4 | | | | | |
| 788.8 | 21.5 | LIMESTONE, gray to dark gray, slightly to moderately weathered, moderately hard to hard, thin to medium bedded, moderately to intensely fractured. (Platteville Formation) | | | | | | | Hidden Falls Member |
| | | | | 2 | | | | | |
| | | | | 1 3/4 | | | | | |
| 786.3 | 24.0 | END OF CORING. | | | | | | | |

NOTES:

BRAUN INTERTEC

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The Science You Build On.

# Photograph of Rock Cores
## Project Paul
## B1806527.00

## ST-89


NOTE: Cores run from left to right and top to bottom in each column. Each row is 24 inches long.

**BRAUN**[SM]
INTERTEC

# LOG OF BORING



**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-90**

LOCATION: N: 144154.378 E: 548709.074. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/14/19** | SCALE: **1" = 4'**

| Elev. feet 811.7 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 811.6 | 0.1 | FILL | FILL: Silty Sand, fine- to medium-grained, with roots, brown, moist. (Topsoil Fill) | | | | | |
| | | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, trace concrete pieces and Lean Clay inclusions, moist. | 10 | | 9 | 14 | |
| | | | | 9* | | | | *No recovery |
| 804.7 | 7.0 | FILL | FILL: Fat Clay, trace Gravel, with Sandy Lean Clay seams and layers, trace Sand seams, gray and olive, moist. | 5 | | 14 | | |
| | | | Concrete pieces at 10 feet, 3 inches. | 50/5" | | | | *3-inch recovery |
| 799.7 | 12.0 | SH | SHALE, gray to olive, moist, hard. (Decorah Shale Bedrock) | 50/4" | | 20 | | |
| 797.7 | 14.0 | LS | LIMESTONE, Carimona Member, dark gray, very dense. (Platteville Formation) | 50/0" | | | | |
| 795.2 | 16.5 | LS | LIMESTONE, Carimona Member, dark gray, slightly weathered, hard, thin bedded, highly fractured. (Platteville Formation) | | | | | Run 1 Switched to coring at 16.5 feet. See Log of Coring for additional information. |
| 794.8 | 16.9 | LS | LIMESTONE, Magnolia Member, light gray, slightly to moderately weathered, moderately hard to hard, medium to thick bedded, highly to slightly fractured, vuggy. (Platteville Formation) Partially filled vug at 20.4 feet. | | | | | Run 2 |
| 787.8 | 23.9 | LS | LIMESTONE, Hidden Falls Member, gray, slightly weathered, moderately hard to hard, thin bedded, moderately to intensely fractured. | | | | | |
| 786.2 | 25.5 | | END OF BORING. | | | | | |

Auger met refusal at 16.5 feet.

Switched to coring at 16.5 feet.

Water not observed while drilling.

Boring immediately backfilled with bentonite grout.

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-90 (cont.)**

LOCATION: N: 144154.378 E: 548709.074. See attached sketch

DATE: **8/14/19** SCALE: **1" = 1'**

| Elev. feet 795.2 | Depth feet 16.5 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 795.2 | 16.5 | LIMESTONE, dark gray, slightly weathered, hard, thin bedded, highly fractured. (Platteville Formation) | 4,650 | 1 1/2 | | | 95 | 76 | Run 1 Carimona Member Magnolia Member |
| 794.8 | 16.9 | LIMESTONE, light gray, slightly to moderately weathered, moderately hard to hard, medium to thick bedded, highly to slightly fractured, vuggy. (Platteville Formation) | | 2 | | | | | |
| | | | | 1 1/2 | | | | | |
| | | | | 2 | | | | | |
| | | Partially filled vug at 20.4 feet. | | 2 1/4 | | | | | |

*Continued Next Page*

NOTES:

BRAUN INTERTEC

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-90 (cont.)**

LOCATION: N: 144154.378 E: 548709.074. See attached sketch

DATE: **8/14/19** SCALE: **1" = 1'**

| Elev. feet 790.2 | Depth feet 21.5 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | LIMESTONE, light gray, slightly to moderately weathered, moderately hard to hard, medium to thick bedded, highly to slightly fractured, vuggy. (Platteville Formation) *(continued)* | 4,650 | 2 1/4 | | | 94 | 77 | Run 2 |
| | | | | 3 | | | | | |
| | | | | 3 | | | | | |
| 787.8 | 23.9 | LIMESTONE, gray, slightly weathered, moderately hard to hard, thin bedded, moderately to intensely fractured. | | | | | | | Hidden Falls Member |
| | | | | 2 3/4 | | | | | |
| 786.2 | 25.5 | END OF CORING. | | | | | | | |

NOTES:

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**Photograph of Rock Cores**
**Project Paul**
**B1806527.00**

# ST-90


NOTE: Cores run from left to right and top to bottom. Each row is 24 inches long.

BRAUN INTERTEC

# LOG OF BORING

| Braun Project B1806527.00<br>GEOTECHNICAL EVALUATION<br>Project Paul - Infrastructure Phase<br>966 Mississippi River Boulevard South<br>Saint Paul, Minnesota | BORING: ST-91<br>LOCATION: N: 143800.233 E: 549057.514. See attached sketch |
|---|---|

| DRILLER: J. Tatro | METHOD: 3 1/4" HSA, Autohammer | DATE: 8/13/19 | SCALE: 1" = 4' |
|---|---|---|---|

| Elev. feet 810.7 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 810.5 | 0.2 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel and roots, dark brown, moist. (Topsoil Fill) | | | | |
| | | CH | FAT CLAY, gray, olive and brown, moist, stiff to very stiff. (Weathered Shale Bedrock) With Silt seam and trace Gravel at 2 1/2 feet. | 9 | | 14 | $q_p$=2 1/2 tsf |
| | | | | 20 | | 17 | A bag sample was collected from 2 to 6 feet from the offset borehole completed for lab testing. See appendix for test results. |
| 803.7 | 7.0 | SH | SHALE, gray, dry, hard. (Decorah Shale Bedrock) | 50/6" | | 18 | |
| 802.7 | 8.0 | | END OF BORING.<br><br>Auger met refusal at 8 feet.<br><br>Water not observed while drilling.<br><br>Boring immediately backfilled. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:21

# LOG OF BORING

BRAUN INTERTEC

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-92**

LOCATION: N: 143754.429 E: 548782.697. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/15/19** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 811.4 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 810.9 | 0.5 | FILL | FILL: Lean Clay, with roots, trace Gravel, dark brown and black, moist. (Topsoil Fill) | | | | | |
| 807.4 | 4.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, brown, moist. | 11 | | 9 | 18 | |
| 799.4 | 12.0 | CL | SANDY LEAN CLAY, with Gravel, gray, moist, stiff to very stiff. (Glacial Till) | 9 | | 14 | | |
| | | | | 10 | | | | *No recovery |
| | | | | 21 | | | | *No recovery |
| 794.2 | 17.2 | LS | LIMESTONE, Carimona Member, dark gray, very dense. (Platteville Formation) | 50/1" | | | | *1-inch recovery |
| | | | | 50/2" | | | | *2-inch recovery |
| 794.0 | 17.4 | LS | LIMESTONE, Magnolia Member, light gray, very dense. (Platteville Formation) | 50/5" | | | | *5-inch recovery |
| | | | END OF BORING. | | | | | |
| | | | Water not observed while drilling. | | | | | |
| | | | Boring immediately backfilled with bentonite grout. | | | | | |

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:22

BRAUN INTERTEC

# LOG OF BORING

## Braun Project B1806527.00
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-93**

LOCATION: N: 143462.553 E: 549080.02. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/15/19** | SCALE: **1" = 4'**

| Elev. feet 811.4 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 811.2 | 0.2 | FILL | FILL: Silty Sand, fine- to medium-grained, with roots, brown, moist. (Topsoil Fill) | | | | | |
| 807.4 | 4.0 | FILL | FILL: Silty Sand, fine- to medium-grained, trace Gravel, brown, moist. | 5* | | 12 | | *No recovery. |
| 804.4 | 7.0 | SC | CLAYEY SAND, with Silt seam and Gravel, trace Sand lenses, brown, moist, very stiff. (Glacial Till) | 20 | | 14 | 41 | $q_p$=2 1/4 tsf |
| | | | | | ▽ | | | |
| 799.4 | 12.0 | SC | CLAYEY SAND, with Gravel, with Shale lenses and seams, brown and gray, wet, hard to medium. (Glacial Till) | 31 | | 14 | 20 | LL=30, PL=16, PI=14 |
| | | | | 8 | | | | *No recovery |
| 794.4 | 17.0 | LS | LIMESTONE, Carimona Member, with Shale lenses and seams at 12 feet, dark gray, very dense. (Platteville Formation) | 50/2"* | | | | *1 1/2-inch recovery |
| | | | | 50/2"* | | | | *2-inch recovery |
| 794.3 | 17.1 | LS | LIMESTONE, Magnolia Member, light gray, trace vugs, very dense. (Platteville Formation) | 50/1"* | | | | *1-inch recovery |

END OF BORING.

Water observed at 7 feet with 7 feet of hollow-stem auger in the ground.

Water observed at 8 feet with 17.1 feet of hollow-stem auger in the ground.

Boring immediately backfilled with bentonite grout.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 1/20/20 08:36

BRAUN INTERTEC

# LOG OF BORING

| | |
|---|---|
| **Braun Project B1806527.00**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul - Infrastructure Phase**<br>**966 Mississippi River Boulevard South**<br>**Saint Paul, Minnesota** | BORING: **ST-94**<br>LOCATION: N: 144197.190 E: 549141.975. See attached sketch |

| DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/21/19** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 809.3 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 808.5 | 0.8 | FILL | FILL: Sandy Lean Clay, with roots, Shale fragments and Gravel, brown, moist. (Topsoil Fill) | | | | |
| 805.3 | 4.0 | FILL | FILL: Silty Sand, fine-grained, dark brown, moist. | 6 | | 17 | |
| 802.3 | 7.0 | CH | FAT CLAY, gray and brown, moist, stiff. (Weathered Shale Bedrock) | 9 | | 28 | $q_p$=3 tsf |
| 797.3 | 12.0 | SH | SHALE, trace Limestone fragments, gray, moist, hard. (Decorah Shale Bedrock) | 50/1"* | | | *1-inch recovery Only fragments of Limestone encountered in sample. |
| | | | | 50/5"* | | 8 | *5-inch recovery LL=55, PL=23, PI=32. California tube samples were taken from 9 to 11 feet from the offset borehole completed for lab testing. See appendix for test results. |
| 792.3 | 17.0 | LS | LIMESTONE, Carimona Member, dark gray, very dense. (Platteville Formation) | 50/1"* | | | *1-inch recovery |
| | | | | 50/2"* | | | *2-inch recovery |
| 789.7 | 19.6 | LS | LIMESTONE, Magnolia Member, trace vugs, light gray, very dense. (Platteville Formation) | 50/2"* | | | *2-inch recovery |
| | | | END OF BORING. | 50/1"* | | | *1-inch recovery |
| | | | Auger met refusal at 19.6 feet. | | | | |
| | | | Water not observed while drilling. | | | | |
| | | | Boring immediately backfilled with bentonite grout. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

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# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-95**

LOCATION: N: 144243.342 E: 549283.843. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/12/19** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 810.7 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 810.5 | 0.2 | FILL | FILL: Silty Sand, trace Gravel, with roots, dark brown, moist. (Topsoil Fill) | | | | | |
| 806.7 | 4.0 | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, with Gravel, brown, moist. | 17 | ▽ | 3 | | |
| 803.7 | 7.0 | FILL | FILL: Poorly Graded Sand with Silt, fine- to coarse-grained, trace Gravel, brown, wet. | 14 | | 9 | | See appendix for sieve analysis results. |
| 798.7 | 12.0 | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, with Gravel, brown, wet. | 27 | | | | |
| | | | | 6 | | 12 | 4 | |
| 796.1 | 14.6 | LS | LIMESTONE, Carimona Member, with Shale lenses and seams at 12 feet, brown and dark gray, moist, very dense. (Platteville Formation) | 50/5" | | | | Chemical odor at 12 feet. |
| | | | END OF BORING. | 50/1" | | | | |

Water observed at 2 feet with 7 feet of hollow-stem auger in the ground.

Water not observed with 15 feet of hollow-stem auger in the ground.

Water observed at 7 feet with a cave-in depth of 9 feet immediately after withdrawal of auger.

Boring immediately backfilled with bentonite grout.

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BRAUN INTERTEC

# LOG OF BORING

| | |
|---|---|
| **Braun Project B1806527.00**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul - Infrastructure Phase**<br>**966 Mississippi River Boulevard South**<br>**Saint Paul, Minnesota** | BORING: **ST-96**<br>LOCATION: N: 144359.905 E: 549706.493. See attached sketch |

| DRILLER: J. Tatro | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/13/19** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 810.2 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 809.6 | 0.6 | CONC | 7 1/2 inches of concrete. | | | | |
| 808.2 | 2.0 | FILL | FILL: Silty Sand, fine- to coarse-grained, with Gravel, brown, dry. | | | | |
| | | SH | SHALE, gray, dry, hard. (Decorah Shale Bedrock) | 48 | | 15 | |
| | | | | 90/6" | | 13 | |
| 802.3 | 7.9 | | | 50/3" | | 15 | LL=53, PL=25, PI=28 |

END OF BORING.

Auger met refusal at 7.9 feet.

Water not observed while drilling.

Boring immediately backfilled.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:22

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-97**

LOCATION: N: 144361.164 E: 550359.237. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **9/30/19** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 833.9 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 833.4 | 0.5 | FILL | FILL: Silty Sand, fine- to medium-grained, with roots, brown, moist. (Topsoil Fill) | | | | |
| 829.9 | 4.0 | FILL | FILL: Silty Sand, with Gravel and Fat Clay layers, trace Silt lenses, brown and gray, moist. | 17 | | | |
| 825.9 | 8.0 | CH | FAT CLAY, trace Silty Sand lenses and Limestone fragments, gray and brown, moist, very stiff. (Weathered Shale Bedrock) | 22 | | 22 | $q_p$=3 1/2 tsf |
| | | | | 72/9" | | 23 | |
| 813.5 | 20.4 | SH | SHALE, trace Limestone fragments, gray, moist to dry, hard. (Decorah Shale Bedrock) | 75/11" | | | |
| | | | | 96/11" | | 14 | |
| | | | | 95 | | 19 | |
| | | | | 50/5" | | | |
| | | | | 50/5" | | | |
| | | | END OF BORING. Water not observed while drilling. Water not observed to cave-in depth of 16 feet immediately after withdrawal of auger. Boring immediately backfilled with bentonite grout. | | | | |

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**BRAUN INTERTEC**

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-98**

LOCATION: N: 144371.391 E: 550540.353. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **9/30/19** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 836.3 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 835.8 | 0.5 | FILL | FILL: Silty Sand, fine- to medium-grained, trace Gravel, brown, moist. | | | | |
| 832.3 | 4.0 | FILL | FILL: Silty Sand, fine- to coarse-grained, with Gravel, brown, moist. | 21 | | 5 | |
| 829.3 | 7.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel and Silt lenses, trace Shale fragments, brown and gray, moist. | 21 | | | |
| 827.3 | 9.0 | FILL | FILL: Fat Clay, trace Gravel and Sand inclusions, gray and brown, moist. | 23 | | | |
| 822.3 | 14.0 | FILL | FILL: Fat Clay, trace Sand inclusions, Gravelly, with Limestone fragments and Shale fragments, gray and brown, moist. | 38<br>51 | ▽ | 8 | |
| 819.3 | 17.0 | FILL | FILL: Poorly Graded Gravel with Silt, fine- to coarse-grained, possible Cobbles, brown, wet. | 31 | | | |
| 815.3 | 21.0 | SP | POORLY GRADED SAND, fine- to medium-grained, trace Gravel, brown, wet, loose to medium dense. (Terrace Deposit) | 6<br>15 | | | |
| | | | END OF BORING.<br><br>Water observed at 14 feet with 15 feet of hollow-stem auger in the ground.<br><br>Water observed at 16 feet with 20 feet of hollow-stem auger in the ground.<br><br>Water not observed to cave-in depth of 10 feet immediately after withdrawal of auger.<br><br>Boring immediately backfilled with bentonite grout. | | | | |

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:22

BRAUN INTERTEC

# LOG OF BORING

| Braun Project B1806527.00<br>GEOTECHNICAL EVALUATION<br>Project Paul - Infrastructure Phase<br>966 Mississippi River Boulevard South<br>Saint Paul, Minnesota | BORING: **ST-99**<br>LOCATION: N: 144645.669 E: 549435.233. See attached sketch |
|---|---|

| DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/28/19** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 811.1 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 810.3 | 0.8 | PAV | 10 inches of aggregate base with concrete pieces. | | | | |
| | | FILL | FILL: Fat Clay, with Gravel and Silty Sand inclusions, gray and brown, moist. | 14 | | 23 | |
| | | | With concrete pieces at 5 feet. | 16 | | 20 | |
| | | | | 13* | | | *Sampler encountered Limestone. No recovery. |
| | | | | 50/1/8"* | | | *1/8-inch recovery |
| 799.1 | 12.0 | SH | SHALE, with Gravel, gray at 12.8 feet, dry, hard. (Decorah Shale Bedrock) | 50/6" | | 18 | |
| 798.0 | 13.1 | LS | LIMESTONE, Carimona Member, light gray to dark gray, slightly to moderately weathered, moderately hard to hard, medium to thin bedded, highly to intensely fractured. (Platteville Formation) | | | | Run 1<br>Switched to coring at 12.8 feet. See Log of Coring for additional information. |
| 794.1 | 17.0 | LS | LIMESTONE, Magnolia Member, light gray, slightly weathered, moderately hard to hard, massive bedded, intensely to highly fractured, vuggy. (Platteville Formation) | | | | Run 2 |
| 788.3 | 22.8 | | END OF BORING.<br><br>Auger met refusal at 12.8 feet.<br><br>Switched to coring at 12.8 feet.<br><br>Water not observed while drilling.<br><br>Boring immediately backfilled with bentonite grout. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-99 (cont.)**

LOCATION: N: 144645.669 E: 549435.233. See attached sketch

DATE: **8/28/19** SCALE: **1" = 1'**

| Elev. feet 798.3 | Depth feet 12.8 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | SHALE, with Gravel, gray at 12.8 feet, dry, hard. (Decorah Shale Bedrock) *(continued)* | 2,790 | 1 3/4 | 110 | 100 | 100 | 59 | Run 1 |
| 798.0 | 13.1 | LIMESTONE, Carimona Member, light gray to dark gray, slightly to moderately weathered, moderately hard to hard, medium to thin bedded, highly to intensely fractured. (Platteville Formation) | | | | | | | Carimona Member |
| | | | 4,650 | 1 1/2 | | | | | |
| | | | | 1 1/4 | 85 | | | | |
| | | | | 1 3/4 | | | | | |
| | | | | 1 3/4 | | | | | |
| 794.1 | 17.0 | LIMESTONE, Magnolia Member, light gray, slightly weathered, moderately hard to hard, massive bedded, intensely to highly fractured, vuggy. (Platteville Formation) | | | | | | | Magnolia Member |

**BRAUN** INTERTEC

*Continued Next Page*

NOTES:

# LOG OF CORING

| Braun Project B1806527.00<br>GEOTECHNICAL EVALUATION<br>Project Paul - Infrastructure Phase<br>966 Mississippi River Boulevard South<br>Saint Paul, Minnesota | CORING: **ST-99 (cont.)**<br>LOCATION: N: 144645.669 E: 549435.233. See attached sketch<br>DATE: 8/28/19 SCALE: 1" = 1' |
|---|---|

| Elev. feet 793.3 | Depth feet 17.8 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | LIMESTONE, Magnolia Member, light gray, slightly weathered, moderately hard to hard, massive bedded, intensely to highly fractured, vuggy. (Platteville Formation) *(continued)* | 4,650 | 1 3/4 | 120 | 100 | 100 | 99 | Run 2 |
| | | | | 1 3/4 | | | | | |
| | | | | 1 3/4 | | | | | |
| | | | | 1 3/4 | | | | | |
| | | | | 1 3/4 | 115 | | | | |
| 788.3 | 22.8 | END OF CORING. | | | | | | | |

NOTES:

BRAUN INTERTEC

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN_V8_CURRENT.GDT 11/27/19 11:49

BRAUN INTERTEC

The Science You Build On.

# Photograph of Rock Cores
# Project Paul
# B1806527.00

## ST-99


NOTE: Cores run from left to right and top to bottom. Each row is 60 inches long.

BRAUN℠ INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-100**

LOCATION: N: 145021.864 E: 549434.663. See attached sketch

DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/29/19** | SCALE: **1" = 4'**

| Elev. feet 813.4 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 812.6 | 0.8 | FILL | FILL: Sandy Lean Clay, trace roots and Shale/Gravel, dark brown, moist. (Topsoil Fill) | | | | |
| 808.9 | 4.5 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel and concrete pieces, dark brown, moist. Limestone fragments at 4 1/2 feet. | 31 | | 12 | |
| 807.4 | 6.0 | CH | FAT CLAY, with Limestone fragments, gray, moist. (Weathered Shale Bedrock) | 16 | | | |
| 798.5 | 14.9 | SH | SHALE, with Limestone fragments, gray, moist, hard. (Decorah Shale Formation) | 55 | | 17 | |
| | | | 5-inch Limestone layer at 10 feet. | 50 | | 12 | Refusal of hammer on Limestone at 10 feet. |
| | | | | 82 | | | |
| 796.4 | 17.0 | SH | SHALE, gray, slightly weathered, soft, thin bedded, intensely fractured. (Decorah Shale Formation) | | | | Run 1 Switched to coring at 14.9 feet. See Log of Coring for additional information. |
| 793.5 | 19.9 | LS | LIMESTONE, Carimona Member, light gray to gray, slightly to moderately weathered, moderately hard to hard, thin to medium bedded, moderately to highly fractured. (Platteville Formation) Shale lenses at 19 feet. | | | | |

END OF BORING.

Auger met refusal at 14.9 feet.

Switched to coring at 14.9 feet.

Water not observed while drilling.

Boring immediately backfilled with bentonite grout.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:23

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-100 (cont.)**

LOCATION: N: 145021.864 E: 549434.663. See attached sketch

DATE: **8/29/19** SCALE: **1" = 1'**

| Elev. feet 798.5 | Depth feet 14.9 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 798.5 | 14.9 | SHALE, gray, slightly weathered, soft, thin bedded, intensely fractured. (Decorah Shale Formation) | 4,185 | 1 3/4 | 120 | 100 | 93 | 48 | Run 1 |
| | | | | 1 3/4 | | | | | |
| 796.4 | 17.0 | LIMESTONE, Carimona Member, light gray to gray, slightly to moderately weathered, moderately hard to hard, thin to medium bedded, moderately to highly fractured. (Platteville Formation) | | 2 | | | | | Carimona Member |
| | | | | 1 3/4 | | | | | |
| | | Shale lenses at 19 feet. | | 1 1/2 | | | | | |
| 793.5 | 19.9 | END OF CORING. | | | | | | | |

NOTES:

BRAUN℠ INTERTEC

BRAUN INTERTEC
The Science You Build On.

**Photograph of Rock Cores**
**Project Paul**
**B1806527.00**

## ST-100

**14.9**  **19.9**

NOTE: Core runs from left to right. The row is 60 inches long.

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-101**

LOCATION: N: 144994.965 E: 549828.121. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/16/19** | SCALE: **1" = 4'**

| Elev. feet 832.3 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 831.8 | 0.5 | FILL | FILL: Silty Sand, fine- to medium-grained, with roots, brown, moist. (Topsoil Fill) | | | | |
| 828.3 | 4.0 | FILL | FILL: Sandy Lean Clay, non- to slightly organic, trace Gravel, with Shale and Limestone fragments, dark brown to black, moist. | 17 | | 13 | |
| 825.3 | 7.0 | CH | FAT CLAY, Gravelly with Sand seams, with Limestone fragments, gray and brown, moist, hard. (Weathered Shale Bedrock) | 35 | | | |
| 818.8 | 13.5 | SH | SHALE, gray, moist, hard. (Decorah Shale Bedrock) | 39 | | 18 | |
| | | | | 50/6" | | 10 | |
| | | | | | ▽ | | |
| | | | | 43 | | 23 | LL=52, PL=26, PI=26 |

END OF BORING.

Water observed at 12 feet with 12 feet of hollow-stem auger in the ground.

Water not observed to cave-in depth of 9 feet.

Boring immediately backfilled.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:23

BRAUN INTERTEC

# Braun Project B1806527.00

**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-102**

LOCATION: N: 145305.185 E: 550038.562. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: | SCALE: **1" = 4'**

| Elev. feet 855.6 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 854.5 | 1.1 | PAV | 5 inches of bituminous over 8 inches of aggregate base. | | | | |
| 848.6 | 7.0 | CH | FAT CLAY, brown and gray, moist, stiff to very stiff. (Weathered Shale Bedrock) | 12 | | 21 | |
| | | | | 19 | | 21 | |
| 829.6 | 26.0 | SH | SHALE, with occasional Limestone fragments, gray, dry to moist, hard. (Decorah Shale Bedrock) | 36 | | | |
| | | | | 70 | | 16 | |
| | | | | 48 | | | |
| | | | | 42 | | 16 | |
| | | | | 58 | | | |
| | | | | 50/5" | | 21 | LL=59, PL=28, PI=31 |
| | | | | 72 | | | |
| | | | | 69 | | 20 | |
| | | | END OF BORING. Water not observed while drilling. Boring immediately backfilled with cement. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:23

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-103**

LOCATION: N: 144651.798 E: 549163.033. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/9/19** | SCALE: **1" = 4'**

| Elev. feet 808.4 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 807.4 | 1.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, brown, dry. | | | | | |
| 803.4 | 5.0 | FILL | FILL: Poorly Graded Sand with Silt, fine- to coarse-grained, with Gravel, brown, moist to wet. | 17 | ▽ | 11 | 12 | |
| 801.4 | 7.0 | FILL | FILL: Clayey Sand, with Gravel, brown and dark brown, wet. | 7 | | 17 | | *Offset a couple of feet. Blind drilled to 7 feet and started sampling. |
| 800.4 | 8.0 | FILL | FILL: Silty Sand, fine-grained, slightly organic, black, wet. | *<br>11 | | 24 | | $q_p$=1.0 tsf<br>OC=4% |
| 797.9 | 10.5 | CH | FAT CLAY, trace fibers, gray and brown, moist, hard. (Weathered Shale Bedrock) | 50/1" | | 29 | | |
| 796.3 | 12.1 | SH | SHALE, with Silty Sand lenses and laminations, gray, moist, hard. (Decorah Shale Bedrock)<br>With Limestone fragments at 12.1 feet. | 50/1" | | | | |

END OF BORING.

Water observed at 7 feet with 7 1/2 feet of hollow-stem auger in the ground.

Water observed at 3 feet immediately after withdrawal of auger.

Boring immediately backfilled with bentonite grout.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:23

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-104**

LOCATION: N: 144867.988 E: 549116.362. See attached sketch

| DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: 8/8/19 | SCALE: 1" = 4' |
|---|---|---|---|

| Elev. feet 808.3 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 807.8 | 0.5 | FILL | FILL: Silty Sand, fine- to medium-grained, mixed with weathered Shale fragments, gray, dry. | | | | | |
| | | FILL | FILL: Clayey Sand, with Gravel and Limestone fragments, brown and dark brown, moist. | 12 | | 7 | 16 | |
| | | | | | ▽ | | | |
| | | | | 5 | | | | *Offset boring 5 feet to complete additional sampling from 6 1/2 to 11 feet. |
| 801.8 | 6.5 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, brown, moist. | * | | | | |
| 800.3 | 8.0 | CH | FAT CLAY, gray and brown, moist, medium. (Weathered Shale Bedrock) | 6 | | 8 | | $q_p$=0.75 tsf |
| 797.8 | 10.5 | SH | SHALE, with Silty Sand lenses and laminations, trace Limestone fragments, gray and brown, moist, hard. (Decorah Shale Bedrock) | 54 | | 29 | | |
| 797.3 | 11.0 | | END OF BORING. | | | | | |

Water observed at 4 1/2 feet with 4 1/2 feet of hollow-stem auger in the ground.

Boring immediately backfilled.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/27/19 09:29

BRAUN INTERTEC

# LOG OF BORING

(See Descriptive Terminology sheet for explanation of abbreviations)

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-105**

LOCATION: N: 145287.262 E: 549121.153. See attached sketch

| DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: 8/7/19 | SCALE: 1" = 4' |
|---|---|---|---|

| Elev. feet 812.6 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 812.1 | 0.5 | FILL | FILL: Silty Sand, fine- to medium-grained, mixed with Shale fragments, brown and gray, dry. | | | | | |
| | | FILL | FILL: Poorly Graded Sand with Silt, fine- to coarse-grained, trace Gravel to with Gravel, brown, moist to wet. | 25 | | 2 | 5 | |
| | | | | 13 | | | | |
| | | | | * 8 | ▽ | 16 | 5 | *Offset boring 5 feet to complete additional sampling from 7 to 12.1 feet. |
| 801.1 | 11.5 | | | 3 | | | | |
| 800.5 | 12.1 | SH | SHALE, gray, moist, hard. (Decorah Shale Bedrock) | 50/1"* | | | | *1-inch recovery |
| | | | END OF BORING. | | | | | |
| | | | Water observed at 7 feet with 7 feet of hollow-stem auger in the ground. | | | | | |
| | | | Water not observed to cave-in depth of 4 feet immediately after withdrawal of auger. | | | | | |
| | | | Boring immediately backfilled. | | | | | |

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/27/19 09:31

BRAUN℠ INTERTEC

# LOG OF BORING

| Braun Project B1806527.00<br>GEOTECHNICAL EVALUATION<br>Project Paul - Infrastructure Phase<br>966 Mississippi River Boulevard South<br>Saint Paul, Minnesota | BORING: **ST-106**<br>LOCATION: N: 145598.468 E: 549799.805. See attached sketch |
|---|---|

| DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: 8/27/19 | SCALE: 1" = 4' |
|---|---|---|---|

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 847.1 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 846.0 | 1.1 | PAV | 5 1/2 inches of bituminous over 8 inches of aggregate base. | | | | |
| 843.1 | 4.0 | CH | FAT CLAY, with Limestone fragments, olive and brown, moist, very stiff. (Weathered Shale Bedrock) | 27 | | 15 | |
| 824.9 | 22.2 | SH | SHALE, with occasional Limestone fragments, olive and brown to 7 1/2 feet then gray, dry, hard. (Decorah Shale Bedrock) | 64 | | | |
| | | | | 60 | | | |
| | | | Trace Silty Sand lenses at 10 feet. | 48 | ▽ | 25 | |
| | | | Moist from 10 to 15 feet. | | | | |
| | | | | 72 | | 23 | |
| | | | | 78 | | | |
| | | | | 89 | | | |
| | | | | 50/6" | | 17 | |
| | | | | 50/3" | | | |
| | | | END OF BORING.<br><br>Auger met refusal at 22.2 feet.<br><br>Water observed at 10 feet with 10 feet of hollow-stem auger in the ground.<br><br>Water observed at 15 feet with 15 feet of hollow-stem auger in the ground.<br><br>Boring immediately backfilled with bentonite grout. | | | | |

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:23

# LOG OF BORING

BRAUN INTERTEC

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-107**

LOCATION: N: 145601.425 E: 549530.201. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/21/19** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 832.8 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 832.6 | 0.2 | FILL | FILL: Silty Sand, fine- to medium-grained, trace roots, dark brown, dry. (Topsoil Fill) | | | | |
| 828.8 | 4.0 | SM | SILTY SAND, fine-grained, with Limestone fragments and Lean Clay lenses, brown, moist, medium dense. (Terrace Deposit) | 20 | | 9 | |
| 825.8 | 7.0 | CH | FAT CLAY, with Silty Sand lenses, trace Limestone fragments, brown and gray, medium. (Weathered Shale Bedrock) | 8 | | 20 | $q_p$=2 tsf |
| 814.9 | 17.9 | SH | SHALE, with Limestone fragments, gray, moist to dry, hard. (Decorah Shale Bedrock) | 32 | | 23 | |
| | | | | 50/5" | | 20 | |
| | | | | 84 | | 17 | |
| | | | | 61 | | 19 | |
| | | | | 50/5" | | | |

END OF BORING.

Water not observed while drilling.

Boring immediately backfilled with bentonite grout.

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:23

BRAUN INTERTEC

# LOG OF BORING

(See Descriptive Terminology sheet for explanation of abbreviations)

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-108**

LOCATION: N: 145596.542 E: 549222.764. See attached sketch

DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/16/19** | SCALE: **1" = 4'**

| Elev. feet 823.1 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 822.0 | 1.1 | PAV | 5 inches of bituminous over 8 inches of aggregate base. | | | | |
| 819.1 | 4.0 | SP-SM | POORLY GRADED SAND with SILT, fine- to medium-grained, with Gravel, brown to dark brown, moist, dense. (Terrace Deposit) | 32 | | | |
| 816.1 | 7.0 | CH | FAT CLAY, gray and brown, dry, very stiff. (Weathered Shale Bedrock) | 26 | | 22 | |
| 800.0 | 23.1 | SH | SHALE, gray, dry, hard. (Decorah Shale Bedrock) | 51 | | 15 | |
| | | | | 63 | | | |
| | | | | 54 | | | |
| | | | | 52 | | 18 | |
| | | | | 70 | | | |
| | | | | 89 | | | |
| 795.0 | 28.1 | LS | LIMESTONE, Carimona Member, slightly to moderately weathered, soft to hard, thin to medium bedded, moderately to intensely fractured. (Platteville Formation)<br>Shale layer from 25.6 to 27.5 feet. | | | | Run 1<br>Switched to coring at 23.1 feet. See Log of Coring for additional information. |
| | | | END OF BORING.<br>Auger met refusal at 23.1 feet.<br>Switched to coring at 23.1 feet.<br>Water not observed while drilling.* | | | | **Boring immediately backfilled with bentonite grout. |

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:23

# LOG OF CORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

CORING: **ST-108 (cont.)**

LOCATION: N: 145596.542 E: 549222.764. See attached sketch

DATE: **8/16/19** SCALE: **1" = 1'**

| Elev. feet 800.0 | Depth feet 23.1 | Description of Core | Bit Pressure (psi) | Rate of Advance (min/ft) | Water Press (psi) | Water Return (%) | Rec. % | RQD % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 800.0 | 23.1 | LIMESTONE, Carimona Member, slightly to moderately weathered, soft to hard, thin to medium bedded, moderately to intensely fractured. (Platteville Formation) | 3,488 | 1 3/4 | 45 | 100 | 96 | 46 | Run 1 Carimona Member |
| | | | 3,720 | 2 1/4 | | | | | |
| | | | | 2 1/4 | | | | | |
| | | Shale layer from 25.6 to 27.5 feet. | | | | | | | |
| | | | | 2 1/4 | | | | | |
| | | | | 2 1/4 | | | | | |
| 795.0 | 28.1 | END OF CORING AT 28.1 FEET. | | | | | | | |

BRAUN INTERTEC

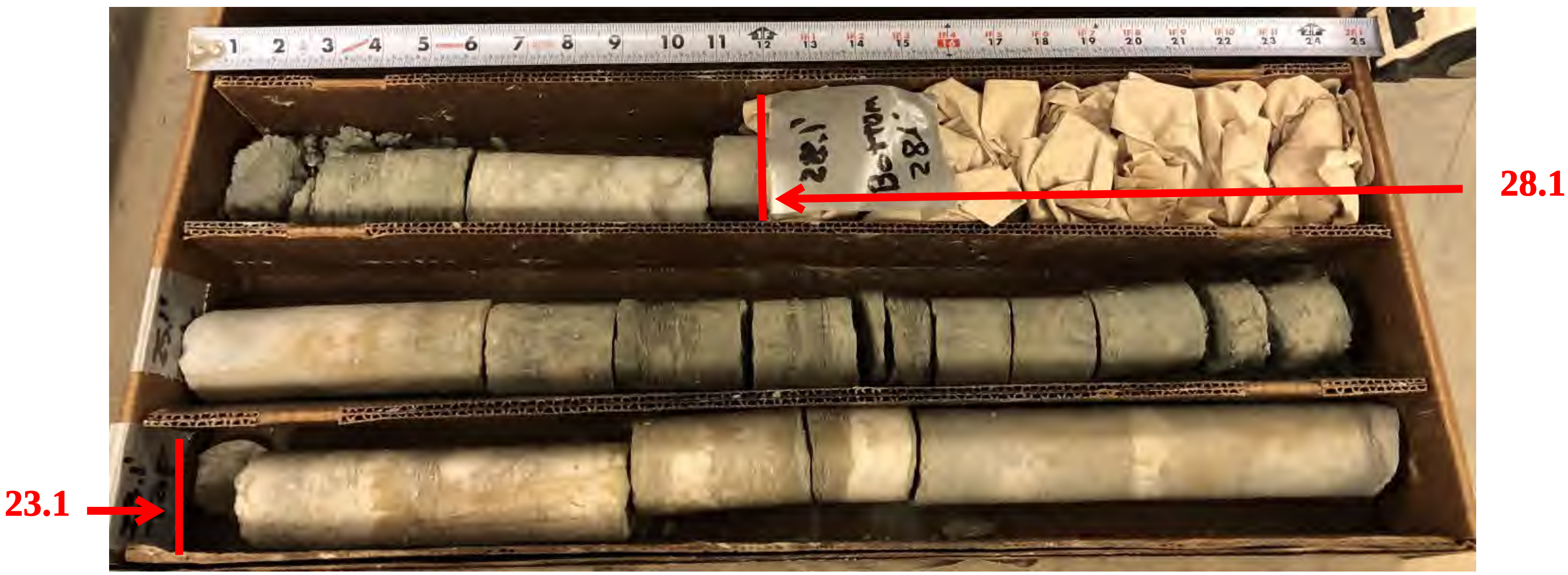
NOTES:

LOG OF CORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00-CORING.GPJ BRAUN_V8_(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC
The Science You Build On.

**Photograph of Rock Cores**
**Project Paul**
**B1806527.00**

# ST-108




NOTE: Cores run from left to right and bottom to top. Each row is 24 inches long.

# BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-109**

LOCATION: N: 145606.926 E: 549034.189. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/5/19** | SCALE: **1" = 4'**

| Elev. feet 816.9 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 816.1 | 0.8 | PAV | 9 inches of bituminous. | | | | |
| 814.9 | 2.0 | OL | SANDY ORGANIC CLAY, with Gravel, black, moist. (Swamp Deposit/Buried Topsoil) | | | 36 | OC=10% |
| 809.9 | 7.0 | CH | FAT CLAY, trace Limestone fragments and fibers, gray and brown, moist, medium to very stiff. (Weathered Shale Bedrock) | 5 | | 23 | $q_p$=1 1/2 tsf<br>LL=67, PL=23, PI=44 |
| | | | | 17 | | 25 | |
| 794.9 | 22.0 | SH | SHALE, gray, dry, hard. (Decorah Shale Bedrock) | 32 | | 21 | |
| | | | | 44 | | | |
| | | | | 74/11" | | 9 | |
| | | | | 50/6" | | | |
| | | | | 50/5" | | 15 | |
| | | | | 50/5" | | | |
| 794.4 | 22.5 | LS | WEATHERED LIMESTONE, weathered, gray. very dense. (Limestone Bedrock) | 50/1" | | | |

END OF BORING.

Water not observed to cave-in depth of 20 feet.

Boring immediately backfilled with bentonite grout.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:23

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-110**

LOCATION: N: 145764.107 E: 549050.104. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/5/19** | SCALE: **1" = 4'**

| Elev. feet 823.2 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 822.8 | 0.4 | PAV | 3 inches of bituminous over 2 inches of aggregate base. | | | | |
| 821.2 | 2.0 | OL | ORGANIC CLAY, with Gravel, black, moist. (Swamp Deposit/Buried Topsoil) | | | 21 | OC=7% |
| 816.2 | 7.0 | SC | CLAYEY SAND, fine- to coarse-grained, with Limestone fragments, brown, moist, hard. (Alluvium) | 34 | | | |
| | | | | 36* | ▽ | | *No recovery |
| 814.2 | 9.0 | CL | LEAN CLAY, with Sand lenses and Limestone fragments, brown and gray, wet, very stiff. (Weathered Shale Bedrock) | 25 | | 23 | LL=42, PL=22, PI=20 |
| 805.7 | 17.5 | SH | SHALE, gray, moist, hard. (Decorah Shale Bedrock) | 53 | | 21 | |
| | | | | 57 | | | |
| | | | | 76 | | 26 | |
| | | | | 97 | | | |

END OF BORING.

Water observed at 5 feet with 5 feet of hollow-stem auger in the ground.

Water observed at 11 feet with 17 feet of hollow-stem auger in the ground.

Water observed at 3 feet with a cave-in depth of 15 feet immediately after withdrawal of auger.

Boring immediately backfilled with bentonite grout.

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-111**

LOCATION: N: 145901.018 E: 549038.73. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/5/19** | SCALE: **1" = 4'**

| Elev. feet 824.6 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 823.7 | 0.8 | PAV | 3 inches of bituminous over 7 inches of aggregate base. | | | | |
| 821.6 | 3.0 | FILL | FILL: Lean Clay, trace Gravel, black, moist. (Topsoil Fill) | 13 | | 22 | |
| 815.6 | 9.0 | CL | LEAN CLAY with SAND, with Limestone and Shale fragments, trace Gravel, gray and brown, moist, stiff to very stiff. (Alluvium) | 13 | | 14 | LL=39, PL=19, PI=20 |
| | | | | 26 | | 13 | |
| 813.6 | 11.0 | GP | POORLY GRADED GRAVEL, with Shale lenses, brown, wet, dense. (Alluvium) | 36 | ▽ | | |
| 808.6 | 16.0 | SH | SHALE, gray, moist, hard. (Decorah Shale Bedrock) | 38 | | 26 | |
| | | | | 56 | | 30 | |

END OF BORING.

Water observed at 10 feet with 10 feet of hollow-stem auger in the ground.

Water observed at 11 1/2 feet with 15 feet of hollow-stem auger in the ground.

Water observed at 5 feet with a cave-in depth of 12 feet immediately after withdrawal of auger.

Boring immediately backfilled with bentonite grout.

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

# LOG OF BORING

| **Braun Project B1806527.00**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul - Infrastructure Phase**<br>**966 Mississippi River Boulevard South**<br>**Saint Paul, Minnesota** | BORING: **ST-112**<br>LOCATION: N: 145916.345 E: 549409.517. See attached sketch |
|---|---|

| DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/27/19** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 836.5 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 835.4 | 1.1 | PAV | 5 inches of bituminous over 8 1/2 inches of aggregate base. | | | | |
| | | CH | (Topsoil Fill) | | | | |
| | | | FAT CLAY, trace Limestone fragments and Silt lenses, olive, brown and gray, moist, medium to very stiff. (Weathered Shale Bedrock) | 7 | | 25 | $q_p$=3 tsf |
| | | | | 14 | | 24 | |
| | | | | 20 | | | |
| 825.5 | 11.0 | | | 20 | | 22 | |
| | | SH | SHALE, with occasional Limestone fragments, gray, dry, hard. (Decorah Shale Bedrock) | | | | |
| | | | | 55 | | 18 | |
| | | | | 66 | | | |
| | | | | 62 | | | |
| | | | | 70 | | | |
| | | | | 63 | | | |
| | | | | 68 | | 15 | |
| | | | | | | | *Water not observed while drilling. |
| | | | | 73 | | | Boring immediately backfilled with bentonite grout. |
| 805.5 | 31.0 | | | 87 | | | |
| | | | END OF BORING.* | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:23

**BRAUN INTERTEC**

# LOG OF BORING

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| **Braun Project B1806527.00**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul - Infrastructure Phase**<br>**966 Mississippi River Boulevard South**<br>**Saint Paul, Minnesota** | BORING: **ST-113**<br>LOCATION: N: 146184.534 E: 549417.588. See attached sketch |

| DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/22/19** | SCALE: **1" = 4'** |
|---|---|---|---|

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 843.0 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 841.0 | 2.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, dark brown, moist. | | | | |
| 836.0 | 7.0 | CH | FAT CLAY, trace Gravel and Silty Sand lenses, brown and gray, moist, stiff. (Weathered Shale Bedrock) | 11 | | 29 | $q_p$=2 1/4 tsf |
| | | | | 14 | | 28 | |
| 824.5 | 18.5 | SH | SHALE, gray, dry to moist, hard. (Decorah Shale Bedrock) | 37* | | | *No recovery |
| | | | | 36 | | | |
| | | | | 39 | | 22 | |
| | | | With Limestone fragments at 15 feet. | 68 | | | |
| | | | | 50/11" | | 20 | |
| | | | END OF BORING.<br>Water not observed while drilling.<br>Boring immediately backfilled with bentonite grout. | | | | |

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:23

BRAUN INTERTEC

# LOG OF BORING

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|---|---|
| **Braun Project B1806527.00**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul - Infrastructure Phase**<br>**966 Mississippi River Boulevard South**<br>**Saint Paul, Minnesota** | BORING: **ST-114**<br>LOCATION: N: 145521.517 E: 547899.777. See attached sketch |

| DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/16/19** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 811.0 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 810.2 | 0.8 | FILL | FILL: Silty Sand, fine-grained, with roots, black, moist. (Topsoil Fill) | | | | |
| 807.0 | 4.0 | FILL | FILL: Silty Sand, fine-grained, non- to slightly organic, brown to dark brown, wet. | 4 | | 19 | |
| 802.0 | 9.0 | CL | SANDY LEAN CLAY, with Gravel, trace Shale and Limestone fragments, brown, moist, stiff to medium. (Glacial Till) With Silty Sand seams at 5 feet. | 9 | | | |
| | | | | 8 | | 14 | LL=20, PL=12, PI=8 |
| 800.0 | 11.0 | SH | SHALE, gray, moist, hard. (Decorah Shale Bedrock) | 45 | | 17 | $q_p$=1 1/4 tsf |
| | | | END OF BORING. Water not observed while drilling. Boring then backfilled. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:23

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-115**

LOCATION: N: 145095.421 E: 548006.286. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **9/18/19** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 810.6 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 808.5 | 2.1 | FILL | FILL: Silty Sand, fine- to medium-grained, with roots, black, moist. (Topsoil Fill) | | | | |
| 806.6 | 4.0 | FILL | FILL: Clayey Sand, brown, moist. | 7 | | 13 | |
| 803.6 | 7.0 | SP | POORLY GRADED SAND, fine- to medium-grained, with Gravel, trace Shale fragments, brown, wet, medium dense. (Terrace Deposit) | 22 | | | |
| 799.6 | 11.0 | CH | FAT CLAY, trace Gravel to with Gravel, gray, moist to wet, stiff to hard. (Weathered Shale Bedrock) | 9 | | 17 | $q_p$=2 1/2 tsf |
| | | | | 81* | | | *3-inch recovery |
| | | | END OF BORING. | | | | |
| | | | Water not observed while drilling. | | | | |
| | | | Boring immediately backfilled. | | | | |

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.00.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:23

BRAUN INTERTEC

# LOG OF BORING

| Braun Project B1806527.00<br>GEOTECHNICAL EVALUATION<br>Project Paul - Infrastructure Phase<br>966 Mississippi River Boulevard South<br>Saint Paul, Minnesota | BORING: ST-116<br>LOCATION: N: 143700.169 E: 548616.518. See attached sketch |
|---|---|

| DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: 9/18/19 | SCALE: 1" = 4' |
|---|---|---|---|

| Elev. feet 807.1 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 806.4 | 0.7 | FILL | FILL: Silty Sand, fine- to medium-grained, with roots, dark brown, moist. (Topsoil Fill) | | | | |
| 803.1 | 4.0 | FILL | FILL: Weathered Shale, with Silty Sand inclusions, trace Gravel, brown and olive, moist. | 11 | ∇ | 17 | |
| 800.1 | 7.0 | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, with Shale layers and seams, with Gravel, brown and gray, wet. | 14 | | | |
| 797.2 | 9.9 | LS | WEATHERED LIMESTONE, gray, dry, very dense. | 50/2"*<br>50/5"* | | | *No recovery with 1 1/2-inch sampler and had 1-inch recovery using a 3-inch sampler<br>*5-inch recovery |
| | | | END OF BORING.<br><br>Water observed at 4 feet with 5 feet of hollow-stem auger in the ground.<br><br>Water observed at 4 feet with 10 feet of hollow-stem auger in the ground.<br><br>Water observed at 4 feet with a cave-in depth of 4 feet immediately after withdrawal of auger.<br><br>Boring immediately backfilled. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-117**

LOCATION: N: 143358.212 E: 548738.358. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **9/18/19** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 808.8 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 806.8 | 2.0 | FILL | FILL: Organic Clay, trace roots, black, moist. (Topsoil Fill) | | | | |
| 804.8 | 4.0 | FILL | FILL: Silty Sand, fine- to medium-grained, trace Gravel, brown, gray and reddish brown, moist. | 8 | | 15 | |
| 799.8 | 9.0 | SM | SILTY SAND, fine-grained, trace Silt lenses, gray and brown, moist, medium dense. (Terrace Deposit) | 18 | | 15 | |
| | | | | 16 | | | |
| 797.8 | 11.0 | SP | POORLY GRADED SAND, fine- to medium-grained, trace Gravel, brown, moist, medium dense. (Terrace Deposit) | 16 | | | |
| | | | END OF BORING.<br><br>Water not observed while drilling.<br><br>Boring immediately backfilled. | | | | |

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# BRAUN INTERTEC

# LOG OF BORING

| | |
|---|---|
| **Braun Project B1806527.00**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul - Infrastructure Phase**<br>**966 Mississippi River Boulevard South**<br>**Saint Paul, Minnesota** | BORING: **ST-118**<br>LOCATION: N: 143091.598 E: 549045.652. See attached sketch |
| DRILLER: B. Kammermeier — METHOD: 3 1/4" HSA, Autohammer | DATE: **9/18/19** — SCALE: **1" = 4'** |

| Elev. feet 810.3 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 808.3 | 2.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with roots, black, moist. (Topsoil Fill) | | | | |
| 803.3 | 7.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel and Shale fragments, brown, moist. | 18<br>15 | | 9 | |
| 801.8 | 8.5 | SC | CLAYEY SAND, with Limestone fragments, brown and gray, moist, hard. (Alluvium) | 51 | | | |
| 800.6 | 9.7 | LS | WEATHERED LIMESTONE, gray, dry, very dense. | 50/3"* | | | *2-inch recovery |
| | | | END OF BORING.<br><br>WWater not observed while drilling.<br><br>Boring immediately backfilled. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

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**BRAUN INTERTEC**

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-119**

LOCATION: N: 144688.049 E: 549001.854. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/9/19** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 811.4 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 810.4 | 1.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, dark brown, dry. | | | 4 | 18 | |
| | | FILL | FILL: Clayey Sand, with Gravel, occasional Sandy Lean Clay and Silty Sand layers, brown and dark brown, moist. | 12* | | | | *No sample recovery |
| | | | With Organic Clay layer at 5 feet. | 6 | | 16 | | |
| | | | | 4 | | 17 | | |
| 801.9 | 9.5 | | With concrete at 9 feet. | | | | | |
| 799.4 | 12.0 | CH | FAT CLAY, with Shale fragments, brownish green, moist, hard. (Weathered Shale Bedrock) | 32 | | 29 | | |
| 798.5 | 12.9 | SH | SHALE, gray, dry, hard. (Decorah Shale Bedrock) | 50/5" | | 12 | | |
| | | | END OF BORING. | | | | | |
| | | | Water not observed with 12 feet of hollow-stem auger in the ground. | | | | | |
| | | | Boring immediately backfilled. | | | | | |

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BRAUN INTERTEC

# LOG OF BORING

| Braun Project B1806527.00<br>GEOTECHNICAL EVALUATION<br>Project Paul - Infrastructure Phase<br>966 Mississippi River Boulevard South<br>Saint Paul, Minnesota | BORING: **ST-120**<br>LOCATION: N: 145425.513 E: 548832.002. See attached sketch |
|---|---|

| DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/7/19** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 808.9 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 807.9 | 1.0 | FILL | FILL: Silty Sand, fine- to medium-grained, mixed with weathered Shale, brown and gray, dry. | | | | |
| | | FILL | FILL: Clayey Sand, with Gravel, brown, moist. | 21 | | 11 | |
| 804.9 | 4.0 | | | | ▽ | | |
| | | FILL | FILL: Poorly Graded Gravel, (mostly Gravel) with Sand, Cobbles and possible Boulders, occasional Clayey Sand layers, brown and gray, wet. | 8 | | | |
| | | | | 3* | | | *No sample recovery |
| 797.9 | 11.0 | | | 44 | | | |
| | | | END OF BORING.<br><br>Water observed at 4 feet with 4 1/2 feet of hollow-stem auger in the ground.<br><br>Water observed at 5 feet with 9 1/2 feet of hollow-stem auger in the ground.<br><br>Water observed at 1 foot with a cave-in depth of 6 feet immediately after withdrawal of auger.<br><br>Boring immediately backfilled. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-121**

LOCATION: N: 144991.53 E: 550040.63. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/22/19** | SCALE: **1" = 4'**

| Elev. feet 846.8 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| | | FILL | FILL: Sandy Lean Clay, with Gravel, brown, moist. | | | | |
| 844.8 | 2.0 | FILL | FILL: Sandy Lean Clay, with Shale inclusions and Limestone fragments, trace Gravel, brown, dark brown and gray, moist. | 8 | | 12 | |
| | | | | 32 | | 13 | |
| 839.8 | 7.0 | FILL | FILL: Fat Clay, slightly organic, with Gravel and Clay tile pieces, black, moist. | 14 | | 18 | OC=5% Possible chemical odor |
| 836.3 | 10.5 | | | 12 | | 26 | $q_p$=2 1/2 tsf |
| 835.8 | 11.0 | CH | FAT CLAY, trace Silt lenses and Limestone fragments, gray and brown, moist, stiff. (Weathered Shale Bedrock) | | | | |
| | | | END OF BORING. | | | | |
| | | | Water not observed while drilling. | | | | |
| | | | Boring immediately backfilled. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

# LOG OF BORING

| Braun Project B1806527.00<br>GEOTECHNICAL EVALUATION<br>Project Paul - Infrastructure Phase<br>966 Mississippi River Boulevard South<br>Saint Paul, Minnesota | BORING: ST-122<br>LOCATION: N: 144570.774 E: 550049.767. See attached sketch |
|---|---|

| DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: 8/22/19 | SCALE: 1" = 4' |
|---|---|---|---|

| Elev. feet 831.7 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 831.2 | 0.5 | FILL | FILL: Silty Sand, fine- to medium-grained, with roots, trace Gravel, dark brown, moist. (Topsoil Fill) | | | | |
| | | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, with Shale lenses, brown, moist. | 8 | | 6 | |
| | | | | 6 | | 9 | |
| 824.7 | 7.0 | CH | FAT CLAY, gray, moist, very stiff. (Weathered Shale Bedrock) | 7 | | 23 | LL=56, PL=25, PI=31 |
| 823.2 | 8.5 | | END OF BORING.<br>Water not observed while drilling.<br>Boring immediately backfilled. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

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**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-123**

LOCATION: N: 144476.603 E: 550060.481. See attached sketch

DRILLER: B. Kammermeier | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/23/19** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 831.9 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 831.4 | 0.5 | FILL | FILL: Sandy Fat Clay, trace roots and Gravel, gray, moist. (Topsoil Fill) | | | | |
| 827.9 | 4.0 | FILL | FILL: Poorly Graded Gravel, fine- to coarse-grained, brown, moist. | 38 | | | |
| 824.9 | 7.0 | CH | FAT CLAY, with Limestone fragments, gray and brown, moist, very stiff. (Weathered Shale Bedrock) | 24 | | 26 | |
| 818.4 | 13.5 | SH | SHALE, with Limestone fragments at 7 feet, gray, dry, hard. (Decorah Shale Bedrock) | 58 | | 12 | |
| | | | | 60 | | | |
| | | | | 79 | | 18 | |
| | | | END OF BORING. Water not observed while drilling. Boring immediately backfilled. | | | | |

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-124**

LOCATION: N 143467.708 E: 549322.616. See attached sketch

DRILLER: M. Barber | METHOD: 3 1/4" HSA, Autohammer | DATE: **9/20/19** | SCALE: **1" = 4'**

| Elev. feet 803.7 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 802.7 | 1.0 | FILL | FILL: Silty Sand, fine-grained, with roots and concrete pieces, black, wet. (Topsoil Fill) | | | | |
| 799.7 | 4.0 | FILL | FILL: Fat Clay, brown and black, moist. | 7 | | 32 | |
| 796.7 | 7.0 | SM | SILTY SAND, fine- to medium-grained, with Limestone fragments, brown, dry, very dense. (Terrace Deposit) | 50/4" | | 9 | |
| 794.7 | 9.0 | LS | LIMESTONE, Magnolia Member, dark gray, dry, very dense. (Platteville Formation) | 50/1" | | | |
| 793.8 | 9.9 | LS | LIMESTONE, Carimona Member, brown and gray, dry, very dense, trace vugs. (Platteville Formation) | 50/5" | | | |

END OF BORING.

Water not observed while drilling.

Boring immediately backfilled.

(See Descriptive Terminology sheet for explanation of abbreviations)

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# LOG OF BORING

**Braun Project B1806527.00**
**GEOTECHNICAL EVALUATION**
**Project Paul - Infrastructure Phase**
**966 Mississippi River Boulevard South**
**Saint Paul, Minnesota**

BORING: **ST-125**

LOCATION: N: 146050.176 E: 549748.848. See attached sketch

DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/27/19** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 854.6 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 853.9 | 0.7 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, dark brown, dry. | | | | |
| | | SH | SHALE, trace Limestone fragments, gray, dry to 12 1/2 feet then moist, hard. (Decorah Shale Bedrock) | 49 | | | |
| | | | | 72 | | 14 | |
| | | | | 52 | | | |
| | | | | 57 | | 14 | |
| | | | | 62 | | 26 | |
| | | | | 67 | ∇ | | |
| 838.6 | 16.0 | | END OF BORING. | | | | |

Water observed at 15 feet with 15 feet of hollow-stem auger in the ground.

Water not observed to cave-in depth of 15 feet immediately after withdrawal of auger.

Boring immediately backfilled with bentonite grout.

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**BRAUN INTERTEC**

# LOG OF BORING

| **Braun Project B1806527.00**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul - Infrastructure Phase**<br>**966 Mississippi River Boulevard South**<br>**Saint Paul, Minnesota** | BORING: **ST-126**<br>LOCATION: N: 145878.842 E: 549748.604. See attached sketch |
|---|---|

| DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: **8/27/19** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 852.2 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 851.1 | 1.1 | PAV | 5 1/2 inches of bituminous over 8 inches of aggregate base. | | | | |
| 848.7 | 3.5 | CL | LEAN CLAY, with Limestone fragments, gray, dry, hard. (Weathered Shale Bedrock) | 37 | | 14 | LL=44, PL=22, PI=22 |
| 836.2 | 16.0 | SH | SHALE, with Limestone fragments, gray, hard. (Decorah Shale Bedrock) | 79 | | 14 | |
| | | | | 54 | | | |
| | | | | 50 | | 16 | |
| | | | | 63 | | | |
| | | | | 73 | | 19 | |
| | | | END OF BORING.<br>Water not observed while drilling.<br>Boring immediately backfilled with bentonite grout. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **TW-1**

LOCATION: N: 146091.573 E: 549683.054. See attached sketch.

DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/18/18** | SCALE: **1" = 4'**

| Elev. feet 853.1 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 852.7 | 0.4 | PAV | 2 inches of bituminous over 3 inches of aggregate base. | 30 | | |
| | | SH | SHALE, gray, moist. (Decorah Shale Bedrock) | 50/6" | | |
| | | | | 50/6" | | |
| | | | | * | | *50 to set 3" |
| | | | | * | | *50 to set 5" |
| 843.1 | 10.0 | | | | | |

END OF BORING.

Water not observed with 10 feet of hollow-stem auger in the ground.

Boring then backfilled.

Temporary wells set with a 1" pvc and 5' screen.

Installed on 7/18/18 to depth of 10.5' bgs.

Water measured on 7/18/18 at 9.5' bgs. Let recharge overnight.

On 7/19/18 water measured at 5.4' bgs. Groundwater sample collected and well sealed.

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

# LOG OF BORING

| **Braun Project B1806527**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul**<br>**966 Mississippi River Boulevard S**<br>**St. Paul, Minnesota** | BORING: **TW-2**<br>LOCATION: N: 145350.327 E: 549981.218. See attached sketch. |
|---|---|
| DRILLER: J. Chermak — METHOD: 3 1/4" HSA, Autohammer | DATE: **7/18/18** — SCALE: **1" = 4'** |

| Elev. feet 851.3 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 849.8 | 1.5 | FILL | FILL: Silty Sand, fine- to medium-grained, trace Gravel, bituminous and concrete, dark brown, moist. | 6 | | |
| 847.3 | 4.0 | CH | FAT CLAY, trace Gravel, brown and gray, moist, stiff. (Weathered Shale Bedrock) | 9 | | |
| 841.3 | 10.0 | SH | SHALE, gray, moist. (Decorah Shale Bedrock)<br>Limestone layer at 7 feet | 52<br>80/8"<br>85/9" | | |

END OF BORING.

Water not observed with 10 feet of hollow-stem auger in the ground.

Boring then backfilled.

Temporary wells set with a 1" pvc and 5' screen.

Installed on 7/18/18 to depth of 10.5' bgs.

Water measured on 7/18/18 at 10' bgs. Let recharge overnight.

On 7/19/18, water measured at approximately 8.5' bgs. Let recharge overnight.

On 7/20/18, water measured at 7.7' bgs. Groundwater sample collected and well sealed.

(See Descriptive Terminology sheet for explanation of abbreviations)

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**BRAUN** INTERTEC

# LOG OF BORING

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **TW-3**

LOCATION: N: 145267.338 E: 549326.258. See attached sketch.

DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/18/18** | SCALE: **1" = 4'**

| Elev. feet 814.9 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| | | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, trace Clay, concrete and bituminous debris, brown, moist. | WH | | | | |
| | | | | 2 | | 12 | 18 | |
| 809.9 | 5.0 | | | 2 | ▽ | 25 | | LL=40, PL=19, PI=21 |
| 808.9 | 6.0 | CL | LEAN CLAY, trace Sand and Gravel, gray, wet, soft. (Weathered Shale Bedrock) | | | | | |
| | | SH | SHALE, gray, wet. (Decorah Shale Bedrock) | 28 | | | | |
| | | | | 50/6" | | | | |
| 804.9 | 10.0 | | END OF BORING. | | | | | |

Water observed at 5 feet with 6 feet of hollow-stem auger in the ground.

Water observed at 6 feet with 8 feet of hollow-stem auger in the ground.

Water not observed to cave-in depth of 6 feet immediately after withdrawal of auger.

Boring then backfilled.

Temporary wells set with a 1" pvc and 5' screen.

Installed on 7/18/18 to depth of 10' bgs.

Water measured at approximately 5' bgs on 7/18/18; water was too silty to sample, so well was allowed to settle overnight.

On 7/19/2018, water measured at 0.8'bgs. Standing water was observed around top of well. Groundwater sample collected and well sealed.

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **TW-4**

LOCATION: N: 144900.236 E: 549436.580. See attached sketch.

DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/17/18** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

| Elev. feet 811.4 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| | | FILL | FILL: Silty Sand, fine- to coarse-grained, with Gravel and crushed concrete, brown and gray, moist. | 14 | | | |
| | | | | 12 | | 13 | |
| | | | | 6 | | | |
| 805.4 | 6.0 | | | | ▽ | | |
| | | FILL | FILL: Fat Clay, with Sand lenses, blue and gray, wet. | 2 | | 31 | LL=61, PL=27, PI=34 |
| 803.4 | 8.0 | | | | | | |
| | | FILL | FILL: Clayey Sand, trace Gravel and Shale/Limestone fragments, gray, moist. | 10 | | | |
| 801.4 | 10.0 | | | | | | |
| | | FILL | FILL: Silty Sand, fine- to coarse-grained, with Gravel and Shale/Limestone fragments, gray, wet. | * | | | *50 to set 4" |
| 799.9 | 11.5 | | | | | | |

END OF BORING.

Water observed at 6 feet with 4 feet of hollow-stem auger in the ground.

Water observed at 11 feet with 10 feet of hollow-stem auger in the ground.

Water not observed to cave-in depth of 10 feet immediately after withdrawal of auger.

Boring then backfilled.

Temporary wells set with a 1" pvc and 5' screen.

Installed on 7/17/18 to depth of 12' bgs.

Water measured on 7/17/18 at 4' bgs. Groundwater sample collected and well sealed.

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:27

BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **TW-5**

LOCATION: N: 145641.205 E: 548423.106. See attached sketch.

DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/17/18** | SCALE: **1" = 4'**

| Elev. feet 810.7 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 806.7 | 4.0 | FILL | FILL: Silty Sand, fine- to medium-grained, trace Clay and Gravel, Limestone fragments, brown, moist. | 25<br>17 | | | | |
| 804.7 | 6.0 | FILL | FILL: Sandy Lean Clay, trace Limestone fragments and organic debris, gray, moist. | 18 | | | | |
| 801.7 | 9.0 | FILL | FILL: Silty Sand, fine- to medium-grained, trace Gravel, dark brown, moist. | 4 | ∇ | 12 | 24 | |
| 800.7 | 10.0 | CH | FAT CLAY, with Gravel and Limestone fragments, blue and gray, moist, stiff. (Weathered Shale Bedrock) | 15 | | | | |

END OF BORING.

Water observed at 7 feet with 6 feet of hollow-stem auger in the ground.

Water observed at 3 feet with 8 feet of hollow-stem auger in the ground.

Water not observed to cave-in depth of 3 feet immediately after withdrawal of auger.

Boring then backfilled.

Temporary wells set with a 1" pvc and 5' screen.

Installed on 7/17/18 to depth of 10' bgs.

Water measured on 7/17/18 at 7' bgs. Groundwater sample collected and well sealed.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:27

# BRAUN INTERTEC

# LOG OF BORING

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **TW-6**

LOCATION: N: 144918.318 E: 548314.009. See attached sketch.

DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/17/18** | SCALE: **1" = 4'**

| Elev. feet 812.1 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 810.1 | 2.0 | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, trace concrete debris, brown, moist. | 15 | | | | |
| 805.1 | 7.0 | FILL | FILL: Silty Sand, fine- to coarse-grained, trace Limestone fragments and Gravel, brown, moist to wet at 4 feet. | 19 | | 10 | 14 | |
| | | | | 16 | ∇ | | | |
| | | | | 20 | | | | |
| 804.1 | 8.0 | LS | LIMESTONE, highly fractured, weathered, light brown and gray, wet. (Platteville Limestone) | | | | | |

END OF BORING.

Water observed at 5 feet with 4 feet of hollow-stem auger in the ground.

Water observed at 4 feet with 6 feet of hollow-stem auger in the ground.

Water not observed to cave-in depth of 4 feet immediately after withdrawal of auger.

Temporary wells set with a 1" pvc and 5' screen.

Installed on 7/17/18 to depth of 8' bgs.

Water measured on 7/17/18 at 5' bgs. Groundwater sample collected and well sealed.

(See Descriptive Terminology sheet for explanation of abbreviations)

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(See Descriptive Terminology sheet for explanation of abbreviations)

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **TW-7**

LOCATION: N: 143602.259 E: 548883.053. See attached sketch.

DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/17/18** | SCALE: **1" = 4'**

| Elev. feet 811.7 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 811.3 | 0.4 | FILL | FILL: Silty Sand, fine- to medium-grained, Gravel, trace roots, dark brown, moist. (Topsoil Fill) | 10 | | | | |
| | | FILL | FILL: Silty Sand, fine- to medium-grained, trace Gravel and Shale fragments, brown and gray, moist. | 6 | | 11 | | |
| 807.7 | 4.0 | SC | CLAYEY SAND, with gravel, trace Shale/Limestone fragments, brown and gray, moist, stiff to very stiff. (Glacial Till) | 12 | | 12 | 40 | |
| | | | | 28 | | | | |
| | | | | 21 | | | | |
| 800.2 | 11.5 | | | 11 | | | | |
| 799.7 | 12.0 | SH | SHALE, gray, moist. (Decorah Shale Bedrock) | | | | | No recovery. Shale in tip of sampler. |

END OF BORING.

Water not observed with 12 feet of hollow-stem auger in the ground.

Boring then backfilled.

Temporary wells set with a 1" pvc and 5' screen.

Installed on 7/17/18 to depth of 12.5' bgs.

Well was dry on 7/17/18. Let recharge overnight.

On 7/18/17, water measured at 9' bgs. Groundwater sample collected and well sealed.

BRAUN℠ INTERTEC

# LOG OF BORING

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **TW-8**

LOCATION: N: 144271.667 E: 549680.982. See attached sketch.

DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/18/18** | SCALE: **1" = 4'**

| Elev. feet 809.7 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| | | FILL | FILL: Poorly Graded Sand, fine- to coarse-grained, Gravel, Shale fragments, brown, moist. | 18 | | |
| | | | | 80/12" | | |
| | | | | 13 | | |
| 803.7 | 6.0 | FILL | FILL: Silty Sand, fine- to coarse-grained, with Shale and Limestone fragments, gray, moist. | | | |
| 802.7 | 7.0 | | | 50/6" | | |
| | | | END OF BORING.<br><br>Auger met refusal at the 7-foot depth.<br><br>Water not observed to cave-in depth of 7 feet immediately after withdrawal of auger.<br><br>Boring then backfilled.<br><br>Temporary wells set with a 1" pvc and 5' screen.<br><br>Installed on 7/18/18 to depth of 7.5' bgs.<br><br>Well dry initially. We let it recharge for a few hours and checked again. Water measured at 6.8' bgs. We collected a partial sample, but well would not recharge for remaining samples. We let recharge overnight.<br><br>On 7/19/18, water measured at 7' bgs. Able to collect remaining groundwater samples and well was sealed. | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:27

**BRAUN INTERTEC**

# LOG OF BORING

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

BORING: **TW-9**

LOCATION: N: 144311.970 E: 550160.939. See attached sketch.

DRILLER: J. Chermak | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/18/18** | SCALE: **1" = 4'**

| Elev. feet 830.4 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 827.4 | 3.0 | FILL | FILL: Silty Sand, fine- to medium-grained, trace organic debris, Gravel and Shale/Limestone fragments, brown, moist. | 8 | | | |
| | | | | 16 | | | |
| 824.4 | 6.0 | CH | FAT CLAY, blue and gray, moist, stiff to hard. (Weathered Shale Bedrock) | 40 | | 26 | LL=70, PL=29, PI=41 |
| 820.4 | 10.0 | SH | SHALE, gray, moist. (Decorah Shale Bedrock) | 75/12" | | | |
| | | | | * | | | *50 to set 2" |

END OF BORING.

Water not observed with 10 feet of hollow-stem auger in the ground.

Boring then backfilled.

Temporary wells set with a 1" pvc and 5' screen.

Installed on 7/18/18 to depth of 10' bgs.

Well dry. Let recharge overnight.

On 7/19/18, water measured a 5.5' bgs. Groundwater samples collected and well sealed.

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN℠ INTERTEC

# LOG OF BORING

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | BORING: TW-10<br>LOCATION: N: 144665.575 E: 550590.182. See attached sketch. |
|---|---|
| DRILLER: M. Barber / METHOD: 3 1/4" HSA, Autohammer | DATE: 8/10/18 / SCALE: 1" = 4' |

| Elev. feet 848.7 | Depth feet 0.0 | Symbol | Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 846.7 | 2.0 | TS | SILTY SAND, fine- to medium-grained, trace roots, dark brown, moist. (Topsoil) | | | |
| 841.7 | 7.0 | CH | FAT CLAY, green brown, moist. (Weathered Shale Bedrock) | 5<br>12 | | |
| 836.2 | 12.5 | SH | SHALE, greenish brown, moist. (Decorah Shale Bedrock)<br>Interbedded Limestone at 11 feet. | 21<br>28<br>37 | | |
| | | | END OF BORING.<br>Auger met refusal at the 11-foot depth.<br>Water not observed with 12 1/2 feet of hollow-stem auger in the ground.<br>Boring then backfilled. | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06527.GPJ BRAUN_V8_CURRENT.GDT 11/22/19 12:27

BRAUN INTERTEC

# LOG OF TEST PIT

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | | TEST PIT: TP-1<br>LOCATION: N: 146049.530 E: 547915.485. Offset 20 feet west. See attached sketch. | |
|---|---|---|---|
| DRILLER: Bolander | METHOD: Backhoe | DATE: 7/11/18 | SCALE: 1" = 4' |

| Elev. feet 808.4 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 807.4 | 1.0 | FILL | FILL: Silty Sand, fine- to medium-grained, trace Gravel, with roots, black, moist. (Topsoil Fill) | | | |
| | | | Irrigation and conduit line at 1 foot. | | | |
| 803.4 | 5.0 | FILL | FILL: Poorly Graded Sand with Silt, fine- to medium-grained, Gravelly with Cobbles, brown, moist. | | | |
| 801.4 | 7.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, brown with light brown, moist. | | | |
| 799.4 | 9.0 | FILL | FILL: Clayey Sand, with Gravel, brown, moist. | | | |
| | | | Bedrock appears to be Shale. | | | |
| | | | BOTTOM OF TEST PIT.<br><br>Test pit immediately backfilled.<br><br>Water seepage not observed during test pit excavation. | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC

# LOG OF TEST PIT

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

TEST PIT: **TP-2**

LOCATION: N: 145928.377 E: 548043.796. See attached sketch.

DRILLER: Bolander | METHOD: Backhoe | DATE: **7/11/18** | SCALE: **1" = 4'**

| Elev. feet 809.6 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 809.3 | 0.3 | BIT | 3 1/2 inches bituminous. | | | |
| 808.3 | 1.3 | AGG | 1 foot aggregate base. | | | |
| 807.8 | 1.8 | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, trace Gravel, brown, moist. | | | |
| 805.6 | 4.0 | FILL | FILL: Lean Clay, with Gravel, non to slightly organic, with Limestone fragments, with chemical odor, black and gray, moist. Concrete debris at 2 1/2 feet. | | | |
| 802.6 | 7.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with Lean Clay inclusions, with fibers, with chemical odor, black with gray, moist. | | ▽ | |
| 802.1 | 7.5 | FILL | FILL: Lean Clay, with fibers, gray with black, wet. | | | |
| 799.6 | 10.0 | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, brown, wet. | | | |
| | | | Bedrock either Limestone or Shale. Couldn't be seen due to cave-in. | | | |
| | | | BOTTOM OF TEST PIT. | | | |
| | | | Test pit immediately backfilled. | | | |
| | | | Water seepage observed at 7 feet during test. | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC

# LOG OF TEST PIT

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

TEST PIT: **TP-3**

LOCATION: N: 146053.722 E: 548424.386. See attached sketch.

DRILLER: Bolander | METHOD: Backhoe | DATE: **7/11/18** | SCALE: **1" = 4'**

| Elev. feet 810.2 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 809.8 | 0.4 | BIT | 5 inches bituminous. | | | | | |
| 809.1 | 1.1 | AGG | 8 inches aggregate base. | | | | | |
| 806.2 | 4.0 | FILL | FILL: Clayey Sand, with Gravel and Cobbles, with organic layers, with concrete debris, brown and black, wet. | | | 29 | | OC=9% |
| 804.2 | 6.0 | FILL | FILL: Clayey Sand, with Gravel, non to slightly organic, gray and black, moist. | | | 17 | 43 | |
| 801.7 | 8.5 | CH | FAT CLAY, trace Gravel, green gray, moist. (Weathered Shale Bedrock) | | | | | |
| 801.2 | 9.0 | LS | LIMESTONE, weathered, tan. (Limestone Bedrock) | | | | | |

BOTTOM OF TEST PIT.

Test pit immediately backfilled.

Water seepage not observed during test pit excavation.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:47

BRAUN INTERTEC

# LOG OF TEST PIT

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

TEST PIT: **TP-4**

LOCATION: N: 146159.096 E: 548799.737. See attached sketch.

| DRILLER: Bolander | METHOD: Backhoe | DATE: **7/13/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 819.0 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 818.7 | 0.3 | BIT | 3 1/2 inches bituminous. | | | | |
| 818.0 | 1.0 | AGG | 8 inches aggregate base. | | | | |
| 817.5 | 1.5 | OL | ORGANIC CLAY, with Gravel, black, moist. (Swamp Deposit/Buried Topsoil) | | | 29 | OC=9% |
| 817.0 | 2.0 | SM | SILTY SAND, fine- to medium-grained, Gravelly, trace Cobbles and Limestone fragments, brown, moist. (Terrace Deposit) | | | | |
| 815.0 | 4.0 | CH | FAT CLAY, little Gravel, gray with brown, moist. (Weathered Shale Bedrock) | | | 29 | LL=67, PL=30, PI=37 |
| 811.0 | 8.0 | SH | WEATHERED SHALE, gray with brown, moist. (Decorah Shale Bedrock)<br>Less weathered, gray at 7 feet. | | | | |
| | | | BOTTOM OF TEST PIT.<br>Test pit immediately backfilled.<br>Water seepage not observed during test pit excavation. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

**BRAUN**[SM]
**INTERTEC**

# LOG OF TEST PIT

| | |
|---|---|
| **Braun Project B1806527**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul**<br>**966 Mississippi River Boulevard S**<br>**St. Paul, Minnesota** | TEST PIT: **TP-5**<br>LOCATION: N: 145880.525 E: 548948.709. See attached sketch. |
| DRILLER: Bolander    METHOD: Backhoe | DATE: **7/13/18**    SCALE: **1" = 4'** |

| Elev. feet 821.1 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 820.8 | 0.3 | BIT | 4 inches bituminous. | | | | |
| 820.3 | 0.8 | AGG | 5 inches aggregate base. | | | | |
| 819.3 | 1.8 | OL | ORGANIC CLAY, trace fibers, black, moist. (Swamp Deposit/Buried Topsoil) | | | 31 | OC=9% |
| 818.3 | 2.8 | SM | SILTY SAND, fine- to medium-grained, Gravelly, with Cobbles and Limestone fragments, brown, moist. (Terrace Deposit) | | | | |
| 811.1 | 10.0 | CH | FAT CLAY, little Gravel, trace Limestone fragments, gray with brown, moist. (Weathered Shale Bedrock)<br><br>Waterbearing Sand seam at 9 feet. | | ▽ | 21 | LL=58, PL=23, PI=35 |
| 809.1 | 12.0 | SH | SHALE, gray, moist. (Decorah Shale Bedrock) | | | | |
| | | | BOTTOM OF TEST PIT.<br><br>Test pit immediately backfilled.<br><br>Water seepage observed at 9 feet during test pit excavation. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:47

BRAUN INTERTEC

# LOG OF TEST PIT

| Braun Project B1806527 | TEST PIT: TP-6 |
|---|---|
| GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | LOCATION: N: 145698.735 E: 549043.752. See attached sketch. |
| DRILLER: Bolander / METHOD: Backhoe | DATE: 7/13/18 / SCALE: 1" = 4' |

| Elev. feet 820.8 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 820.5 | 0.3 | BIT | 4 inches bituminous. | | | | |
| 819.8 | 1.0 | AGG | 8 inches aggregate base. | | | | |
| 817.8 | 3.0 | OL | ORGANIC CLAY, trace fibers, Cobbles and Gravel, black, moist. (Swamp Deposit/Buried Topsoil) | | | 23 | OC=6% |
| 816.8 | 4.0 | SP | POORLY GRADED SAND, fine- to medium-grained, Gravelly, trace Cobbles and Limestone fragments, brown, wet. (Terrace Deposit) | | | | |
| 813.8 | 7.0 | CH | FAT CLAY, little Gravel, trace Limestone fragments, Cobbles and Boulders, gray with brown, moist. (Weathered Shale Bedrock) | | | 16 | LL=60, PL=25, PI=35 |
| 807.8 | 13.0 | SH | SHALE, trace Cobbles and Boulders, gray with brown, moist. (Decorah Shale Bedrock) | | | | |
| | | | BOTTOM OF TEST PIT.<br><br>Test pit immediately backfilled.<br><br>Water seepage not observed during test pit excavation. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:47

# BRAUN INTERTEC

# LOG OF TEST PIT

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | TEST PIT: **TP-7**<br>LOCATION: N: 145797.972 E: 549350.276. See attached sketch. |
|---|---|
| DRILLER: Bolander / METHOD: Backhoe | DATE: **7/13/18** / SCALE: **1" = 4'** |

| Elev. feet 829.3 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 829.0 | 0.3 | BIT | 4 inches bituminous. | | | | |
| 828.5 | 0.8 | AGG | 6 inches aggregate base. | | | | |
| 827.5 | 1.8 | OL | ORGANIC CLAY, with fibers, black, moist. (Swamp Deposit/Buried Topsoil) | | | 35 | OC=25% |
| 826.5 | 2.8 | CL | SANDY LEAN CLAY, with Limestone fragments, trace Cobbles, gray with brown, moist. (Glacial Till) | | | 25 | |
| 825.5 | 3.8 | SP | POORLY GRADED SAND, fine- to medium-grained, Gravelly, with Cobbles, brown, moist. (Terrace Deposit) | | | 11 | |
| 825.3 | 4.0 | LS | 3 inch layer of Weathered Limestone. | | | | |
| 821.3 | 8.0 | SH | SHALE, gray with brown, moist. (Decorah Shale Bedrock)<br>Less fractured from 6 to 8 feet. | | | 31 | |
| | | | BOTTOM OF TEST PIT. | | | | |
| | | | Test pit immediately backfilled. | | | | |
| | | | Water seepage not observed during test pit excavation. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

# LOG OF TEST PIT

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | TEST PIT: **TP-8**<br>LOCATION: N: 145999.507 E: 549628.585. See attached sketch. |
|---|---|
| DRILLER: Bolander / METHOD: Backhoe | DATE: **7/13/18** / SCALE: **1" = 4'** |

| Elev. feet 851.3 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 850.9 | 0.4 | BIT | 4 inches bituminous. | | | |
| 850.3 | 1.0 | AGG | 8 inches aggregate base. | | | |
| 849.8 | 1.5 | FILL | FILL: Silty Sand, fine- to medium-grained, little Gravel, brown, moist. Buried pvc pipe with electrical lines at 1 1/2 feet. | | | |
| 846.3 | 5.0 | CH | FAT CLAY, with fractured Limestone fragments, gray with brown, moist. (Weathered Shale Bedrock) | | | |
| 844.3 | 7.0 | SH | SHALE, gray, moist. (Decorah Shale Bedrock) | | | |
| | | | BOTTOM OF TEST PIT.<br>Test pit immediately backfilled.<br>Water seepage not observed during test pit excavation. | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠ INTERTEC

# LOG OF TEST PIT

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | | TEST PIT: **TP-9**<br>LOCATION: N: 145616.527 E: 549938.771. See attached sketch. | |
|---|---|---|---|
| DRILLER: Bolander | METHOD: Backhoe | DATE: **7/12/18** | SCALE: **1" = 4'** |

| Elev. feet 853.8 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 853.5 | 0.3 | BIT | 4 inches bituminous. | | | |
| 852.5 | 1.3 | AGG | 1 foot aggregate base. | | | |
| 851.9 | 1.9 | FILL | FILL: Poorly Graded Sand with Silt, fine- to medium-grained, brown, moist. | | | |
| | | SH | SHALE, gray, moist.<br>(Decorah Shale Bedrock)<br><br>Not as fractured, harder at 7 feet. | | ▽ | |
| 844.8 | 9.0 | | BOTTOM OF TEST PIT.<br><br>Test pit immediately backfilled.<br><br>Water seepage observed at 8 feet during test pit excavation. | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:47

BRAUN℠ INTERTEC

# LOG OF TEST PIT

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

TEST PIT: **TP-10**

LOCATION: N: 145312.595 E: 549930.929. See attached sketch.

DRILLER: Bolander | METHOD: Backhoe | DATE: **7/12/18** | SCALE: **1" = 4'**

| Elev. feet 846.8 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 846.4 | 0.4 | BIT | 5 inches bituminous. | | | |
| 845.5 | 1.3 | AGG | 10 inches aggregate base. | | | |
| 844.8 | 2.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, brown, moist. | | | |
| 843.8 | 3.0 | CH | FAT CLAY, with Limestone fragments, gray and brown, moist. (Weathered Shale Bedrock) | | | |
| 833.8 | 13.0 | SH | SHALE, with Limestone fragments to 8 feet, gray with brown, moist. (Decorah Shale Bedrock)<br>Gray, harder at 8 feet. | | ▽ | |
| | | | BOTTOM OF TEST PIT.<br>Test pit immediately backfilled.<br>Water seepage observed at 7 feet during test pit excavation. | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

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INTERTEC

# LOG OF TEST PIT

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

TEST PIT: **TP-11**

LOCATION: N: 145501.891 E: 549700.706. See attached sketch.

DRILLER: Bolander | METHOD: Backhoe | DATE: **7/12/18** | SCALE: **1" = 4'**

| Elev. feet 832.0 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 831.3 | 0.7 | CONC | 8 inches concrete reinforced slab on grade. | | | | |
| 830.3 | 1.7 | AGG | 1 foot aggregate base. | | | | |
| 828.0 | 4.0 | CH | FAT CLAY, trace fractured Limestone, gray with brown, moist. (Weathered Shale Bedrock) | | | 26 | LL=63, PL=29, PI=34 |
| 825.5 | 6.5 | SH | SHALE, trace fractured Limestone, gray with brown, moist. (Decorah Shale Bedrock) | | | | |
| 825.0 | 7.0 | LS | LIMESTONE. (Limestone Bedrock) | | | | |
| | | | BOTTOM OF TEST PIT. | | | | |
| | | | Test pit immediately backfilled. | | | | |
| | | | Water seepage not observed during test pit excavation. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

BRAUN INTERTEC

# LOG OF TEST PIT

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

TEST PIT: **TP-12**

LOCATION: N: 144846.271 E: 549972.225. Offset 50 feet south due to access. See attached sketch.

DRILLER: Bolander | METHOD: Backhoe | DATE: **7/12/18** | SCALE: **1" = 4'**

| Elev. feet 831.6 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 831.3 | 0.3 | CONC | 4-inch concrete slab. | | | | | |
| 828.6 | 3.0 | FILL | FILL: Silty Sand, fine- to medium-grained, trace Gravel, brown and gray, moist. | | ∇ | 17 | 18 | |
| 826.6 | 5.0 | SH | SHALE, with fractured Limestone, gray with brown, moist. (Decorah Shale Bedrock) Solid Bedrock. Appeared to be Limestone. | | | 32 | | LL=66, PL=29, PI=37 |

BOTTOM OF TEST PIT.

Test pit immediately backfilled.

Water seepage observed at 2 feet during test pit excavation.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

**BRAUN** INTERTEC

# LOG OF TEST PIT

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|---|---|
| **Braun Project B1806527**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul**<br>**966 Mississippi River Boulevard S**<br>**St. Paul, Minnesota** | TEST PIT: **TP-13**<br>LOCATION: N: 145424.364 E: 549197.590. See attached sketch. |
| DRILLER: Bolander / METHOD: Backhoe | DATE: **7/12/18** / SCALE: **1" = 4'** |

| Elev. feet 815.2 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 813.2 | 2.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, trace wood debris, pvc conduit and wire, brown, moist.<br>With slightly organic layer at 2 feet. | | | | |
| 809.2 | 6.0 | CH | FAT CLAY, trace Gravel, gray with brown, moist. (Weathered Shale Bedrock) | | ▽ | 26 | LL=67, PL=28, PI=39 |
| 806.2 | 9.0 | SH | SHALE, gray, moist. (Decorah Shale Bedrock) | | | | |
| | | | BOTTOM OF TEST PIT.<br>Test pit immediately backfilled.<br>Water seepage observed at 6 feet during test pit excavation. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | | TEST PIT: **TP-14**<br>LOCATION: N: 145205.607 E: 549372.009.<br>Offset 50 feet north. See attached sketch. | |
|---|---|---|---|
| DRILLER: Bolander | METHOD: Backhoe | DATE: **7/12/18** | SCALE: **1" = 4'** |

| Elev. feet 813.6 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| | | FILL | FILL: Clayey Sand, with Gravel, trace Cobbles, non to slightly organic, dark brown, moist. | | | | | |
| 811.6 | 2.0 | FILL | FILL: Poorly Graded Sand with Silt, fine- to medium-grained, with Gravel and Lean Clay inclusions, brown, wet. | | | 10 | 10 | |
| | | | Concrete slab approximately 12 1/2 x 50 feet at 4 feet. | | | | | |
| 806.6 | 7.0 | | Approximately 4-inch layer of bituminous at 7 feet. | | | | | |
| | | CH | FAT CLAY, trace Gravel, gray with brown, moist. (Weathered Shale Bedrock) | | | | | |
| 802.6 | 11.0 | | BOTTOM OF TEST PIT. | | | | | |
| | | | Test pit immediately backfilled. | | | | | |
| | | | Water seepage not observed during test pit excavation. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

BRAUN℠ INTERTEC

# LOG OF TEST PIT

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|---|---|
| **Braun Project B1806527**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul**<br>**966 Mississippi River Boulevard S**<br>**St. Paul, Minnesota** | TEST PIT: **TP-15**<br>LOCATION: N: 145022.450 E: 549455.977. See attached sketch. |
| DRILLER: Bolander / METHOD: Backhoe | DATE: **7/12/18** / SCALE: **1" = 4'** |

| Elev. feet 813.7 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 810.7 | 3.0 | FILL | FILL: Poorly Graded Sand with Silt, fine- to medium-grained, with Gravel, trace concrete and steel debris, moist. | | | | |
| 804.7 | 9.0 | CH | FAT CLAY, trace roots, gray with brown, moist. (Weathered Shale Bedrock) | | | 24 | LL=60, PL=24, PI=36 |
| 801.7 | 12.0 | SH | SHALE, gray, moist. (Decorah Shale Bedrock) | | | | |
| | | | BOTTOM OF TEST PIT.<br><br>Test pit immediately backfilled.<br><br>Water seepage not observed during test pit excavation. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

**BRAUN**[SM] INTERTEC

# LOG OF TEST PIT

| **Braun Project B1806527**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul**<br>**966 Mississippi River Boulevard S**<br>**St. Paul, Minnesota** | TEST PIT: **TP-16**<br>LOCATION: N: 144843.871 E: 549475.661. See attached sketch. |
|---|---|

| DRILLER: Bolander | METHOD: Backhoe | DATE: **7/10/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 811.3 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 810.8 | 0.5 | FILL | FILL: Gravel, with Sand (road cover). | | | | | |
| | | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, Clay nodules and clay pipe fragments, brown, moist. | | | 10 | 15 | |
| | | | Moist to wet at 6 feet. | | ▽ | | | |
| 803.3 | 8.0 | FILL | FILL: Sandy Lean Clay, with Gravel, Shale and Limestone fragments, gray and brown mottled, moist. | | | 20 | | |
| | | | Trace concrete and asphalt chunks at 10 feet. | | | | | |
| 799.3 | 12.0 | | Refusal on concrete in place at 12 feet, chunks in bucket, scrapping test pit bottom. | | | | | |
| | | | BOTTOM OF TEST PIT. | | | | | |
| | | | Test pit immediately backfilled. | | | | | |
| | | | Water seepage observed at 6 feet during test pit excavation. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

**BRAUN**℠
**INTERTEC**

# LOG OF TEST PIT

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

TEST PIT: **TP-17**

LOCATION: N: 144433.804 E: 549652.475. See attached sketch.

| DRILLER: Bolander | METHOD: Backhoe | DATE: **7/13/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 809.4 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| | | FILL | FILL: Silty Sand, fine- to medium-grained, little Gravel, brown, moist. | | | |
| 807.4 | 2.0 | | Pieces of bituminous and occasional layers of aggregate base, pvc pipe with a piece of lumber above at 2 feet. | | | |
| | | SH | SHALE, gray, moist. (Decorah Shale Bedrock) | | | |
| 805.4 | 4.0 | | BOTTOM OF TEST PIT. | | | |
| | | | Test pit immediately backfilled. | | | |
| | | | Water seepage not observed during test pit excavation. | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

# LOG OF TEST PIT

BRAUN INTERTEC

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

TEST PIT: **TP-18**

LOCATION: N: 145436.250 E: 548539.369. See attached sketch.

DRILLER: Bolander | METHOD: Backhoe | DATE: **7/11/18** | SCALE: **1" = 4'**

| Elev. feet 811.3 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 805.3 | 6.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, Cobbles and Boulders, trace brick and concrete, with Lean Clay inclusions and occasional slightly organic layers, brown, dark brown, moist. | | | 13 | 34 | OC=3% |
| 800.3 | 11.0 | CH | FAT CLAY, trace Gravel, gray and brown mottled, moist. (Weathered Shale Bedrock) | | | 26 | | LL=72, PL=22, PI=50 |
| 799.3 | 12.0 | SH | SHALE, trace Gravel, gray, moist. (Decorah Shale Bedrock) | | | | | |
| | | | BOTTOM OF TEST PIT. | | | | | |

Test pit immediately backfilled.

Water seepage observed at 9 feet during test pit excavation.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

BRAUN INTERTEC

# LOG OF TEST PIT

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|---|---|
| **Braun Project B1806527**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul**<br>**966 Mississippi River Boulevard S**<br>**St. Paul, Minnesota** | TEST PIT: **TP-19**<br>LOCATION: N: 145402.774 E: 548262.134. See attached sketch. |

| DRILLER: Bolander | METHOD: Backhoe | DATE: **7/11/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 812.2 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 809.2 | 3.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, trace brick, concrete and broken clay pipe, brown, black, and dark brown, moist. | | | 11 | 27 | |
| 805.2 | 7.0 | SC | CLAYEY SAND, trace Gravel and Shale fragments, gray and brown mottled, moist. (Glacial Till) | | | 15 | | |
| 799.2 | 13.0 | SH | SHALE, trace Gravel, gray, wet. (Decorah Shale Bedrock) | | | | | |
| | | | BOTTOM OF TEST PIT.<br><br>Test pit immediately backfilled.<br><br>Water seepage not observed during test pit excavation. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

BRAUN℠ INTERTEC

# LOG OF TEST PIT

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

TEST PIT: **TP-20**

LOCATION: N: 144558.405 E: 548358.253.
Offset 5 feet south of stake. See attached sketch.

DRILLER: Bolander | METHOD: Backhoe | DATE: **7/10/18** | SCALE: **1" = 4'**

| Elev. feet 812.3 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 811.8 | 0.5 | FILL | FILL: Gravel (road cover), trace Sand and Silt. | | | | |
| 809.3 | 3.0 | FILL | FILL: Poorly Graded Sand, fine- to coarse-grained, with Gravel, trace Clay and construction debris (concrete and rebar). | | | | |
| 807.3 | 5.0 | FILL | FILL: Poorly Graded Sand with Silt, with Gravel, trace Clay, brown, moist. | | | | |
| 806.3 | 6.0 | CL | LEAN CLAY, slightly organic, with Sand and Gravel. (Buried Topsoil) | | | 17 | OC=3% |
| 802.3 | 10.0 | SC | CLAYEY SAND, fine- to medium-grained, with Gravel, grayish brown, moist. (Glacial Till) | | | | |
| 800.3 | 12.0 | SH | SHALE, trace Gravel, gray, moist. (Decorah Shale Bedrock) | | | | |
| | | | Refusal on Limestone Bedrock at 12 feet. | | | | |
| | | | BOTTOM OF TEST PIT. | | | | |
| | | | Test pit immediately backfilled. | | | | |
| | | | Water seepage not observed during test pit excavation. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 11:24

BRAUN INTERTEC

# LOG OF TEST PIT

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

TEST PIT: **TP-21**

LOCATION: N: 144549.206 E: 548696.040. See attached sketch.

DRILLER: Bolander | METHOD: Backhoe | DATE: **7/10/18** | SCALE: **1" = 4'**

| Elev. feet 812.1 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 810.1 | 2.0 | FILL | FILL: Silty Sand, fine- to coarse-grained, with Gravel, some weathered Shale and Limestone fragments, moist. | | | | | |
| 808.1 | 4.0 | FILL | FILL: Clayey Sand, with Gravel and Limestone fragments, moist. Ceramic drain pipe fragments at 3 feet. | | | 16 | 37 | |
| 803.1 | 9.0 | CL | SANDY LEAN CLAY, with Sand and Gravel, trace Cobbles, brown, medium stiff to stiff. (Glacial Till) | | | 18 | | |
| | | | With Shale fragments from 8 to 9 feet. | | | 15 | | |
| | | | BOTTOM OF TEST PIT. | | | | | |
| | | | Test pit immediately backfilled. | | | | | |
| | | | Water seepage not observed during test pit excavation. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

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# LOG OF TEST PIT

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|---|---|
| **Braun Project B1806527**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul**<br>**966 Mississippi River Boulevard S**<br>**St. Paul, Minnesota** | TEST PIT: **TP-22**<br>LOCATION: N: 145271.358 E: 547975.706. See attached sketch. |

| DRILLER: Bolander | METHOD: Backhoe | DATE: **7/11/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 811.3 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 808.3 | 3.0 | FILL | FILL: Silty Sand, fine- to medium-grained, trace Gravel, with roots, black, moist. (Topsoil) | | | |
| 806.3 | 5.0 | SM | SILTY SAND, fine- to medium-grained, with Gravel and Cobbles, brown, moist. (Glacial Till) | | | |
| 802.3 | 9.0 | SC | CLAYEY SAND, trace Gravel, brown and gray mottled, moist. (Glacial Till)<br>With wet Sand seam, Limestone and Shale fragments at 9 feet. | | ▽ | |
| | | | BOTTOM OF TEST PIT.<br><br>Test pit then backfilled.<br><br>Water seepage observed at 9 feet during test pit excavation. | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

BRAUN INTERTEC

# LOG OF TEST PIT

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

TEST PIT: **TP-23**

LOCATION: N: 144306.601 E: 548423.020. Offset 8 feet east of stake. See attached sketch.

DRILLER: Bolander | METHOD: Backhoe | DATE: **7/10/18** | SCALE: **1" = 4'**

| Elev. feet 811.9 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 810.9 | 1.0 | FILL | FILL: Gravel, with Sand (road cover). | | | | | |
| 803.9 | 8.0 | FILL | FILL: Poorly Graded Sand with Silt, fine- to medium-grained, with Gravel, trace Cobbles and Clay, brown, moist. Metal debris at 7 feet. Clayey Sand from 7 to 8 feet. | | ∇ | 5 | 10 | |
| 799.9 | 12.0 | SM | SILTY SAND, fine- to medium-grained, with Gravel, Clay, light brown. (Glacial Till) | | | 16 | | |
| 797.9 | 14.0 | CH | FAT CLAY, with Gravel, green gray, moist. (Weathered Shale Bedrock) | | | 16 | | |
| | | | BOTTOM OF TEST PIT. Test pit then backfilled. Water seepage observed at 8 feet during test pit excavation. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

BRAUN INTERTEC

# LOG OF TEST PIT

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | TEST PIT: TP-24<br>LOCATION: N: 144061.890 E: 548786.486. See attached sketch. |
|---|---|
| DRILLER: Bolander METHOD: Backhoe | DATE: 7/10/18 SCALE: 1" = 4' |

| Elev. feet 809.7 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 807.7 | 2.0 | FILL | FILL: Poorly Graded Sand with Silt, with Gravel, trace Cobbles, concrete debris and Clay, brown, moist. | | | | |
| 806.7 | 3.0 | FILL | FILL: Lean Clay, organic, dark brown to black. | | | | |
| 804.7 | 5.0 | FILL | FILL: Lean Clay with Sand, with Gravel, grayish brown, stiff.<br>Perched water from 3 1/2 to 4 feet, east side flow in Gravel. | | ▽ | 18 | |
| 801.7 | 8.0 | CH | FAT CLAY with SAND, with Gravel, greenish gray, stiff.<br>(Weathered Shale Bedrock) | | | | |
| | | | BOTTOM OF TEST PIT.<br><br>Test pit then backfilled.<br><br>Water seepage observed at 3 1/2 feet during test pit excavation. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

BRAUN INTERTEC

# LOG OF TEST PIT

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

TEST PIT: **TP-25**

LOCATION: N: 143730.760 E: 549075.079. See attached sketch.

| DRILLER: Bolander | METHOD: Backhoe | DATE: **7/10/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 810.1 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 808.1 | 2.0 | FILL | FILL: Poorly Graded Sand with Silt, fine- to medium-grained, with roots, concrete, rock, and Gravel, brown, moist. | | | | |
| 803.6 | 6.5 | CL | LEAN CLAY, trace Gravel and Sand, gray and brown. (Weathered Shale Bedrock) | | | 21 | LL=41, PL=18, PI=23 |
| | | | Shale Bedrock at 6 1/2 feet, highly fractured, thin bedded. | | | | |
| | | | BOTTOM OF TEST PIT. | | | | |
| | | | Test pit then backfilled. | | | | |
| | | | Water seepage not observed during test pit excavation. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

**BRAUN** INTERTEC

# LOG OF TEST PIT

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

TEST PIT: **TP-26**

LOCATION: N: 143528.639 E: 549217.769. See attached sketch.

| DRILLER: Bolander | METHOD: Backhoe | DATE: **7/10/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 807.8 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 804.8 | 3.0 | FILL | FILL: Silty Sand, fine- to coarse-grained, with Gravel, concrete debris, roots and clay chunks, brown and dark brown, moist. | | | 13 | 43 | |
| 803.8 | 4.0 | CL | LEAN CLAY, trace Sand and organics, dark brown, moist. (Buried Topsoil/Swamp Deposit) | | | | | |
| 801.8 | 6.0 | CH | FAT CLAY, trace Gravel and Sand, gray and brown mottled, moist. (Weathered Shale Bedrock) | | | | | |
| | | | Limestone, crystalline, medium hard to hard, light brown. | | | | | |
| | | | BOTTOM OF TEST PIT. | | | | | |
| | | | Test pit then backfilled. | | | | | |
| | | | Water seepage not observed during test pit excavation. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 11:24

BRAUN INTERTEC

# LOG OF TEST PIT

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

TEST PIT: **TP-27**

LOCATION: N: 143656.746 E: 548700.987. See attached sketch.

DRILLER: Bolander | METHOD: Backhoe | DATE: **7/10/18** | SCALE: **1" = 4'**

| Elev. feet 810.1 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 805.6 | 4.5 | FILL | FILL: Poorly Graded Sand with Silt, fine- to medium-grained, with Gravel, trace Clay and roots, pvc debris from old utility at 2 feet, some Cobbles and Clay chunks, brown and dark brown, moist. | | | |
| 804.1 | 6.0 | FILL | FILL: Crushed concrete. | | ▽ | Perched seepage in concrete on top of Clay. |
| 800.1 | 10.0 | CL | LEAN CLAY with SAND, with Gravel and Limestone fragments, gray and brown mottled. (Glacial Till) | | | |
| 797.1 | 13.0 | CH | FAT CLAY, with Gravel and some Sand, greenish gray, stiff to very stiff. (Weathered Shale Bedrock) | | | |

BOTTOM OF TEST PIT.

Test pit then backfilled.

Water seepage observed at 6 feet during test pit excavation.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

BRAUN INTERTEC

# LOG OF TEST PIT

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

TEST PIT: **TP-28**

LOCATION: N: 143529.783 E: 548919.047. See attached sketch.

DRILLER: Bolander | METHOD: Backhoe | DATE: **7/10/18** | SCALE: **1" = 4'**

| Elev. feet 810.3 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 806.3 | 4.0 | FILL | FILL: Silty Sand, fine- to coarse-grained, with Gravel, brick, concrete, rebar, rock fragments and bituminous, moist to wet. | | | 14 | 20 | |
| 802.3 | 8.0 | SM | SILTY SAND, fine- to medium-grained, with Gravel and Clay, brown, moist to wet. (Glacial Till) | | ▽ | 16 | | |
| 800.3 | 10.0 | CL | LEAN CLAY with SAND, trace Gravel and Shale fragments, Limestone chunks up to 1 to 2 inches in Clay or on top of Clay, gray, moist. (Glacial Till) | | | | | |
| | | | Limestone Bedrock at 10 feet. | | | | | |
| | | | BOTTOM OF TEST PIT. | | | | | |
| | | | Test pit then backfilled. | | | | | |
| | | | Water seepage observed at 5 feet during test pit excavation. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

**BRAUN INTERTEC**

# LOG OF TEST PIT

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | | TEST PIT: **TP-29**<br>LOCATION: N: 143307.595 E: 549179.409. See attached sketch. | |
|---|---|---|---|
| DRILLER: Bolander | METHOD: Backhoe | DATE: **7/11/18** | SCALE: **1" = 4'** |

| Elev. feet 810.2 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 807.4 | 2.8 | FILL | FILL: Silty Sand, fine- to medium-grained, trace Gravel, irrigation line at 1 foot, black. (Topsoil) | | | |
| 805.2 | 5.0 | SM | SILTY SAND, fine- to medium-grained, boulder at 4 feet, brown, moist. (Terrace Deposit) | | | |
| 803.2 | 7.0 | CH | FAT CLAY, trace Gravel, gray and brown, moist. (Weathered Shale Bedrock) | | | |
| | | | Limestone Bedrock at 7 feet. | | | |
| | | | BOTTOM OF TEST PIT.<br><br>Test pit then backfilled.<br><br>Water seepage not observed during test pit excavation. | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

**BRAUN** INTERTEC

# LOG OF TEST PIT

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | | TEST PIT: **TP-30**<br>LOCATION: N: 143199.548 E: 549084.997. Offset 24 feet north. See attached sketch. | |
|---|---|---|---|
| DRILLER: Bolander | METHOD: Backhoe | DATE: **7/11/18** | SCALE: **1" = 4'** |

| Elev. feet 810.4 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 808.7 | 1.7 | FILL | FILL: Silty Sand, fine- to medium-grained, black, moist. (Topsoil) | | | | | |
| 805.4 | 5.0 | SC | CLAYEY SAND, with Gravel, Cobbles and Limestone fragments, trace Boulders, brown to light brown, moist. (Terrace Deposit) | | | 20 | 40 | |
| 803.4 | 7.0 | SC | CLAYEY SAND, with Limestone fragments, brown and gray, moist. (Glacial Till) | | ▽ | | | |
| 802.4 | 8.0 | SM | SILTY SAND, fine- to medium-grained, little Gravel, brown. (Glacial Till) | | | | | |
| | | | BOTTOM OF TEST PIT.<br><br>Test pit then backfilled.<br><br>Water seepage at 7 feet during test pit excavation. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

# LOG OF TEST PIT

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | TEST PIT: **TP-31**<br>LOCATION: N: 143179.648 E: 548943.815. See attached sketch. |
|---|---|

| DRILLER: Bolander | METHOD: Backhoe | DATE: **7/10/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 810.4 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 809.2 | 1.2 | FILL | FILL: Silty Sand, fine- to medium-grained, trace Gravel, black. (Topsoil) | | | | | |
| 805.9 | 4.5 | SM | Irrigation pipe at 14 inches. SILTY SAND, fine- to medium-grained, with Gravel and fractured Limestone pieces, dark brown to brown, moist. (Terrace Deposit) | | | 12 | 36 | |
| 804.4 | 6.0 | SP-SM | POORLY GRADED SAND with SILT, fine- to medium-grained, with Gravel and fractured Limestone pieces, brown, moist. (Terrace Deposit) | | | | | |
| | | | BOTTOM OF TEST PIT.<br><br>Test pit then backfilled.<br><br>Water seepage not observed during test pit excavation. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN
INTERTEC

# LOG OF TEST PIT

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|---|---|
| **Braun Project B1806527**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul**<br>**966 Mississippi River Boulevard S**<br>**St. Paul, Minnesota** | TEST PIT: **TP-32**<br>LOCATION: N: 144409.031 E: 550036.253. Offset 104 feet northwest 305° on compass. See attached sketch. |

| DRILLER: Bolander | METHOD: Backhoe | DATE: **7/12/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 829.7 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 825.7 | 4.0 | FILL | FILL: Sandy Lean Clay, with Fat Clay and Silty Sand inclusions, Limestone fragments, and Gravel, trace Cobbles, pvc conduit, concrete and wood debris, with occasional slightly organic to organic layers, brown, moist. | | | 20 | OC=3% |
| 823.7 | 6.0 | CH | FAT CLAY, trace Gravel, with Limestone fragments, grayish green, moist. (Weathered Shale Bedrock) | | ▽ | | |
| 818.7 | 11.0 | SH | SHALE, trace Gravel, gray, wet. (Decorah Shale Bedrock) | | | | |
| | | | BOTTOM OF TEST PIT.<br><br>Test pit then backfilled.<br><br>Water seepage observed at 6 feet during test pit excavation. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

BRAUN
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# LOG OF TEST PIT

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | TEST PIT: **TP-33**<br>LOCATION: N: 144181.062 E: 549937.650. See attached sketch. |
|---|---|

| DRILLER: Bolander | METHOD: Backhoe | DATE: **7/13/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 811.0 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 810.2 | 0.8 | CONC | Concrete reinforced slab. | | | |
| 809.5 | 1.5 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, brown, wet. | | | |
| 805.0 | 6.0 | SH | SHALE, gray, moist. (Decorah Shale Bedrock)<br>Harder at 6 feet. | | | |
| | | | BOTTOM OF TEST PIT.<br><br>Test pit then backfilled.<br><br>Water seepage not observed during test pit excavation. | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

BRAUN INTERTEC

# LOG OF TEST PIT

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

TEST PIT: **TP-34**

LOCATION: N: 144044.866 E: 550330.882. See attached sketch.

| DRILLER: Bolander | METHOD: Backhoe | DATE: **7/13/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 831.1 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 830.4 | 0.7 | CONC | 8 inch concrete slab. | | | | | |
| 830.1 | 1.0 | FILL | FILL: Poorly Graded Sand with Silt, fine- to medium-grained, trace Gravel, brown, moist. | | | | | |
| 827.1 | 4.0 | FILL | FILL: Poorly Graded Sand with Silt, fine- to medium-grained, Gravelly, with fractured Limestone fragments, brown to light brown, moist. | | | 9 | 11 | |
| 825.1 | 6.0 | CH | FAT CLAY, trace Gravel, gray with brown, moist. (Weathered Shale Bedrock)<br>Limestone at 5.8 feet. | | | | | |
| | | | BOTTOM OF TEST PIT.<br><br>Test pit then backfilled.<br><br>Water seepage not observed during test pit excavation. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN[SM]
INTERTEC

# LOG OF TEST PIT

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| **Braun Project B1806527**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul**<br>**966 Mississippi River Boulevard S**<br>**St. Paul, Minnesota** | TEST PIT: **TP-35**<br>LOCATION: N: 143923.654 E: 550618.095. Offset 6 feet south. See attached sketch. |
| DRILLER: Bolander  METHOD: Backhoe | DATE: **7/11/18**  SCALE: **1" = 4'** |

| Elev. feet 832.3 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 831.6 | 0.7 | AGG | 8 inches of aggregate base. | | | | |
| 830.6 | 1.7 | OL | ORGANIC CLAY, fibrous, black, moist. (Buried Topsoil/Swamp Deposit) | | | 32 | OC=13% |
| 828.3 | 4.0 | SM | SILTY SAND, fine- to medium-grained, with Lean Clay inclusions, with Gravel, Cobbles, Boulders, and Limestone fragments, dry. (Terrace Deposit) | | | 13 | |
| 826.3 | 6.0 | CH | FAT CLAY, trace Gravel, gray, moist. (Weathered Shale Bedrock) | | | | |
| | | | Limestone Bedrock. | | | | |
| | | | BOTTOM OF TEST PIT.<br><br>Test pit then backfilled.<br><br>Water seepage not observed during test pit excavation. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

**BRAUN** INTERTEC

# LOG OF TEST PIT

| **Braun Project B1806527**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul**<br>**966 Mississippi River Boulevard S**<br>**St. Paul, Minnesota** | TEST PIT: **TP-36**<br>LOCATION: N: 144596.376 E: 549104.778. See attached sketch. |
|---|---|
| DRILLER: Bolander — METHOD: Backhoe | DATE: **7/10/18** — SCALE: **1" = 4'** |

| Elev. feet 808.9 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| | | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, with Gravel, Clay nodules and Limestone fragments, brown. | | | 9 | 2 | |
| 803.9 | 5.0 | FILL | FILL: Fat Clay and Shale, trace Sand and Gravel, occasional chunks of organics/Peat, gray, moist. | | ▽ | | | |
| 799.9 | 9.0 | | Shale Bedrock at 9 feet.<br>BOTTOM OF TEST PIT.<br><br>Test pit then backfilled.<br><br>Water seepage observed at 5 feet during test pit excavation. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

# LOG OF TEST PIT

BRAUN INTERTEC

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| **Braun Project B1806527**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul**<br>**966 Mississippi River Boulevard S**<br>**St. Paul, Minnesota** | TEST PIT: **TP-37**<br>LOCATION: N: 144359.618 E: 549080.752. See attached sketch. |
| DRILLER: Bolander / METHOD: Backhoe | DATE: **7/11/18** / SCALE: **1" = 4'** |

| Elev. feet 810.3 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 807.3 | 3.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with brick fragments, Gravel, Cobbles, plastic and plastic poly, piece of rebar and cable, dark brown, brown and black, | | | | | |
| 803.3 | 7.0 | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, trace Gravel, brown, moist.<br>Wet at 5 feet. | | ∇ | 13 | 2 | |
| 800.3 | 10.0 | SH | SHALE, trace Gravel, gray, moist. (Decorah Shale Bedrock) | | | | | |
| | | | Hard/Bedrock - likely Limestone. | | | | | |
| | | | BOTTOM OF TEST PIT.<br>Test pit then backfilled.<br>Water seepage observed at 6 1/2 feet during test pit excavation. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | TEST PIT: TP-38<br>LOCATION: N: 145851.540 E: 548261.273. See attached sketch. |
|---|---|

| DRILLER: Bolander | METHOD: Backhoe | DATE: 7/11/18 | SCALE: 1" = 4' |
|---|---|---|---|

| Elev. feet 810.4 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 809.9 | 0.5 | FILL | FILL: Lean Clay, with Gravel, trace Cobbles and roots, gray, black and brown, moist. (Topsoil) | | | | | |
| | | FILL | FILL: Poorly Graded Sand with Silt, fine- to medium-grained, little Gravel, brown, moist. | | | 4 | 3 | |
| 805.4 | 5.0 | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, with Gravel, brown, moist to wet at 6 feet. | | ▽ | | | |
| 800.4 | 10.0 | | Bedrock at 10 feet. Couldn't see due to cave-in.<br>BOTTOM OF TEST PIT.<br><br>Test pit then backfilled.<br><br>Water seepage observed at 6 feet during test pit excavation. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN[SM]
INTERTEC

# LOG OF TEST PIT

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | TEST PIT: **TP-39**<br>LOCATION: N: 145601.530 E: 548697.366. See attached sketch. |
|---|---|

| DRILLER: Bolander | METHOD: Backhoe | DATE: **7/11/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 810.2 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 808.2 | 2.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, trace Cobbles, occasional Clay and Organic Clay inclusions, dark brown with black, moist. | | | 9 | 20 | |
| 798.2 | 12.0 | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, little Gravel, trace Cobbles, brown, moist.<br>Wet at 6 feet. | | ▽ | | | |
| | | | Shale Bedrock at 12 feet. | | | | | |

BOTTOM OF TEST PIT.

Test pit then backfilled.

Water seepage observed at 6 feet during test pit excavation.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

# BRAUN INTERTEC

# LOG OF TEST PIT

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

TEST PIT: **TP-40**

LOCATION: N: 145217.230 E: 548836.894. See attached sketch.

DRILLER: Bolander | METHOD: Backhoe | DATE: **7/10/18** | SCALE: **1" = 4'**

| Elev. feet 809.2 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 808.2 | 1.0 | FILL | FILL: Sandy Lean Clay, with Gravel and a few concrete fragments, dark brown and gray, moist. | | | |
| | | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, Gravel, brown, moist. | | | |
| | | | Clay/Shale inclusions below 8 feet. | | ▽ | |
| 794.2 | 15.0 | | Bedrock - likely Shale. | | | |
| | | | BOTTOM OF TEST PIT. | | | |
| | | | Test pit then backfilled. | | | |
| | | | Water seepage observed at 9 feet during test pit excavation. | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

BRAUN INTERTEC

# LOG OF TEST PIT

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| **Braun Project B1806527**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul**<br>**966 Mississippi River Boulevard S**<br>**St. Paul, Minnesota** | TEST PIT: **TP-41**<br>LOCATION: N: 145026.748 E: 549147.759. See attached sketch. |

| DRILLER: Bolander | METHOD: Backhoe | DATE: **7/10/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 811.0 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 809.0 | 2.0 | FILL | FILL: Clayey Sand, fine- to medium-grained, with Gravel, trace Cobbles and occasional Fat Clay inclusions, dark brown, moist. | 14 | | |
| 796.0 | 15.0 | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, with Gravel, occasional Clay inclusions, brown, moist. | | ∇ | |
| | | | Bedrock - unknown. Did not observe due to side collapse. | | | |
| | | | BOTTOM OF TEST PIT.<br><br>Test pit then backfilled.<br><br>Water seepage observed at 8 feet during test pit excavation. | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

BRAUN℠ INTERTEC

# LOG OF TEST PIT

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

TEST PIT: **TP-42**

LOCATION: N: 144654.588 E: 549310.289 See attached sketch.

DRILLER: Bolander | METHOD: Backhoe | DATE: **7/10/18** | SCALE: **1" = 4'**

| Elev. feet 809.8 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| 808.8 | 1.0 | FILL | FILL: Sandy Lean Clay, with Gravel, trace organics and Limestone fragments, dark brown. | | | | | |
| 796.8 | 13.0 | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, with Gravel and some Clay nodules, brown. | | | 3 | 1 | |
| | | | Likely Limestone Bedrock. | | | | | |
| | | | BOTTOM OF TEST PIT. | | | | | |
| | | | Test pit then backfilled. | | | | | |
| | | | Water seepage not observed during test pit excavation. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

BRAUN INTERTEC

# LOG OF TEST PIT

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|---|---|
| **Braun Project B1806527**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul**<br>**966 Mississippi River Boulevard S**<br>**St. Paul, Minnesota** | TEST PIT: **TP-43**<br>LOCATION: N: 144561.555 E: 548959.652. See attached sketch. |

| DRILLER: Bolander | METHOD: Backhoe | DATE: **7/10/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 812.2 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 811.2 | 1.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel and concrete debris, brown, moist. | | | | |
| 804.2 | 8.0 | FILL | FILL: Sandy Lean Clay mixed with Silty Sand, with Gravel, Cobbles and concrete fragments, brown and gray.<br>Wood debris at 3 feet.<br>Concrete/rebar debris at 4 feet.<br>Ceramic drain pipe fragments from 4 to 5 feet. | | | 21<br>16 | |
| 802.2 | 10.0 | FILL | FILL: Crushed concrete layer (gravel-sized), grayish brown. | | | | |
| | | | In-place concrete footing/slab at 10 feet, observed conduit wiring in concrete. | | | | |
| | | | BOTTOM OF TEST PIT.<br>Test pit then backfilled.<br>Water seepage not observed during test pit excavation. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

BRAUN℠ INTERTEC

# LOG OF TEST PIT

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

TEST PIT: **TP-44**

LOCATION: N: 144781.511 E: 548579.370. See attached sketch.

DRILLER: Bolander | METHOD: Backhoe | DATE: **7/10/18** | SCALE: **1" = 4'**

| Elev. feet 811.5 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 810.5 | 1.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, Limestone and concrete fragments. | | | | |
| 807.5 | 4.0 | FILL | FILL: Sandy Lean Clay, with Gravel and Limestone fragments, moist. | | | 15 | |
| 805.0 | 6.5 | FILL | FILL: Lean Clay with Sand, with Gravel, brown, moist. | | | 14 | |
| 802.5 | 9.0 | FILL | FILL: Poorly Graded Sand, fine- to coarse-grained, with Gravel and Clay nodules, brown, moist. | | | | |
| 800.5 | 11.0 | FILL | FILL: Fat Clay, with Shale fragments, trace Gravel, blue gray and brown, moist. | | | 60 | |
| 799.5 | 12.0 | CL | LEAN CLAY, with Gravel and Limestone fragments, brown, moist. (Glacial Till) | | | 15 | |
| | | | Limestone Bedrock at 12 feet. | | | | |
| | | | BOTTOM OF TEST PIT. | | | | |
| | | | Test pit then backfilled. | | | | |
| | | | Water seepage not observed during test pit excavation. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

BRAUN INTERTEC

# LOG OF TEST PIT

| **Braun Project B1806527**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul**<br>**966 Mississippi River Boulevard S**<br>**St. Paul, Minnesota** | TEST PIT: **TP-45**<br>LOCATION: N: 145494.503 E: 549566.977. See attached sketch. |
|---|---|
| DRILLER: Bolander / METHOD: Backhoe | DATE: **7/12/18** / SCALE: **1" = 4'** |

| Elev. feet 832.6 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| | | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel and Cobbles, trace concrete and brick debris, with occasional Lean Clay inclusions and slightly organic layers, brown, moist. | | | 11 | 18 | |
| 827.1 | 5.5 | | Concrete pipe at 5 feet. | | | | | |
| | | CH | FAT CLAY, trace Gravel and Limestone fragments, gray and brown, moist. (Weathered Shale Bedrock) | | | | | |
| 825.6 | 7.0 | | Dolomitic Limestone layer at 7 feet. | | | | | |
| | | | BOTTOM OF TEST PIT.<br><br>Test pit then backfilled.<br><br>Water seepage not observed during test pit excavation. | | | | | |

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC

# LOG OF TEST PIT

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

TEST PIT: **TP-46**

LOCATION: N: 144855.225 E: 549760.792. See attached sketch.

DRILLER: Bolander | METHOD: Backhoe | DATE: **7/12/18** | SCALE: **1" = 4'**

| Elev. feet 831.4 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | P200 % | Tests or Notes |
|---|---|---|---|---|---|---|---|---|
| | | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, trace concrete debris, brown, moist. | | | | | |
| 829.4 | 2.0 | | Peat layer at 2 feet. | | | 36 | | OC=12% |
| | | FILL | FILL: Poorly Graded Sand with Silt, fine- to medium-grained, with Gravel, brown, moist. | | | 6 | 6 | |
| 827.4 | 4.0 | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, with Gravel, Lean Clay inclusions and Limestone fragments, gray with brown, wet. | | | | | |
| | | | Weathered Shale at 7 feet. | | ▽ | | | Note: Weathered Shale present in excavation sidewall from 7 feet to end of test pit. Top of bedrock near 7 feet adjacent to test pit. |
| 817.4 | 14.0 | | Bedrock - unknown. Did not observe due to side collapse. | | | | | |
| | | | BOTTOM OF TEST PIT. | | | | | |
| | | | Test pit then backfilled. | | | | | |
| | | | Water seepage observed at 7 feet during test pit excavation. | | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:48

BRAUN INTERTEC

# LOG OF TEST PIT

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|---|---|
| **Braun Project B1806527**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul**<br>**966 Mississippi River Boulevard S**<br>**St. Paul, Minnesota** | TEST PIT: **ENV-TP-1**<br>LOCATION: N: 145171.047 E: 548665.935. See attached sketch. |
| DRILLER: Bolander — METHOD: Backhoe | DATE: **8/9/18** — SCALE: **1" = 4'** |

| Elev. feet 812.0 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 810.0 | 2.0 | FILL | FILL: Sandy Lean Clay, with Gravel, trace concrete debris, non- to slightly organic, dark brown, moist. (Topsoil) | | | |
| 802.0 | 10.0 | FILL | FILL: Crushed concrete (gravel-sized), brown, moist.<br>Apparent concrete slab. | | ▽ | |
| | | | BOTTOM OF TEST PIT.<br>Test pit immediately backfilled.<br>Water seepage observed at 9 1/2 feet during test pit excavation. | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:49

BRAUN℠ INTERTEC

# LOG OF TEST PIT

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | TEST PIT: **ENV-TP-2**<br>LOCATION: N: 145753.046 E: 548545.451. See attached sketch. |
|---|---|

| DRILLER: Bolander | METHOD: Backhoe | DATE: **8/9/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 810.6 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 809.6 | 1.0 | FILL | FILL: Clayey Sand, with occasional Fat Clay inclusions, non- to slightly organic, brown, moist. | | | | |
| 800.6 | 10.0 | FILL | FILL: Poorly Graded Sand, fine- to medium-grained, trace Cobbles, little Gravel, brown, moist to 10 feet then wet. | | ▽ | 9 | |
| 799.1 | 11.5 | CONC | CONCRETE. Top of footing at 10 feet (left in place). Approximately 6'x6'x16" deep. | | | | |
| 798.6 | 12.0 | CH | FAT CLAY, little Gravel, trace Limestone fragments, gray and brown, wet. (Weathered Shale Bedrock) | | | | |
| | | | BOTTOM OF TEST PIT.<br><br>Test pit immediately backfilled.<br><br>Water seepage observed at 10 feet during test pit excavation. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:49

BRAUN INTERTEC

# LOG OF TEST PIT

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|---|---|
| **Braun Project B1806527**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul**<br>**966 Mississippi River Boulevard S**<br>**St. Paul, Minnesota** | TEST PIT: **ENV-TP-3**<br>LOCATION: N: 145519.219 E: 549718.451. See attached sketch. |

| DRILLER: Bolander | METHOD: Backhoe | DATE: **8/10/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 832.7 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 831.7 | 1.0 | FILL | FILL: Silty Sand, fine- to medium-grained, trace Gravel and Fat Clay inclusions, brown, moist. | | | | |
| 825.7 | 7.0 | FILL | FILL: Fat Clay, organic layer between 1 and 1 1/2 feet, trace concrete, tile, bituminous and plastic debris, a piece of porcelain at 1 foot, with Sand inclusions and occasional Gravelly layers.<br>Concrete mass starts at 7 to 8 feet. Appears cut into bedrock and was left in place. | | | 19 | |
| 824.7 | 8.0 | SH | SHALE, hard, gray, moist.<br>(Decorah Shale Bedrock) | | | | |
| | | | BOTTOM OF TEST PIT.<br>Test pit immediately backfilled.<br>Water seepage not observed during test pit excavation. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:49

BRAUN INTERTEC

# LOG OF TEST PIT

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | TEST PIT: **ENV-TP-4**<br>LOCATION: N: 144819.371 E: 549933.722. See attached sketch. |
|---|---|
| DRILLER: Bolander — METHOD: Backhoe | DATE: **8/10/18** — SCALE: **1" = 4'** |

| Elev. feet 832.2 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 831.7 | 0.5 | FILL | FILL: Silty Sand, fine- to medium-grained, little Gravel, brown, moist. | | | |
| 828.2 | 4.0 | FILL | FILL: Fat Clay, with Silty Sand inclusions and occasional slightly organic layers, trace steel, rebar, plastic, bituminous and clay pipe debris, brown and black, moist. | | | |
| 827.2 | 5.0 | SM | SILTY SAND, fine- to medium-grained, with Gravel, trace Limestone fragments, brown, moist. (Terrace Deposit) | 7 | | |
| 826.2 | 6.0 | SP | POORLY GRADED SAND, fine- to medium-grained, trace Gravel, brown, moist. (Terrace Deposit) | | | |
| 824.2 | 8.0 | SH | SHALE, trace Limestone fragments, harder at 7 feet, gray with brown to 7 feet then gray, moist. (Decorah Shale Bedrock) | | | |
| | | | BOTTOM OF TEST PIT.<br><br>Test pit immediately backfilled.<br><br>Water seepage not observed during test pit excavation. | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:49

BRAUN INTERTEC

# LOG OF TEST PIT

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

TEST PIT: **ENV-TP-5**

LOCATION: N: 145168.877 E: 548501.000. See attached sketch.

DRILLER: Bolander | METHOD: Backhoe | DATE: **8/9/18** | SCALE: **1" = 4'**

| Elev. feet 812.5 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 810.5 | 2.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel, occasional non- to slightly organic layers and Fat Clay inclusions, trace concrete, Cobbles, wood and rebar debris, brown, moist. | | | |
| 801.5 | 11.0 | FILL | FILL: Crushed concrete (gravel-sized), brown, moist. | | ∇ | |
| 801.3 | 11.2 | SH | SHALE, gray, moist. (Decorah Shale Bedrock) | | | |
| | | | BOTTOM OF TEST PIT. | | | |

Test pit immediately backfilled.

Water seepage observed at 9 feet during test pit excavation.

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:49

BRAUN INTERTEC

# LOG OF TEST PIT

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | TEST PIT: **ENV-TP-6**<br>LOCATION: N: 144237.076 E: 548573.565. See attached sketch. |
|---|---|

| DRILLER: Bolander | METHOD: Backhoe | DATE: **8/9/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 812.5 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 811.5 | 1.0 | FILL | FILL: Poorly Graded Sand with Silt, fine- to medium-grained, little Gravel, trace Cobbles, Clay pipe at 1 foot, brown, moist. | | | | |
| 811.3 | 1.2 | OL | ORGANIC CLAY, trace Gravel, black, moist. (Swamp Deposit/Buried Topsoil) | | | | 65" X 65" concrete footing and pier approximately 1 to 4 feet below grade. |
| 805.5 | 7.0 | SC | CLAYEY SAND, with Poorly Graded Sand seams and layers, trace Limestone fragments, brownish gray to gray with brown, moist. (Glacial Till) | | | 15 | |
| 802.5 | 10.0 | SH | SHALE, trace Gravel and Limestone fragments, gray, moist. (Decorah Shale Bedrock) | | | | |
| | | | BOTTOM OF TEST PIT.<br><br>Test pit immediately backfilled.<br><br>Water seepage not observed during test pit excavation. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

# LOG OF TEST PIT

**Braun Project B1806527**
**GEOTECHNICAL EVALUATION**
**Project Paul**
**966 Mississippi River Boulevard S**
**St. Paul, Minnesota**

TEST PIT: **ENV-TP-8**

LOCATION: N: 144408.809 E: 548532.792. See attached sketch.

| DRILLER: Bolander | METHOD: Backhoe | DATE: 8/9/18 | SCALE: 1" = 4' |
|---|---|---|---|

| Elev. feet 812.9 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 810.9 | 2.0 | FILL | FILL: Silty Sand, fine- to medium-grained, with occasional slightly organic layers, Lean Clay and Fat Clay inclusions, Clay pipe at 1/2 foot, brown, moist. | | | | |
| 806.9 | 6.0 | SC | CLAYEY SAND, with Sand seams/layers and Limestone fragments, trace Gravel, brownish gray, moist. (Glacial Till) | | ▽ | | |
| 804.9 | 8.0 | SH | SHALE, with Limestone fragments, gray, moist. (Decorah Shale Bedrock) | | | 26 | |
| | | | BOTTOM OF TEST PIT.<br>Test pit immediately backfilled.<br>Water seepage observed at 6 feet during test pit excavation. | | | | |

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:49 (See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC

# LOG OF TEST PIT

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | TEST PIT: ENV-TP-9<br>LOCATION: N: 144409.717 E: 548710.801. See attached sketch. |
|---|---|
| DRILLER: Bolander \| METHOD: Backhoe | DATE: 8/9/18 \| SCALE: 1" = 4' |

| Elev. feet 812.6 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 808.6 | 4.0 | FILL | FILL: Concrete pit filled with Silty Sand, fine- to medium-grained, with Gravel, brown, moist.<br><br>Pipe at approximately 2 feet in north and south portions of pit. | | | |
| | | | BOTTOM OF TEST PIT.<br><br>Test pit left open. Approximately half of concrete pit remained in place.<br><br>Water seepage not observed during test pit excavation. | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

# LOG OF TEST PIT

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | TEST PIT: ENV-TP-10<br>LOCATION: N: 144540.174 E: 548600.912. See attached sketch. |
|---|---|
| DRILLER: Bolander · METHOD: Backhoe | DATE: 8/10/18 · SCALE: 1" = 4' |

| Elev. feet 812.9 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 808.9 | 4.0 | FILL | FILL: Clayey Sand, with Gravel, non- to slightly organic, with steel beams and concrete masses (column pad and other debris), brown, moist.<br>Mainly concrete at 3 feet. | | | | Note: North portion of test pit had crushed concrete fill to approximately 6 feet. |
| 806.9 | 6.0 | CH | FAT CLAY, with Limestone fragments, little Gravel, brown with gray, moist.<br>(Weathered Shale Bedrock) | | ▽ | | |
| 803.9 | 9.0 | SH | SHALE, gray, wet.<br>(Decorah Shale Bedrock) | | | 18 | LL=35, PL=14, PI=21 |
| | | | BOTTOM OF TEST PIT.<br>Test pit immediately backfilled.<br>Water seepage observed at 6 feet during test pit excavation. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

# LOG OF TEST PIT

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| **Braun Project B1806527**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul**<br>**966 Mississippi River Boulevard S**<br>**St. Paul, Minnesota** | TEST PIT: **ENV-TP-30**<br>LOCATION: N: 144523.224 E: 549532.296. See attached sketch. |

| DRILLER: Bolander | METHOD: Backhoe | DATE: **8/10/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 808.0 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 807.5 | 0.5 | FILL | FILL: Organic Clay, trace Gravel, black, moist. (Topsoil Fill) | | | |
| 805.0 | 3.0 | FILL | FILL: Poorly Graded Sand with Silt, fine- to medium-grained, trace Gravel, concrete, rebar, PVC, aggregate base and bituminous fragments, brown, moist. | | ▽ | |
| 801.0 | 7.0 | SH | SHALE, trace Gravel, gray with brown to 5 feet then gray, moist. (Decorah Shale Bedrock)<br>Less weathered at 5 feet. | | | |
| | | | BOTTOM OF TEST PIT.<br><br>Test pit immediately backfilled.<br><br>Water seepage observed at 3 feet during test pit excavation. | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:49

BRAUN INTERTEC

# LOG OF TEST PIT

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| **Braun Project B1806527**<br>**GEOTECHNICAL EVALUATION**<br>**Project Paul**<br>**966 Mississippi River Boulevard S**<br>**St. Paul, Minnesota** | TEST PIT: **ENV-TP-58**<br>LOCATION: N: 145009.482 E: 548634.932. See attached sketch. |

| DRILLER: Bolander | METHOD: Backhoe | DATE: **8/9/18** | SCALE: **1" = 4'** |
|---|---|---|---|

| Elev. feet 812.2 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 811.2<br>810.7 | 1.0<br>1.5 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel and occasional Fat Clay deposits and concrete debris, pipe at 1 feet, brown, moist. | | | | |
| | | SM | SILTY SAND, fine-grained, slightly organic, trace Gravel and roots, black, moist. (Buried Topsoil) | | | | |
| 809.2 | 3.0 | SP-SM | POORLY GRADED SAND with SILT, fine- to medium-grained, with Gravel, trace Cobbles, Boulders and Limestone fragments, brown, moist. (Terrace Deposit) | | | 13 | |
| 806.2 | 6.0 | SC | CLAYEY SAND, with Gravel and Limestone fragments, brown with gray, moist. (Glacial Till) | | | | |
| 803.2 | 9.0 | SH | SHALE, trace Limestone fragments, gray, moist. (Decorah Shale Bedrock) | | | | |
| | | | BOTTOM OF TEST PIT.<br><br>Test pit immediately backfilled.<br><br>Water seepage not observed during test pit excavation. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:49

BRAUN℠ INTERTEC

# LOG OF TEST PIT

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | TEST PIT: **ENV-TP-63**<br>LOCATION: N: 144703.931 E: 548930.299. See attached sketch. |
|---|---|
| DRILLER: Bolander / METHOD: Backhoe | DATE: **8/10/18** / SCALE: **1" = 4'** |

| Elev. feet 812.2 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | MC % | Tests or Notes |
|---|---|---|---|---|---|---|---|
| 809.7 | 2.5 | FILL | FILL: Silty Sand, fine- to medium-grained, with Gravel and Limestone fragments, trace Cobbles, with pipe and concrete debris at 1 foot, brown, moist. | | | | |
| 807.2 | 5.0 | SM | SILTY SAND, fine-grained, non- to slightly organic, black to brown, moist. (Buried Topsoil) | | | 13 | OC=2% |
| 806.7 | 5.5 | SM | SILTY SAND, fine- to coarse-grained, Gravelly, trace Cobbles, brown, moist. (Terrace Deposit) | | | | |
| 804.2 | 8.0 | CH | FAT CLAY, trace Gravel, brown with gray, moist. (Weathered Shale Bedrock.) | | | | |
| 803.2 | 9.0 | SH | SHALE, gray, moist. (Decorah Shale Bedrock) | | | | |
| | | | BOTTOM OF TEST PIT.<br><br>Test pit immediately backfilled.<br><br>Water seepage observed at 5 1/2 feet during test pit excavation. | | | | |

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC

# LOG OF TEST PIT

| Braun Project B1806527<br>GEOTECHNICAL EVALUATION<br>Project Paul<br>966 Mississippi River Boulevard S<br>St. Paul, Minnesota | TEST PIT: **ENV-TP-94**<br>LOCATION: N: 145509.874 E: 548082.913. See attached sketch. |
|---|---|
| DRILLER: Bolander / METHOD: Backhoe | DATE: **8/9/18** / SCALE: **1" = 4'** |

| Elev. feet 812.5 | Depth feet 0.0 | ASTM Symbol | Description of Materials (ASTM D2488 or D2487) | BPF | WL | Tests or Notes |
|---|---|---|---|---|---|---|
| 811.5 | 1.0 | FILL | FILL: Poorly Graded Sand with Silt, fine- to medium-grained, trace Gravel, with occasional Lean Clay and Fat Clay inclusions, pipe at 1 to 2 feet, brown, moist. | | | |
| 810.0 | 2.5 | SM | SILTY SAND, fine-grained, slightly organic, black, moist. (Buried Topsoil/Swamp Deposit) | | | |
| 809.0 | 3.5 | SM | SILTY SAND, fine-grained, little Gravel, brown, moist. (Terrace Deposit) | | | |
| 803.5 | 9.0 | CH | FAT CLAY, with fractured Limestone and Cobbles, brown with gray, moist. (Weathered Shale Bedrock) | | | |
| 800.5 | 12.0 | SH | SHALE, trace Gravel and Limestone fragments, gray, moist. (Decorah Shale Bedrock) | | | |

BOTTOM OF TEST PIT.

Test pit immediately backfilled.

Water seepage observed at 12 feet during test pit excavation.

(See Descriptive Terminology sheet for explanation of abbreviations)

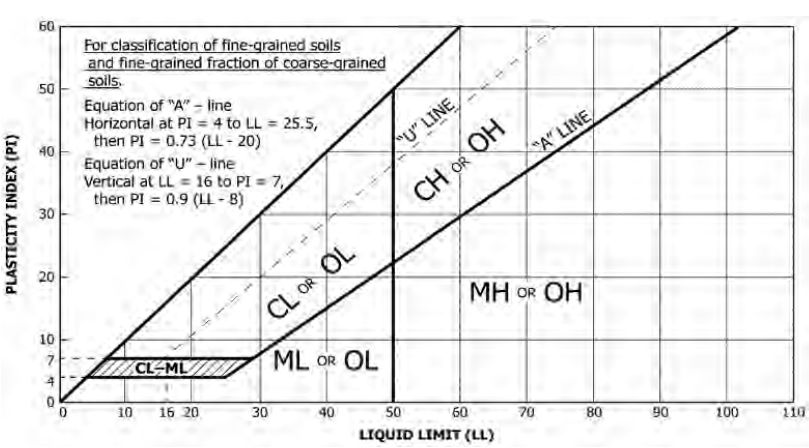
LOG OF TEST PIT N:\GINT\PROJECTS\AX PROJECTS\2018\06527 - TEST PITS.GPJ BRAUN_V8_CURRENT.GDT 11/26/19 09:49

# Descriptive Terminology of Soil

Based on Standards ASTM D2487/2488
(Unified Soil Classification System)

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

A. Based on the material passing the 3-inch (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. $C_u = D_{60} / D_{10}$   $C_c = (D_{30})^2 / (D_{10} \times D_{60})$
E. If soil contains ≥ 15% sand, add "with sand" to group name.
F. If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
G. If fines are organic, add "with organic fines" to group name.
H. 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
I. If soil contains ≥ 15% gravel, add "with gravel" to group name.
J. If Atterberg limits plot in hatched area, soil is CL-ML, silty clay.
K. If soil contains 15 to < 30% 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.




### Particle Size Identification

Boulders.............. over 12"
Cobbles................ 3" to 12"
Gravel
- Coarse............. 3/4" to 3" (19.00 mm to 75.00 mm)
- Fine................. No. 4 to 3/4" (4.75 mm to 19.00 mm)

Sand
- Coarse.............. No. 10 to No. 4 (2.00 mm to 4.75 mm)
- Medium........... No. 40 to No. 10 (0.425 mm to 2.00 mm)
- Fine.................. No. 200 to No. 40 (0.075 mm to 0.425 mm)

Silt........................ No. 200 (0.075 mm) to .005 mm
Clay...................... < .005 mm

### Relative Proportions[L, M]

trace............................. 0 to 5%
little.............................. 6 to 14%
with.............................. ≥ 15%

### Inclusion Thicknesses

lens............................... 0 to 1/8"
seam............................. 1/8" to 1"
layer.............................. over 1"

### Apparent Relative Density of Cohesionless Soils

Very loose ..................... 0 to 4 BPF
Loose ............................ 5 to 10 BPF
Medium dense.............. 11 to 30 BPF
Dense............................ 31 to 50 BPF
Very dense.................... over 50 BPF

| Consistency of Cohesive Soils | Blows Per Foot | Approximate Unconfined Compressive Strength |
|---|---|---|
| Very soft | 0 to 1 BPF | < 0.25 tsf |
| Soft | 2 to 4 BPF | 0.25 to 0.5 tsf |
| Medium | 5 to 8 BPF | 0.5 to 1 tsf |
| Stiff | 9 to 15 BPF | 1 to 2 tsf |
| Very Stiff | 16 to 30 BPF | 2 to 4 tsf |
| Hard | over 30 BPF | > 4 tsf |

### Moisture Content:

**Dry:** Absence of moisture, dusty, dry to the touch.
**Moist:** Damp but no visible water.
**Wet:** Visible free water, usually soil is below water table.

### Drilling Notes:

**Blows/N-value:** Blows indicate the driving resistance recorded for each 6-inch interval. The reported N-value is the blows per foot recorded by summing the second and third interval in accordance with the Standard Penetration Test, ASTM D1586.

**Partial Penetration:** If the sampler could not be driven through a full 6-inch interval, the number of blows for that partial penetration is shown as #/x" (i.e. 50/2"). The N-value is reported as "REF" indicating refusal.

**Recovery:** Indicates the inches of sample recovered from the sampled interval. For a standard penetration test, full recovery is 18", and is 24" for a thinwall/shelby tube sample.

**WOH:** Indicates the sampler penetrated soil under weight of hammer and rods alone; driving not required.

**WOR:** Indicates the sampler penetrated soil under weight of rods alone; hammer weight and driving not required.

**Water Level:** Indicates the water level measured by the drillers either while drilling ( ▽ ), at the end of drilling ( ▼ ), or at some time after drilling ( ▼ ).

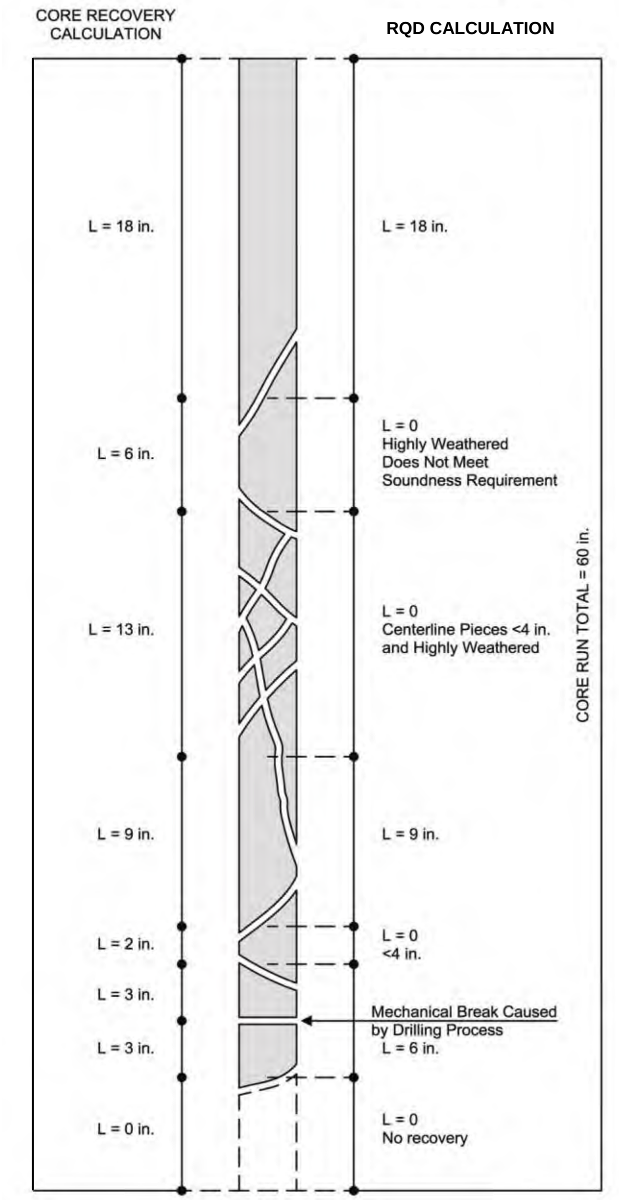
### Laboratory Tests

| | | | | | |
|---|---|---|---|---|---|
| **DD** | Dry density, pcf | **OC** | Organic content, % | **LL** | Liquid limit |
| **WD** | Wet density, pcf | **$q_p$** | Pocket penetrometer strength, tsf | **PL** | Plastic limit |
| **P200** | % Passing #200 sieve | **MC** | Moisture content, % | **PI** | Plasticity index |
| | | **$q_U$** | Unconfined compression test, tsf | | |

BRAUN INTERTEC

# *Descriptive Terminology of Rock*

Based on U.S. Army Corps of Engineers EM 1110-1-2908




**Example Calculations**

Core Recovery, CR = <u>Total length of rock recovered</u>
Total core run length

*Example:CR = <u>(18 + 6 + 13 + 9 + 2 + 3 + 3)</u>*
*(60)*

*CR = 90%*

RQD = <u>Sum of sound pieces 4 inches or larger</u>
Total core run length

| <u>RQD Percent</u> | <u>Rock Quality</u> |
|---|---|
| < 25 | very poor |
| 25 < 50 | poor |
| 50 < 75 | fair |
| 75 < 90 | good |
| 90 < 100 | excellent |

*Example: RQD = <u>(18 + 9 + 6)</u>*
*(60)*

RQD = 55%

## Weathering

*Unweathered:* No evidence of chemical or mechanical alteration.

*Slightly weathered:* Slight discoloration on surface, slight alteration along discontinuities, less than 10% of rock volume altered.

*Moderately Weathered:* Discoloration evident, surface pitted and altered with alteration penetrating well below rock surfaces, weathering halos evident, 10% to 50% of the rock altered.

*Highly Weathered:* Entire mass discolored, alteration pervading nearly all of the rock, with some pockets of slightly weathered rock noticeable, some mineral leached away.

*Decomposed:* Rock reduced to a soil consistency with relict rock texture, generally molded and crumbled by hand.

## Hardness

| | |
|---|---|
| *Very soft:* | Can be deformed by hand |
| *Soft:* | Can be scratched with a fingernail |
| *Moderately hard:* | Can be scratched easily with a knife |
| *Hard:* | Can be scratched with difficulty with a knife |
| *Very hard:* | Cannot be scratched with a knife |

## Texture

| *Sedimentary Rocks:* | <u>*Grain Size*</u> |
|---|---|
| Coarse grained | 2 – 5 mm |
| Medium grained | 0.4 – 2 mm |
| Fine grained | 0.1 – 0.4 mm |
| Very fine grained | < 0.1 mm |
| *Igneous and Metamorphic Rocks:* | |
| Coarse grained | 5 mm |
| Medium grained | 1 – 5 mm |
| Fine grained | 0.1 – 1 mm |
| Aphanitic | < 0.1 mm |

## Thickness of Bedding

| | |
|---|---|
| *Massive:* | 3 ft. thick or greater |
| *Thick bedded:* | 1 to 3 ft. thick |
| *Medium bedded:* | 4 in. to 1 ft. thick |
| *Thin bedded*: | 4 in. thick or less |

## Degree of Fracturing (Jointing)

| | |
|---|---|
| *Unfractured:* | Fracture spacing 6 ft. of more |
| *Slightly fractured:* | Fracture spacing 2 to 6 ft. |
| *Moderately fractured:* | Fracture spacing 8 in. to 2 ft. |
| *Highly fractured:* | Fracture spacing 2 in. to 8 in. |
| *Intensely fractured:* | Fracture spacing 2 in. or less |