Design Report

Lab USA's Ash Processing Facility - Red Wing

Red Wing, Minnesota

SEH No. LABUS 136249 4.00

June 15, 2016

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Prepared for Lab USA Corp.

1.0 Introduction

Lab USA Corp. (Lab USA) is proposing to develop a new resource recovery facility in the City of Red Wing, Minnesota. The resource recovery facility will process municipal solid waste (MSW) combustor ash currently being generated at Xcel Energy's Red Wing Generating Plant as well as combustor ash previously placed in nearby landfills owned by the City of Red Wing (City) and Xcel Energy.

This Design Report is organized as follows:

- Section 2.0 provides general facility information regarding facility description, physical setting, location standards, environmental review, and associated permits.
- Section 3.0 presents the facility plan in reference to site access and control, waste flows, facility design, and waste management operations.

1.1 Project Description

Currently, more than 6 million tons of combustor ash have been disposed in landfills within the state of Minnesota with more combustor ash being generated every day. Combustor ash is composed of both fly ash and bottom ash resulting in a moist coarse aggregate-like mixture with some partially unburned material. Combustor ash can contain metals of many sizes that can be beneficially used in industry across the country. Lab USA is proposing to develop a processing facility to recover the ferrous and non-ferrous metals from combustor ash currently being generated and landfilled in the Red Wing area. The technology being applied to the processing was developed in Europe where sustainability is the focus of the waste-to-energy (WTE) industry and the bulk of all combustor ash is recycled and beneficially used.

The proposed resource recovery facility in Red Wing will include development of a 27,500 square foot building to house all processing operations indoors. Lab's processing is a purely mechanical process that does not change the classification of combustor ash because of its additive-free process. The operations will include:

- Offloading
- Crushing/Screening Processing (oversized material removal)
- Magnetic Separator Processing (mid-fraction ferrous and non-ferrous removal)
- Eddy Current Processing (mid and fine-fraction non-ferrous removal)
- Loading Operations

Based on equipment capacity, it is anticipated that the proposed facility can process up to 150,000 tons of combustor ash each year. The proposed resource recovery facility will process combustor ash currently being generated at Xcel Energy's Red Wing Generating Plant as well as combustor ash previously placed in nearby landfills owned by the City of Red Wing and Xcel Energy.

1.2 Regulatory Requirements

Resource recovery and waste processing are regulated by the Minnesota Pollution Control Agency (MPCA) and fall under Minnesota Rules 7035. As a result, Lab USA must obtain a solid waste permit to construct and operate the proposed facility. Due to the facility accepting waste material and ultimately transferring the residual processed material to other permitted solid waste facilities for final disposal, the MPCA has indicated that the proposed resource recovery facility will be permitted under Minnesota's transfer station rules. The facility must meet solid waste siting rules as well as regulatory requirements regarding the facility design, solid waste storage, stormwater, air quality, operations, and closure.

This report is intended to fulfill the MPCA requirements regarding design as stated in Minnesota Rules 7001.3300 (all solid waste facilities), 7035.2855 (solid waste storage standards), and 7035.2870 (solid waste transfer facilities). The following submittals comprise the full application for the proposed issuance of the solid waste permit number:

1. Permit Application and Checklists, Lab USA's Ash Processing Facility – Red Wing (SEH, June 2016).
2. Design Report, Lab USA's Ash Processing Facility – Red Wing (SEH, June 2016).
3. Operation and Maintenance Plan, Lab USA's Ash Processing Facility – Red Wing (SEH, June 2016).
4. Permit Drawings, C100, C200, C300, A100, Lab USA's Ash Processing Facility – Red Wing (SEH, June 2016).

The checklists referenced above were prepared by the MPCA to assist in the preparation and review of solid waste permit applications and include:

- Solid Waste Facility Application Checklist (Minnesota Rules 7001.0050, 7001.0060, 7001.0070, 7001.3150, 7001.3300 and 7035.2870)
- Solid Waste Transfer Station Application Checklist (Minnesota Rules 7001.2870 and 7001.3400)

1.3 Associated Landfill Activities

As stated above, the proposed resource recovery facility will process combustor ash currently being generated at Xcel Energy's Red Wing Generating Plant as well as combustor ash previously placed in the City's Red Wing Land Disposal Facility (co-owned and operated with Goodhue County under solid waste permit number SW-174) and Xcel Energy's Red Wing Ash Disposal Facility (operated under solid waste permit number SW-307). Operations of each landfill are regulated under the current facility solid waste permits and Minnesota Rules 7035.2885 for combustor ash land disposal facilities.

All ownership, operations, and liabilities of the City's landfill and Xcel Energy's landfill will remain with the respective permittees. Any modifications to their current solid waste permits will be the responsibility of the landfill owners and will be prepared as separate submittals by each permittee.

1.4 Environmental Justice and Stewardship

As a solid waste facility, the project incorporates the MPCA environmental justice policy that closely mirrors the U.S. Environmental Protection Agency's (EPA) environmental justice policy (Environmental Justice Framework 2015-2018; MPCA, December 17, 2015). Some project-related activities directly involving the community include:

- **Public Involvement through Permitting** – the public will be involved in the process of gaining approval to construct the project through the solid waste permitting process, and the City of Red Wing's Conditional Use Permit (CUP) approval process. Residents and businesses will be invited to participate during public comment periods related to this project.
- **Voluntary Environmental Review** – This project does not meet the requirements of any mandatory Environmental Assessment Worksheet (EAW) category set forth in Minnesota Rules 4410.4300, nor does the combustor ash processing fall under any mandatory Environmental Impact Statement (EIS) category set forth in Minnesota Rules 4410.4400. However, Lab USA has elected to complete a discretionary EAW for the proposed project as part of the application to obtain a solid waste permit. This will provide additional opportunity for citizens to participate on the environmental aspects of the project.

In addition, as part of the development of a material recovery facility in Minnesota, Lab USA has considered many issues for siting the proposed facility. Citizens have already participated in a number of local municipal meetings regarding proposed activities in the area. Their comments were heard and incorporated into the permitting documents. Considerations for the facility included the following:

- **Green Initiative –** recovering ferrous and nonferrous metals reduces the need to mine natural ores in other areas for the production of refined metals.
- **Site Location** – the proposed location in Red Wing is in an area that has been used for solid waste land disposal around 30 years. The solid waste processing facility is not introducing a new solid waste activity in an area without current solid waste facilities.
- **Existing Waste Source** – the solid waste to be processed is generated and landfilled locally. By siting the facility in close proximity to the landfills and generating plant, hauling distances to transport the material is minimized which decreases the overall carbon footprint of the proposed facility.
- **Engagement of Local Decision Makers** – City staff were involved in technical workshops and tours regarding the technology and operations of the proposed facility. In addition, City representatives were involved in noise demonstrations at the existing facilities.
- **Additional Technical Evaluations** – technical evaluations have been conducted for air emissions, risk assessment, and noise to assure regulatory requirements can be met. Efforts to mitigate citizen concerns were included in the design and operations including combustor ash staging that alleviates weekend and holiday work as well as noise associated with tailgate slams at the landfill.
- **Facility Design** – proposing to conduct processing and storage activities within a building structure facing away from the nearest residents, not only reduces the whole visibility and potential noise of the operations, it eliminates the potential to produce contamination for water resources.
- **Employment Opportunities** – because the processing facility is new to the area, the facility will employ a number of local residents in a new and groundbreaking industry, bringing technical jobs to the local community.

As described above, more than 6 million tons of combustor ash have been disposed in landfills within the state of Minnesota with more combustor ash being generated every day. Lab USA's facility will remove materials from the waste stream when currently the only option is land disposal. Under Xcel Energy's current Conditional Use Permit (CUP) with the City of Red Wing, they are required to evaluate alternative management methods for the disposal of combustor ash. In addition, Minnesota Statutes 115A.02 emphasizes the goal of reducing toxicity and volume of wastes. Minnesota Rules 7035.0350 also states that "…the goal of solid waste management should be to use wastes of the highest and best value and to dispose of them only after other feasible options have been evaluated…" The end result of the proposed development of Lab USA's Ash Processing Facility is to reduce the volume of waste disposed on land through the recovery of ferrous and nonferrous materials prior to final disposal.

2.0 General Facility Information

2.1 Facility Description

Lab USA’s new resource recovery facility is proposed for construction near the intersection of Bench Street and Featherstone (**Permit Drawing No. C100**). Currently, the land is owned by Xcel Energy and leased to the City of Red Wing. Lab USA will sublease the facility from the City for development of the resource recovery facility. The property proposed for the resource recovery facility is currently included as buffer land for Xcel Energy’s Red Wing Ash Disposal Facility (Xcel’s Landfill) that has been operating under solid waste permit number SW-307 since 1987. Adjacent property includes the City’s Red Wing Land Disposal Facility (City Landfill) which has been operating under solid waste permit number SW-174 since 1976 (as an MSW Landfill) and 1982 (with the addition of MSW combustor ash).

The Facility Site Plan is provided as **Permit Drawing No. C200**. The general facility information is summarized below.

Name of Site:	Lab USA’s Ash Processing Facility – Red Wing
Site Location:	Facility: 3.39 acres Building: 27,500 square feet 1540 Bench Street, Red Wing, Minnesota, 55066 Located approximately 1 mile south of Highway 61 on Bench Street (County 1 Blvd), in the east 1/2 of the of Section 35, T113N, R15W, Red Wing, Goodhue County.
Owner/Permittee	Lab USA 130 East Walnut Street, Suite 903 Green Bay, WI 54301 Phone: 920.544.9432
Operator:	Lab USA 130 East Walnut Street, Suite 903 Green Bay, WI 54301 Phone: 920.544.9432
Expected Waste Type:	Combustor Ash (incidental MSW Fines)
Expected Waste Flows:	150,000 cubic yards per year (processed) 15,000 cubic yards per year (recovered ferrous and nonferrous metals) 135,000 cubic yards per year (land disposal per SW-174 and SW-307)
Submittal Prepared by:	Short Elliott Hendrickson Inc. (SEH) 1200 South 25th Avenue - PO Box 1717 Saint Cloud, MN 56302-1717 Project Manager: Melanie Niday, PG Project Engineer: Darryl Heaps, PE

2.2 Physical Setting

The physical setting of the site proposed for development of the resource recovery facility was previously evaluated and presented in permitting documents prepared for Xcel Energy’s Red Wing Ash Disposal Facility (SW-307). Numerous publications are also available for the region. In addition, geotechnical soil borings were completed as part of the resource recovery facility permitting and included in **Appendix F**. The following sections summarize the existing conditions regarding topography and hydrology, surficial geology, bedrock geology, hydrogeology, and water usage.

2.2.1 Surface Water

The Red Wing area is characterized by steep bluffs, dissected by ravines, which rise above the level floodplains of the Mississippi River. The project area and all of Goodhue County are drained by the Mississippi River and its tributaries. The tributaries in the Red Wing area include the Cannon River, Spring Creek, and Hay Creek. The floodplain of the Mississippi River is very broad, averaging about three miles in this area. The main river channel and the floodplains of the local tributaries contain numerous backwater sloughs, lakes and wetlands.

The Minnesota Department of Natural Resources (DNR) has no listed public waters or wetlands located on the project site. The nearest public water is Hay Creek which is a designated trout stream, located approximately 0.5 miles east of the site. Information from the National Wetlands Inventory (NWI) provided in **Appendix A** indicates that the nearest wetlands are located approximately 0.25 miles east of the project site. A drainage way (ditch) is located north of the project area along the access road. The current drainage ways near the site are associated with the development of Xcel Energy's Landfill; the drainage ways collect stormwater runoff from the site which then flows off-site to the east into a culvert at CSAH 1. The culvert then directs its drainage to a wetland area on the east side of the highway.

2.2.2 Topography

The elevation of the Mississippi River is about 670 feet at Red Wing, and the floodplain areas generally lie below 700 feet in elevation. Some areas include Pleistocene alluvial terraces that lie at elevations between 700 and 800 feet. Around the project site, the local topography is as shown in **Permit Drawing No C100**.

The site topography is illustrated on **Permit Drawing No. C100**. Current conditions indicate the project site generally slopes from 839 to 798 feet toward the northeast, with lower elevations within drainage ways, well above the local floodplain. As part of site development, grades will be modified to accommodate the building foot print as well as traffic and stormwater needs; elevations around the perimeter of the building are proposed at 811 feet with the ground surface gently sloping away from the building at 3 percent or less to approximately 809 feet as shown in **Permit Drawing No. C100**. Drainage will be directed to a sedimentation pond along the northern edge of the project site.

2.2.3 Surficial Geology

The Geologic Atlas of Goodhue County, Minnesota (County Atlas Series C-12, MGS, 1998) describe the local valleys as older, diversion channels of the Mississippi River, formed when the main channel was blocked by glaciation. The deepest sediments within the valleys are designated as valley fill sediment consisting of pre-Wisconsin age fine to very fine sand and probably slope wash. Valley walls are often draped in colluvium formed from weathering, erosion and/or mass wasting of bedrock. Where present, the valley fill and colluvium, may be overlain by the Wisconsin age Michigan alluvium which consists mostly of silt and sand derived from upland loess, old till, and bedrock.

Previous investigations completed for Xcel's Landfill permitting, indicate the surficial soils in the area are generally between 2 and 84 feet thick. A 1992 report by Donohue describes the unconsolidated surficial sediments in the area as consisting of alluvium, colluvium, and loess, and thicknesses up to 47 feet thick. In that same report, boring data was interpreted to show a combination of alluvium (terrace deposits) and colluvium (slope wash) overlying colluvium derived from in-place weathering of the underlying bedrock.

In March 2016, 11 soil borings were advanced as part of a geotechnical evaluation for the project site. Original soil boring logs and soil testing results are included in **Appendix F**. In general, the soil borings on the project site encountered seven 7 to 29.5 feet of surficial soil overlying bedrock. Soils include units of sandy lean clay (CL), clayey sand (SC), and silty sand (SM). In most soil borings, the soils directly above bedrock consist of colluvium and are generally classified as of silty sand (SM). The remaining soils range from Cl to SC to SM and represent fine to coarse alluvial deposits.

2.2.4 Bedrock Geology

The Geologic Atlas of Goodhue County, Minnesota (County Atlas Series C-12, Part A; MGS, 1998) describes the bedrock surface as have sharp valleys incised into more resistant bedrock units. Valleys generally formed within bedrock fractures as softer underlying units were readily eroded away. As mentioned in the previous section, unconsolidated surficial deposits directly overlie bedrock in this area. Based on the Geologic Atlas (Bedrock Geology; Runkel, 1998), the uppermost bedrock in the vicinity of the project areas consist, from oldest to youngest, the St. Lawrence and Franconia Formations, the Jordan Sandstone, and the Prairie du Chien Group. (Please note that as of August 1, 2014, the Minnesota Geological Survey has replaced the old stratigraphic unit designations for the St. Lawrence and Franconia Formations to the St. Lawrence-Tunnel City.)

The Prairie du Chien Group and the softer, underlying Jordan Sandstone are only present at higher elevations. Underlying the Jordan Sandstone is the more expansive St. Lawrence Formation containing silty dolomites, siltstone, and thin shale beds. Finally, the older Tunnel City Group (formerly known as the Franconia Formation) includes mostly sandstone with some shale and dolomite. The Tunnel City Group is generally coarser grained and more poorly cemented than the overlying St. Lawrence Formation.

Lithology in this area is highly variable. Due to extensive erosion of the bedrock, the Prairie du Chien, Jordan, and St. Lawrence Formation may be absent altogether in large areas. Based on the Geologic Atlas (Bedrock Geology; Runkel, 1998), the uppermost bedrock beneath the project site is primarily poorly cemented sandstone of the Tunnel City Group.

In March 2016, 11 soil borings were advanced as part of a geotechnical evaluation for the project site. Original soil boring logs and soil testing results are included in **Appendix F**. Bedrock was encountered in 9 of the 11 soil borings and was generally described as light brown to brown, soft, highly weathered sandstone with occasional glauconitic seams (appearing green). Depth to bedrock ranged from seven (7) to 29.5 feet, corresponding to elevations ranging from less than 762 feet (downslope) to as high as 813.4 feet (upslope).

2.2.5 Hydrogeology

The Geologic Atlas for Goodhue County, Minnesota (County Atlas Series C-12, Part B; DNR, 2003) indicates the upper most aquifer in the vicinity of the project site is the Tunnel City Group (Franconia). As indicated under Section 2.2.4, the MGS has replaced the old stratigraphic unit designations for the St. Lawrence and Franconia Formations to the St. Lawrence-Tunnel City; reference to both systems is included below for clarity with previous publications and regulatory documents.) With the overlying, lower permeable, St. Lawrence Formation thin to non-existent, the Tunnel City Group is considered an unconfined aquifer. Below the Tunnel City Group is the aquifer associated with the Wonewac Sandstone (formerly known as the Ironton and Galesville Sandstones). The middle member (Tomah) of the Tunnel City Group appears to be an aquitard. The lowest unit of the Tunnel City Group, the Birkmose Member, is interconnected to the Wonewac Sandstone and collectively they are considered a confined aquifer. As illustrated in Figure 16, research by Runkel et al., (2003:

Hydrogeology of the Paleozoic Bedrock in Southeastern Minnesota, MGS RI 61) indicates that groundwater flow in the Ironton-Galesville Sandstone (Wonewac Sandstone) is toward the northeast.

Based on the Geologic Atlas (Bedrock and Water-Table Hydrogeology; Berg and Bradt, 2003), depth to the water table in the vicinity of the site generally ranges from 20 to 50 feet at lower elevations, and from 50 to 100 feet at higher elevations. Monitoring wells and piezometers associated with Xcel Energy's Landfill to the north-northwest indicate a depth to groundwater ranging from 60 to 200 feet; monitoring wells associated with the Goodhue/Red Wing Land Disposal Facility indicate a depth to groundwater ranging from 9 to 15 feet suggesting depth to groundwater is highly variable due to wide range in topographic conditions. The water table tends to mimic surface topography indicating groundwater flow generally moves from higher elevations down toward lower elevations as illustrated in Runkel et al. (2003). Therefore, groundwater flow at the water table for the project site is anticipated to flow toward the north-northeast, following the existing topography.

As described above, 11 soil borings were advanced in March 2016 as part of a geotechnical evaluation for the project site. Original soil boring logs and soil testing results are included in **Appendix F**. At the time of drilling, groundwater was observed in four (4) of the 11 geotechnical soil borings ranging in depth from 12 to 24.5 feet, corresponding to approximate water elevations of 770.8 feet (downslope) and 797.6 feet; however, given historical water levels from monitoring wells on neighboring property, these water elevations appear to be representative of local, perched groundwater conditions and not the actual water table. Given the location, the water table may occur in either surficial soils or in shallow bedrock of the Tunnel City Group. Based on the topography, groundwater flow at the water table across the project site would appear to be toward the northeast mimicking the surface topography as described for local conditions by Runkel et al. (2003).

2.3 Location Standards

Locations standards for the proposed resource recovery facility are regulated under Minnesota Rules 7035.2555 and 7035.2855. A summary of the criteria is as follows:

- **Floodplains:** The project site is not located within any designated floodplain. The nearest floodplain is the Hay Creek Floodplain, located downslope and generally occurring below an elevation of 700 feet. The site elevation occurs well over 800 feet.
- **Shoreland or wild and scenic river land use district:** The project site is not located within a designated shoreland or wild and scenic river land use district.
- **Wetland:** The NWI indicates that the nearest wetlands are located approximately 0.25 miles east of the project site (see **Appendix A**).
- **Emissions of air pollutants:** The types and capacity for the proposed activities are unlikely to violate the air quality standards as presented in **Appendix B-2**.
- **Karst features, including sinkholes, caves, and disappearing streams:** No karst features have been identified in the immediate project area based on information presented on the Karst Features Website maintained by the Minnesota Geological Survey. Given the uppermost bedrock consists primarily of sandstones and shales, karst is not likely to develop.
- **Water table:** Depth to groundwater on the project site ranges from seven (7) to 24.5 feet under pre-development conditions. Following grading and construction activities, depth to groundwater is anticipated to range 10 to 30 feet below the surface.

2.4 Environmental Review

As proposed, combustor ash processing permitted under solid waste transfer station and solid waste storage rules do not meet the requirements of any mandatory Environmental Assessment Worksheet (EAW) category set forth in Minnesota Rules 4410.4300, nor does the combustor ash processing fall under any mandatory Environmental Impact Statement (EIS) category set forth in Minnesota Rules 4410.4400.

Lab USA has elected to complete a discretionary EAW for the proposed project as part of the application to obtain a solid waste permit. Lab USA requested that the MPCA act as the Responsible Governmental Unit (RGU) for the EAW in a letter to the Environmental Quality Board (EQB) dated April 26, 2016, because the MPCA appears to have the greatest responsibility to approve or carry out the proposed project. The EQB identified the MPCA as the RGU for the discretionary review in a letter dated May 11, 2016.

2.5 Associated Permits

The proposed project will require a number of regulatory permits summarized as follows:

Unit of Government	Permittee	Type of Application	Application Date
MPCA	Lab USA	Solid Waste Permit to Construct and Operate a Solid Waste Transfer Station (including processing and storage)	June 2016
MPCA	City of Red Wing	Solid Waste Permit No. SW-174 - Goodhue County/Red Wing Ash Disposal Facility (major modification)	June 2016
MPCA	Xcel Energy	Solid Waste Permit No. SW-307 - Xcel Energy’s Red Wing Ash Disposal Facility (major modification)	June 2016
MPCA	Lab USA	National Pollutant Discharge Elimination System/State Disposal System (NPDES/SDS) - General Construction Permit	To be submitted prior to construction
MPCA	Lab USA	NPDES/SDS Multi-Sector General Permit - Industrial Stormwater Permit – No Exposure (MNRNE3D5B)	Issued May 20, 2016 (Appendix B-1)
MPCA	Lab USA	Air Emission Permit	Not Applicable (See Section 2.5.2)
City of Red Wing	Lab USA	Conditional Use Permit	To be submitted upon EAW approval
City of Red Wing	Lab USA	Special Discharge Permit	Not Applicable (See Section 2.5.1)
City of Red Wing	Lab USA	Building, Plumbing and Mechanical Permits	To be submitted prior to construction
City of Red Wing	Lab USA	Utility Permit on City Right of Way	To be submitted upon CUP issuance

2.5.1 Special Discharge Permit

The proposed Facility’s wastewater will be discharged directly to existing municipal sanitary sewer collection system where it flows to the Red Wing WWTF. The proposed Facility will generally generate on average less than 500 gallons per day (gpd) of wastewater based on projected daily sanitary needs and an estimated maximum of incidental moisture associated with the MSW combustor ash being processed. Based on the associated landfill leachate, the industrial wastewater generated at Lab USA's ash processing facility is anticipated to have low biochemical oxygen demand (BOD) and total suspended solids (TSS), well below that of domestic sewage. If the flow is less than 25,000 gpd, and if the BOD and TSS are less than domestic strength wastewater, the City of Red Wing has determined that the facility would not be a significant industrial discharger and a pretreatment permit would not be required.

Monitoring of the wastewater discharge will be conducted during the initial facility start up to establish discharge information for the City and confirm that no pretreatment permit is needed. If conditions warrant otherwise, the proposed facility will need to comply with any local requirements regarding wastewater as directed by the City of Red Wing.

2.5.2 Minnesota Air Quality Emissions

An evaluation was completed to assess the proposed facility activities in reference to Minnesota regulatory requirements regarding air quality emissions. A copy of the original technical memorandum including detailed assumptions is provided in **Appendix B-2**. The Facility would recover metals from combined fly and bottom ash using a crusher and screens.

The facility's ash handling/processing operations (occurring at ambient temperatures) have the potential to emit particulate matter (PM) and PM less than 10 microns in diameter (PM10). In addition, fuel combustion by the Facility's diesel front end loader has the potential to emit PM, PM10, sulfur dioxide (SO2), oxides of nitrogen (NOx), carbon monoxide (CO), and volatile organic compounds (VOCs). Stationary source permit thresholds for these pollutants are listed in Minnesota Administrate Rules, 7007.0250, Subp. 4. Facilities in Minnesota with emissions below these thresholds are not required to obtain an air permit. The facility's air emissions were estimated based on the proposed process design including (process design steps that have the potential to generate ash dust are labeled as “*”):

1. Trucks deliver bottom ash (material) to the Facility
2. *Trucks unload (dump) material at the Facility
3. *A front end loader loads the material into the processing equipment
4. *Material is crushed with a crusher
5. *Crushed material is separated using three screens (two of the screens in series)
6. *Conveyors transfers material between different process steps
7. *Processed material is dropped into temporary storage piles and/or storage bins
8. Of the Facility’s processed material, about 10% is refined ash with ferrous and non-ferrous metals that is hauled off-site for a beneficial use. The other 90% of the processed material is processed ash that is delivered to the ash landfill via trucks.
9. *Both the metals and the processed ash is loaded into trucks with a second front end loader
10. Both front end loaders (internal combustion engines) are fueled with diesel.

Emissions were calculated in the following table using current AP-42 emission factors and the following assumptions:

- Expected moisture content is greater than 25%, but calculations 15% moisture (more conservative) were utilized.
- Unprocessed material throughput is assumed to be 600 tons per day, the maximum throughput of the Facility's equipment, for 365 days per year. Actual processing will only occur weekdays; no processing will occur on weekends and major holidays.
- Both front end loaders are assumed to have 200 hp engines, are fueled with ultra-low sulfur diesel (USLD) fuel, and operate an average of 10 hours per day.
- Material processing steps (crushing, screening, drop points) are not enclosed (worst-case). Actual processing will be conducted completely indoors.
- Combined area of the temporary storage piles is 0.1 acres (4,350 square feet) and includes no wind shields/barriers (however, the proposed stockpiles will be covered and enclosed on three sides).
- For the first year of operations, an average of 28 truck trips per day for ash delivery (round trip distance of 6,200 feet) plus an average of 3 truck trips per day for roll-offs (round trip distance of 4,800 feet) are used in the emission calculations. Thus, the round trip distance for these truck trips on haul roads includes a total average daily distance of 35.6 miles of the total 48 miles as presented in **Section 3.4**.
- No dust control (e.g. water application, road binder, etc.) on the unpaved roadways (however, the proposed project will utilize dust suppression methods to prevent any unlikely visible emissions as required by existing solid waste landfill permits).

As is shown below, the truck traffic evaluation concluded that the first year of operation of the Facility represents overall greater truck traffic and associated dust emissions than subsequent years of operation.

	PM (ton/yr)	**PM_{10} (ton/yr)**	**CO (ton/yr)**	**NO_x (ton/yr)**	**SO_2 (ton/yr)**	**VOC (ton/yr)**
Facility Emissions - First Year	**45.0**	**13.6**	**4.9**	**22.6**	**<0.01**	**1.8**
*Ash Processing/Handling Emissions**	*1.5*	*0.7*	-	-	-	-
Roadway Emissions (truck traffic)	*41.9*	*11.3*	-	-	-	-
Front End Loader Engines Emissions	*1.6*	*1.6*	*4.9*	*22.6*	*<0.01*	*1.8*
Facility Emissions - Subsequent Years	**31.3**	**9.9**	**4.9**	**22.6**	**<0.01**	**1.8**
*Ash Processing/Handling Emissions**	*1.5*	*0.7*	-	-	-	-
Roadway Emissions (truck traffic)	*28.2*	*7.6*	-	-	-	-
Front End Loader Engines Emissions	*1.6*	*1.6*	*4.9*	*22.6*	*<0.01*	*1.8*
MN State Air Permit Thresholds	**100**	**25**	**100**	**100**	**50**	**100**

Based on the conditions presented with a lower moisture content of 15 percent, the estimated emissions from the ash processing facility (not including ash excavation or other activities at the landfill) are as follows: 45.0 tons per year of PM, 13.6 ton/yr of PM10, 4.9 ton/yr of CO, 22.6 ton/yr of NOx, <0.01 ton/yr of SO2, and 1.8 ton/yr of VOC, is tons per year and the estimated facility emissions for PM10 is tons per year. The estimated facility emissions are well below the established Minnesota State Air Permit Thresholds for each pollutant (25 ton/yr for PM10, 50 ton/yr for SO2, 100 ton/yr for the other pollutants).

The evaluation indicates that the largest source of emissions for the facility is dust from on-site truck traffic.

2.5.3 Air Quality Risk Evaluation

Haley & Aldrich, Inc., Bedford, New Hampshire, completed a risk characterization for potential health risks regarding the proposed facility. The evaluation included potential cumulative impacts from operations at Xcel Energy's Landfill and the City's proposed concrete crushing activities on adjacent property. A copy of the final report is provided in **Appendix B-2**.

The evaluation was completed by using the emissions estimates from a March 2016 air emissions evaluation that differs slightly from those presented above with additional models to predict the off-site PM and PM10 concentrations in air and soil via dispersion and deposition, respectively. The estimated ash-derived air and soil concentrations were then compared to conservative, health-protective risk-based screening levels to put the estimated emissions into context. The findings in the report are still valid for the updated emissions estimates presented above (changes to PM and PM10 emission estimates were made after this report was completed.

As presented in the report (**Appendix B-2**), the air and soil concentrations of ash-derived constituents that may result from ash processing are estimated to be orders of magnitude lower than the relevant screening levels, indicated that potential health risks associated with particulate migration off of the Xcel property are negligible.

2.6 Adjacent Landowners

Adjacent landowners to the proposed facility have been identified and are provided in **Appendix A**.

3.0 Facility Plan

The proposed resource recovery facility in Red Wing will include development of a 27,500 square foot building to house all processing operations indoors. Lab's processing is a mechanical process that does not chemically alter the combustor ash. Based on equipment capacity, it is anticipated that the proposed facility can process up to 150,000 tons of combustor ash each year. The operations will generally include:

- Offloading
- Crushing/Screening Processing (oversized material removal)
- Magnetic Separator Processing (mid-fraction ferrous and non-ferrous removal)
- Eddy Current Processing (mid and fine-fraction non-ferrous removal)
- Loading Operations

The following sections describe the combustor ash sources for the processing facility, general solid waste operations, and the facility design.

3.1 Combustor Ash Sources

The proposed resource recovery facility will process combustor ash currently being generated at Xcel Energy's Red Wing Generating Plant as well as combustor ash previously placed in nearby landfills owned by the City of Red Wing and Xcel Energy. The combustor ash contains metals of many sizes that can be beneficially used in many industries across the country. Lab USA is proposing to process the combustor ash to recover the ferrous and non-ferrous metals that is currently being landfilled. The following sections describe the characteristics of the combustor ash sources, the anticipated waste flows, and order of processing.

3.1.1 Combustor Ash Characteristics

Combustor ash is generally composed of both fly ash and bottom ash generated from the combustion of solid waste resulting in a moist coarse, well graded aggregate-like mixture with some unburned material. The proposed resource recovery facility will process combustor ash generated at Xcel Energy's Red Wing Generating Plant and the former City of Red Wing Incinerator located on the City's Integrated Solid Waste Management Campus. The combustor ash produced by Xcel's electrical generator is a mixture of fly ash, bottom ash, and lime scrubber solids resulting from the combustion of refuse derived fuel (RDF). The combustor ash generated at the City's former incinerator is a mixture of fly ash, bottom ash, and MSW fines. Both facilities have been or were in operation around 30 years.

Lab USA is proposing to metals from the combustor ash and discontinue the practice of land disposal for ferrous and nonferrous metals at these facilities. The technology being applied to the processing was developed in Europe and the bulk of all combustor ash materials are recycled and beneficially used. Lab USA's process will recover materials down to less than 1 millimeter in size.

The combustor ash from both facilities are well characterized through routine testing performed in accordance with Minnesota 7035.1910. WTE facilities are required to conduct annual testing and assessment of its ash based on quarterly samples that have been composited into a single sample. Parameters primarily include moisture content, metals and other inorganic compounds as well as dioxin and furans. Due to low concentrations, analysis for dioxins and furans was eventually discontinued at each facility.

Testing results for both facilities were reported to the MPCA as part of past permitting efforts and/or annual reporting requirements. Copies of recent test results for both facilities are included in **Appendix C**. In addition to combustor ash characterization, analysis conducted for MSW fines for the City of Red Wing to obtain a variance for co-disposal is also provided in **Appendix C**. Please note that combustor ash testing was discontinued at the City's incinerator with its closure in 2014.

Moisture content of the combustor ash is also documented through routine testing. Before being transported to landfills, the ash has a notable moisture content from quench water used to allow efficient management at the WTE facility. The moisture content of the combustor ash leaving an incinerator is generally greater than 25 percent. Once combustor ash been placed in the landfill, it may lose some moisture due to evaporation and gravity drainage. However, recent sample collection at Xcel's Landfill shows evidence that the low permeability of the combustor ash in the landfill helps maintain that moisture content following disposal. Maintaining a certain moisture content is a key element in resource recovery since the entire ash processing operation incorporates an optimum moisture content between 15 to 22 percent to aid in the processing and to help minimize fugitive dust.

3.1.2 Waste Flows

The proposed resource recovery facility will process combustor ash currently being generated at Xcel Energy's Red Wing Generating Plant as well as combustor ash previously placed in the City's Red Wing Land Disposal Facility (co-owned and operated with Goodhue County under solid waste permit number SW-174) and Xcel Energy's Red Wing Ash Disposal Facility (operated under solid waste permit number SW-307). Based on facility equipment capacity, it is anticipated that the proposed facility can process between 100,000 and 150,000 tons of combustor ash each year or approximately 8,000 to 13,000 tons each month. It is anticipated that Lab USA's processing will recover up to 10 percent by weight of the total throughput of combustor ash or approximately 10,000 to 15,000 tons of ferrous and nonferrous metals will be recovered annually. Some variation occurs due to ash quality and conditions. Given an approximate density of 2000 lbs/cy, the proposed facility will be able to process up to 150,000 cy of combustor ash each year and recover up to 15,000 cy of ferrous and nonferrous metals.

Combustor ash transport will include the diversion of Xcel Energy's current highway trucks from the Red Wing Generating Plant to the processing facility as well as the use of off highway dump trucks between the landfills and the processing facility. The off highway dump trucks will bring combustor ash from Xcel's Landfill for processing and return residual, processed ash back to the landfill. Recovered metals will be stored in covered roll-offs on-site. As the roll-offs of recovered metals are filled, the containers will be transported off-site as a recycled commodity ready for further metals processing at another facility.

Final waste flows to be processed, recovered, and disposed will be refined during actual startup of the processing facility. However, the anticipated overall schedule and coordination of the waste stream is proposed to accommodate the needs of the City and current operations of Xcel Energy as described below.

3.1.2.1 Red Wing Land Disposal Facility (SW-174)

The City of Red Wing is in the process of implementing the final closure of their Red Wing Land Disposal Facility. The City's and Goodhue County's goal is to complete their landfill final closure prior to 2019 for placement into the state-managed Closed Landfill Program. As part of closure activities, the final landfill closure grades will require modification due to the loss in landfilled material following the 2014 shutdown of the City's WTE facility. Re-grading the landfill will offer the opportunity to recover ferrous and nonferrous materials from the in-place waste prior to final landfill closure.

To maximize the recovery of material from the City's ash landfill, the City will develop a phasing plan to remove and replace waste over an approximate one year period only. Operations of the City's Landfill is regulated under the current facility solid waste permits and Minnesota Rules 7035.2885 for combustor ash land disposal facilities. Any modifications to the current solid waste permit will be prepared by the City. Modifications that includes the phasing plan will identify the available ash for processing, limits of excavation, and order of excavation.

For estimating waste flows from the City's Landfill, the total volume of ash to be processed will be based on the following information:

- Original permitted capacity (212,000 cy)
- Combustor ash volume in-place (174,000 cy)
- Original landfill base grade elevations
- Proposed liner buffer thickness of 6 to 8 feet above the sand drainage layer
- Current elevations of waste in-place (2016 survey data)

Using the 2016 survey data and the original landfill base grades, it is estimated that the landfill currently has 174,000 cy of combustor ash in-place. Subtracting the buffer thickness layer from the combustor ash in-place results in 130,000 cy yards of combustor ash available for processing. Assuming a density of 2000 lbs/cy, it is assumed that approximately 130,000 tons of combustor ash is available for processing from the City's Landfill over the first year of operations.

After processing, the residual ash will be returned to the City's Landfill for final disposal in accordance with the MPCA-approved phasing plan and the facility permit.

3.1.2.2 Xcel Energy's Red Wing Generating Plant

Xcel Energy's Red Wing Generating Plant is an electric power generating station located along the Mississippi River in Red Wing, Minnesota. The Red Wing Plant is rated at 25 Megawatts (MW) and has two boilers that primarily burn RDF processed under contract with the City of Red Wing's Integrated Solid Waste Campus, the Ramsey/Washington Resource Recovery Facility in Newport, Minnesota, and the Elk River Resource Recovery Facility in Elk River, Minnesota. The facility generates approximately 50,000 cy of combustor ash annually for disposal at Xcel Energy's Red Wing Ash Disposal Facility (SW-307).

Once all the available combustor ash at the City's Landfill has been processed, the combustor ash produced at the Xcel's Red Wing Generating Plant will be directly diverted to Lab USA's processing facility to recover ferrous and nonferrous metals prior to final disposal. Because there is no change is occurring in waste flows from Xcel's Generating Plant, waste flows into Lab USA's ash processing facility are anticipated to remain at approximately 50,000 cy of combustor ash annually (or about 1,000 cy per week). Once processed, the residual ash will be transported to the Xcel's Landfill in accordance with their solid waste permit (SW-307).

3.1.2.3 Xcel Energy's Red Wing Ash Disposal Facility (SW-307)

Once all the available combustor ash at the City's Landfill has been processed, the amount of combustor ash being diverted from Xcel Energy's Red Wing Generating Plant will not maximize the processing capacity of Lab USA's resource recovery facility. Therefore, to recover more metals, waste flows from the Generating Plant will be supplemented with combustor ash previously disposed in Xcel's Landfill.

Xcel Energy will develop a phasing plan to remove and replace waste over an approximate 10 year period; processing of ash from closed areas are not planned at this time. Operations of Xcel's Landfill is regulated under the current facility solid waste permit and Minnesota Rules 7035.2885 for combustor ash land disposal facilities. Any modifications to their current solid waste permits will be prepared by the Xcel Energy. Modifications that includes the phasing plan will identify the available ash for processing, limits of excavation, and order of excavation.

For estimating waste flows from the Xcel's Landfill, the total volume of ash to be processed will be based on the following information:

- Volume of ash in-place
- Closed areas not available for processing
- Original landfill base grade elevations
- Proposed liner buffer thickness

Xcel Energy has determined they have 690,000 cubic yards or combustor ash in place for processing. Given the proposed 10-year processing time period, the available combustor ash will more than meet the volumes necessary to maximize the processing capacity of Lab USA's facility. Assuming that 50,000 cy of combustor ash is directly diverted from the Generating Plant, additional supplemental material will be transported from Xcel's Landfill for processing.

After processing, the residual ash will be returned to Xcel's Landfill for final disposal in accordance with the MPCA-approved phasing plan and the facility permit.

3.2 Facility Design

Resource recovery and waste processing fall under Minnesota Rules 7035. Due to the facility accepting waste material and ultimately transferring the residual processed material to other permitted solid waste facilities for final disposal, the MPCA has indicated that the proposed resource recovery facility will be permitted under Minnesota's transfer station rules (Minnesota Rules 7035.2870) as well as solid waste storage standards for recovered materials (Minnesota Rules 7035.2855). The proposed facility must also meet design requirements regarding air quality, transfer station facilities, solid waste storage, and stormwater.

The facility design has been established based on a number of site or process evaluations, regulatory requirements, and proposed ash processing systems and operations. The following sections summarize the results of those evaluations in reference to the proposed facility design and regulatory requirements. Detailed evaluations are included in the appendices referenced.

3.2.1 Facility Layout

In order to develop a facility layout, existing and future site features needed to be taken into consideration. A detailed discussion on the development of the final layout is provided in **Appendix D**. The site will include access roads for hauling ash in and out of the facility, one building for processing and interior ash storage, and exterior storage of covered roll-offs as well as parking for facility employees. Stormwater will be managed via a drainage ditch and pond system on property to the east leased by the City of Red Wing. The facility layout is illustrated on **Permit Drawing No. C200**.

In general, the proposed building is located on the southwestern portion of the project site. The ultimate location of the facility was restricted by three existing or future site features:

1. The south edge of the site is made up of a wooded area that contains a scenic easement that limits development. (Where is this and what regulatory requirement? We should show on the layout.)
2. The eastern portion of the site is designated for use by the City of Red Wing.
3. The northern portion of the site is designated for future Xcel Energy stormwater treatment ponds.

The site is located on a hillside that rises as you travel south on the access road. The access road will climb a 10 percent grade, closely matching the existing hill slope, and a moderate slope for truck traffic. The site roads are all-weather and suitable for the volume and types of collection vehicles or other transportation equipment that will be used to move waste from the entrance to loading and unloading areas.

The building is the high point of the pad, with slopes draining away from the building generally towards the north. The southwest corner of the building will require cutting the existing grade down to allow for a relatively flat pad. This cut will require up to 1.5H:1V slopes to the south of the building to ensure our grading doesn’t impact the wooded area to the south.

The proposed building will have a gravel pad on the east and north sides that is sized to allow trucks to back into the building from the north side. The design truck used for the turning movements was a WB-67 (tractor with 53-foot long trailer). Access to the pad will be via a 30-foot wide gravel access road that will come from the north and allow trucks to enter the pad on the west side.

Based on the geotechnical exploration onsite (**Appendix G**), bedrock is shallow across the site with competent bedrock within the building footprint at elevation 804.50 feet. In order to protect the structural integrity of the concrete floor, a minimum of 7-foot separation is proposed between the finish floor elevation and the competent bedrock when determining the building elevation. Therefore, the finished floor elevation of the building is set at 811.00 feet, which is also the maximum possible elevation achievable while still remaining at 10 percent slope coming up the access road.

The site will require potable water, sanitary sewer, and electricity. These utilities are generally located north and east of our site. Potable water will connect to the city water main at Bench Street to the northeast. Sanitary sewer will connect to the existing city sewer to the north. Electricity will connect to the existing electrical feeder at Bench Street.

Access on the site will be suitable for the volumes and types of collection vehicles or other transportation equipment that will be used to transport waste to the loading and unloading areas. The building entrances and exits will have clearance for all vehicle types expected to use the facility, and have capacity to store and handle waste and other materials expected for the facility.

3.2.2 Stormwater Design

Preliminary design calculations were completed to evaluate stormwater needs and design a stormwater pond and are included in **Appendix E**. The pond will manage stormwater from access roads and facility parking areas. The preliminary grades and facility layout with the stormwater pond are illustrated on **Permit Drawing No. C300.** Final stormwater pond design will be completed by the City.

All stormwater runoff that drains from the pad or building will be diverted to the proposed drainage ditch and associated stormwater pond. All off-site runoff around the pad will be diverted to minimize the pond footprint; a diversion berm will be graded along the top of the cut south of the building to minimize runoff down the slope and help minimize the stormwater pond size.

The combined runoff collection system and stormwater pond are sized to slow the post-development runoff rates to less than the pre-development runoff rates. The pond will also provide sediment storage which will minimize any downstream migration of sediment from the site. The pond was designed with the following criteria:

- The contributing drainage area is approximately 4 acres.
- The downward slopes for all areas within the facility will not exceed 10 percent grade and the upward slopes throughout not to exceed six percent grade.
- The combined drainage ditch and stormwater pond are sized to maintain a post development runoff rate less than or equal to the pre-development runoff rate for the 2-year (2.89-inch), 10-year (4.33-inch), and 100-year (7.61-inch) storm events.

The pond outlet will discharge down the hill to lower elevations where it will continue to the east towards Bench Street entering the City’s municipal stormwater system; discharge to the City’s stormwater system will meet requirements impose under their current MS4 permit.

3.2.3 Geotechnical Evaluation

In March 2016, 11 soil borings were advanced as part of a geotechnical evaluation for the project site. A subsurface investigation report provided by Northern Technologies, Inc. (NTI) is included in **Appendix F**. Soil borings consisted of standard penetration test (SPT) borings conducted in accordance with ASTM D 1586 and soils were classified in accordance with ASTM D 2487 and 2488. A number of laboratory tests were also assigned to selected samples by SEH to further define geotechnical condition. The SEH geotechnical report is included in **Appendix G**.

In general, the site soils consisted of varying, but distinct layers of silty sand and sandy lean clay overlying a fine-grained granular material interpreted as weathered sandstone. The weathered sandstone material was generally dense to very dense with some medium dense zones occurring at the top of the formation. Seven of the borings met auger refusal prior to reaching their target depth. For the purposes of this report, the depth of auger refusal was interpreted as the apparent top of bedrock. Site excavation to proposed final grades is anticipated to encounter very dense weathered sandstone. It is expected that excavating in the weathered sandstone can be accomplished with traditional methods.

Shallow foundations for support of the steel frame members are proposed to be square spread footings. With a finished floor elevation of 811 feet, the footings are anticipated to bear on very dense weathered sandstone along the south perimeter. Along the north perimeter, soils at footing depths are anticipated to vary from medium dense silty sand to firm to stiff sandy lean clay.

Estimated foundation settlements vary from less than ¼ inch over weathered sandstone to up to 3 inches over sandy lean clay. Therefore, given the variability within foundation soils, a load distribution platform (LDP) is recommended beneath a portion of the building footprint to mitigate the risk of differential settlement. An alternative to the LDP foundation recommendation could be to support the footings and slab on a modest deep foundation system. Such a system that may be feasible at this site is a Geopier system, which is a design-build soil reinforcement system commonly used to support structures as a potential cost-saving alternative to extensive soil correction or other deep foundations (e.g. piles and caissons).

As presented in detail in **Appendix G**, the following recommendations are provided regarding geotechnical conditions of the facility:

1. Perform additional investigation to verify the upslope extent of weathered sandstone and the interpreted top of bedrock elevation and in-situ bedrock conditions in areas where borings encountered auger refusal. Perform two additional borings to a minimum depth of 20 feet below auger refusal elevations along the proposed building's south perimeter.
2. Strip existing topsoil a minimum of 6 inches and replace with topsoil borrow.
3. Slope unsupported excavations to 1.5H:1V or shallower (consistent with OSHA Type C soil type). Provide temporary erosion protection for excavation backslopes exposed longer than 24 hours.
4. Provide sumps and drainage rock or other measures as necessary to maintain a dewatered excavation. Direct surface runoff away from all excavations.
5. Construct Load Distribution Platform beneath spread footings and reinforced concrete slab under northeast quadrant of building. Perform minimum 2-foot replacement subcut of sandy lean clay below LDP.
6. Design spread footings using an allowable bearing pressure of 2000 psf.
7. Design concrete slab using an allowable bearing pressure of 3000 psf.
8. Provide and place structural backfill as recommended for foundations and utilities.
9. Install anchored turf reinforcement mat system on finished slopes steeper than 2H:1V. Evaluate slope stability and confirm preliminary design requirements for anchored turf reinforcement mat system during final design.
10. Grade pond slopes no steeper than 3H:1V. Provide riprap or equivalent armoring and filter protections along pond slopes to accommodate seepage conditions.
11. Provide recommended bedding and filter protection for pond outlet pipe.

3.2.4 Structural Evaluation and Preliminary Building Design

A structural evaluation was completed to determine structural design elements of the proposed structure. A copy of the evaluation is included in **Appendix H**. The structures will be designed to ACI 318-11 and ASCE 7-10 standards in addition to the building codes detailed in **Appendix H**.

A Pre-Engineered Metal Building (PEMB) will be utilized to maximize space and construction efficiency. The foundation system for the building will be cast-in-place (CIP) concrete piers with spread footings, adequately sized to accomplish the bearing capacity requirements detailed within Section 3.2.3 and **Appendix G**. The push walls and floor slab will be CIP concrete, designed to withstand the pressures from the waste material and the operating equipment that will be used to move the material. Floor slabs will be sloped, treated (to reduce absorption), and have control joints with water stops to ensure leachate containment.

The floors will consist of 5,000 psi concrete in accordance with Minnesota Rules 7035.2870, which are designed for heavy equipment traffic and processing equipment, and bermed to contain any spilled liquids. All stored materials on site will be covered and contained by berms in accordance with Minnesota Rules 7035.2855. Stormwater will not contact materials during off loading, loading or processing of the materials and water from the materials themselves will be contained within the building. Stormwater will be managed on site in accordance with City of Red Wing stormwater ordinances as well as state and federal requirements.

The 27,500 square foot facility will be enclosed on the south, east and west sides with ventilation openings along the top of the east and west walls. The north side will have two openings (70’-0” wide x 25’-0” high) on each end to accommodate heavy equipment movement in and out of the building. The roof will be an un-insulated prefinished metal standing seam system over a PEMB frame. The exterior walls will be un-insulated prefinished metal wall panel system over a PEMB frame.

There will be an office space located on in the inside face of the north wall. It will be insulated steel stud construction with prefinished metal liner panels on the production side and gypsum board walls to the interior. The space will contain 2 private offices, and American Disabilities Act (ADA) restroom, break area, locker area, mechanical room and electrical room. The space will be heated and air conditioned.

As described in Section 2.5.1, dust is not considered an issue as part of processing. Offloading and loading of all combustor ash will also occur within the building. Water is available for operations to maintain optimum moisture content for processing and can be used, if necessary, to manage any dust that may occur within the building during the warmer and drier summer months. Industrial standard of operations and best management practices will be utilized for worker safety in accordance with OSHA standards.

At the processing facility, noise will primarily be controlled by the building and operating hours. Trucks at the processing facility location will be working on the north side of the building. The building will have a finished height of approximately 35 feet, so noise occurring outside the building and in the loading and unloading areas will be projected primarily to the north over the area of both landfills. Because the proposed process will be enclosed within the building, only a minimum of unobstructed noise would be expected to emanate from the building. Noise from the equipment operating inside the building will be dampened and very low at the building exterior. Internal noise levels will be manageable, being measured at approximately 85 decibels (db) in similar facilities, and are anticipated to be barely discernable outside the building.

3.2.5 Construction Inspection

In accordance with Minnesota Rules 7035.2855, Subp. 5, during installation of all lining material for storage areas, including concrete floor, construction inspection must be conducted as follows:

1. Liner and cover systems must be inspected during construction or installation for uniformity, damage, and imperfections. Immediately after construction or installation:
    a. Synthetic liners and covers must be inspected to ensure tight seams and joints and the absence of tears, punctures, or blisters; and
    b. Soil based and admixed liners and covers must be inspected for imperfections including lenses, cracks, channels, root holes, material variability, or other structural non-uniformities.
2. The construction of the liner must be certified by an engineer registered in Minnesota in compliance with the approved plans and specifications.

3.3 Waste Management Operations

As part of the facility plan, a summary of the waste management operations is provided in order to assess design features described in Section 3.2 in reference to specific site activities. The following section summarizes operations in reference to offloading, frequency and method of waste removal, storage capacity and expected storage, and ultimate waste deposition.

3.3.1 Offloading Operations

Planned traffic patterns are illustrated on **Permit Drawing No. C200** and summarized as follows:

- During the first year of operations, all trucks coming from the City's Landfill will be highway quad-axle trucks and will access the processing facility from the eastern access road.
- During the second year of operations and thereafter, all trucks coming from Xcel Energy's Red Wing Generator plant will be highway quad-axle trucks and will approach the processing facility from the eastern access road.
- During the second year of operations and thereafter, off-road, quad axle dump trucks will be used to haul combustor ash from Xcel's Landfill only and will approach the processing facility from the western access road.

All trucks will back up into the processing building to offload the fresh combustor ash under cover onto a north-facing, tipping floor located on the eastern end of the processing building. Offloaded combustor ash may be stored for several days to optimize moisture content for processing and accommodate weekend and holiday hauling schedules. To obtain optimum moisture content, ash with moisture contents below initial levels may be wetted, as necessary, prior to processing, while ash with higher moisture contents may need to dry slightly in order to meet a processing moisture content range of 15 – 22 percent.

3.3.2 Frequency and Method of Waste Removal

As indicated above, offloaded combustor ash may be stored for several days to optimize moisture content and accommodate weekend and holiday hauling schedules. During processing, waste streams will be generated and managed as follows:

→ Ferrous Scrap Metal → Covered Roll-off – Ferrous Material

→ Nonferrous Scrap Metal → Covered Roll-off – Nonferrous Material

→ Bulky Waste Material (Oversized/Unburnt Material) → Loading Area (Hauled to Landfill)

→ Residual Combustor Ash Material → Loading Area (Hauled to Landfill)

Hoppers and/or bins will be used to collect separated materials within the building. As hoppers or bins fill, the recovered material will be moved to its final destination listed above by front-end loader, skid steer and/or forklift operators. Covered roll-offs will be stored in the designated storage area outside the building.

Processed or residual combustor ash will be placed in the loading area for removal. As with the offloading area, residual combustor ash may be stored in the loading area for several days to accommodate weekend and holiday hauling schedules. Material will be loaded by front-end loader into dump trucks for transport into the designated combustor ash landfill.

Once full, covered roll-offs will be removed from the site as needed to suitable metals processing facilities for beneficial use. Up to seven roll-offs will be available at any one time to accommodate storage of recovered metals with up to 15 roll-offs removed from the site per week.

3.3.3 Expected Storage and Storage Capacity

In order to accommodate weekend and holiday schedules, it is assumed that, at a minimum, three to four days of storage will be needed for combustor ash coming directly from Xcel Energy's Red Wing Generating Plant. Based on anticipated waste flows from the Generating Plant is generally 10 truckloads per day or about 150 cy per day, the minimum storage capacity needed in the offloading area is about 500 cy. Additional storage on the tipping floor is also provided to allow evaluation and management of moisture content of ash coming from the landfills; however, hauling schedules from the landfill can be adjusted as needed based on processing operations and storage capacity. Less storage is provided on the loading end because ash is only placed there as a result of processing.

The storage areas for both offloading and loading areas are shown on **Permit Drawing No. A100**. The proposed horizontal dimensions of push walls for the offloading area includes two sides at 100 feet by 75 feet with a proposed height of 14 feet. With an assumed fill level to only 10 feet, the providing a storage capacity of over 2,500 cy. This proposed storage capacity should be able to accommodate any variations in day-to-day process operations.

3.3.4 Ultimate Deposition of Waste

As described in Section 3.1.2, the proposed resource recovery facility will process combustor ash currently being generated at Xcel Energy's Red Wing Generating Plant as well as combustor ash previously placed in the City's Red Wing Land Disposal Facility (SW-174) and Xcel Energy's Red Wing Ash Disposal Facility (SW-307). As a result, combustor ash obtained from the City's Landfill will be processed with all residual material returned to the City's Landfill. Likewise, all combustor ash received from the Generating Plant and obtained from Xcel's Landfill will be processed with all residual material returned to Xcel's Landfill. Operations of the landfills are regulated under their respective facility solid waste permits and Minnesota Rules 7035.2885 for combustor ash land disposal facilities.

Ferrous and nonferrous material recovered from the processing will be transported off-site as a recycled commodity ready for further metals processing at another facility. No recovered material will be transported from the processing unless the Lab USA has reasonable belief that the person or facility receiving the waste may lawfully do so under applicable federal, state, or local rules. Lab USA will verify that the person or facility receiving the waste holds a valid license, permit, or other approval, or that no such approval is required.

3.4 Traffic, Roads, Vehicles, and Equipment

The facility layout including roads are described in Section 3.2.1 and illustrated on **Permit Drawing No. C200**. Because combustor ash will be received from multiple facilities and, as a result, traffic patterns and vehicles will also change during the facility's operation. Information regarding traffic, roads, vehicles, and equipment are presented in the following sections. The estimated truck traffics is based on the capacity of the processing equipment and the availability of MSW combustor ash from the City and Xcel Energy summarized as follows:

Year of Operation/ Source of Traffic	**Traffic Route**	**Days of Operation***	**Hours of Operation***	**Average Daily Traffic**	**Maximum Daily Traffic**
First Year of Operation					
Goodhue/Red Wing Land Disposal Facility (truckloads)	Internal Haul Roads	Monday – Friday Saturday if needed	7 am to 5 pm	28	35
Roll-Off Removal (truckloads)	Internal Haul Roads and Bench Street	Monday – Friday	7 am to 5 pm	3	5
Subsequent Years of Operation					
Xcel Energy Red Wing Generating Plant (truckloads)	Internal Haul Roads and Bench Street	Sunday - Saturday	7 am to 5 pm	10	12
Xcel Energy's Red Wing Ash Disposal Facility (truckloads)	Internal Haul Roads	Monday – Friday	7 am to 5 pm	20	23
Roll-Off Removal (truckloads)	Internal Haul Roads and Bench Street	Monday – Friday	7 am to 5 pm	3	5

* Traffic days and times conditional to Contingency Action provisions.

3.4.1 Traffic

The proposed resource recovery facility will process combustor ash currently being generated at Xcel Energy's Red Wing Generating Plant as well as combustor ash previously placed in nearby landfills owned by the City of Red Wing and Xcel Energy. As a result traffic patterns will vary at different points in time based on the needs of each facility. Roads and anticipated traffic patterns are shown on **Permit Drawing No. C200**. In addition to combustor ash transport to and from Xcel's Generating Plant as well as the two landfills, up to the volume equivalent of 15 roll-offs will be removed from the site per week for the recovered metals obtained during processing.

The facility layout was designed using the turning movements of a WB-67 tractor trailer (53-foot long trailer). A tandem axle dump truck was also modeled but the WB-67 was determined to be the limiting design movement. Access to the bays of the building for offloading/loading will require a truck to perform a 90 degree backing maneuver into the building. These maneuvers were modeled using Autoturn v.9.0 in AutoCAD 2016.

3.4.1.1 Red Wing Land Disposal Facility (SW-174)

As described 3.1.2.1, the City of Red Wing is in the process of implementing the final closure of the City's Landfill. The City's goal is to complete their landfill final closure by the end of 2018 for placement into the state-managed Closed Landfill Program. To maximize the recovery of material, the City's Landfill will develop a phasing plan to excavate and re-place waste over an approximate one year period only, the first year of operation of the Lab USA's Ash Processing Facility – Red Wing. Normal hours of operation for truck transport to and from the landfill would be from 7:00 am to 5:00 pm Monday through Friday. Facility operations may continue past 5 pm to complete processing of any stockpiled ash in the offloading area. If needed, the hours of operation may also include work from 7:00 am to 5:00 pm on Saturdays in order to meet City and County timelines related to entering the Closed Landfill Program.

Trucks will be loaded within the lined area of the landfill to transport waste material from the City's Landfill to the processing facility. Ash transport will include an average of 25 to 30 truckloads per day consisting of highway quad axle dump trucks with about 18 cubic yards of capacity. Trucks will cross tracking pads to minimize any transport of waste material onto access roads. Trucks will enter the processing facility from the eastern access road. Then they will back up into the processing building to offload the excavated waste material under cover onto a tipping floor. Once empty, the truck will move westward to the loading area to be re-filled under cover with processed combustor ash. The truck will return to the City's Landfill via the eastern access road for disposal in preparation of final closure activities in accordance with the solid waste permit issued by the MPCA. All processed waste material from the City's Landfill will only be returned to the City's Landfill.

3.4.1.2 Xcel Energy's Red Wing Generating Plant

Under Xcel Energy's current solid waste permit, approximately up to 12 truckloads of combustor ash are hauled each day, Monday through Sunday, from the Xcel Energy Red Wing Generating Facility to the Xcel Energy Ash Disposal Facility via Bench Street. The current trucks consist of highway quad-axle dump trucks with about 18 cubic yards of capacity and are covered for transport. No change is anticipated in the number of loads entering the site from Bench Street. However, before the combustor ash is permanently disposed into Xcel's Landfill, it can be diverted into Lab USA's Ash Processing Facility to recover ferrous and nonferrous metals. At this time, diversion of the combustor ash from Xcel's Generating Plant is anticipated to begin during the second year of operations as described Section 3.4.1.1. For contingency purposes, the processing facility can be bypassed with the combustor ash being placed directly in the landfill in accordance with the current landfilling practices. Normal hours of operation would be from 7:00 am to 5:00 pm Monday through Sunday, seven days per week.

When processing combustor ash from Xcel's Generating Plant, trucks will enter the processing facility from the eastern access road and will back up into the processing building to offload the fresh combustor ash under cover onto a north-facing, tipping floor located on the eastern end of the processing building. Once empty, the truck will return to the Generating Plant via the eastern access road. The tipping floor and loading area will have sufficient storage capacity of pre-processed and processed material to manage weekend and holiday schedules. All processed combustor ash from the Xcel's Generating Plant will only be returned to the Xcel's Landfill.

3.4.1.3 Xcel Energy's Red Wing Ash Disposal Facility (SW-307)

Following closure of the City's Landfill, diversion of combustor ash from Xcel's Generating Plant will begin during the second year of operations. Based on the capacity of the processing equipment, additional processing capacity will be available. Xcel Energy has been disposing combustor ash at their landfill for nearly 30 years; therefore, in order to recover the resources within the existing landfill, Xcel will develop a phasing plan for their landfill to excavate and re-place waste over a number of years. Combustor ash obtained from Xcel's Landfill will not be processed until all of the City's accessible landfill ash has been processed Normal hours of operation for truck transport to and from the landfill would be from 7:00 am to 5:00 pm Monday through Friday. Facility operations may continue past 5 pm to complete processing of any stockpiled ash in the offloading area.

Similar to operations from the City's Landfill, trucks will be loaded within the lined area of the landfill to transport combustor ash from the Xcel's Landfill to the processing facility. Trucks will consist of off highway dump trucks with up to 25 cubic yards of capacity, and up to (20) truckloads per day. Trucks will enter the processing facility from the western access road. Then they will back up into the processing building to offload the excavated waste material under cover onto a tipping floor at the eastern edge of the building. Once empty, the truck will move westward to the loading area to be re-filled under cover with processed combustor ash. Then the truck will return to the Xcel's Landfill for disposal in accordance with the solid waste permit issued by the MPCA. All processed waste material from the Xcel's Landfill will only be returned to the Xcel's Landfill.

Processing of material from the City's Landfill and Xcel's Landfill will not occur during the same time periods, so truck traffic would be limited per that required for each entity. The number of years of processing from Xcel's Landfill will be dependent on final phasing plans approved by the MPCA with the intent to process for 10-12 years.

3.4.2 On-Site Road Design and Maintenance

Under Xcel Energy's current solid waste permit, up to 12 truckloads of combustor ash are hauled each day, Monday through Sunday, from the Xcel Energy Red Wing Generating Facility to the Xcel Energy Ash Disposal Facility via Bench Street. No change is anticipated regarding traffic associated with Bench Street except for the removal of up to the equivalent volume of 15 roll-offs each week for recovered materials from the processing.

Traffic entering the property occurs on a gravel road currently maintained by Xcel Energy and the City of Red Wing for access to their respective landfills. Roads that cross the site will be Class 5 base course aggregate as specified in MnDOT Section 3138 "Aggregates for Surface and Base Course" or comparable underlay with separation geotextile.

3.4.3 Vehicles and Equipment

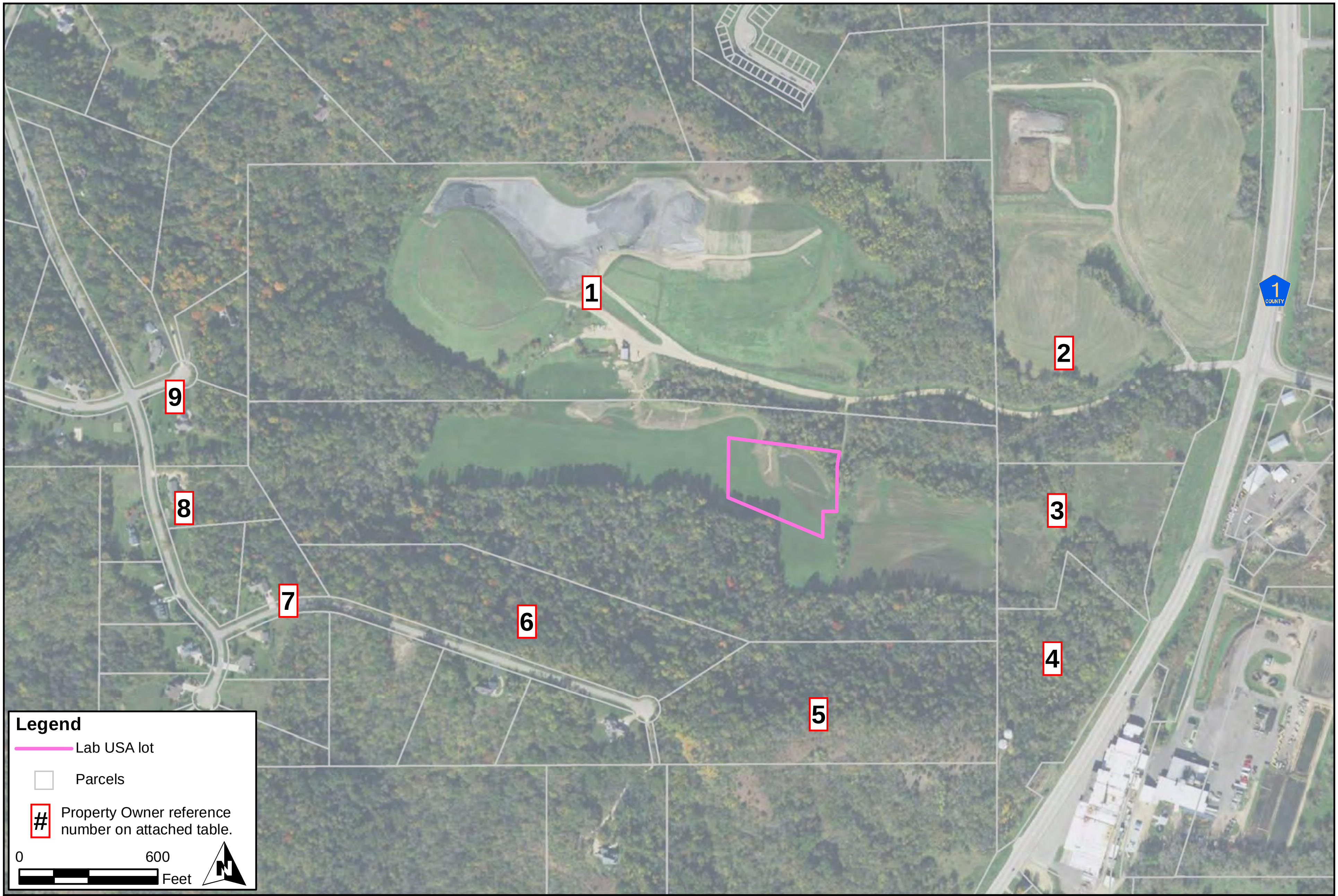
Vehicles and equipment were described in previous sections are include the following:

- Highway quad-axle dump trucks (18 cubic yards) - from the Generating Plant and from the City's Landfill
- Off highway dump trucks (up to 25 cubic yards)
- Roll-off trucks
- Front-end loader, skid steer and/or forklifts
- Hoppers and/or bins
- Roll-offs (15 cubic yards)
- Conveyor belt systems
- Crusher/Screening Equipment
- Magnetic Separators Equipment
- Eddy Current Processing Equipment

Appendix A

Siting Information

Path: \\sp3020-1\Projects\KO\L\LABUS\133967\3-env-stdy-regs\99_GIS\Drafted_Maps\appedixA_PRoperty.mxd



SEH
3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110
PHONE: (651) 490-2000
FAX: (651) 490-2150
WATTS: 800-325-2055
www.sehinc.com

Project: LABUS 133967
Print Date: 5/26/2016

Map by: msherrill
Projection: UTM Zone 15N
Source: MDH
Goodhue County
ESRI
City of Red Wing Parcel data

Lab USA

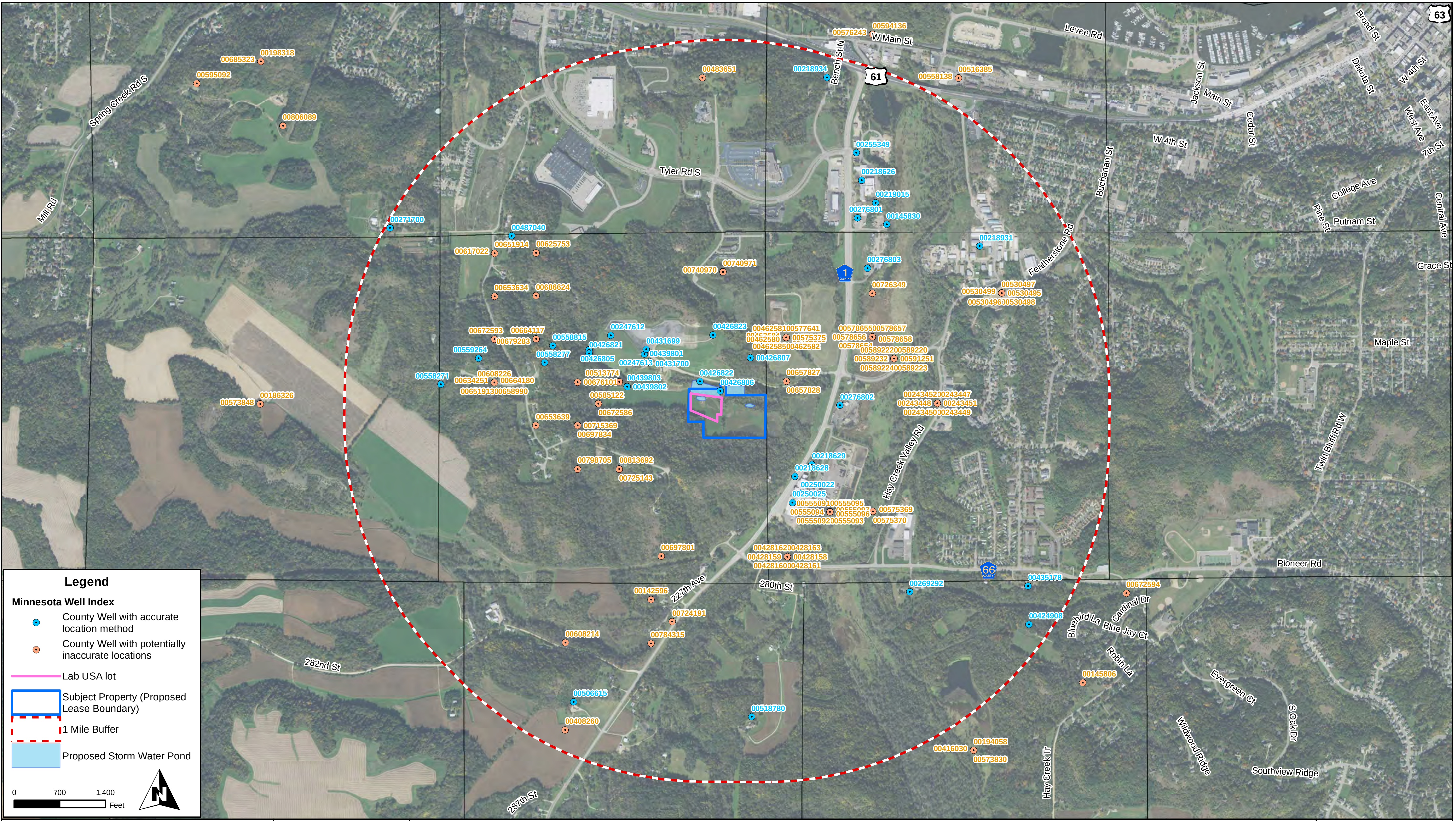
Adjacent Property Owners

Lab USA's Ash Processing Facility - Red Wing
Goodhue County, MN

Appendix
A

Appendix A
Adjacent Landowners
Lab USA's Ash Processing Facility - Red Wing
Goodhue County, Minnesota

Map ID	Parcel ID	Property Address	Taxpayer Name	Mailing Address
1	55.735.0051	No Property Address	Northern States Power Company	414 Nicollet Mall, Minneapolis, MN 55401
2	55.645.0240	1500 Bench St.	Goodhue County	1500 Bench St., Red Wing, MN 55066
3	55.645.0670	No Property Address	Laurie R. Budensiek et al	34441 240th Ave., Goodhue, MN 55027
4	55.645.0700	No Property Address	City of Red Wing	315 4th St. W, Red Wing, MN 55066
5	55.929.0140	No Property Address	Mark R. Walsworth	2860 Jewel Ln. N, Plymouth, MN 55447
6	55.932.0030	No Property Address	Jess L. Brehmer	2985 Cougar Ct., Red Wing, MN 55066
7	55.929.0130	3160 Cougar Ct.	Mike Stensland	3160 Cougar Ct., Red Wing, MN 55066
8	55.929.0110	1685 Red Fox Dr.	Timothy R. Sloan	1685 Red Fox Dr., Red Wing, MN 55066
9	55.927.0100	3255 Wild Turkey Ln.	Thomas D. McNurlin	3255 Wild Turkey Ln., Red Wing, MN 55066



Path: \\sp3020-1\Projects\KO\L\LABUS\133967\3-env-stdy-regs\99_GIS\Wells_LABUSA.mxd

SEH

3535 VADNAIS CENTER DR.
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PHONE: (651) 490-2000
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www.sehinc.com

Project: LABUS 133967
Print Date: 5/25/2016

Map by: msherrill
Projection: UTM Zone 15N
Source: MDH
Goodhue County
ESRI
MnGeo FSA aerial

Minnesota County Well Index

Lab USA's Ash Processing Facility - Red Wing
Conditional Use Permit Request
City of Red Wing, MN

Lab USA

Figure
1

Appendix A
County Well Index Wells
Conditional Use Permit Request
City of Red Wing, MN
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Unique Well No.	Well Owner	Well Name	Township	Range	Direction	Section	Subsection	Elevation	Aquifer Name	Well Type	Depth	Year Drilled	Distance from Subject Property (ft)	Location Method/Data Source
00426806	NSP ASH DISPOSAL MW-2	NSP ASH DISPOSAL MW-2	113	15	W	35	ADCDAD	86D	CTLR	MW	97	1986	0	Located
00426822	NSP ASH DIS. PZ-2 (MW-4)	NSP ASH DIS. PZ-2 (MW-4)	113	15	W	35	ADCBDD	86D	CTCW	MW	136	1986	112	Located
00657827	GOODHUE COUNTY	MW-7C	113	15	W	36	BCC	-	-	MW	39	0	384	Centroid
00657828	GOODHUE COUNTY	MW-7D	113	15	W	36	BCC	-	-	MW	72	0	384	Centroid
00426807	NSP ASH DISPOSAL MW-3	NSP ASH DISPOSAL MW-3	113	15	W	35	ADADCD	86D	CTLR	MW	188	1986	556	Located
00439801	NSP ASH DISPOSAL C-2	NSP ASH DISPOSAL C-2	113	15	W	35	ACACCD	86D	CTLR	MW	113	1987	726	Located
00431700	NSP C-1	NSP C-1	113	15	W	35	ACACCD	86D	CTLR	MW	87	1987	734	Located
00218628	S.B. FOOT TANNING CO. 3	S.B. FOOT TANNING CO. 3	113	15	W	36	CBCDBD	86D	MTPL	PP	658	1960	747	Located
00426823	NSP ASH DIS. PZ-3 (MW-5)	NSP ASH DIS. PZ-3 (MW-5)	113	15	W	35	ADBACD	86D	CWOC	MW	262	1986	760	Located
00218629	S.B. FOOT TANNING CO. 3	S.B. FOOT TANNING CO. 3	113	15	W	36	CDBDCC	86D	MTPL	PP	655	1967	824	Located
00247613	NSP C-2	NSP C-2	113	15	W	35	ACACAC	86D	-	TW	199	0	866	Located
00431699	NSP B-1	NSP B-1	113	15	W	35	ACACAB	86D	CTLR	MW	120	1987	890	Located
00575373	MW-101	MW-101	113	15	W	36	BCB	-	-	MW	155	0	938	Centroid
00575374	MW-102	MW-102	113	15	W	36	BCB	-	-	MW	163	0	938	Centroid
00575375	MW-103	MW-103	113	15	W	36	BCB	-	-	MW	105	0	938	Centroid
00577641	MW-104	MW-104	113	15	W	36	BCB	-	-	MW	98	0	938	Centroid
00577642	MW-105	MW-105	113	15	W	36	BCB	-	-	MW	155	0	938	Centroid
00598717	MW-106	MW-106	113	15	W	36	BCB	-	-	MW	102	0	938	Centroid
00462576		MW-1A	113	15	W	36	BCB	-	-	MW	28	1990	938	Centroid
00578913	MW-202	MW-202	113	15	W	36	BCB	-	-	MW	163	0	938	Centroid
00462577	GOODHUE COUNTY	MW-2A	113	15	W	36	BCB	-	-	MW	95	1990	938	Centroid
00462578	GOODHUE COUNTY	MW-3A	113	15	W	36	BCB	-	-	MW	95	1990	938	Centroid
00462579		MW-4A	113	15	W	36	BCB	-	-	MW	65	1990	938	Centroid
00462580	GOODHUE COUNTY	MW-5A	113	15	W	36	BCB	-	-	MW	25	1990	938	Centroid
00462581	GOODHUE COUNTY	MW-6A	113	15	W	36	BCB	-	-	MW	25	1990	938	Centroid
00462582	GOODHUE COUNTY	MW-7A	113	15	W	36	BCB	-	-	AB	44	1990	938	Centroid
00462583	GOODHUE COUNTY	MW-7B	113	15	W	36	BCB	-	-	AB	70	1990	938	Centroid
00462584	GOODHUE COUNTY	MW-8A	113	15	W	36	BCB	-	-	MW	28	1990	938	Centroid
00462585	GOODHUE COUNTY	MW-8B	113	15	W	36	BCB	-	-	MW	61	1990	938	Centroid
00470677		MW-9A	113	15	W	36	BCB	-	-	AB	125	1990	938	Centroid
00439802	NSP ASH DISPOSAL D-1	NSP ASH DISPOSAL D-1	113	15	W	35	ACCADC	86D	CTLR	MW	79	1987	946	Located
00439803	NSP ASH DISPOSAL D-2	NSP ASH DISPOSAL D-2	113	15	W	35	ACCADC	86D	CTLR	MW	103	1987	946	Located
00250022	S.B. FOOT TANNING OLD 1	S.B. FOOT TANNING OLD 1	113	15	W	36	CCBAAC	86D	MTPL	AB	491	1995	1007	Located
00513774	MW	MW	113	15	W	35	ACC	-	-	MW	98	1992	1072	Centroid
00250025	S.B. FOOT TANNING NEW 1	S.B. FOOT TANNING NEW 1	113	15	W	36	CCBACA	86D	MTPL	AB	459	1995	1076	Located
00276802	ALAKSON'S BLACKTOPPING SERVICE	ALAKSON'S BLACKTOPPING SERVICE	113	15	W	36	CBAABA	86D	-	-	0	0	1146	Located
00813692		KNAPP, BRIAN	113	15	W	35	DBC	-	-	DO	500	0	1283	Centroid
00725143	WENZEL, ED	WENZEL, ED	113	15	W	35	DBC	-	-	DO	480	0	1283	Centroid
00672586	KOELLER, DON	KOELLER, DON	113	15	W	35		-	-	DO	440	0	1381	Centroid
00585122	TURNER, DAVE	TURNER, DAVE	113	15	W	35		86D	-	DO	460	1996	1381	Centroid
00247612	NSP C-1	NSP C-1	113	15	W	35	ACBBDC	86D	-	TW	60	0	1449	Located
00555093		MW=18A	113	15	W	36	CCA	-	-	MW	47	0	1510	Centroid
00555091	MW-16	MW-16	113	15	W	36	CCA	-	-	MW	17	0	1510	Centroid

Appendix A
County Well Index Wells
Conditional Use Permit Request
City of Red Wing, MN
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Unique Well No.	Well Owner	Well Name	Township	Range	Direction	Section	Subsection	Elevation	Aquifer Name	Well Type	Depth	Year Drilled	Distance from Subject Property (ft)	Location Method/Data Source
00555092	MW-17	MW-17	113	15	W	36	CCA	-	-	MW	17	0	1510	Centroid
00555095	MW-18B	MW-18B	113	15	W	36	CCA	-	-	MW	33	0	1510	Centroid
00555094	MW-19A	MW-19A	113	15	W	36	CCA	-	-	MW	23	0	1510	Centroid
00555097	MW-20	MW-20	113	15	W	36	CCA	-	-	MW	45	0	1510	Centroid
00555096		MW-79B	113	15	W	36	CCA	-	-	MW	39	0	1510	Centroid
00426821	NSP ASH PZ-1 (MW-1A)	NSP ASH PZ-1 (MW-1A)	113	15	W	35	BDADDA	86D	CTLR	MW	225	1986	1622	Located
00426805	NSP ASH DISPOSAL MW-1	NSP ASH DISPOSAL MW-1	113	15	W	35	BDADDA	86D	CTLR	MW	110	1986	1641	Located
00715369	BENDER, DAN & DEE	BENDER, DAN & DEE	113	15	W	35	CAA	-	-	DO	430	0	1700	Centroid
00697834	SLOAN, TIM & CHAR	SLOAN, TIM & CHAR	113	15	W	35	CAA	-	-	DO	430	0	1700	Centroid
00676101	KARJALA, DUANE & MARY	KARJALA, DUANE & MARY	113	15	W	35	BDD	-	-	DO	420	0	1709	Centroid
00740971	CITY OF RED WING	CITY OF RED WING	113	15	W	35	AA	-	-	MW	100	0	1719	Centroid
00740970	MW-22A	MW-22A	113	15	W	35	AA	-	-	MW	180	0	1719	Centroid
00798705	NOESEN, GEORGE	NOESEN, GEORGE	113	15	W	35	CAD	-	-	SI	500	0	1847	Centroid
00428158		MW	113	15	W	36	CCC	-	-	MW	27	1986	1853	Centroid
00428160		MW ST-12	113	15	W	36	CCC	-	-	MW	15	1986	1853	Centroid
00428162		MW- ST-14	113	15	W	36	CCC	-	-	MW	13	1986	1853	Centroid
00428159		MW-B11-A	113	15	W	36	CCC	-	-	MW	13	1986	1853	Centroid
00428161		MW-ST-13	113	15	W	36	CCC	-	-	MW	11	1986	1853	Centroid
00428163		MW-ST-15	113	15	W	36	CCC	-	-	MW	13	1986	1853	Centroid
00578657	GOODHUE CO. DISPOSAL FACILITY	MW-13	113	15	W	36	BDB	-	-	MW	10	0	1866	Centroid
00578658	GOODHUE CO DISPOSAL FACILITY	MW-13D	113	15	W	36	BDB	-	-	MW	30	0	1866	Centroid
00578654		MW-14	113	15	W	36	BDB	-	-	MW	10	0	1866	Centroid
00578655	MW-14D	MW-14D	113	15	W	36	BDB	-	-	MW	30	0	1866	Centroid
00578656	GOODHUE CO DISPOSAL FACILITY	MW-15	113	15	W	36	BDB	-	-	MW	10	0	1866	Centroid
00697801	BAHL, DAVID	BAHL, DAVID	113	15	W	35	DCD	-	-	DO	420	0	1933	Centroid
00575369		MW-18E	113	15	W	36	CDB	-	-	MW	84	0	2001	Centroid
00575370	MW-20D	MW-20D	113	15	W	36	CDB	-	-	MW	47	0	2001	Centroid
00589220	GOODHUE CO LANDFILL	MW-14E	113	15	W	36	BD	-	-	MW	47	0	2049	Centroid
00589222	GOODHUE LANDFILL	MW-16D	113	15	W	36	BD	-	-	MW	29	0	2049	Centroid
00589223	GOODHUE CO LANDFILL	MW-17D	113	15	W	36	BD	-	-	MW	41	0	2049	Centroid
00589224	GOODHUE CO. LANDFILL	MW-18	113	15	W	36	BD	-	-	MW	12	0	2049	Centroid
00589232	GOODHUE CO LANDFILL	MW-18D	113	15	W	36	BD	-	-	MW	42	0	2049	Centroid
00591251	GOODHUE CO LANDFILL	MW-19D	113	15	W	36	BD	-	-	MW	36	0	2049	Centroid
00558815	KALWAT, WAYNE	KALWAT, WAYNE	113	15	W	35	BDBDAD	86D	MTPL	DO	420	1995	2189	Located
00558277	SWANSON, BRAD	SWANSON, BRAD	113	15	W	35	BDCAAB	86D	MTPL	DO	420	1995	2248	Located
00726349	MW-21D	MW-21D	113	15	W	36	BAC	-	-	MW	67	0	2260	Centroid
00653639	WALCH, CHRIS & MEG	WALCH, CHRIS & MEG	113	15	W	35	CAB	-	-	DO	435	0	2340	Centroid
00664117	BIERMANN HOMES, INC.	BIERMANN HOMES, INC.	113	15	W	35	BDB	-	-	DO	460	0	2464	Centroid
00679283	SCHUELLER, TODD	SCHUELLER, TODD	113	15	W	35	BDB	-	-	DO	440	0	2464	Centroid
00276803	RED WING CONSTRUCTION	RED WING CONSTRUCTION	113	15	W	36	BABCDD	86D	-	-	0	0	2494	Located

Appendix A
County Well Index Wells
Conditional Use Permit Request
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Unique Well No.	Well Owner	Well Name	Township	Range	Direction	Section	Subsection	Elevation	Aquifer Name	Well Type	Depth	Year Drilled	Distance from Subject Property (ft)	Location Method/Data Source
00142596	LINDSTROM	LINDSTROM	112	15	W	2	ABB	86D	-	DO	220	1978	2613	Centroid
00243447		-	113	15	W	36	-	-	-	AB	21	0	2636	Centroid
00243448		-	113	15	W	36	-	-	-	AB	16	0	2636	Centroid
00243449		-	113	15	W	36	-	-	-	AB	21	0	2636	Centroid
00243450		-	113	15	W	36	-	-	-	AB	14	0	2636	Centroid
00243451		-	113	15	W	36	-	-	-	AB	10	0	2636	Centroid
00243452		-	113	15	W	36	-	-	-	AB	26	0	2636	Centroid
00686624	STENSLAND, MIKE	STENSLAND, MIKE	113	15	W	35	BAC	-	-	DO	440	0	2742	Centroid
00724191	WILDEMAN, BRIAN & BECKY	WILDEMAN, BRIAN & BECKY	112	15	W	2	AB	-	-	-	155	0	2869	Centroid
00658990	COOK, ROBERT	COOK, ROBERT	113	15	W	35	BCD	-	-	DO	440	0	2984	Centroid
00664180	COOK, ROBERT	FERRIAN, PETER	113	15	W	35	BCD	-	-	DO	460	0	2984	Centroid
00651913	FERRIAN, PETER	ISETTS, BRIAN	113	15	W	35	BCD	-	-	DO	420	0	2984	Centroid
00608226	LYONS, DAVID	LYONS, DAVID	113	15	W	35	BCD	-	-	DO	460	0	2984	Centroid
00634251	MOLLGAARD, RICK	MOLLGAARD, RICK	113	15	W	35	BCD	-	-	DO	460	0	2984	Centroid
00276801	SUBURBAN DISPOSAL, INC.	SUBURBAN DISPOSAL, INC.	113	15	W	25	CDCCCA	86D	-	-	0	0	3059	Located
00672593	WINN, DARIN	WINN, DARIN	113	15	W	35	BCA	-	-	DO	460	0	3077	Centroid
00625753	MCNURLIN, TOM	MCNURLIN, TOM	113	15	W	35	BAB	-	-	DO	420	0	3135	Centroid
00145830	WEDRICKA, TONI	WEDRICKA, TONI	113	15	W	25	CDCDDC	86D	CECR	DO	170	1977	3209	Located
00269292	FERRIN, ANN	FERRIN, ANN	112	15	W	1	BABACB	86D	-	DO	0	0	3240	Located
00559264	SHIMEK, CHRIS	SHIMEK, CHRIS	113	15	W	35	BCACDC	86D	MTPL	DO	460	1995	3256	Located
00784315	WALKER, BRIAN	WALKER, BRIAN	112	15	W	2	ABC	-	-	DO	140	0	3261	Centroid
00653634	ROSCHEN, DARYL & KARI	ROSCHEN, DARYL & KARI	113	15	W	35	BBD	-	-	DO	255	0	3299	Centroid
00219015	S.B. FOOT TANNING CO. 4	S.B. FOOT TANNING CO. 4	113	15	W	25	CDCCCC	86D	CEMS	PP	343	1964	3396	Located
00487040	HEITMAN, DOUG	HEITMAN, DOUG	113	15	W	35	BBAAAD	86D	CTCW	DO	240	1991	3588	Located
00218626	S.B. FOOT TANNING CO. 5	S.B. FOOT TANNING CO. 5	113	15	W	25	CDBCCD	86D	MTPL	PP	530	2005	3609	Located
00617022	MCNEIL, BILL & DIANE	MCNEIL, BILL & DIANE	113	15	W	35	BBA	-	-	DO	315	0	3631	Centroid
00651914	WEINMANN, CARL	WEINMANN, CARL	113	15	W	35	BBA	-	-	DO	260	0	3631	Centroid
00608214	RUBLE, ARDELLE	RUBLE, ARDELLE	112	15	W	2	BAC	-	-	DO	200	0	3790	Centroid
00558271	DELAHUNTY, JOHN	DELAHUNTY, JOHN	113	15	W	35	BCCCAA	86D	MTPL	DO	410	1995	3803	Located
00530497	MW-10A	MW-10A	113	15	W	36	ABD	-	-	MW	165	0	3945	Centroid
00530495	MW-11A	MW-11A	113	15	W	36	ABD	-	-	MW	45	0	3945	Centroid
00530499		MW-12A	113	15	W	36	ABD	-	-	MW	105	0	3945	Centroid
00530498	MW-5B	MW-5B	113	15	W	36	ABD	-	-	MW	47	0	3945	Centroid

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County Well Index Wells
Conditional Use Permit Request
City of Red Wing, MN

Unique Well No.	Well Owner	Well Name	Township	Range	Direction	Section	Subsection	Elevation	Aquifer Name	Well Type	Depth	Year Drilled	Distance from Subject Property (ft)	Location Method/Data Source
00530496	MW-8C	MW-8C	113	15	W	36	ABD	-	-	MW	170	0	3945	Centroid
00255349	S.&B. FOOT TANNING	S.&B. FOOT TANNING	113	15	W	25	CDBBCA	86D	CECR	DO	145	2000	3967	Located
00218931	RED WING SEWER PIPE CO.	RED WING SEWER PIPE CO.	113	15	W	36	ABBADD	86D	INDT	IN	675	0	3998	Located
00518780	RIEGELMAN, ROBERT	RIEGELMAN, ROBERT	112	15	W	2	ADCAAD	86D	CWOC	DO	280	1992	4280	Located
00506615	MCCLELLAND, GENE	MCCLELLAND, GENE	112	15	W	2	BDBDDC	86D	CTLR	DO	220	1989	4518	Located
00435178	VALTAKIS, PETE	VALTAKIS, PETE	112	15	W	1	BAABDB	86D	CTLR	DO	180	1987	4628	Located
00483651	RED WING PUBLISHING	MW-1	113	15	W	26	DAB	-	-	AB	46	1992	4706	Centroid
00424908	HILL, DOUG & COLEEN	HILL, DOUG & COLEEN	112	15	W	1	ABDBAC	86D	CTLR	DO	160	1986	4956	Located
00218934	RIEDELL, PAUL	RIEDELL, PAUL	113	15	W	25	CBABDD	86D	CAMB	DO	440	1959	4958	Located
00408260	VOTH, MARTIN	VOTH, MARTIN	112	15	W	2	BDC	86D	-	DO	350	1983	4961	Centroid
00271700	FALCONER WINERY	FALCONER WINERY	113	15	W	27	DDDCCC	86D	CJTC	PN	220	2010	5201	Located
00516385	MW-3	MW-3	113	15	W	25	DBB	-	-	MW	35	0	5690	Centroid
00558138	MW-6	MW-6	113	15	W	25	DBB	-	-	MW	32	0	5690	Centroid
00416030	ALMS, MYRON	ALMS, MYRON	112	15	W	1	-	86D	-	DO	240	1984	5762	Centroid
00573830	JENSON, ARLO	JENSON, ARLO	112	15	W	1	-	86D	-	DO	240	1996	5762	Centroid
00194058	KARSRUD, DENNIS	KARSRUD, DENNIS	112	15	W	1	-	86D	-	DO	200	1982	5762	Centroid
00576243	MW	MW	113	15	W	25	BDC	-	-	MW	20	0	5767	Centroid
00594136	MW-5	MW-5	113	15	W	25	BDC	-	-	MW	27	0	5767	Centroid
00672594	PETERSON, ZAK	PETERSON, ZAK	112	15	W	1	AAA	-	-	DO	200	0	6029	Centroid
00524406	MW-1	MW-1	113	15	W	26	ADA	-	-	MW	46	0	6040	Centroid
00665822	RED WING PUBLISHING CO	MW-2	113	15	W	26	ADA	-	-	AB	45	0	6040	Centroid
00665821	RED WING PUBLISHING CO	MW-3	113	15	W	26	ADA	-	-	AB	45	0	6040	Centroid
00665823	RED WING PUBLISHING CO	MW-4	113	15	W	26	ADA	-	-	AB	43	0	6040	Centroid
00145806		-	112	15	W	1	ADB	86D	-	DO	175	1977	6148	Centroid
00478538	FINA OIL & CHEMICAL CO	MW-1	113	15	W	26	BDA	-	-	AB	57	1991	6301	Centroid
00478539	FINA OIL & CHEMICAL CO	MW-2	113	15	W	26	BDA	-	-	AB	55	1991	6301	Centroid
00478540	FINA OIL & CHEMICAL CO	MW-3	113	15	W	26	BDA	-	-	AB	55	1991	6301	Centroid
00513916	CITY OF REDWING	MW-4	113	15	W	26	BDB	-	-	AB	54	1992	6494	Centroid
00573848	KLEIN, RANDY	KLEIN, RANDY	113	15	W	34	-	86D	-	DO	240	1996	6574	Centroid
00186326		STCYNSKE, STEVE	113	15	W	34	-	86C	-	DO	278	1983	6574	Centroid
00241223		PETERSON, AUGUST	113	15	W	26	B	86D	-	DO	355	0	6914	Centroid
00554100	MW-4	MW-4	113	15	W	25	BAC	-	-	MW	32	0	7042	Centroid
00554099	MW-5	MW-5	113	15	W	25	BAC	-	-	MW	32	0	7042	Centroid
00806089	ANDERSON, RYAN	ANDERSON, RYAN	113	15	W	27	DBC	-	-	DO	300	0	7422	Centroid
00170874	JOE MASS REALITY	JOE MASS REALITY	112	15	W	2	CDC	86D	-	DO	140	1980	7470	Centroid
00685323	CITY OF RED WING	ANDERSON PARK TW	113	15	W	27	-	-	-	TW	605	0	8267	Centroid
00198318	ECKHOFF, STEVEN	ECKHOFF, STEVEN	113	15	W	27	-	86D	-	DO	175	1984	8267	Centroid
00723927	BYSTROM, KELLY	BYSTROM, KELLY	112	15	W	1	DDC	-	-	DO	200	0	8644	Centroid
00595092	YANTZ, MIKE	YANTZ, MIKE	113	15	W	27	CAB	-	-	DO	440	0	8884	Centroid

Note: The information on this table includes located and centroid wells that were identified within the 1 mile buffer arear and are registered with the Minnesota Department of Health (MDH) County Well Index (CWI).

- Information not provided

* Centroid wells are those with potentially inaccurate coordinate locations. These are mapped to the most accurate TRS/subsection provided.

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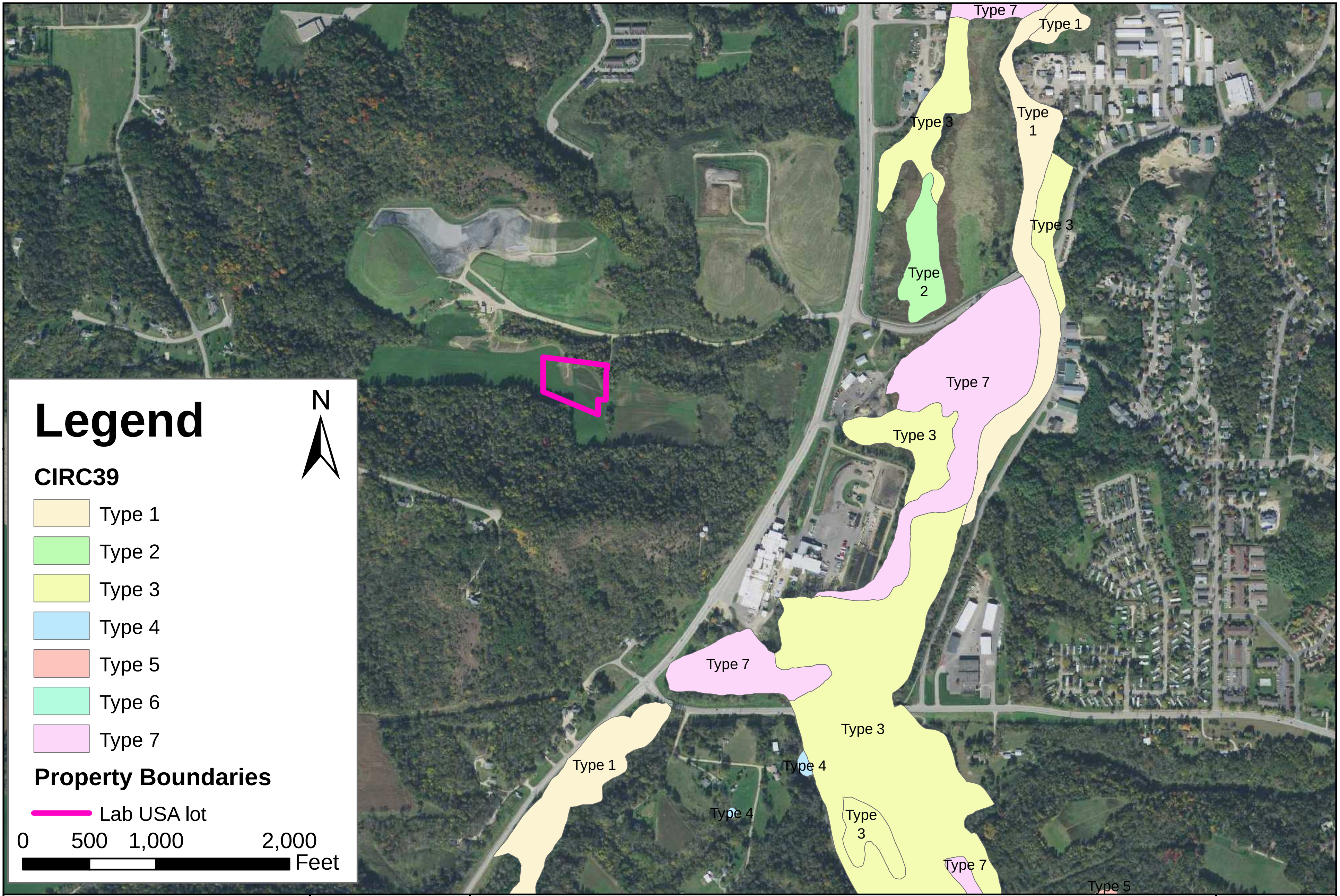

Path: P:\KO\L\LABUS\137360\5-final-dsgn\51-drawings\90-GIS\Fig 15_NWI Map.mxd

1200 25TH AVENUE SOUTH
ST. CLOUD, MN 56302-1717
PHONE: (320) 229.4300

www.sehinc.com

Project: LABUS 137360
Print Date: 5/24/2016

Map by: jasp
Projection:UTM 15N
Source: USA Topo, MnGeo, and SEH

NATIONAL WETLAND INVENTORY MAP

Lab USA's Ash Processing Facility - Red Wing
Goodhue County, Minnesota

Figure
15

Appendix B

Associated Permits

B-1 – Industrial Stormwater
B-2 – Air Quality

B-1 – Industrial Stormwater

Minnesota Pollution
Control Agency

520 Lafayette Road North
St. Paul, MN 55155-4194

05/20/2016

Lab USA's Ash Processing Facility - Red Wing
1540 Bench St
Red Wing, MN 55066

RE: Application for No Exposure Exclusion from Minnesota's Industrial Stormwater Permit
Permit ID Number: MNRNE3D5B
Facility Name: Lab USA's Ash Processing Facility - Red Wing
Facility Address: 1540 Bench St Red Wing, MN 55066

Dear ,

The Minnesota Pollution Control Agency (MPCA) has reviewed and approved your application for the No Exposure Exclusion from Minnesota's Industrial Stormwater Multi-Sector General Permit.

In certifying No Exposure, Lab USA's Ash Processing Facility - Red Wing (MNRNE3D5B) indicates that this facility has certified that 100% of stormwater discharges do not come into contact with industrial activities or significant materials, 100% of the time. The No Exposure Exclusion is a temporary exclusion from the Industrial Stormwater Multi-Sector General Permit and must be re-certified by the permittee at a minimum once every five years.

The No-Exposure exclusion is conditional. If circumstances change and conditions for the No Exposure exclusion no longer apply to the facility, you must apply for permit coverage.

The No Exposure Notification Card should be posted at the facility in a visible location.

To see a full description of No Exposure exclusion requirements or for additional information about the program, go to: http://www.pca.state.mn.us/industrialstormwater/.

Industrial Activities authorized under this permit

Industrial Activity	Industrial Subsector	Industrial Sector
5093 Scrap and Waste Materials	N1 Scrap Recycling Facilities	N Scrap Recycling and Waste Recycling Facilities

Read and follow all applicable permit requirements. For a copy of the permit in its entirety go to: www.pca.state.mn.us/industrialstormwater/. There is also additional information about the Industrial Stormwater Multi-Sector General Permit including Frequently Asked Questions, a SWPPP template and checklist, the BMP Guidebook, the Sampling Guidance Manual, and many more guidance materials there.

If you have questions contact the Industrial Stormwater Program by email: iswprogram.pca@state.mn.us or call the Stormwater Hotline at 651-757-2119 or 800-657-3804 (non-metro only).

Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155-4194

Notice of No Exposure Exclusion

Industrial Stormwater Multi-Sector General Permit MNR050000

The facility listed below is authorized by the Industrial Stormwater No Exposure Exclusion.

This facility has certified that 100% of stormwater discharges do not come into contact with industrial activities or significant materials, 100% of the time.

This Exclusion expires at the end of the current five year cycle of the Industrial Stormwater Multi-Sector General Permit (April 5, 2020), unless there is a change such that the facility no longermeets all conditions of No Exposure, and then must apply for permit coverage. This facility must re-apply for coverage when the next five year cycle begins.

Industrial Activities authorized under this permit

Industrial Activity	Industrial Subsector	Industrial Sector
5093 Scrap and Waste Materials	N1 Scrap Recycling Facilities	N Scrap Recycling and Waste Recycling Facilities

If you have questions regarding the industrial stormwater program, please email:iswprogram.pca@state.mn.us, visit: www.pca.state.mn.us/industrialstormwater or call the Stormwater Hotline at 651-757-2119 or 800-657-3804.

Permit ID Number: **MNRNE3D5B**

Facility Name: Lab USA's Ash Processing Facility - Red Wing

Facility Address: 1540 Bench St Red Wing, MN 55066

Beginning Date: 05/20/2016

Expiration Date: 4/5/2020

Post this Coverage Card in a visible location

Minnesota Pollution
Control Agency

520 Lafayette Road North
St. Paul, MN 55155-4194

Combined Industrial Stormwater Multi-Sector General Permit and No Exposure Certification Application

NPDES/SDS Industrial Stormwater Multi-Sector General Permit

Doc Type: Permit Application

Before you apply:

- Determine if you are required to apply for the General Permit or for No Exposure.
- Read the *Application Instructions* before applying (found on the Minnesota Pollution Control Agency (MPCA) website at https://www.pca.state.mn.us/water/step-6-apply-modify-or-terminate-permit-coverageno-exposure-certification).

Submittal:

No Exposure applicants may submit applications electronically or by paper copy. To submit a *PDF version*: save the form to your computer and send to the MPCA by using the 'Submit' button at the end of the form. To submit a *MS Word version:* Save the form to your computer and send to the MPCA as an e-mail attachment to iswprogram.pca@state.mn.us.
If you do not receive an e-mail confirmation receipt within five business days, please contact the Industrial Stormwater Program.at iswprogram.pca@state.mn.us.

General Permit applicants must mail a paper copy of this application with a $400 check payable: "Minnesota Pollution Control Agency, Fiscal Services – 6th floor", to the address above.

All applicants: Incomplete applications will be returned.

Questions? Email program staff at: iswprogram.pca@state.mn.us, or call the Stormwater hotline at: 651-757-2119 or 800-657-3804 (non-metro only).

1. What is your facility's primary SIC code? 5093 (Sector N1)

(See the instructions for the definition of "primary" SIC Code.)

2. List up to five additional authorized SIC codes from the instructions, if applicable:

3. If you listed SIC codes 2869, 4512, 4513, 4522, or 4581 in 1 or 2, list the corresponding subsector:

(Examples: 2869-C7 or 4581-S2 and S3. Note: There is an additional subsector for Air Transportation, 4512, 4513, 4522, and 4581.)

4. Select all applicable Narrative Activities from the list below. If none are applicable, leave this section blank.

Subsector	Subsector description	Check if applicable
A4	Timber products: discharges from wet decking storage areas	☐
C1	Runoff from phosphate fertilizer manufacturing facilities that comes into contact with any raw materials, finished product, by-products, or waste products	☐
D2	Discharges from production of asphalt emulsions areas	☐
E3	Cement manufacturing facility, material storage runoff (note: this is **not** a concrete ready mix facility)	☐
K1	Hazardous waste treatment/storage/disposal facility for discharges not subject to effluent limitations in 40 CFR pt. 445, subp. A (note: this is **not** a hazardous waste generator)	☐
K2	Hazardous waste treatment/storage/disposal facility for discharges subject to effluent limitations in 40 CFR pt. 445, subp. A (note: this is **not** a hazardous waste generator)	☐
L1	Municipal solid waste landfill areas closed in accordance with 40 CFR 258.60	☐
L2	Open or closed non-hazardous waste landfill and land application site not discharging to surface water	☐
L3	Landfill that discharges to surface waters stormwater that has directly contacted solid waste	☐
O1	Coal fired and oil fired steam electric generating facility	☐
O2	Nuclear, natural gas fired, and any other fuel source used for steam electric generation	☐
O3	Runoff from coal storage piles at steam electric generating facility	☐
S3	Existing and new primary airports with 1,000 or more annual jet departures that discharge wastewater associated with airfield pavement deicing that contains urea commingled with stormwater	☐
T1	Treatment works with design flow of one million gallons per day or more or are required to have an approved pretreatment program under 40 CFR pt. 403	☐

5. Briefly describe the *industrial activities* performed at this facility:

Lab USA Corp. is developing a resource recovery facility in the City of Red Wing. The facility is planned for a 2017 construction and will obtain a Construction Stormwater Permit. The facility will process municipal solid waste (MSW) combustor ash currently being generated at Xcel Energy's Red Wing Generating Plant as well as combustor ash previously placed in nearby landfills owned by the City of Red Wing and Xcel Energy. Recovered material will include ferrous and nonferrous metals.

The proposed facility includes construction of a 27,500 sq. ft. building that will completely house all industrial activities including offloading, processing, and loading of materials. No stormwater will have contact with industrial materials or equipment within the building. Any incidental water collected in the building will be treated as wastewater through the City sanitary sewer system. Temporary storage of recovered materials will occur outside within covered roll-offs for routine pickup.

6. Facility Information (Enter the facility name, and full physical address/location of the facility.)

Facility name: Lab USA's Ash Processing Facility – Red Wing
Facility street address: 1540 Bench Street
City: Red Wing State: MN Zip: 55066 County: Goodhue
Permit No./Facility ID No. (ex. MNR0533XX, MNRNE3438 or none): None

7. Facility location information

Enter the decimal latitude and longitude of the geographical center of the facility. To find this information online, use the search tool on the iTouchMap.com website at http://itouchmap.com/latlong.html

Decimal Latitude: 44.550118 *(ex: 44. 956497)* **Decimal Longitude:** -92.576597 *(ex: -93. 084619)*

How was this information obtained? ☐ GPS Unit ☒ Online Map Locator ☐ Topographic Map
☐ Other-please explain:

8. Contact information

Enter the name, email address, phone number, fax number and address of the owner of the facility/business, the facility operator, the contact person, and the billing contact person.

A. Facility/Business owner

Owner contact name: Kane Flett Company/Organization name: Lab USA Corp.
Owner mailing address: 130 East Walnut Street #902
City: Green Bay State: WI Zip: 54301 County: Brown
Phone: 920.544.9710 Fax: E-mail: kane.flett@labusa.us

B. Facility operator

Operator contact name: Kane Flett Company/Organization name: Lab USA Corp.
Operator mailing address: 130 East Walnut Street #902
City: Green Bay State: MN Zip: 54301 County: Brown
Phone: 920.544.9710 Fax: E-mail: kane.flett@labusa.us

C. Facility contact

Contact name: Kane Flett Company/Organization name: Lab USA Corp.
Contact mailing address: 130 East Walnut Street #902
City: Green Bay State: WI Zip: 54301 County: Brown
Phone: 920.544.9710 Fax: E-mail: kane.flett@labusa.us

D. Billing contact

Contact name: Kane Flett Company/Organization name: Lab USA Corp.
Contact mailing address: 130 East Walnut Street #902
City: Green Bay State: WI Zip: 54301 County: Brown
Phone: 920.544.9710 Fax: E-mail: kane.flett@labusa.us

9. **No Exposure. These questions apply to your entire facility.** To qualify for the No Exposure exclusion, 100% of your industrial activities and significant materials must be indoors or within a storm-resistant shelter 100% of the time for you to be able to answer "No" to all of the questions below. Storm-resistant shelters include completely roofed and walled buildings and structures, or structures with a top cover that are bermed, sloped inward, or otherwise prevent stormwater from running into the area or for potential materials or spills, including windblown materials from leaving the area.

Are any of the following materials or activities exposed to precipitation, now or in the foreseeable future?

	Materials or Activities	Examples (Not inclusive)	
A.	Use, storage or cleaning of industrial machinery or equipment; areas where residuals from these activities and equipment remain exposed to stormwater	Vehicle and equipment washing, maintenance and storage areas, molds or forms used to make products, outdoor manufacturing or processing areas	☐ Yes ☒ No
B.	Spills or leaks on the ground or in stormwater inlets	Hydraulic fluid, fuel, oil, other fluid or material leaks or spills	☐ Yes ☒ No
C.	Residuals, equipment, or products from past industrial activity	Materials from past industrial activities/owners are still outside and exposed to stormwater	☐ Yes ☒ No
D.	Inadequately maintained facility equipment or vehicles	Leaking forklifts, trolleys, delivery vehicles, leaking machinery performing loading/unloading activities	☐ Yes ☒ No
E.	Facility vehicle fueling; loading/unloading/transporting materials or products	Raw material delivery/storage, loading/unloading operations; facility vehicle maintenance; loading/unloading of biosolids, fueling activities, other substance transfer areas that include solvents, coolants, lubricants, and cleaners	☐ Yes ☒ No
F.	Storage of material or product (except final products intended for outside use such as new cars)	Raw materials, metallic materials, chemicals or intermediate products, rusted or corrodible racks; spent equipment; salvaged vehicles or vehicle parts, final products not meant to be outdoors, any of which are a potential source of contaminants	☐ Yes ☒ No
G.	Containers of materials or products which are deteriorated or leaking; containers without proper covers or secondary containment	Open storage tanks, drums, broken or contaminated pallets, totes, or dumpsters, containers, racks and platforms that are not pollutant-free or are rusting/deteriorating	☐ Yes ☒ No
H.	Stockpiling or transfer of materials or products onsite or on roads or railways owned or maintained by the facility	Salt, coal, sand, gravel, and other materials, by-products, or waste products including biosolids, hazardous materials/wastes or other waste destined for land application	☐ Yes ☒ No
I.	Waste materials in uncovered disposal areas, open dumpsters, or open roll off containers	Scrap metal, oily rags, sawdust, broken pallets, spent equipment, batteries, hazardous wastes	☐ Yes ☒ No
J.	Disposal of process wastewater. *Must have a National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) permit or authorization from local Wastewater Treatment Facility*	Unpermitted process wastewater disposal including land application; permitted wastewater disposal that stains the ground or leaves visual deposits of residuals	☐ Yes ☒ No
K.	Visible deposits of particulate matter or residuals from roof stacks and/or vents or other sources and evident in the stormwater runoff	Baghouse dust or smokestack residue, road dust from industrial vehicle traffic, wood debris and dust, dust and debris from grinding, cutting, buffing, or brazing metal or plastic parts	☐ Yes ☒ No

Unsure if you qualify for the No Exposure Exclusion? Call the Stormwater Hotline at 651-757-2119.

Potential violations and penalties may be issued to a facility that has sources of exposure after having certified for the No Exposure exclusion.

If you checked "Yes**" to any question(s) A-K, you are** not eligible **for the No Exposure exclusion.**
Continue to question 11.

If you checked "No**" to all of the questions in A-K, you** qualify **for the No Exposure exclusion.**
Go to question 10, sign, and mail this form to the MPCA.

10. No Exposure Owner and Operator Certification ***(This certification is required by Federal Regulation 40 CFR 122.26(g)(4)(iv).)***

☒ Yes - I certify under penalty of law that I have read and understand the eligibility requirements for claiming a condition of ‘‘no exposure’’ and obtaining an exclusion from NPDES/SDS stormwater permitting; and that there are no discharges of storm water contaminated by exposure to industrial activities or materials from the industrial facility identified in this document.

I understand that I am obligated to submit a no exposure certification form once every five years to the NPDES/SDS permitting authority and, if requested, to the operator of the local Municipal Separate Storm Sewer Systems (MS4) into which this facility discharges.

I understand that I must allow the NPDES/SDS permitting authority, or MS4 operator where the discharge is into the local MS4, to perform inspections to confirm the condition of no exposure and to make such inspection reports publicly available upon request.

I understand that I must obtain coverage under an NPDES Permit prior to any point source discharge of stormwater from the facility. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted.

Based upon my inquiry of the person or persons who manage the system, or those persons directly involved in gathering the information, the information submitted is to the best of my knowledge and belief true, accurate and complete.

I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

By typing my name in the following box, I certify the above statements to be true and correct, to the best of my knowledge, and that this information can be used for the purpose of processing my application.

Owner authorized signature:

Name: Kane Flett

(This document has been electronically signed.)

Title: Business Development Manager

Date (mm/dd/yyyy): 05/18/2016

Operator authorized signature (if different):

Name:

(This document has been electronically signed.)

Title:

Date (mm/dd/yyyy):

If you were unable to certify for the No Exposure exclusion, continue to the next question.

11. What is the total acreage of only ***outdoor industrial activities and materials?*** _____

12. Has a Stormwater Pollution Prevention Plan (SWPPP) been completed? ☐ Yes ☐ No

Note: A SWPPP ***must*** be completed before submitting this application. If a SWPPP has not been completed, stop now, complete a SWPPP, resume filling out this application.

13. Does your industrial stormwater discharge into a street curb drain or into a manhole cover? (This is a regulated Municipal Separate Storm Sewer System, also called a MS4)

☐ Yes ☐ No If Yes, name of Regulated MS4 Owner:

(Ex: St. Paul Municipal Stormwater)

14. List all surface waters within a mile that receive your industrial stormwater discharges.

Indicate below the name of surface water and type of surface water (Fen, Ditch, Lake, Lake Trout Lake, Pond, River, Stream, Trout Stream, or Wetland) that receive your industrial stormwater discharges. Indicate “Yes” or “No” if the surface water is within one mile of any of the facility’s monitoring location, if it is an Outstanding Resource Value Water or if it is impaired. See the instructions for more information. Attach additional sheets as necessary.

Name of surface water	Type of surface water	Within one mile?	Is the surface water an Outstanding Resource Value Water?	Is the surface water an impaired water?
Ex: St. Croix River	***Ex: River***	☒ ***Yes*** ☐ ***No***	☐ ***Yes*** ☒ ***No***	☒ ***Yes*** ☐ ***No***
Ex: Unnamed Ditch	***Ex. Ditch***	☒ ***Yes*** ☐ ***No***	☐ ***Yes*** ☒ ***No***	☐ ***Yes*** ☒ ***No***
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
		☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

15. Monitoring location information.

List all monitoring locations where industrial stormwater discharges leave your facility. **A minimum of one monitoring location is required.** See the instructions for clarification. Attach additional sheets as necessary.

#	Describe the location of the monitoring location	Latitude	Longitude	List Subsector of Narrative Activities and/or SIC Codes for monitoring location
	Ex: NW corner of facility, near road	*Ex: 44. 956497*	*Ex: -93. 084619*	*Ex: SIC 3111*
		Ex: 44. 956497	*Ex: -93. 084619*	*Ex: O2*
1				
2				
3				

16. Application fee.

Is the required $400 Application Fee payable to **MPCA Fiscal Services – 6th floor**, enclosed? ☐ Yes

17. Owner and operator certification. *(This certification is required by 7001.0070 and 7001.0540.)*

☐ Yes - I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted.

I certify that based on my inquiry of the person, or persons, who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete.

I am aware that there are significant penalties for submitting false information, including the possibility of civil and criminal penalties. By typing my name in the following box I certify the above statements to be true and correct, to the best of my knowledge, and that this information can be used for the purpose of processing my application.

Owner authorized signature:

Name: ____________________

(This document has been electronically signed.)

Title: ____________________

Date (mm/dd/yyyy): ____________________

Operator authorized signature (if different):

Name: ____________________

(This document has been electronically signed.)

Title: ____________________

Date (mm/dd/yyyy): ____________________

B-2 – Air Quality

Building a Better World
for All of Us®

MEMORANDUM

TO: Todd Potas, PE (SEH)

FROM: Steve Plachinski, CHMM, CEM (SEH)

DATE: June 15, 2016

RE: Air Emissions Evaluation Update for Lab USA Ash Processing Facility
SEH No. LABUS 136249

This memo documents the air emission calculations and air permit applicability review for the proposed Lab USA Ash Processing Facility ("Facility") located at the Xcel Energy Ash Landfill in Red Wing, Minnesota. The Facility would recover ferrous and non-ferrous metals from bottom ash using a crusher and screens. Applicability for state (Minor Source) and federal (Title V) air quality permits were reviewed for the proposed Facility. If applicable, an air quality permit would be required prior to construction and operation of the Facility.

PROCESS DESIGN

To calculate air emissions from the Facility, the following process design was assumed. This design was in part based on the sample equipment diagram included in Attachment 1. The process design steps that have the potential to generate ash dust are labeled as "*".

1. Trucks deliver bottom ash (material) to the Facility
2. *Trucks unload (dump) material at the Facility
3. *A front end loader loads the material into the processing equipment
4. *Material is crushed with a crusher
5. *Crushed material is separated using three screens (two of the screens in series)
6. *Conveyors transfers material between different process steps
7. *Processed material is dropped into temporary storage piles and/or storage bins
8. Of the Facility's processed material, about 10% is refined ash with ferrous and non-ferrous metals that is hauled off-site for a beneficial use. The other 90% of the processed material is processed ash that is delivered to the ash landfill via trucks.
9. *Both the metals and the processed ash is loaded into trucks with a second front end loader
10. Both front end loaders (internal combustion engines) are fueled with diesel.

TRAFFIC EVALUATION

Anticipated truck traffic for the proposed Facility was evaluated as part of the solid waste permit application process. Average daily traffic and distance associated with the operations of the proposed Facility and other landfill activities are summarized in Table 1 below. As is shown in the table, the truck traffic evaluation concluded that the first year of operation of the Facility represents overall greater truck traffic and associated dust emissions than subsequent years of operation.

Table 1. Traffic Associated with from Lab USA Red Wing, MN Facility and Neighboring Landfills

Traffic Routes	Average Number of Daily Round Trips	Average Daily Distance Traveled (miles)	Number of Trips on Bench Street
Existing Operations			
Bench Street to City Landfill (Current Solid Waste Permit)	12	6.4	
Bench Street to Xcel Energy Landfill	10	11.4	
Total Distance		17.7	22
1st Year of Operation			
Bench Street to City Landfill (Final City Operations)	2	1.1	
Bench Street to Xcel Energy Landfill	10	11.4	
Bench Street to Lab USA's Facility (Roll Offs)	3	2.7	
City Landfill to Lab USA's Facility	28	32.9	
Total Distance		48.0	15
Subsequent Years of Operations			
Bench Street to City Landfill (Landfill Closed)	0	0.0	
Bench Street to Xcel Energy Landfill (Trucks Diverted)	0	0.0	
Bench Street to Lab USA's Facility (Roll Offs)	3	2.7	
Bench Street to Lab USA's Facility (Xcel Energy Plant)	10	9.1	
City Landfill to Lab USA's Facility	0	0.0	
Xcel Energy Landfill to Lab USA's Facility	20	12.1	
Total Distance		23.9	13

AIR EMISSION ASSUMPTIONS

The Facility’s ash handling/processing operations (occurring at ambient temperatures) have the potential to emit particulate matter (PM) and PM less than 10 microns in diameter (PM_{10}). In addition, fuel combustion by the Facility’s diesel front end loader has the potential to emit PM, PM_{10}, sulfur dioxide (SO_2), oxides of nitrogen (NO_x), carbon monoxide (CO), and volatile organic compounds (VOCs). Emissions are calculated using emission factors from the most current U.S. Environmental Protection Agency (USEPA) AP-42 document. For the purposes of this evaluation, the following conservative assumptions are used in calculations:

- Expected moisture content is greater than 25%, but calculations for 15% moisture (more conservative) are shown below.
- Unprocessed material throughput is assumed to be 600 tons per day, the maximum throughput of the Facility’s equipment, for 365 days per year. Actual processing will only occur weekdays; no processing will occur on weekends and major holidays.
- Both front end loaders are assumed to have 200 hp engines, are fueled with ultra-low sulfur diesel (USLD) fuel, and operate an average of 10 hours per day.
- Material processing steps (crushing, screening, drop points) are not enclosed (worst-case). Actual processing will be conducted completely indoors.
- Combined area of temporary storage piles is 0.1 acres (4,350 square feet) and includes no wind shields/barriers (however, the proposed stockpiles will be covered and enclosed on three sides).

- Calculations for truck traffic emissions are completed for both the first year of operation and subsequent years:
    - For the first year of operations, an average of 28 truck trips per day for ash delivery (round trip distance of 6,200 feet) plus an average of 3 truck trips per day for roll-offs (round trip distance of 4,800 feet) are used in the emission calculations. Thus, the round trip distance for these truck trips on haul roads includes a total average daily distance of 35.6 miles of the total 48 miles as presented in Table 1. (Please note that the average daily distance of 12.4 miles for traffic associated with landfill activities are addressed separately in a memorandum entitled Air Emissions Evaluation for Landfill Activities Associated with Lab USA (SEH, June 15, 2016).
    - For subsequent years of operation, an average of 20 truck trips per day for ash delivery from the Xcel Energy Landfill (round trip distance of 3,200 feet), an average of 10 truck trips per day for ash delivery from the Xcel Energy Plant (round trip distance of 4,800 feet), and an average of 3 truck trips per day for roll-offs (round trip distance of 4,800 feet) are used in the emission calculations. The round trip distance for these truck trips on haul roads includes all of the subsequent year mileage (total average daily distance of 23.9 miles) in Table 1.
- No dust control (e.g. water application, road binder, etc.) on the unpaved roadways (however, the proposed project will utilize dust suppression methods to prevent any unlikely visible emissions as required by existing solid waste landfill permits).

RESULTS

Table 2 shows the projected Facility-wide emissions for both the first year of operation and subsequent years. As is shown, the vast majority of calculated emissions at the Facility is attributable to truck traffic on the Facility's unpaved roadways.

Table 2. Projected Air Emissions from Lab USA Red Wing, MN Facility

	PM (ton/yr)	PM_{10} (ton/yr)	CO (ton/yr)	NO_x (ton/yr)	SO_2 (ton/yr)	VOC (ton/yr)
Facility Emissions - First Year	**45.0**	**13.6**	**4.9**	**22.6**	**<0.01**	**1.8**
*Ash Processing/Handling Emissions**	*1.5*	*0.7*	-	-	-	-
Roadway Emissions (truck traffic)	*41.9*	*11.3*	-	-	-	-
Front End Loader Engines Emissions	*1.6*	*1.6*	*4.9*	*22.6*	*<0.01*	*1.8*
Facility Emissions - Subsequent Years	**31.3**	**9.9**	**4.9**	**22.6**	**<0.01**	**1.8**
*Ash Processing/Handling Emissions**	*1.5*	*0.7*	-	-	-	-
Roadway Emissions (truck traffic)	*28.2*	*7.6*	-	-	-	-
Front End Loader Engines Emissions	*1.6*	*1.6*	*4.9*	*22.6*	*<0.01*	*1.8*
MN State Air Permit Thresholds	**100**	**25**	**100**	**100**	**50**	**100**

*Only the emission factors from AP-42 Section 13.2.4 (used for ash loading/unloading and drop point emissions) are based in part on moisture content. The emission factors from AP-42 Section 11.19.2 (used for crushing, screening, and conveying) are controlled emission factors (i.e. wet material) and do not change based on assumed moisture content.

Table 2 also shows the emission thresholds for State Air Permits in Minnesota. These thresholds are listed in MN Administrate Rules, 7007.0250, Subp. 4 and on the Minnesota Pollution Control Agency (MPCA) website (https://www.pca.state.mn.us/air/who-needs-air-permit). Facilities in Minnesota with emissions below these thresholds are not required to obtain a stationary source air permit. The total projected emissions from the Facility, even with the conservative assumptions described above, are still well below air permit thresholds.[1]

This evaluation does not calculate projected Facility emissions based on equipment capacities (e.g. crusher capacity of 100 ton/hr). The Facility emissions calculated based on this capacity/bottleneck method could be higher than the approach presented in this memo (i.e. applying a 100% safety factor to expected daily production).

Attachments

- Attachment 1 – Sample Equipment Diagram
- Attachment 2 – Air Emission Calculations Spreadsheet (First Year of Operation)
- Attachment 3 – Air Emission Calculations Spreadsheet (Subsequent Years)

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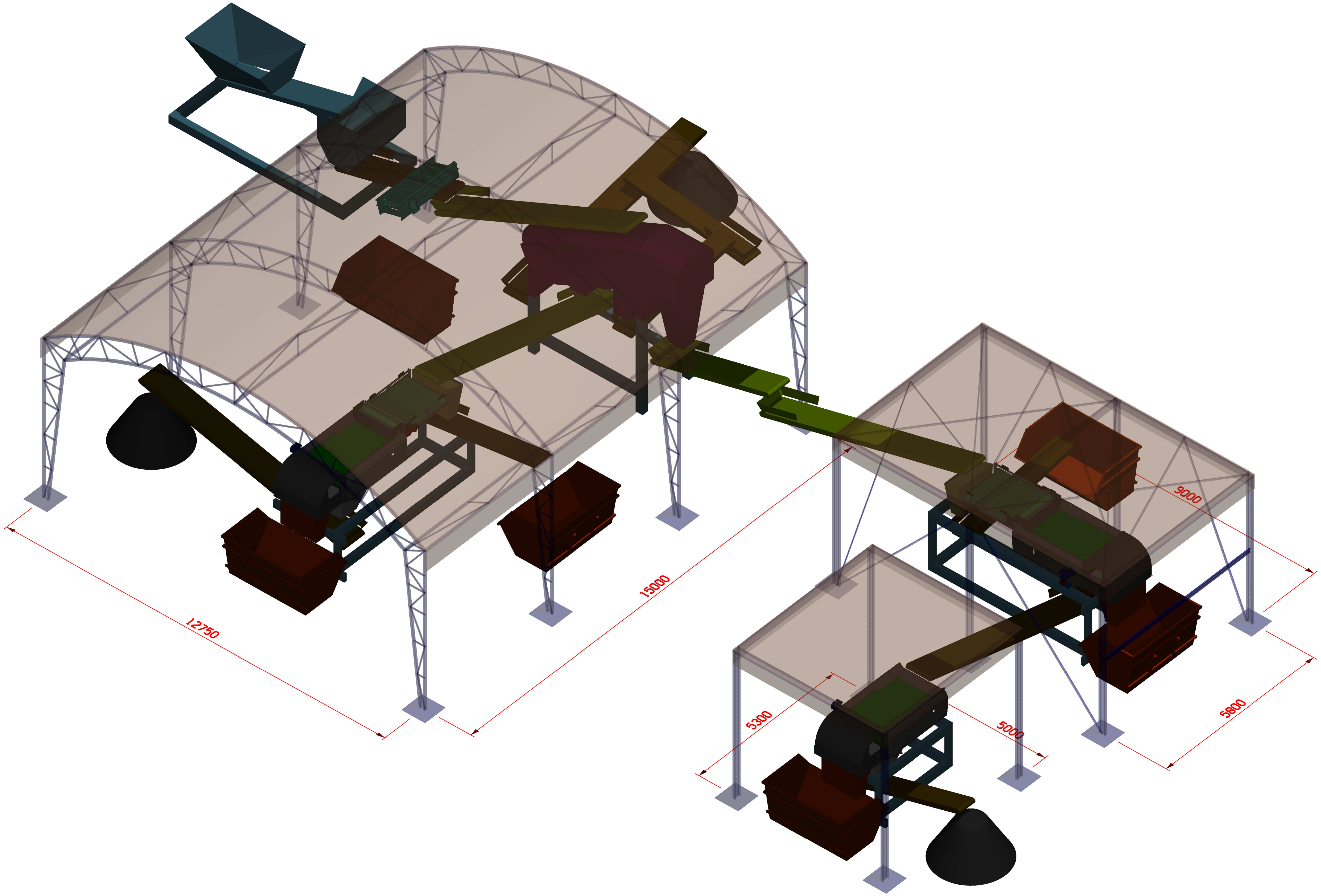
[1] Note: non-road engines that power non-stationary equipment (such as the front end loader engine) are not typically required to be included in facility emissions total when determining permit applicability. The loader engine emissions are included in the table above as a conservative measure.


12750
15000
9000
5800
5300
5000

Lab USA Ash Processing - Red Wing, MN

1st Year of Operation

PM Emissions (assuming 15% moisture ash)

Process	**Control**	**Maximum Daily Production**	**Annual Capacity**	**PM Emission Rate**	**Hourly Emissions^1**	**Annual Emissions**	**Comments on Emission Factors**
		ton/day	**ton/yr**	**lb/ton**	**lb PM/hr**	**ton PM/yr**	
Bottom Ash Processing Plant							
F01A - Truck Unloading	Moisture Present in Ash	600	219,000	0.00037	0.01	0.04	AP-42 13.2.4 (1): EF = k * 0.0032 * $(U/5)^{1.3}$ / $(M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 15%
F02A - Loading into Processing Equipment	Moisture Present in Ash	600	219,000	0.00037	0.01	0.04	AP-42 13.2.4 (1): EF = k * 0.0032 * $(U/5)^{1.3}$ / $(M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 15%
F02B - Front End Loader Diesel Engine	n/a				0.44	0.80	See Table A.
F03 - Conveyor Transfer Points (assume 4)	Moisture Present in Ash	2400	876,000	0.00014	0.01	0.06	AP-42 Table 11.19.2-2. Controlled Crushing
F04 - Crusher	Moisture Present in Ash	600	219,000	0.0012	0.03	0.13	AP-42 Table 11.19.2-2. Tertiary Crushing (controlled)
F05A - Screen #1	Moisture Present in Ash	300	109,500	0.0022	0.03	0.12	AP-42 Table 11.19.2-2. Screening (controlled)
F05B - Screen #2 & #3	Moisture Present in Ash	600	219,000	0.0022	0.06	0.24	AP-42 Table 11.19.2-2. Screening (controlled)
F06 - Drop Points onto bin/piles	Moisture Present in Ash	600	219,000	0.00037	0.01	0.04	AP-42 13.2.4 (1): EF = k * 0.0032 * $(U/5)^{1.3}$ / $(M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 15%
F07 - Small Temporary Storage Piles	Moisture Present in Ash				0.19	0.83	See Table B.
F08A - Truck Loading	Moisture Present in Ash	600	219,000	0.00037	0.01	0.04	AP-42 13.2.4 (1): EF = k * 0.0032 * $(U/5)^{1.3}$ / $(M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 15%
F08B - Front End Loader Diesel Engine	n/a				0.44	0.80	See Table A.
F09 - Vehicle Traffic Unpaved	Natural Moisture + Wetting				22.7	41.9	See Table C.
				Totals =	**23.9**	**45.0**	

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100 MPCA Air Permit threshold - PTE (ton/yr)

Lab USA Ash Processing - Red Wing, MN

1st Year of Operation

PM$_{10}$ Emissions (assuming 15% moisture ash)

Process	Control	Maximum Daily Production	Annual Capacity	PM10 Emission Rate	Hourly Emissions^{1}	Annual Emissions	Comments on Emission Factors
		ton/day	ton/yr	lb/ton	lb PM10/hr	ton PM10/yr	
Bottom Ash Processing Plant							
F01A - Truck Unloading	Moisture Present in Ash	600	219,000	0.00017	0.004	0.02	AP-42 13.2.4 (1): EF = k * 0.0032 * $(U/5)^{1.3}$ / $(M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 15%
F02A - Loading into Processing Equipment	Moisture Present in Ash	600	219,000	0.00017	0.004	0.02	AP-42 13.2.4 (1): EF = k * 0.0032 * $(U/5)^{1.3}$ / $(M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 15%
F02B - Front End Loader Diesel Engine	n/a				0.44	0.80	See Table A.
F03 - Conveyor Transfer Points (assume 4)	Moisture Present in Ash	2400	876,000	0.000046	0.00	0.02	AP-42 Table 11.19.2-2. Controlled Crushing
F04 - Crusher	Moisture Present in Ash	600	219,000	0.00054	0.01	0.06	AP-42 Table 11.19.2-2. Tertiary Crushing (controlled)
F05A - Screen #1	Moisture Present in Ash	300	109,500	0.00074	0.01	0.04	AP-42 Table 11.19.2-2. Screening (controlled)
F05B - Screen #2 & #3	Moisture Present in Ash	600	219,000	0.00074	0.02	0.08	AP-42 Table 11.19.2-2. Screening (controlled)
F06 - Drop Points onto bin/piles	Moisture Present in Ash	600	219,000	0.00017	0.00	0.02	AP-42 13.2.4 (1): EF = k * 0.0032 * $(U/5)^{1.3}$ / $(M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 15%
F07 - Small Temporary Storage Piles	Moisture Present in Ash				0.09	0.39	See Table B.
F08A - Truck Loading	Moisture Present in Ash	600	219,000	0.00017	0.00	0.02	AP-42 13.2.4 (1): EF = k * 0.0032 * $(U/5)^{1.3}$ / $(M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 15%
F08B - Front End Loader Diesel Engine	n/a				0.44	0.80	See Table A.
F09 - Vehicle Traffic Unpaved	Natural Moisture + Wetting				6.1	11.31	See Table C.
				Totals =	**7.16**	**13.58**	

25 MPCA Air Permit threshold - PTE (ton/yr)

Table A

Combustion Emissions from Front End Loader Diesel Engine

Loader Assumptions:

Engine size:	***200***	***hp***
Fuel:	***Diesel***	
Operating Hours:	***10***	***hr/day***
	7	***day/week***
	365	***day/yr***

Diesel Engine for Loader #1 (F02)

Pollutant	Annual Operating Hours (hr/yr)	Emission Factor AP-42 Section 3.3 (lb/hp-hr)		**Max Hourly Emissions (lb/hr)**	**Annual Emissions (ton/yr)**
CO	3,650	0.00668		1.3	**2.44**
NMHC (VOC)		0.00247		0.5	**0.90**
NO_x		0.03100		6.2	**11.32**
PM, PM10		0.00220		0.4	**0.80**
SO_2		0.000011		0.002	**0.004**

Diesel Engine for Loader #2 (F08)

Pollutant	Annual Operating Hours (hr/yr)	Emission Factor AP-42 Section 3.3 (lb/hp-hr)		**Max Hourly Emissions (lb/hr)**	**Annual Emissions (ton/yr)**
CO	3,650	0.00668		1.3	**2.44**
NMHC (VOC)		0.00247		0.5	**0.90**
NO_x		0.03100		6.2	**11.32**
PM, PM10		0.00220		0.4	**0.80**
SO_2		0.000011		0.002	**0.004**

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Table B
Storage Piles - Potential Fugitive PM Emissions

Material Handling factors (AP-42, Sect. 13.2.4, Aggregate Handling and Storage Piles, 2006)
Assume PM30 as presented in AP-42 equates to total PM.

k = 0.053 for PM 2.5
k = 0.35 for PM 10
k = 0.74 for PM 30

Emission Factors

Active Piles
Emission Factor = 0.72 * u lb PM 30/acre/hr (disturbed area)
From Fifth Edition of AP-42, Table 11.9-1, Chapter 11.9, "Western Surface Coal Mining", 1998
Note: No scaling factors available for PM 2.5 & 10; use ratio of 'k' factors (above)
u = 10.5 mph (average wind speed for Minneapolis-St. Paul, MN)
(from http://lwf.ncdc.noaa.gov/oa/climate/online/ccd/avgwind.html)
EF = **0.54** lb PM 2.5/acre/hr (uncontrolled)
EF = **3.58** lb PM 10/acre/hr (uncontrolled)
EF = **7.56** lb PM 30/acre/hr (uncontrolled)

Inactive Piles
Emission Factor = 0.38 ton PM/acre/yr (undisturbed area)
From Fifth Edition of AP-42, Table 11.9-4, Chapter 11.9, "Western Surface Coal Mining", 1998
Note: No scaling factors available for PM 2.5 & 10; use ratio of 'k' factors (above)
EF = **0.03** ton PM 2.5/acre/year (uncontrolled)
EF = **0.18** ton PM 10/acre/year (uncontrolled)
EF = **0.38** ton PM 30/acre/year (uncontrolled)

Emission Calculations

**Calculations assume a 75% control efficiency from natural moisture

Active Piles
Disturbed area = 0.1 acres
PM Emissions = Area * Active Storage Pile EF * Disturbed Hours/yr
PTE worst case: Disturbed hours = 24 hr/day x 365 day/yr = 8760 hr

PM 2.5 Emissions = **0.01** lb/hr **0.06** ton/yr
PM 10 Emissions = **0.09** lb/hr **0.39** ton/yr
PM 30 Emissions = **0.19** lb/hr **0.83** ton/yr

Inactive Piles
Inactive pile area = 0.00 acres
PM Emissions = Area * Inactive Storage Pile EF * yr

PM 2.5 Emissions = **0.00** lb/hr **0.00** ton/yr
PM 10 Emissions = **0.00** lb/hr **0.00** ton/yr
PM 30 Emissions = **0.00** lb/hr **0.00** ton/yr

ANNUAL EMISSIONS	**ton PM 2.5/yr**	**ton PM 10/yr**	**ton PM 30/yr**
Active Storage Piles =	0.06	0.39	0.83
Inactive Storage Piles =	0.00	0.00	0.00
SITE TOTALS =	**0.06**	**0.39**	**0.83**

HOURLY EMISSIONS	**lb PM 2.5/hr**	**lb PM 10/hr**	**lb PM 30/hr**
Active Storage Piles =	0.01	0.09	0.19
Inactive Storage Piles =	0.00	0.00	0.00
SITE TOTALS =	**0.01**	**0.09**	**0.19**

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Table C
1st Year of Operation
Vehicle Traffic on Unpaved Roads

(based on AP-42 Section 13.2.2 Unpaved Roads, 2006)

$E = k(s/12)^a(W/3)^b * [(365 - P)/365]$ Particulate emission factor, lb/VMT

Where:

k (PM 10) = 1.5 constant for PM-10, lb/VMT
a = 0.9
b = 0.45
k (PM 30) = 4.9 constant for PM-30, lb/VMT
a = 0.7
b = 0.45

s = **6.4** surface material silt content, %
(from AP-42 Table 13.2.2.1 for MSW Landfill)
W = **34** Mean weight of vehicles, tons
(Truck weight: 25 tons empty, 25+18 tons full)
P = **115** (Figure 13.2.1.2 for days with >0.01 in precipitation)

EF = 1.7 PM-10 lb/VMT
EF = 6.4 PM-30 lb/VMT

Control Efficiency from watering = **0%**

Annual Emission Rates

Ash Trips = 28 Average number of daily round trips (City Landfill to Lab USA)
Distance = 6,200 Distance per trip, feet

Roll-off Trips = 3 Average number of daily round trips (Roll-offs)
Distance = 4,800 Distance per trip, feet

Total VMT = 35.6 Average vehicle miles traveled per day
12,996 Average vehicle miles traveled per year

Uncontrolled		Controlled (with watering)	
11.3	tpy PM 10	11.3	tpy PM 10
41.9	tpy PM 30	41.9	tpy PM 30

Estimated Maximum Hourly Emission Rates

Trips = 3.0 Vehicle trips per hour
Distance = 6,200 Distance per trip, feet
VMT = 3.5 Vehicle miles traveled per hour

Uncontrolled		Controlled (with watering)	
6.1	lb/hr PM 10	6.1	lb/hr PM 10
22.7	lb/hr PM 30	22.7	lb/hr PM 30

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Lab USA Ash Processing - Red Wing, MN

Subsequent Years (after 1st Year)

PM Emissions (assuming 15% moisture ash)

Process	Control	Maximum Daily Production	Annual Capacity	PM Emission Rate	Hourly Emissions[1]	Annual Emissions	Comments on Emission Factors
		ton/day	ton/yr	lb/ton	lb PM/hr	ton PM/yr	
				Bottom Ash Processing Plant			
F01A - Truck Unloading	Moisture Present in Ash	600	219,000	0.00037	0.01	0.04	AP-42 13.2.4 (1): EF = k * 0.0032 * $(U/5)^{1.3}$ / $(M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 15%
F02A - Loading into Processing Equipment	Moisture Present in Ash	600	219,000	0.00037	0.01	0.04	AP-42 13.2.4 (1): EF = k * 0.0032 * $(U/5)^{1.3}$ / $(M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 15%
F02B - Front End Loader Diesel Engine	n/a				0.44	0.80	See Table A.
F03 - Conveyor Transfer Points (assume 4)	Moisture Present in Ash	2400	876,000	0.00014	0.01	0.06	AP-42 Table 11.19.2-2. Controlled Crushing
F04 - Crusher	Moisture Present in Ash	600	219,000	0.0012	0.03	0.13	AP-42 Table 11.19.2-2. Tertiary Crushing (controlled)
F05A - Screen #1	Moisture Present in Ash	300	109,500	0.0022	0.03	0.12	AP-42 Table 11.19.2-2. Screening (controlled)
F05B - Screen #2 & #3	Moisture Present in Ash	600	219,000	0.0022	0.06	0.24	AP-42 Table 11.19.2-2. Screening (controlled)
F06 - Drop Points onto bin/piles	Moisture Present in Ash	600	219,000	0.00037	0.01	0.04	AP-42 13.2.4 (1): EF = k * 0.0032 * $(U/5)^{1.3}$ / $(M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 15%
F07 - Small Temporary Storage Piles	Moisture Present in Ash				0.19	0.83	See Table B.
F08A - Truck Loading	Moisture Present in Ash	600	219,000	0.00037	0.01	0.04	AP-42 13.2.4 (1): EF = k * 0.0032 * $(U/5)^{1.3}$ / $(M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 15%
F08B - Front End Loader Diesel Engine	n/a				0.44	0.80	See Table A.
F09 - Vehicle Traffic Unpaved	Natural Moisture + Wetting				22.7	28.2	See Table C.
				Totals =	**23.9**	**31.3**	

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100 MPCA Air Permit threshold - PTE (ton/yr)

Lab USA Ash Processing - Red Wing, MN

Subsequent Years (after 1st Year)

PM$_{10}$ Emissions (assuming 15% moisture ash)

Process	Control	Maximum Daily Production	Annual Capacity	PM10 Emission Rate	Hourly Emissions^1	Annual Emissions	Comments on Emission Factors
		ton/day	ton/yr	lb/ton	lb PM10/hr	ton PM10/yr	
Bottom Ash Processing Plant							
F01A - Truck Unloading	Moisture Present in Ash	600	219,000	0.00017	0.004	0.02	AP-42 13.2.4 (1): $EF = k * 0.0032 * (U/5)^{1.3} / (M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 15%
F02A - Loading into Processing Equipment	Moisture Present in Ash	600	219,000	0.00017	0.004	0.02	AP-42 13.2.4 (1): $EF = k * 0.0032 * (U/5)^{1.3} / (M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 15%
F02B - Front End Loader Diesel Engine	n/a				0.44	0.80	See Table A.
F03 - Conveyor Transfer Points (assume 4)	Moisture Present in Ash	2400	876,000	0.000046	0.00	0.02	AP-42 Table 11.19.2-2. Controlled Crushing
F04 - Crusher	Moisture Present in Ash	600	219,000	0.00054	0.01	0.06	AP-42 Table 11.19.2-2. Tertiary Crushing (controlled)
F05A - Screen #1	Moisture Present in Ash	300	109,500	0.00074	0.01	0.04	AP-42 Table 11.19.2-2. Screening (controlled)
F05B - Screen #2 & #3	Moisture Present in Ash	600	219,000	0.00074	0.02	0.08	AP-42 Table 11.19.2-2. Screening (controlled)
F06 - Drop Points onto bin/piles	Moisture Present in Ash	600	219,000	0.00017	0.00	0.02	AP-42 13.2.4 (1): $EF = k * 0.0032 * (U/5)^{1.3} / (M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 15%
F07 - Small Temporary Storage Piles	Moisture Present in Ash				0.09	0.39	See Table B.
F08A - Truck Loading	Moisture Present in Ash	600	219,000	0.00017	0.00	0.02	AP-42 13.2.4 (1): $EF = k * 0.0032 * (U/5)^{1.3} / (M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 15%
F08B - Front End Loader Diesel Engine	n/a				0.44	0.80	See Table A.
F09 - Vehicle Traffic Unpaved	Natural Moisture + Wetting				6.1	7.60	See Table C.
				Totals =	**7.16**	**9.88**	

25 MPCA Air Permit threshold - PTE (ton/yr)

Table A
Combustion Emissions from Front End Loader Diesel Engine

Loader Assumptions:

Engine size:	***200***	***hp***
Fuel:	***Diesel***	
Operating Hours:	***10***	***hr/day***
	7	***day/week***
	365	***day/yr***

Diesel Engine for Loader #1 (F02)

Pollutant	Annual Operating Hours (hr/yr)	Emission Factor AP-42 Section 3.3 (lb/hp-hr)		**Max Hourly Emissions (lb/hr)**	**Annual Emissions (ton/yr)**
CO	3,650	0.00668		1.3	**2.44**
NMHC (VOC)		0.00247		0.5	**0.90**
NO_x		0.03100		6.2	**11.32**
PM, PM10		0.00220		0.4	**0.80**
SO_2		0.000011		0.002	**0.004**

Diesel Engine for Loader #2 (F08)

Pollutant	Annual Operating Hours (hr/yr)	Emission Factor AP-42 Section 3.3 (lb/hp-hr)		**Max Hourly Emissions (lb/hr)**	**Annual Emissions (ton/yr)**
CO	3,650	0.00668		1.3	**2.44**
NMHC (VOC)		0.00247		0.5	**0.90**
NO_x		0.03100		6.2	**11.32**
PM, PM10		0.00220		0.4	**0.80**
SO_2		0.000011		0.002	**0.004**

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Table B
Storage Piles - Potential Fugitive PM Emissions

Material Handling factors (AP-42, Sect. 13.2.4, Aggregate Handling and Storage Piles, 2006)

Assume PM30 as presented in AP-42 equates to total PM.

k = 0.053 for PM 2.5
k = 0.35 for PM 10
k = 0.74 for PM 30

Emission Factors

Active Piles

Emission Factor = 0.72 * u lb PM 30/acre/hr (disturbed area)

From Fifth Edition of AP-42, Table 11.9-1, Chapter 11.9, "Western Surface Coal Mining", 1998

Note: No scaling factors available for PM 2.5 & 10; use ratio of 'k' factors (above)

u = 10.5 mph (average wind speed for Minneapolis-St. Paul, MN)
(from http://lwf.ncdc.noaa.gov/oa/climate/online/ccd/avgwind.html)

EF = **0.54** lb PM 2.5/acre/hr (uncontrolled)
EF = **3.58** lb PM 10/acre/hr (uncontrolled)
EF = **7.56** lb PM 30/acre/hr (uncontrolled)

Inactive Piles

Emission Factor = 0.38 ton PM/acre/yr (undisturbed area)

From Fifth Edition of AP-42, Table 11.9-4, Chapter 11.9, "Western Surface Coal Mining", 1998

Note: No scaling factors available for PM 2.5 & 10; use ratio of 'k' factors (above)

EF = **0.03** ton PM 2.5/acre/year (uncontrolled)
EF = **0.18** ton PM 10/acre/year (uncontrolled)
EF = **0.38** ton PM 30/acre/year (uncontrolled)

Emission Calculations

**Calculations assume a 75% control efficiency from natural moisture

Active Piles

Disturbed area = 0.1 acres
PM Emissions = Area * Active Storage Pile EF * Disturbed Hours/yr
PTE worst case: Disturbed hours = 24 hr/day x 365 day/yr = 8760 hr

PM 2.5 Emissions = **0.01** lb/hr **0.06** ton/yr
PM 10 Emissions = **0.09** lb/hr **0.39** ton/yr
PM 30 Emissions = **0.19** lb/hr **0.83** ton/yr

Inactive Piles

Inactive pile area = 0.00 acres
PM Emissions = Area * Inactive Storage Pile EF * yr

PM 2.5 Emissions = **0.00** lb/hr **0.00** ton/yr
PM 10 Emissions = **0.00** lb/hr **0.00** ton/yr
PM 30 Emissions = **0.00** lb/hr **0.00** ton/yr

ANNUAL EMISSIONS	**ton PM 2.5/yr**	**ton PM 10/yr**	**ton PM 30/yr**
Active Storage Piles =	0.06	0.39	0.83
Inactive Storage Piles =	0.00	0.00	0.00
SITE TOTALS =	**0.06**	**0.39**	**0.83**

HOURLY EMISSIONS	**lb PM 2.5/hr**	**lb PM 10/hr**	**lb PM 30/hr**
Active Storage Piles =	0.01	0.09	0.19
Inactive Storage Piles =	0.00	0.00	0.00
SITE TOTALS =	**0.01**	**0.09**	**0.19**

June 14, 2016

Table C
Subsequent Years (after 1st Year)
Vehicle Traffic on Unpaved Roads

(based on AP-42 Section 13.2.2 Unpaved Roads, 2006)

$E = k(s/12)^a(W/3)^b * [(365 - P)/365]$ Particulate emission factor, lb/VMT

Where:

k (PM 10) = 1.5 constant for PM-10, lb/VMT
a = 0.9
b = 0.45
k (PM 30) = 4.9 constant for PM-30, lb/VMT
a = 0.7
b = 0.45

s = **6.4** surface material silt content, %
(from AP-42 Table 13.2.2.1 for MSW Landfill)
W = **34** Mean weight of vehicles, tons
(Truck weight: 25 tons empty, 25+18 tons full)
P = **115** (Figure 13.2.1.2 for days with >0.01 in precipitation)

EF = 1.7 PM-10 lb/VMT
EF = 6.4 PM-30 lb/VMT

Control Efficiency from watering = **0%**

Annual Emission Rates

Landfill Ash Trips = 20 Average number of daily round trips (Xcel Landfill to Lab USA)
Distance = 3,200 Distance per trip, feet

Plant Ash Trips = 10 Average number of daily round trips (Xcel Plant to Lab USA)
Distance = 4,800 Distance per trip, feet

Roll-off Trips = 3 Average number of daily round trips (Roll-offs)
Distance = 4,800 Distance per trip, feet

Total VMT = 23.9 Average vehicle miles traveled per day
8,738 Average vehicle miles traveled per year

Uncontrolled		Controlled (with watering)	
7.6	tpy PM 10	7.6	tpy PM 10
28.2	tpy PM 30	28.2	tpy PM 30

Estimated Maximum Hourly Emission Rates

Trips = 3.0 Vehicle trips per hour
Distance = 6,200 Distance per trip, feet
VMT = 3.5 Vehicle miles traveled per hour

Uncontrolled		Controlled (with watering)	
6.1	lb/hr PM 10	6.1	lb/hr PM 10
22.7	lb/hr PM 30	22.7	lb/hr PM 30

June 14, 2016

HALEY ALDRICH

www.haleyaldrich.com

REPORT ON
RISK CHARACTERIZATION – PROPOSED LABUSA ASH PROCESSING FACILITY RED WING, MINNESOTA

by Haley & Aldrich, Inc.
Bedford, New Hampshire

for LabUSA
Green Bay, Wisconsin

File No. 43311-000
May 2016

HALEY
ALDRICH

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3 Bedford Farms Drive
Bedford, NH 03110
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4 May 2016
File No. 43311-000

LabUSA
130 E. Walnut Street, Suite 902
Green Bay, Wisconsin 54301

Attention: Mr. Kane Flett
Director of Business Development

Subject: Risk Characterization – Proposed LabUSA Ash Processing Facility, Red Wing, MN

Ladies and Gentlemen:

This report provides an evaluation of potential health risks associated with estimated air emissions from the LabUSA Ash Processing Facility that is proposed to be constructed at the Xcel Energy Ash Landfill in Red Wing, Minnesota. This report also provides a review of potential health risks associated with estimated particulate emissions from the City of Red Wing concrete crushing operation, which is also proposed to be located at the Xcel Ash Landfill.

The evaluation was completed by using the emissions estimates previously performed by Short Elliott Hendrickson, Inc. (SEH) with additional models to predict the off-site particulate concentrations in air and soil via dispersion and deposition, respectively. The emission and deposition estimates were used with analytical data for ash and receptor location information provided by LabUSA, to estimate concentrations of ash-derived constituents in air and surface soil that could hypothetically occur around the proposed facility. The estimated ash-derived air and soil concentrations were then compared to conservative, health-protective risk-based screening levels to put the estimated emissions into context.

As documented in this report, the air and soil concentrations of ash-derived constituents that may result from ash processing are estimated to be orders of magnitude lower than the relevant screening levels, indicating that potential health risks associated with particulate migration off of the Xcel property are negligible (i.e., well below levels that would be of regulatory concern). Similarly, concrete crushing activities proposed by the city are not estimated to produce emissions that would pose health risks of concern.

Feel free to contact us if you have any comments or need additional information.

Sincerely yours,
HALEY & ALDRICH, INC.

Jay Peters
Senior Risk Assessment Specialist

Lisa JN Bradley

Lisa JN Bradley, PhD, DABT
Senior Toxicologist

Enclosures

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1. Introduction

This report provides an evaluation of potential health risks associated with estimated air emissions from the LabUSA Ash Processing Facility that is proposed to be constructed at the Xcel Energy Ash Landfill in Red Wing, Minnesota. The evaluation was completed by performing air dispersion modeling that followed Minnesota Pollution Control Agency (MPCA) guidance, to derive estimates of particulate emission and deposition. The emission and deposition estimates were used to derive concentrations of ash-derived constituents in air and surface soil that could hypothetically occur within a 5 kilometer radius around the proposed facility. The estimated ash-derived air and soil concentrations were then compared to conservative, health-protective risk-based screening levels to put the estimated emissions into context.

This report also provides a review of potential health risks associated with estimated particulate emissions from the City of Red Wing concrete crushing operation, which is also proposed to be located at the Xcel Ash Landfill.

As documented in this report, the air and soil concentrations of ash-derived constituents that may result from ash processing are estimated to be orders of magnitude lower than the relevant screening levels, indicating that potential health risks associated with particulate migration off of the Xcel property are negligible (i.e., well below levels that would be of regulatory concern). Similarly, concrete crushing activities proposed by the city are not estimated to produce emissions that would pose health risks of concern.

2. Description of Proposed Ash Processing Facility

LabUSA is proposing to construct a facility at the Xcel Energy Ash Landfill that will recover ferrous and non-ferrous metals from ash. The existing landfill and proposed facility are shown in Figure 1.

The overall process for transporting and processing ash was summarized by SEH (2016) (provided here as Attachment A), as follows:

1. Trucks deliver combined ash (material) to the facility and unload the material in the facility's unloading bay, onto a concrete floor;
2. Material is crushed with a crusher;
3. Crushed material is separated using three screens (two of the screens in series);
4. Conveyors transfers material between different process steps;
5. Processed material is dropped into temporary storage piles and/or storage bins;
6. Of the facility's processed material, about 5% is refined ash with ferrous and non-ferrous metals that is loaded into trucks and hauled off-site to a beneficial user;
7. The other 95% of the processed material is processed ash that is delivered to the ash landfill. This processed ash is hauled to the ash landfill using the same trucks that deliver the incoming bottom ash to the facility (resulting in one combined truck trip on the facility site).

All processing operations will be performed in a semi-enclosed space. In addition, since the ash processing involves only physical treatment of the ash (i.e., does not involve any combustion of the ash); the facility only has the potential to emit particulate matter (PM).

Using the information summarized above, with information concerning the volume of ash to be processed and ash moisture content, SEH performed modelling to estimate the emissions of particulates from sources that include: ash loading/unloading; temporary storage piles; crushing, screening, and processing; as well as truck traffic (i.e., dust generated from truck traffic over dirt roads).

The modeling demonstrated that emissions of particulates with an aerodynamic diameter of less than 10 microns (PM10), associated with ash processing and handling, are estimated to be less than 1/25th of the Minnesota state air permit threshold of 25 tons per year PM10; Therefore, in accordance with Minnesota law, the emissions from the facility were estimated to be lower than those that would trigger a need to obtain an air permit from the state (SEH, 2016).

3. Conceptual Site Model

In addition to the results of the air modeling evaluation, which demonstrated that particulate emissions from the proposed facility are estimated to be negligible (i.e., below levels that require regulation via a state air permit), LabUSA has elected to further evaluate the estimated emissions in the context of potential health risks. To facilitate an understanding of how ash processing at the facility may affect the environment, a conceptual site model (CSM) was developed. The CSM describes the sources and potential migration pathways through which ash-derived constituents may be transported to other environmental media (receiving media), and the human and environmental receptors that may in turn contact the receiving media. The linkage between a receiving medium and potential exposure is called an exposure pathway. For an exposure pathway to be complete, the following conditions must exist (as defined by USEPA [1989]):

1. A source and mechanism of chemical release to the environment;
2. An environmental transport medium (e.g., air, water, soil);
3. A point of potential contact with the receiving medium by a receptor; and
4. A receptor exposure route at the contact point (e.g., inhalation, ingestion, dermal contact).

Each of these components is discussed in this section.

3.1 SOURCES

As described in Section 2, ash processing operations have the potential to release particulate matter to the air. Since ash is the unburned/unburnable material remaining after the combustion of refuse derived fuel, it contains elements that were naturally occurring in the solid waste materials.

In accordance with the Minnesota Municipal Solid Waste Combustor Ash Rules, Xcel is required to conduct annual testing and assessment of its ash from the Red Wing Steam Plant. Testing of the ash includes sampling the ash quarterly (each quarterly sample is collected over a seven day period), combining the quarterly samples to create a single annual composite ash sample, and then analyzing the composite sample for a list of inorganic constituents. The composite ash sample is representative of the fly ash and bottom ash that is generated by the facility annually. The ash sample is analyzed in six parts (to create six samples and six resulting analytical measurements for each parameter tested) to help quantify variability in concentrations. Attachment C provides the ash testing results for the period 2009 through 2015.

Prior to 1996, the ash was tested for dioxins and furans as well as inorganic parameters. However, due to downward trends in dioxin/furan concentrations in the ash, and consistent findings that 2,3,7,8-TCDD was below a concentration of one part per billion in the ash, MPCA determined that ash from the Xcel facility no longer required testing for dioxin/furan (Xcel, 2015).

Table 1 provides a summary of the analytical data from the 2015 annual testing of ash from the Red Wing Steam Plant. The data in Table 1 are representative of the constituent concentrations in ash that is being placed in the Xcel ash landfill in Red Wing. As shown in Attachment B, the concentrations reported in the 2015 annual sampling are similar to those reported during previous annual testing, indicating analytical consistency in the ash that has been placed in the landfill.

Table 1 also provides the dioxin/furan data from the 1995 annual testing of ash from the Red Wing Steam Plant (i.e., the last year that dioxin/furan testing was required) (NSP, 1996). These data are included in Table 1 to provide a conservative representation of dioxin/furan concentrations that may potentially occur in ash that is in the landfill. As discussed above, dioxin/furan concentrations had been decreasing through the early 1990's, to the point that MPCA no longer required testing for dioxin/furan.

3.2 MIGRATION PATHWAYS

Particulates that may be released to air from the ash processing operations can disperse and migrate with wind. Particulates in the air can then be deposited on surfaces (e.g., the ground, trees, grass). The larger the particle size, the less time it will remain entrained in air, and the less distance from the source (i.e., ash processing operations) it will travel before being deposited. Small particulates (PM10) can remain in air for longer periods of time and potentially migrate further from emissions sources. Emissions modeling previously performed indicated that PM10 emissions from ash processing would not result in downwind migration that would be of regulatory concern (SEH, 2016). Nevertheless, low concentrations of particulates could migrate from ash processing to downwind locations. Since the source of particulates is the ash, and the ash contains the constituents listed in Table 1, air dispersion of ash constituents in particulates is a migration pathway that is assumed to exist at the proposed facility.

3.3 RECEPTORS AND EXPOSURE ROUTES

Receptors represent the human populations that may contact the constituents that are transported through the migration pathways. At the Red Wing facility, receptors may include residents who live near the facility and workers in nearby businesses, as well as visitors, patrons, and pedestrians. Figure 2 shows the locations of nearby receptors. There are two principal mechanisms by which these receptors may potentially contact particulate matter entrained in the air:

1. Inhaling air containing entrained particulate matter. Specifically, very small particulates (e.g., less than 10 microns) are considered to be respirable, meaning that when they are entrained in air, they can be inhaled and deposited on the lungs. Therefore, PM10 that migrates downwind to nearby receptors can potentially be inhaled.
2. Direct contact with particulate matter that has been deposited on surfaces and/or directly on to soil. Particulate matter that is deposited on surfaces eventually washes into the soil during rain events and snow melt. Receptors can contact soil by touching it during outdoor activities such as landscaping and yard work, play, and recreation. Soil that is contacted can adhere to the skin, and then be accidentally ingested if soil covered fingers are placed in the mouth or handle food. Some constituents present in soil can also be absorbed through the skin. Finally, soil that is disturbed through digging, raking, or tilling can release dust which can then be inhaled.

3.4 CSM SUMMARY

In summary, the CSM for the Red Wing facility is based on the following:

1. Ash that will be processed to extract precious metals contains constituents listed in Table 1;
2. Processing of the ash will release particulates to the air that is in close proximity to the processing operations. Large diameter particulates released during ash processing will settle near the processing operations, but smaller diameter particulates (e.g., PM10) may be entrained in air and migrate further from the processing operations;

3. PM10 emissions are estimated to be low – well below levels that would trigger a need for a state air permit. Nevertheless, low levels of particulates containing ash constituents may migrate with wind to locations off of the facility property;
4. Particulates containing ash constituents can be deposited on soil and/or surfaces where they are eventually washed into the soil;
5. Nearby receptors (residents, workers) could breathe air containing the entrained particulates or contact soil where particulate matter has been deposited.

4. Air Dispersion Modeling Analysis

SEH performed modeling to estimate the particulate emissions from the proposed ash processing facility. The modeling conducted here supplements the SEH work by using the SEH emissions estimates in additional models to predict the off-site particulate concentrations in air and soil via dispersion and deposition, respectively.

To quantify the potential exposures to particulate matter emissions from the facility, air dispersion modeling was performed. The modeling was performed in accordance with MPCA Air Dispersion Modeling Guidance (MPCA, 2014) and the United States Environmental Protection Agency's (USEPA's) Guideline on Air Quality Models codified in 40 Code of Federal Regulations (CFR) 51, Appendix W. Dispersion modeling was performed using USEPA's preferred model, AERMOD, following the procedures documented below.

4.1 METEOROLOGICAL DATA

Pre-processed meteorological data is available from MPCA's website in a format suitable for use in AERMOD for a 5-year period from 2009 through 2013. Meteorological data for St. Paul Downtown Airport (STP) was selected as the most representative dataset, due to proximity to the site and the lack of distinctive complex terrain. MPCA used surface data from STP and upper air data from the radiosonde station at Chanhassen, Minnesota. MPCA processed the data using AERMET version 14134. The base elevation of the STP weather station is identified as 212 meters by MPCA. For comparison, the facility elevation is 251 meters.

4.2 SOURCE PARAMETERS

Sources of particulate matter from ash at the facility will include truck unloading, conveyor transfer points, a crusher, screening, drop points, storage piles, and truck loading. Emission rates for total particulate and PM10 for each of these sources were provided in an SEH report (Attachment A).

Ash processing operations will primarily occur within a covered area. Therefore, for modeling purposes, all sources of particulate matter from fly ash were modeled from a single volume source. Source parameters for the volume source were based upon a building height of 28 feet are summarized in the table below.

VOLUME SOURCE STACK PARAMETERS

Parameter	Ash Processing Facility
Release Height	14 feet
Building Height	28 feet
Length of Side	50 feet
Initial Lateral Dimension (Length of Side / 4.3)	11.63 feet
Initial Vertical Dimension (Building height / 2.15)	13.02 feet
Total Ash Particulate Emission Rate	0.41 lb/hr
Total Ash PM10 Emission Rate	0.186 lb/hr

Emission rates for individual constituents selected for modeling were calculated as a mass fraction of the total ash PM10 emission rate for each constituent within the fly ash. Particulate matter with a larger diameter is not generally considered respirable and is typically not included when evaluating the inhalation pathway for exposure to air-borne constituents.

4.3 MODELING INPUTS

Modeling was performed using USEPA's regulatory default options to calculate the average air concentrations of each constituent over a period of 5 years. Modeling inputs are summarized in the following table.

AERMOD MODELING PARAMETERS

Parameter	Selection
Dispersion Model	AERMOD version 15181
Averaging Time	5-year period
Terrain Data / Elevations	30m National Elevation Dataset (NED) Elevations were assigned using AERMAP version 11103.
Meteorological Data	Pre-processed meteorological data for STP weather station (2009-2013)
Urban/Rural Determination	Rural
Receptors	Receptors were placed at 50 meter intervals out to 500 meters and at 200 meter intervals out to 5,000 meters in a Cartesian grid.
Building Downwash	Not applicable to volume sources.

Total particulate deposition was also modeled using the total particulate emission rate and the particle size distribution assumed in the SEH memorandum. No dry depletion or wet depletion was assumed, providing a very conservative estimate of potential deposition.

4.4 MODELING RESULTS

Figure 3 provides a summary of the estimated annual average particulate PM10 concentrations in units of micrograms per cubic meter (ug/m^3) as averaged over a 5-year period. As indicated, the highest estimated PM10 concentration is 7.90 ug/m^3 at a location immediately adjacent to the ash processing operation (on the facility property). All predicted PM10 concentrations in air off of the overall facility property are estimated to be less than 0.5 ug/m^3. For comparison, the historical National Ambient Air Quality Standard (NAAQS) and current Minnesota Ambient Air Quality Standard (MAAQS) for annual PM10 is 50 ug/m^3 averaged over three years. The maximum annual average background concentration of PM10 measured in Minnesota was 27 ug/m^3 in 2013. Adding the maximum predicted off-site concentration from the proposed ash processing operations to the background concentration shows predicted impacts that are substantially lower than the MAAQS.

Figure 4 provides a summary of the estimated five year cumulative deposition of particulate matter, in units of grams per square meter (g/m^2). As indicated, the highest deposition estimate is 62.46 g/m^2 at a location immediately adjacent to the ash processing operation (on the facility property). All deposition estimates for locations off of the overall facility property are estimated to be less than 0.5 g/m^2.

5. Risk-Based Screening

To put the air dispersion modeling results into context with respect to potential receptor exposure, a risk-based screening analysis was performed. Risk-based screening is conducted by comparing constituent concentrations in environmental media to screening levels that are considered to be protective of specific human exposures. The risk-based screening evaluation, therefore, is comprised of two components:

1. Identification of constituent concentrations in environmental media; and
2. Identification of screening levels.

5.1 DERIVATION OF MEDIA CONCENTRATIONS

The average concentrations of constituents in ash (Table 1) were used with the modeling results to estimate constituent concentrations in air and soil.

In air, constituent concentrations were estimated by multiplying the PM10 concentration by the mass fraction of constituent in ash, to derive constituent concentrations in air. Air concentrations were derived for PM10 concentrations of 1 ug/m^3, 0.5 ug/m^3, 0.1 ug/m^3, and 0.05 ug/m^3, to correspond with the PM10 contours shown on Figure 3. Table 2 provides the calculated constituent concentrations in air.

For soil, constituent concentrations were estimated by assuming that the particulate deposition becomes mixed with the top two centimeters of soil. Using this approach, a concentration of particulate matter in soil was derived, and that concentration was then multiplied by the mass fraction of each constituent, to derive estimated soil concentrations for each constituent. Soil concentrations were derived for depositional amounts of 1 g/m^2, 0.5 g/m^2, 0.1 g/m^2, and 0.05 g/m^2 to correspond with the deposition contours shown on Figure 4. Table 3 provides the calculated constituent concentrations in soil.

5.2 RISK-BASED SCREENING LEVELS

Risk-based screening levels are derived by combing a specific target risk level with an assumed exposure scenario and toxicity information from USEPA to calculate a concentration of a constituent in an environmental medium (for example soil) that is protective of a person in that exposure scenario (for example, a resident contacting soil in their yard).

Risk-based screening levels are designed to provide a conservative estimate of the concentration to which a person (receptor) can be exposed without experiencing adverse health effects. Risk-based screening levels are derived by regulatory agencies using conservative assumptions about the potential toxicity of constituents and the potential for exposure to those constituents in environmental media. The goal is to over-estimate rather than under-estimate toxicity and exposure, and this is done by employing default parameters defined by USEPA in the screening level derivation. Due to the conservative methods used to derive risk-based screening levels, it can be assumed with reasonable certainty that concentrations below screening levels will not result in adverse health effects, and that no further evaluation is necessary. Concentrations above conservative risk-based screening levels do not necessarily indicate that a potential risk exists, but indicate that further evaluation may be warranted.

To evaluate estimated air concentrations of ash constituents that may be associated with emissions generated by ash processing, risk-based screening levels for residential exposure to air were identified from the USEPA Regional Screening Level (RSL) tables (USEPA, 2015). The residential air RSL values are based on the assumption that children and adults breathe air containing the constituents under evaluation 24 hours per day, 350 days per year, for 26 continuous years. When applied to the evaluation of constituents in PM10 in the outdoor air, the RSLs are protective for an assumption that a person spends all of their time outdoors and never leaves their place of residence. The residential air RSLs are provided in Table 2. The air RSLs are based on a target cancer risk of 1 in 1 million (1E-06) and a target hazard index (HI) of 1.

To evaluate estimated soil concentrations of ash constituents that may be associated with particulate matter deposition generated by ash processing, USEPA RSLs for residential exposure to soil were used (USEPA, 2015). The residential soil RSLs assume that children and adults contact soil in a residential yard by incidental ingestion, dermal contact, and dust inhalation (from disturbing the soil through activities such as lawn mowing), 350 days per year for 26 continuous years. The air RSLs are based on a target cancer risk of 1 in 1 million (1E-06) and a target HI of 1. Soil Reference Values (SRVs) published by MPCA were also identified and used as screening values (MPCA, 2009). The residential soil SRVs are based on residential exposure assumptions similar to those used by USEPA to derive the residential soil RSLs, but are based on a target cancer risk of 1 in 100,000 (1E-05) and a target HI of 0.2. The RSLs SRVs are provided in Table 3.

5.3 RISK-BASED SCREENING RESULTS

Tables 2 and 3 provide comparisons of estimated air and soil concentrations to air and soil RSLs, respectively.

As shown in Table 2, estimated air concentrations of all ash constituents are below residential air RSL values, for all PM10 concentrations evaluated. As indicated in Figure 3, the receptors nearest to the proposed facility fall within a zone of modeled PM10 that ranges from 0.05 ug/m^3 to 0.1 ug/m^3. As indicated in Table 2, ash-derived constituents associated with those PM10 concentrations are a few hundred to several thousand times lower than residential RSL values.

As shown in Table 3, estimated soil concentrations of all ash-derived constituents are below residential soil RSL and SRV values, for all PM10 concentrations evaluated. As indicated in Figure 4, the receptors nearest to the proposed facility fall within a zone of modeled deposition that ranges from 0.05 g/m^2 to 0.1 g/m^2. As indicated in Table 3, ash-related constituents associated with deposition in those ranges are generally several thousand times lower than the screening values. Moreover, a comparison of estimated surface soil concentrations of ash constituents to available surface soil background values published by MPCA (MPCA, 2015) indicates that the contribution of particulate deposition to surface soil would result in indistinguishable increases over background conditions, as shown in the following table.

COMPARISON OF ESTIMATED SOIL CONCENTRATIONS TO BACKGROUND CONCENTRATIONS

Parameter	Estimated Concentration in Soil at 0.1 ug/m^2 Particulate Deposition [a] (mg/kg)	Minnesota Background Concentration [b] (mg/kg)
Aluminum	0.078	23095
Arsenic	0.000070	9
Barium	0.0017	190
Chromium	0.00035	25
Iron	0.040	26000
2,3,7,8-TCDD (TEQ)	3.8E-09	2.0E-06

[a] – Derived in Table 3

[b] – MPCA, 2015; parameters listed on table are those that were detected in ash and for which MPCA has published background values.

Overall, the results of the risk-based screening indicate that particulates generated during ash processing would be associated with negligible health risks for receptors living or working near the facility. Furthermore, although these estimates are based on deposition over a five year period (consistent with standard air modelling protocols), additional deposition beyond 5 years would not meaningfully increase the estimated concentrations shown in Table 3; soil concentrations would still be well below natural background levels.

6. City of Red Wing Concrete Crushing Operations

As mentioned in Section 1 and shown in Figure 1, the City of Red Wing is proposing to site its concrete and asphalt crushing activities near the proposed ash processing facility. The City is proposing to perform asphalt and concrete crushing over a single four to six week period annually. To support siting of the facility, an air dispersion modeling assessment was performed by SEH; the assessment was similar to the one that SEH performed for the proposed ash processing facility and was provided in the City of Red Wing City Council Agenda Report (Moskwa, 2016). SEH concluded that the maximum 24-hour PM10 concentration that may result from concrete crushing operations would be 0.1 ug/m^3 at the property line. This value is less than 0.07% of the National Ambient Air Quality Standard (NAAQS) for PM10 (150 ug/m^3). This indicates that concrete crushing is not expected to create dust that will migrate off-property at concentrations that are of regulatory concern.

As reported by SEH, concrete crushing does not involve the types of activities that are recognized for potentially creating respirable particles (e.g., less than 4 microns), such as grinding, drilling, and cutting. Nevertheless, even if all of the PM10 was assumed to be crystalline silica, the concentration would be lower than the air RSL for silica (3.1 ug/m^3; Table 2), as well as the Occupational Health and Safety Administration (OSHA) recently promulgated permissible exposure level (PEL) for respirable crystalline silica[1] of 50 ug/m^3. This provides further evidence that concrete crushing operations would be associated with negligible health risks for receptors living or working near the facility.

---

[1] www.osha.gov/silica/

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TABLE 1
SUMMARY OF 2015 ANNUAL ASH TESTING ANALYTICAL RESULTS
RED WING ASH LANDFILL
RED WING, MINNESOTA

Parameter	Frequency of Detection [a]	Range of Detected Concentrations	Arithmetic Mean Concentration
Inorganics (mg/kg)			
Aluminum	6 / 6	21900 - 27900	24917
Arsenic	6 / 6	19.6 - 24.7	22
Barium	6 / 6	480 - 662	532
Beryllium	6 / 6	0.4 - 2.1	0.71
Boron	6 / 6	177 - 211	187
Cadmium	6 / 6	16.9 - 19.4	18.2
Calcium	6 / 6	96600 - 117000	103933
Chromium	6 / 6	102 - 128	112
Copper	6 / 6	1370 - 2470	1853
Hg Solids	6 / 6	1.63 - 1.81	1.7
Iron	6 / 6	11900 - 13800	12800
Lead	6 / 6	738 - 807	768
Magnesium	6 / 6	8760 - 9910	9188
Manganese	6 / 6	763 - 1250	887
Nickel	6 / 6	79.4 - 159	102
Selenium	6 / 6	1.2 - 4.3	2.2
Silicon	6 / 6	331 - 948	491
Silver	6 / 6	2.43 - 4.41	2.9
Sodium	6 / 6	11900 - 13600	12567
Strontium	6 / 6	238 - 281	259
Tin	6 / 6	97.2 - 121	113
Zinc	6 / 6	2530 - 3360	2863
Dioxins/Furans (mg/kg) [b]			
2,3,7,8-TCDD (TEQ)	1 / 1	0.00121 - 0.00121	0.00121
Other			
Chloride (mg/L)	6 / 6	332 - 487	390
Sulfate (mg/L)	6 / 6	47 - 64.2	54
M_ADL (%)	6 / 6	16.4272 - 16.4272	16.4
M_Loss on Ignition (%)	6 / 6	7.82 - 7.82	7.8

Notes:

mg/kg: milligram per kilogram

mg/L: milligram per liter

TEQ - Toxic Equivalent Concentration

[a] Represents the number of samples in which the parameter was detected over the total number of samples in which the parameter was analyzed. Samples represent the 2015 annual composite for combined ash. Data were obtained from the "Xcel Energy Annual Ash Testing Report for the Red Wing Ash Disposal Facility, MPCA Peri

[b] Analytical results represent the 1995 annual composite for combined ash. Data were obtained from the "1995 Annual Ash Testing Report for the Northern States Power Company's Red Wing Steam Plant". The concentration presented is the 2,3,7,8-TCDD toxic equivalent concentration. Documentation of the TEQ calculation is provided in Attachment C.

TABLE 2
ESTIMATION OF AIR CONCENTRATIONS FROM PM10 EMISSIONS AND COMPARISON TO RISK-BASED SCREENING LEVELS
RED WING ASH LANDFILL
RED WING, MINNESOTA

Parameter	Arithmetic Mean Ash Concentration [a] (mg/kg)	Mass Fraction in Ash [e] (unitless)	Estimated Air Concentration (ug/m3) for PM10 of: [b]								Residential Air RSL [d] (ug/m³)	Is Highest Air Concentration Above RSL?
			1.0	ug/m^3	0.5	ug/m^3	0.1	ug/m^3	0.05	ug/m^3		
Inorganics												
Aluminum	24917	2.49E-02	2.5E-02	ug/m^3	1.2E-02	ug/m^3	2.5E-03	ug/m^3	1.2E-03	ug/m^3	5.2 n	No
Arsenic	22	2.24E-05	2.2E-05	ug/m^3	1.1E-05	ug/m^3	2.2E-06	ug/m^3	1.1E-06	ug/m^3	0.00065 c	No
Barium	532	5.32E-04	5.3E-04	ug/m^3	2.7E-04	ug/m^3	5.3E-05	ug/m^3	2.7E-05	ug/m^3	0.52 n	No
Beryllium	0.71	7.08E-07	7.1E-07	ug/m^3	3.5E-07	ug/m^3	7.1E-08	ug/m^3	3.5E-08	ug/m^3	0.0012 c	No
Boron	187	1.87E-04	1.9E-04	ug/m^3	9.4E-05	ug/m^3	1.9E-05	ug/m^3	9.4E-06	ug/m^3	21 n	No
Cadmium	18.2	1.82E-05	1.8E-05	ug/m^3	9.1E-06	ug/m^3	1.8E-06	ug/m^3	9.1E-07	ug/m^3	0.0016 c	No
Calcium	103933	1.04E-01	1.0E-01	ug/m^3	5.2E-02	ug/m^3	1.0E-02	ug/m^3	5.2E-03	ug/m^3	NA	NA
Chromium	112	1.12E-04	1.1E-04	ug/m^3	5.6E-05	ug/m^3	1.1E-05	ug/m^3	5.6E-06	ug/m^3	NA	NA
Copper	1853	1.85E-03	1.9E-03	ug/m^3	9.3E-04	ug/m^3	1.9E-04	ug/m^3	9.3E-05	ug/m^3	NA	NA
Mercury	1.7	1.70E-06	1.7E-06	ug/m^3	8.5E-07	ug/m^3	1.7E-07	ug/m^3	8.5E-08	ug/m^3	0.31 n	No
Iron	12800	1.28E-02	1.3E-02	ug/m^3	6.4E-03	ug/m^3	1.3E-03	ug/m^3	6.4E-04	ug/m^3	NA	NA
Lead	768	7.68E-04	7.7E-04	ug/m^3	3.8E-04	ug/m^3	7.7E-05	ug/m^3	3.8E-05	ug/m^3	0.15 L	No
Magnesium	9188	9.19E-03	9.2E-03	ug/m^3	4.6E-03	ug/m^3	9.2E-04	ug/m^3	4.6E-04	ug/m^3	NA	NA
Manganese	887	8.87E-04	8.9E-04	ug/m^3	4.4E-04	ug/m^3	8.9E-05	ug/m^3	4.4E-05	ug/m^3	0.052 n	No
Nickel	102	1.02E-04	1.0E-04	ug/m^3	5.1E-05	ug/m^3	1.0E-05	ug/m^3	5.1E-06	ug/m^3	0.011 c	No
Selenium	2.2	2.15E-06	2.2E-06	ug/m^3	1.1E-06	ug/m^3	2.2E-07	ug/m^3	1.1E-07	ug/m^3	21 n	No
Silicon [c]	491	4.91E-04	1.1E-03	ug/m^3	5.3E-04	ug/m^3	1.1E-04	ug/m^3	5.3E-05	ug/m^3	3.1 n	No
Silver	2.9	2.89E-06	2.9E-06	ug/m^3	1.4E-06	ug/m^3	2.9E-07	ug/m^3	1.4E-07	ug/m^3	NA	NA
Sodium	12567	1.26E-02	1.3E-02	ug/m^3	6.3E-03	ug/m^3	1.3E-03	ug/m^3	6.3E-04	ug/m^3	NA	NA
Strontium	259	2.59E-04	2.6E-04	ug/m^3	1.3E-04	ug/m^3	2.6E-05	ug/m^3	1.3E-05	ug/m^3	NA	NA
Tin	113	1.13E-04	1.1E-04	ug/m^3	5.6E-05	ug/m^3	1.1E-05	ug/m^3	5.6E-06	ug/m^3	NA	NA
Zinc	2863	2.86E-03	2.9E-03	ug/m^3	1.4E-03	ug/m^3	2.9E-04	ug/m^3	1.4E-04	ug/m^3	NA	NA
Dioxins/Furans												
2,3,7,8-TCDD (TEQ)	0.00121	1.21E-09	1.2E-09	ug/m^3	6.1E-10	ug/m^3	1.2E-10	ug/m^3	6.1E-11	ug/m^3	7.4E-08 c	No

Notes:

mg/kg: milligram per kilogram
ug/m^3: microgram per cubic meter
NA: No screening level available; comparison is not applicable
RSL: Regional Screening Level (USEPA, 2015)
TEQ - Toxic Equivalent Concentration
n: Based on a target non-cancer hazard index of 1.
c: Based on a target cancer risk of 1 in 1 million (1E-06).
L: USEPA recommended screening level for lead in residential air, equal to the National Ambient Air Quality Standard (NAAQS) for lead.
[a] Arithmetic mean concentration of constituents in ash is provided in Table 1.
[b] Calculated constituent concentrations in air are derived as follows:
Air concentration (ug/m3) = [PM10 (ug/m3) x mass fraction (unitless)]
[c] Silicon is evaluated as silica using the RSL for silica.
To convert silicon concentrations to silica (SiO2), the silicon concentrations are multiplied by the molar ratio of SiO2 (60.083 g/mol) to Si (28.085 g/mol)
[d] USEPA, 2015. Regional Screening Levels. https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2015
[e] Calculated by multiplying the arithmetic mean ash concentration (mg/kg) by 1E-06 kg/mg

TABLE 3
ESTIMATION OF SOIL CONCENTRATIONS FOLLOWING PARTICLE DEPOSITION AND COMPARISON TO RISK-BASED SCREENING LEVELS
RED WING ASH LANDFILL
RED WING, MINNESOTA

Parameter	Arithmetic Mean Ash Concentration [a] (mg/kg)	Mass Fraction in Ash [e] (unitless)	Estimated Soil Concentration (mg/kg) for Particle Matter Deposition of: [b]								Residential Soil RSL [c] (mg/kg)	MN Residential Soil SRV [d] (mg/kg)	Is Highest Soil Concentration Above RSL or SRV?
			1.0	g/m^2	0.5	g/m^2	0.1	g/m^2	0.05	g/m^2			
Inorganics													
Aluminum	24917	2.49E-02	7.8E-01	mg/kg	3.9E-01	mg/kg	7.8E-02	mg/kg	3.9E-02	mg/kg	77000 n	30000	No
Arsenic	22	2.24E-05	7.0E-04	mg/kg	3.5E-04	mg/kg	7.0E-05	mg/kg	3.5E-05	mg/kg	0.68 c	9	No
Barium	532	5.32E-04	1.7E-02	mg/kg	8.4E-03	mg/kg	1.7E-03	mg/kg	8.4E-04	mg/kg	15000 n	1100	No
Beryllium	0.71	7.08E-07	2.2E-05	mg/kg	1.1E-05	mg/kg	2.2E-06	mg/kg	1.1E-06	mg/kg	160 n	55	No
Boron	187	1.87E-04	5.9E-03	mg/kg	2.9E-03	mg/kg	5.9E-04	mg/kg	2.9E-04	mg/kg	16000 n	6000	No
Cadmium	18.2	1.82E-05	5.7E-04	mg/kg	2.9E-04	mg/kg	5.7E-05	mg/kg	2.9E-05	mg/kg	71 n	25	No
Calcium	103933	1.04E-01	3.3E+00	mg/kg	1.6E+00	mg/kg	3.3E-01	mg/kg	1.6E-01	mg/kg	NA	NA	NA
Chromium	112	1.12E-04	3.5E-03	mg/kg	1.8E-03	mg/kg	3.5E-04	mg/kg	1.8E-04	mg/kg	120000 n	44000	No
Copper	1853	1.85E-03	5.8E-02	mg/kg	2.9E-02	mg/kg	5.8E-03	mg/kg	2.9E-03	mg/kg	3100 n	100	No
Mercury	1.7	1.70E-06	5.3E-05	mg/kg	2.7E-05	mg/kg	5.3E-06	mg/kg	2.7E-06	mg/kg	11 n	0.5	No
Iron	12800	1.28E-02	4.0E-01	mg/kg	2.0E-01	mg/kg	4.0E-02	mg/kg	2.0E-02	mg/kg	55000 n	9000	No
Lead	768	7.68E-04	2.4E-02	mg/kg	1.2E-02	mg/kg	2.4E-03	mg/kg	1.2E-03	mg/kg	400 L	300	No
Magnesium	9188	9.19E-03	2.9E-01	mg/kg	1.4E-01	mg/kg	2.9E-02	mg/kg	1.4E-02	mg/kg	NA	NA	NA
Manganese	887	8.87E-04	2.8E-02	mg/kg	1.4E-02	mg/kg	2.8E-03	mg/kg	1.4E-03	mg/kg	1800 n	3600	No
Nickel	102	1.02E-04	3.2E-03	mg/kg	1.6E-03	mg/kg	3.2E-04	mg/kg	1.6E-04	mg/kg	1500 n	560	No
Selenium	2.2	2.15E-06	6.8E-05	mg/kg	3.4E-05	mg/kg	6.8E-06	mg/kg	3.4E-06	mg/kg	390 n	160	No
Silicon	491	4.91E-04	1.5E-02	mg/kg	7.7E-03	mg/kg	1.5E-03	mg/kg	7.7E-04	mg/kg	NA	NA	NA
Silver	2.9	2.89E-06	9.1E-05	mg/kg	4.5E-05	mg/kg	9.1E-06	mg/kg	4.5E-06	mg/kg	390 n	160	No
Sodium	12567	1.26E-02	4.0E-01	mg/kg	2.0E-01	mg/kg	4.0E-02	mg/kg	2.0E-02	mg/kg	NA	NA	NA
Strontium	259	2.59E-04	8.1E-03	mg/kg	4.1E-03	mg/kg	8.1E-04	mg/kg	4.1E-04	mg/kg	47000 n	18000	No
Tin	113	1.13E-04	3.5E-03	mg/kg	1.8E-03	mg/kg	3.5E-04	mg/kg	1.8E-04	mg/kg	47000 n	9000	No
Zinc	2863	2.86E-03	9.0E-02	mg/kg	4.5E-02	mg/kg	9.0E-03	mg/kg	4.5E-03	mg/kg	23000 n	8700	No
Dioxins/Furans													
2,3,7,8-TCDD (TEQ)	0.00121	1.21E-09	3.8E-08	mg/kg	1.9E-08	mg/kg	3.8E-09	mg/kg	1.9E-09	mg/kg	4.8E-06 c	2.0E-05	No

Notes:

mg/kg: milligram per kilogram

g/m^2: gram per square meter

NA: No screening level available; comparison is not applicable

RSL: Regional Screening Level (USEPA, 2015)

TEQ - Toxic Equivalent Concentration

n: Based on a target non-cancer hazard index of 1.

c: Based on a target cancer risk of 1 in 1 million (1E-06).

L: USEPA recommended screening level for lead in residential soil.

[a] Arithmetic mean concentration of constituents in ash is provided in Table 1.

[b] Calculated constituent concentrations in soil are based on the assumption that deposited particulate matter is mixed with the top two centimeters of soil.

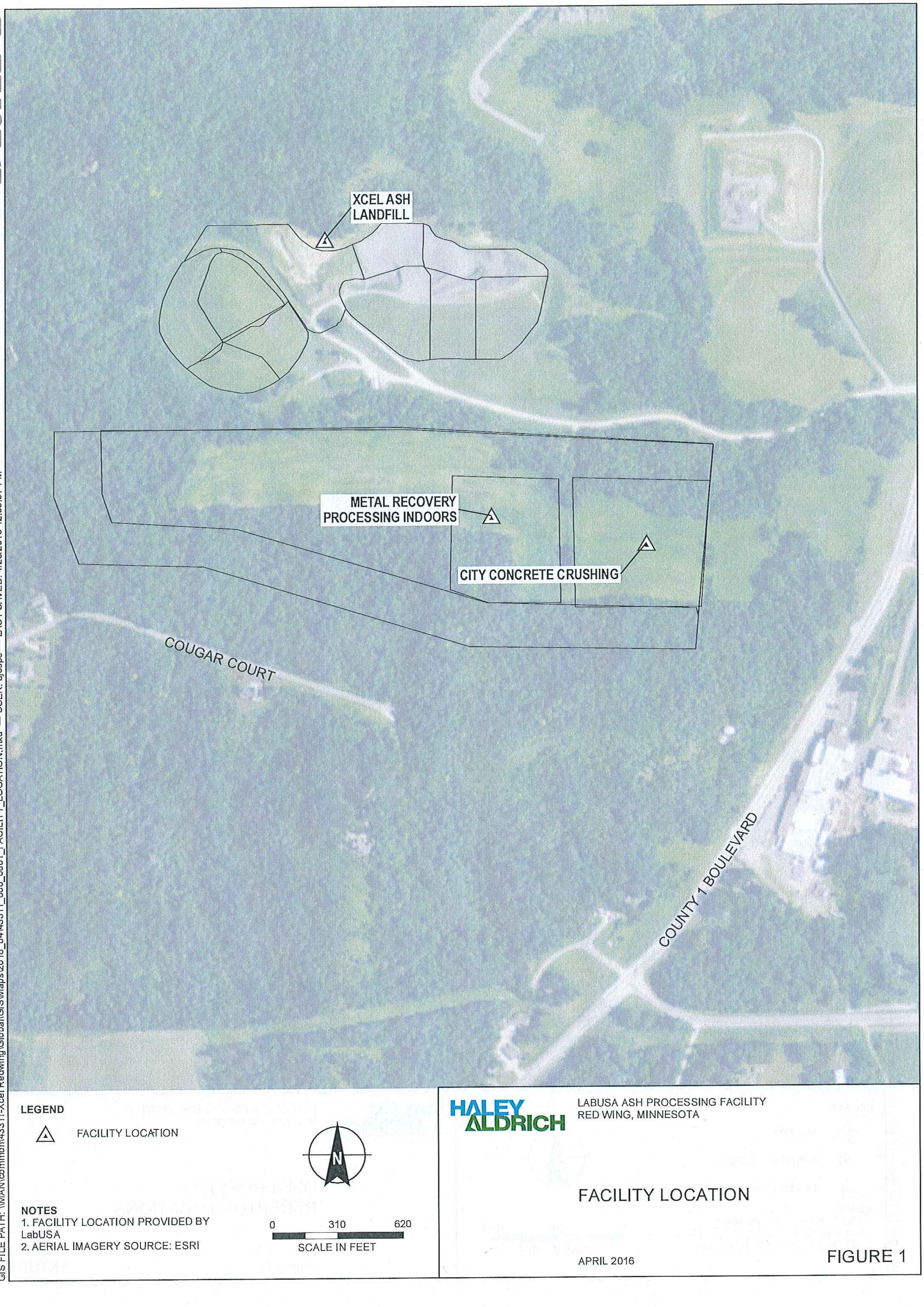
Soil concentration (mg/kg) = [deposition (g/m2) x mass fraction (unitless) x 1000 mg/g] / [mass of soil (kg) per m2, assuming that particulates are mixed with soil to a depth of 2 cm]

Mass of soil is derived using a bulk density of 1.59 g/cm3 for loam.

[c] USEPA, 2015. Regional Screening Levels. https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2015

[d] MN Residential SRV: Minnesota Soil Reference Value. SRV Tier I Residential Values (current version: 6/09) (www.pca.state.mn.us/waste/risk-based-site-evaluation-guidance)

[e] Calculated by multiplying the arithmetic mean ash concentration (mg/kg) by 1E-06 kg/mg



NOTES
1. FACILITY LOCATION PROVIDED BY LabUSA
2. AERIAL IMAGERY SOURCE: ESRI

HALEY ALDRICH

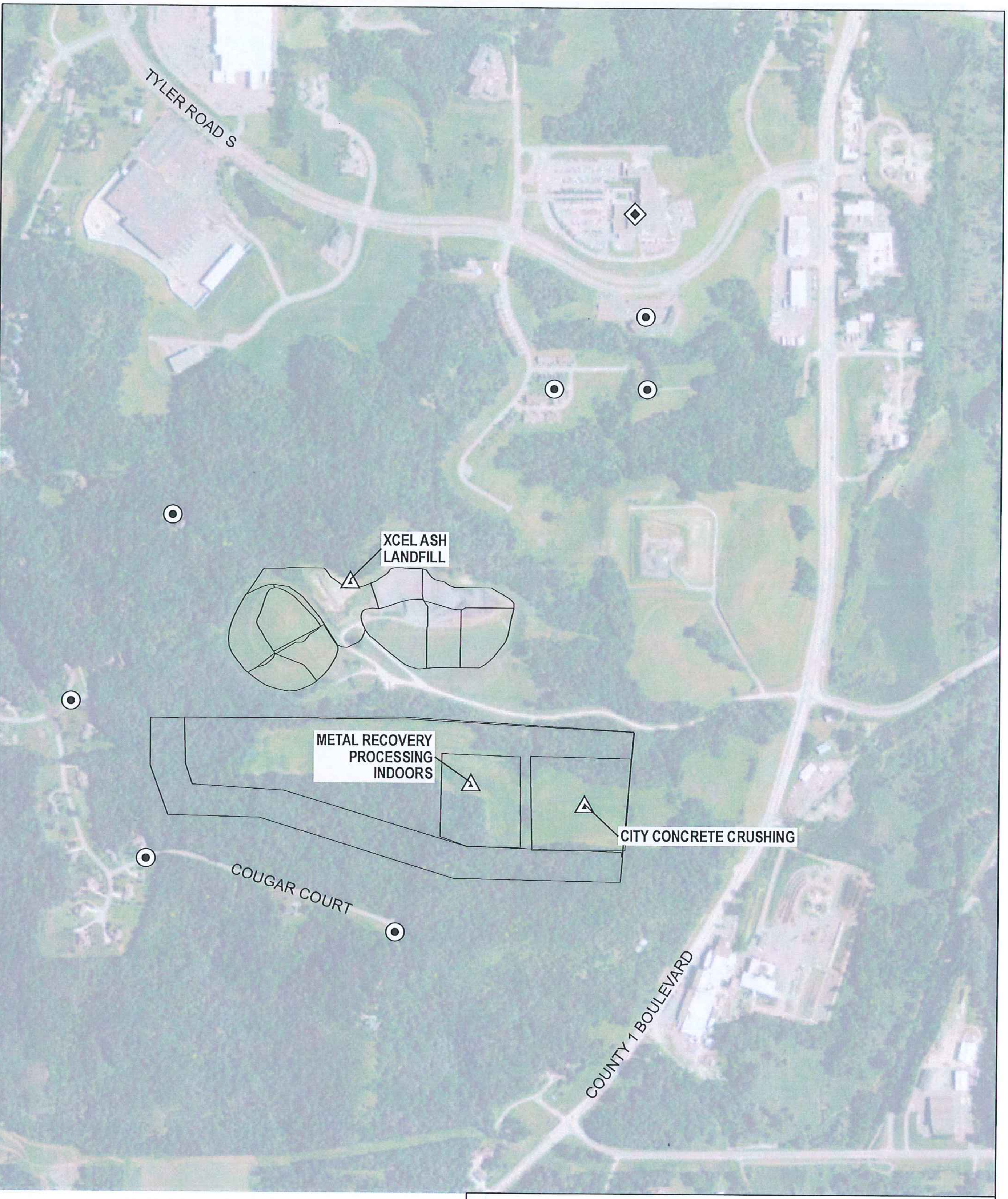
LABUSA ASH PROCESSING FACILITY
RED WING, MINNESOTA

FACILITY LOCATION

APRIL 2016

FIGURE 1

GIS FILE PATH: \\MAN\common\43311-Xcel Redwing\Global\GIS\Maps\2016_04\43311_000_0001_FACILITY_LOCATION.mxd — USER: ajospe — LAST SAVED: 4/26/2016 12:56:57 PM



LEGEND

◆ HOSPITAL

⊙ RESIDENTIAL AREA

△ FACILITY LOCATION

NOTES

1. RESIDENTIAL AND HOSPITAL LOCATION DATA PROVIDED BY LabUSA
2. AERIAL IMAGERY SOURCE: ESRI

0 470 940
SCALE IN FEET

HALEY ALDRICH

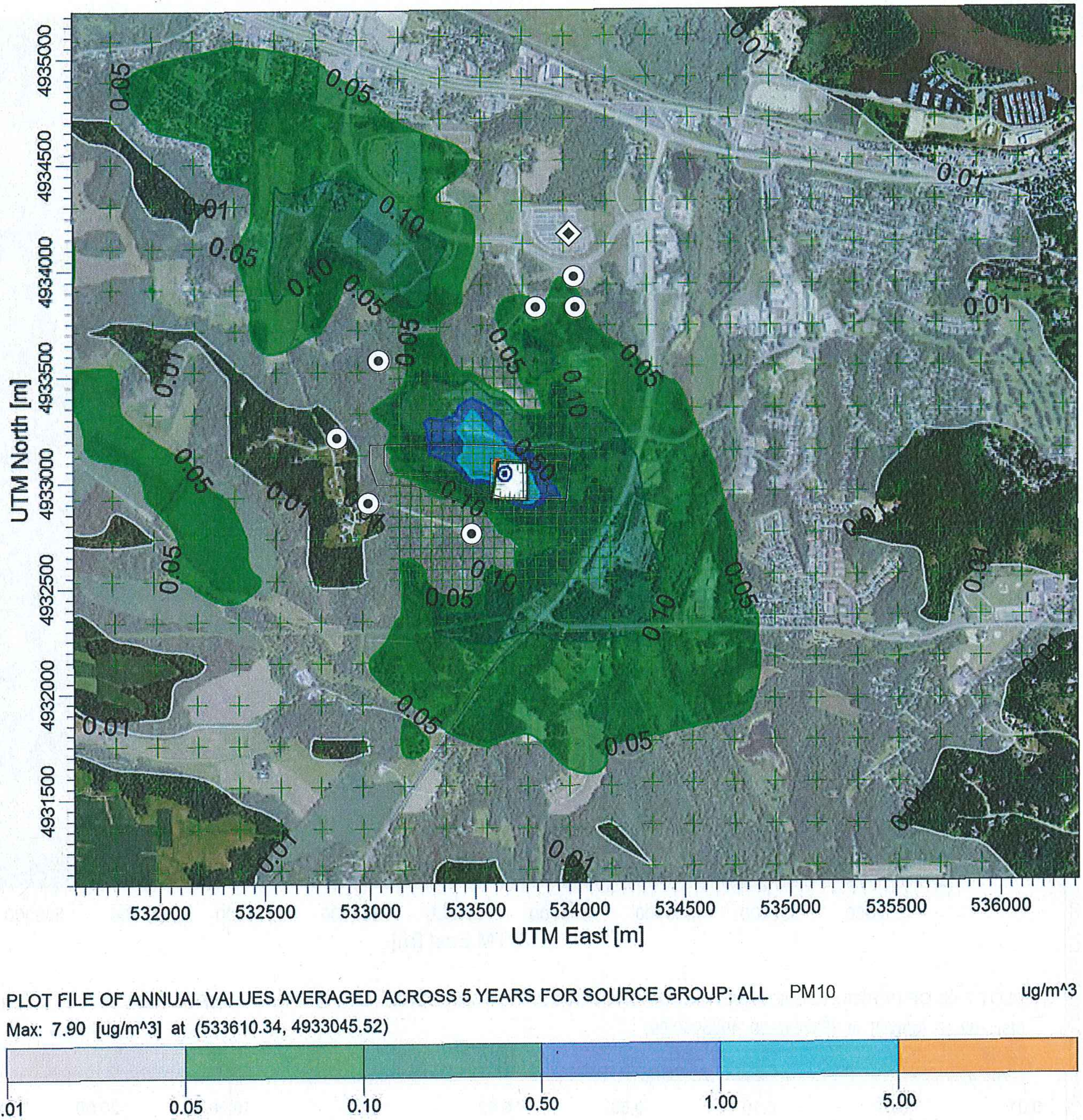
LABUSA ASH PROCESSING FACILITY
RED WING, MINNESOTA

OFF-PROPERTY RECEPTOR LOCATIONS

APRIL 2016

FIGURE 2

GIS FILE PATH: \\MAN\common\43311-Xcel Redwing\Global\GIS\Maps\2016_04\43311_000_0001_FACILITY_LOCATION.mxd — USER: ajospe — LAST SAVED: 4/26/2016 12:56:57 PM



LEGEND

◆ HOSPITAL

◉ RESIDENTIAL AREA

NOTES

1. CONTOURS BASED UPON TOTAL PARTICULATE EMISSION RATE.
2. RESIDENTIAL AND HOSPITAL LOCATION DATA PROVIDED BY LabUSA

0 1,250 2,500

SCALE IN FEET

HALEY ALDRICH

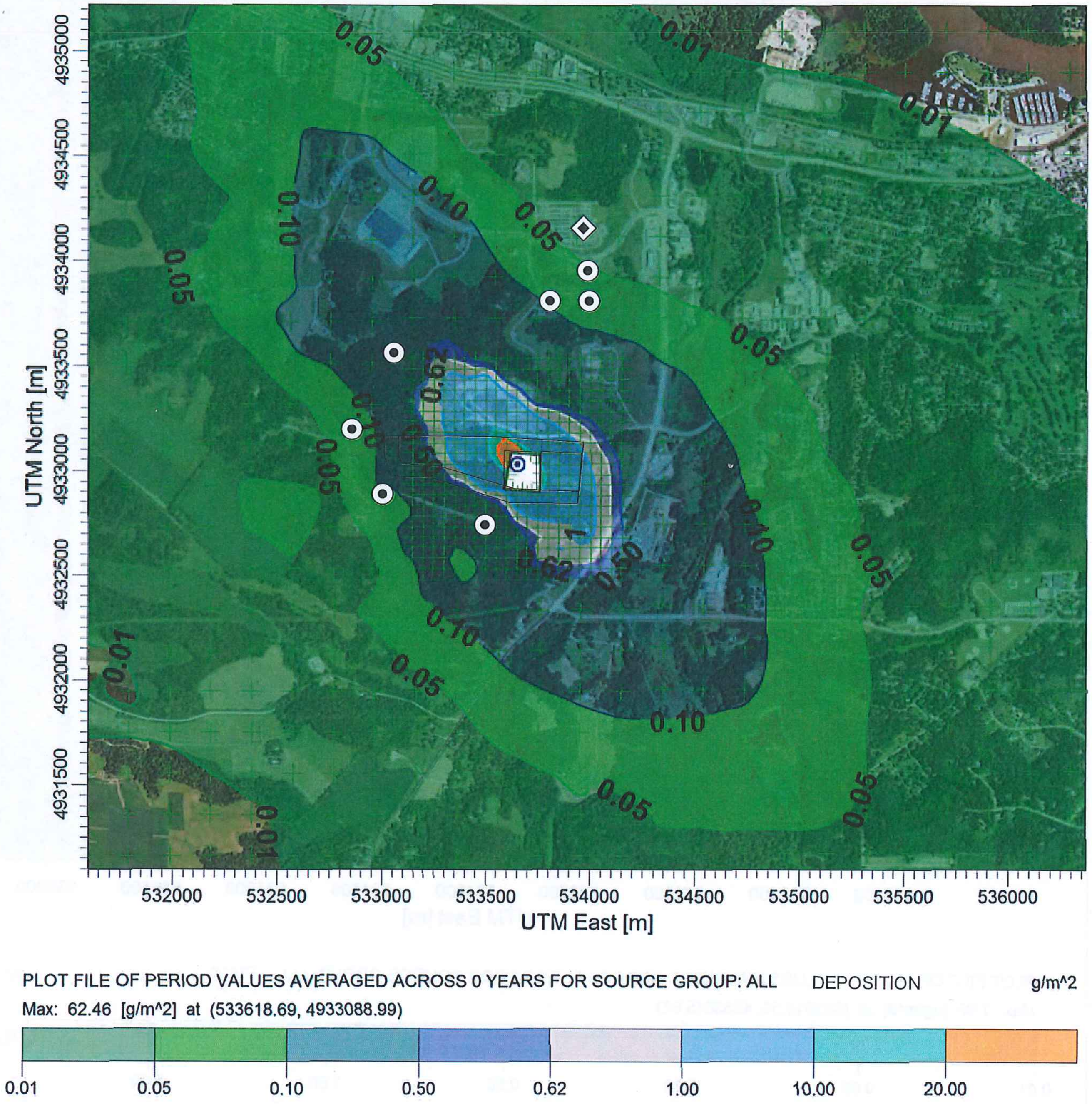
LABUSA ASH PROCESSING FACILITY
RED WING, MINNESOTA

MODELED PM10 CONCENTRATIONS ANNUAL VALUES AVERAGED ACROSS 5 YEARS

APRIL 2016

FIGURE 3

GIS FILE PATH: \\MAN\common\43311-Xcel Redwing\Global\GIS\Maps\2016_04\43311_000_0001_FACILITY_LOCATION.mxd — USER: ajospe — LAST SAVED: 4/26/2016 12:56:57 PM



LEGEND

◆ HOSPITAL

● RESIDENTIAL AREA

NOTES

1. CONTOURS BASED UPON TOTAL PARTICULATE EMISSION RATE.
2. RESIDENTIAL AND HOSPITAL LOCATION DATA PROVIDED BY LabUSA

N

0 1,250 2,500
SCALE IN FEET

HALEY ALDRICH

LABUSA ASH PROCESSING FACILITY
RED WING, MINNESOTA

MODELED 5-YEAR TOTAL DEPOSITION

APRIL 2016

FIGURE 4

GIS FILE PATH: \\MAN\common\43311-Xcel Redwing\Global\GIS\Maps\2016_04\43311_000_0001_FACILITY_LOCATION.mxd — USER: ajospe — LAST SAVED: 4/26/2016 12:56:57 PM

ATTACHMENT A

Air Emissions Evaluation for Lab USA Ash Processing Facility

SEH

Building a Better World
for All of Us®

MEMORANDUM

TO: Todd Potas, PE (SEH)

FROM: Steve Plachinski, CHMM, CEM (SEH)

DATE: March 22, 2016

RE: Air Emissions Evaluation for Lab USA Ash Processing Facility
SEH No. LABUS 136249

This memo documents the air emission calculations and air permit applicability review for the proposed Lab USA Ash Processing Facility ("Facility") located at the Xcel Energy Ash Landfill in Red Wing, Minnesota. The Facility would recover metals from bottom ash using a crusher and screens. Applicability for state (Minor Source) and federal (Title V) air quality permits were reviewed for the proposed Facility. If applicable, an air quality permit would be required prior to construction and operation of the Facility.

To calculate air emissions from the Facility, the following process design was assumed. This design was in part based on the sample equipment diagram included in Attachment 1.

1. Trucks deliver bottom ash (material) to the Facility and unload the material in a bin
2. Material is crushed with a crusher
3. Crushed material is separated using three screens (two of the screens in series)
4. Conveyors transfers material between different process steps
5. Processed material is dropped into temporary storage piles and/or storage bins
6. Of the Facility's processed material, about 5% is refined ash with precious metals that is loaded into trucks and hauled off-site to a beneficial user.
7. The other 95% of the processed material is processed ash that is delivered to the ash landfill. This processed ash is hauled to the ash landfill using the same trucks that deliver the incoming bottom ash to the Facility (resulting in one combined truck trip on the Facility site).

Because the Facility does not include combustion units and only includes ash handling/processing at ambient temperatures, the Facility only has the potential to emit particulate matter (PM) and PM less than 10 microns in diameter (PM_{10}). Emissions are calculated using emission factors from the most current U.S. Environmental Protection Agency (USEPA) AP-42 document. For the purposes of this evaluation, the following conservative assumptions are used in calculations:

- Incoming ash moisture content of 15% (however, expected moisture content is greater than 25%)
- Material throughput is assumed to be 48 trucks/day, equivalent to 864 tons material per day (however, currently expected throughput is only 24 trucks/day)
- Material processing steps (crushing, screening, drop points) are not enclosed (worst-case)
- Combined area of the temporary storage piles is 0.1 acres (4,350 square feet) and includes no wind shields/barriers (however, the proposed stockpiles will be covered and enclosed on three sides)
- Round trip travel distance for truck traffic on the Facility site is 2,250 feet per truck load. (Emissions from truck traffic off of the Facility site is not included)

- No dust control (e.g. water application, road binder, etc.) on the unpaved roadways (however, the proposed project will utilize dust suppression methods to prevent any unlikely visible emissions as required by existing solid waste landfill permits)

Table 1 shows the projected Facility-wide emissions of PM and PM_{10} for two different ash moisture assumptions. As is shown, the vast majority of calculated emissions at the Facility is attributable to truck traffic on the Facility's unpaved roadways.

Table 1. Projected Air Emissions from Lab USA Red Wing, MN Facility

	PM (ton/yr)	PM_{10} (ton/yr)
Facility Emissions (15% moisture ash)	**27.1**	**7.6**
Roadway Emissions (truck traffic)	*25.3*	*6.8*
*Ash Processing/Handling Emissions**	*1.8*	*0.8*
Facility Emissions (25% moisture ash)	**27.0**	**7.5**
Roadway Emissions (truck traffic)	*25.3*	*6.8*
*Ash Processing/Handling Emissions**	*1.7*	*0.7*
MN State Air Permit Thresholds	**100**	**25**

*Only the emission factors from AP-42 Section 13.2.4 (used for ash loading/unloading and drop point emissions) are based in part on moisture content and are different in the two assumptions presented here. The emission factors from AP-42 Section 11.19.2 (used for crushing, screening, and conveying) are controlled emission factors (i.e. wet material) and do not change in the two assumptions.

Table 1 also shows the emission thresholds for State Air Permits in Minnesota. These thresholds for PM and PM_{10} are listed in MN Administrate Rules, 7007.0250, Subp. 4 and on the Minnesota Pollution Control Agency (MPCA) website (https://www.pca.state.mn.us/air/about-air-permits#who). Facilities in Minnesota with emissions below these thresholds are not required to obtain an air permit. The total projected PM and PM_{10} emissions from the Facility, even with the conservative assumptions described above, are still well below air permit thresholds.

This evaluation does not calculate projected Facility emissions based on equipment capacities and/or a capacity bottleneck (e.g. crusher capacity of 100 ton/hr). The Facility emissions calculated based on this capacity/bottleneck method could be higher than the approach presented in this memo (i.e. applying a 100% safety factor to expected daily production).

Attachments

- Attachment 1 – Sample Equipment Diagram
- Attachment 2 – Air Emission Calculations Spreadsheet (15% Moisture Ash)
- Attachment 3 – Air Emission Calculations Spreadsheet (25% Moisture Ash)

sdp/TAP

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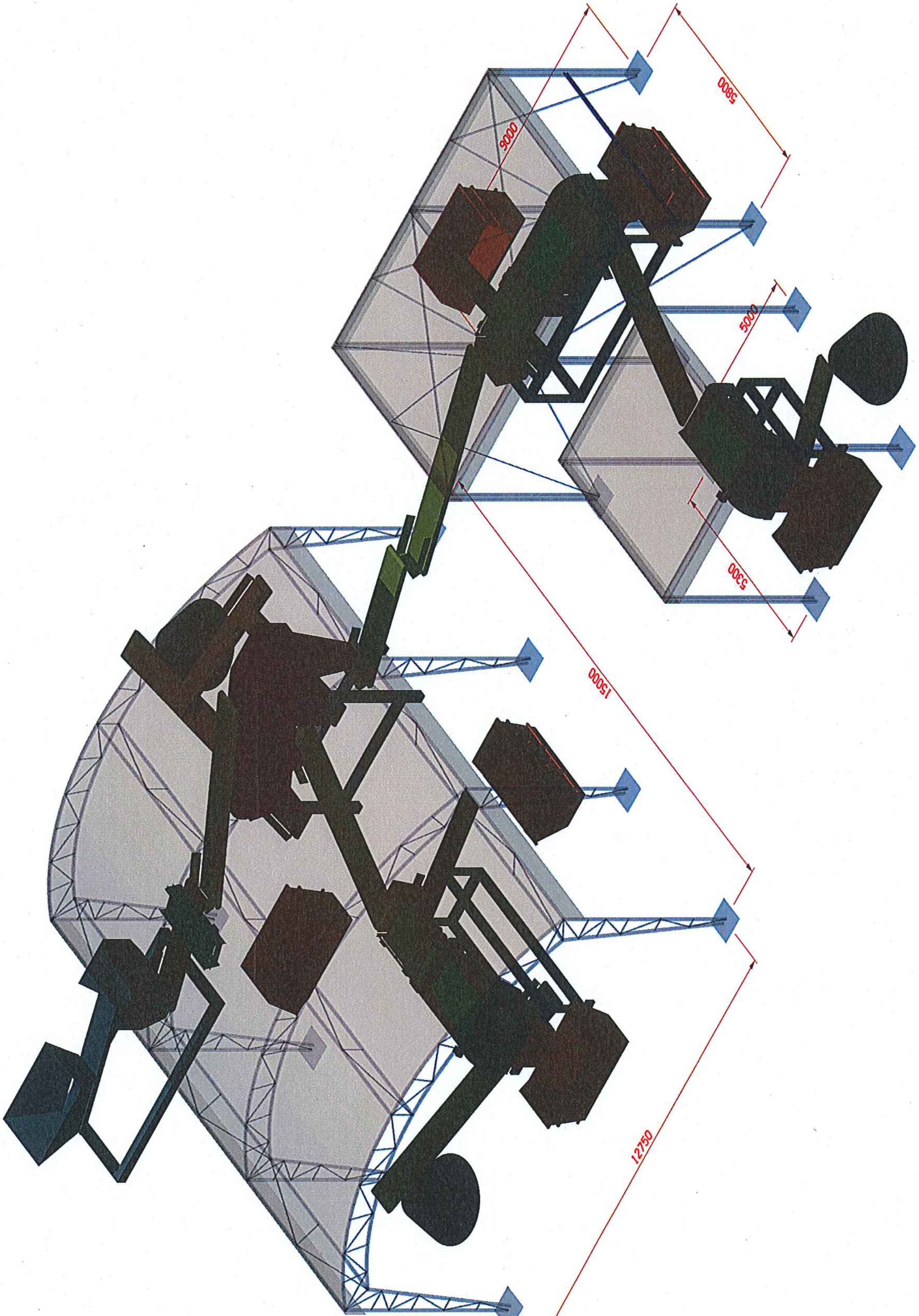
9000
5800
5000
5300
15000
12750

Attachment 2

Lab USA Ash Processing - Red Wing, MN
PM Emissions (assuming 15% moisture ash)

Process	Control	Daily Production	Safety Factor	Daily Production w/ Safety	Annual Capacity	PM Emission Rate	Hourly Emissions[1]	Annual Emissions	Comments on Emission Factors
		ton/day	%	ton/day	ton/yr	lb/ton	lb PM/hr	ton PM/yr	
				Bottom Ash Processing Plant					
F01 - Truck Unloading	Moisture Present in Ash	432	100%	864	315,360	0.00037	0.013	0.06	AP-42 13.2.4 (1): $EF = k * 0.0032 * (U/5)^{1.3} / (M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 15%
F02 - Conveyor Transfer Points (assume 4)	Moisture Present in Ash			3456	1,261,440	0.00014	0.02	0.09	AP-42 Table 11.19.2-2. Controlled Crushing
F03 - Crusher	Moisture Present in Ash			864	315,360	0.0012	0.04	0.19	AP-42 Table 11.19.2-2. Tertiary Crushing (controlled)
F04A - Screen #1	Moisture Present in Ash			432	157,680	0.0022	0.04	0.17	AP-42 Table 11.19.2-2. Screening (controlled)
F04B - Screen #2 & #3	Moisture Present in Ash			864	315,360	0.0022	0.08	0.35	AP-42 Table 11.19.2-2. Screening (controlled)
F05 - Drop Points onto bin/piles	Moisture Present in Ash			864	315,360	0.00037	0.01	0.06	AP-42 13.2.4 (1): $EF = k * 0.0032 * (U/5)^{1.3} / (M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 15%
F06 - Small Temporary Storage Piles	Moisture Present in Ash						0.19	0.83	See Table A.
F07 - Truck Loading	Moisture Present in Ash			864	315,360	0.00037	0.01	0.06	AP-42 13.2.4 (1): $EF = k * 0.0032 * (U/5)^{1.3} / (M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 15%
Vehicle Traffic Unpaved	Natural Moisture + Wetting						11.0	25.3	See Table B.
						Totals =	**11.4**	**27.1**	

March 9, 2016

100 MPCA Air Permit threshold - PTE (ton/yr)

Lab USA Ash Processing - Red Wing, MN

PM_{10} Emissions (assuming 15% moisture ash)

Process	Control	Daily Production	Safety Factor	Daily Production w/ Safety	Annual Capacity	PM10 Emission Rate	Hourly Emissions[1]	Annual Emissions	Comments on Emission Factors
		ton/day	%	ton/day	ton/yr	lb/ton	lb PM10/hr	ton PM10/yr	
				Bottom Ash Processing Plant					
F01 - Truck Unloading	Moisture Present in Ash	432	100%	864	315,360	0.00017	0.006	0.03	AP-42 13.2.4 (1): EF = k * 0.0032 * $(U/5)^{1.3}$ / $(M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 15%
F02 - Conveyor Transfer Points (assume 4)	Moisture Present in Ash			3456	1,261,440	0.000046	0.01	0.03	AP-42 Table 11.19.2-2. Controlled Crushing
F03 - Crusher	Moisture Present in Ash			864	315,360	0.00054	0.02	0.09	AP-42 Table 11.19.2-2. Tertiary Crushing (controlled)
F04A - Screen #1	Moisture Present in Ash			432	157,680	0.00074	0.01	0.06	AP-42 Table 11.19.2-2. Screening (controlled)
F04B - Screen #2 & #3	Moisture Present in Ash			864	315,360	0.00074	0.03	0.12	AP-42 Table 11.19.2-2. Screening (controlled)
F05 - Drop Points onto bin/piles	Moisture Present in Ash			864	315,360	0.00017	0.01	0.03	AP-42 13.2.4 (1): EF = k * 0.0032 * $(U/5)^{1.3}$ / $(M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 15%
F06 - Small Temporary Storage Piles	Moisture Present in Ash						0.09	0.39	See Table A.
F07 - Truck Loading	Moisture Present in Ash			864	315,360	0.00017	0.01	0.03	AP-42 13.2.4 (1): EF = k * 0.0032 * $(U/5)^{1.3}$ / $(M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 15%
Vehicle Traffic Unpaved	Natural Moisture + Wetting						3.0	6.8	See Table B.
						Totals =	3.1	7.6	

25 MPCA Air Permit threshold - PTE (ton/yr)

Table A
Storage Piles - Potential Fugitive PM Emissions

Material Handling factors (AP-42, Sect. 13.2.4, Aggregate Handling and Storage Piles, 2006)
Assume PM30 as presented in AP-42 equates to total PM.

k = 0.053 for PM 2.5
k = 0.35 for PM 10
k = 0.74 for PM 30

Emission Factors

Active Piles

Emission Factor = 0.72 * u lb PM 30/acre/hr (disturbed area)
From Fifth Edition of AP-42, Table 11.9-1, Chapter 11.9, "Western Surface Coal Mining", 1998
Note: No scaling factors available for PM 2.5 & 10; use ratio of 'k' factors (above)
u = 10.5 mph (average wind speed for Minneapolis-St. Paul, MN)
(from http://lwf.ncdc.noaa.gov/oa/climate/online/ccd/avgwind.html)
EF = **0.54** lb PM 2.5/acre/hr (uncontrolled)
EF = **3.58** lb PM 10/acre/hr (uncontrolled)
EF = **7.56** lb PM 30/acre/hr (uncontrolled)

Inactive Piles

Emission Factor = 0.38 ton PM/acre/yr (undisturbed area)
From Fifth Edition of AP-42, Table 11.9-4, Chapter 11.9, "Western Surface Coal Mining", 1998
Note: No scaling factors available for PM 2.5 & 10; use ratio of 'k' factors (above)
EF = **0.03** ton PM 2.5/acre/year (uncontrolled)
EF = **0.18** ton PM 10/acre/year (uncontrolled)
EF = **0.38** ton PM 30/acre/year (uncontrolled)

Emission Calculations

**Calculations assume a 75% control efficiency from natural moisture

Active Piles

Disturbed area = 0.1 acres
PM Emissions = Area * Active Storage Pile EF * Disturbed Hours/yr
PTE worst case: Disturbed hours = 24 hr/day x 365 day/yr = 8760 hr

PM 2.5 Emissions =	**0.01**	lb/hr	**0.06**	ton/yr
PM 10 Emissions =	**0.09**	lb/hr	**0.39**	ton/yr
PM 30 Emissions =	**0.19**	lb/hr	**0.83**	ton/yr

Inactive Piles

Inactive pile area = 0.00 acres
PM Emissions = Area * Inactive Storage Pile EF * yr

PM 2.5 Emissions =	**0.00**	lb/hr	**0.00**	ton/yr
PM 10 Emissions =	**0.00**	lb/hr	**0.00**	ton/yr
PM 30 Emissions =	**0.00**	lb/hr	**0.00**	ton/yr

ANNUAL EMISSIONS	ton PM 2.5/yr	ton PM 10/yr	ton PM 30/yr
Active Storage Piles =	0.06	0.39	0.83
Inactive Storage Piles =	0.00	0.00	0.00
SITE TOTALS =	**0.06**	**0.39**	**0.83**

HOURLY EMISSIONS	lb PM 2.5/hr	lb PM 10/hr	lb PM 30/hr
Active Storage Piles =	0.01	0.09	0.19
Inactive Storage Piles =	0.00	0.00	0.00
SITE TOTALS =	**0.01**	**0.09**	**0.19**

Table B
Vehicle Traffic on Unpaved Roads

(based on AP-42 Section 13.2.2 Unpaved Roads, 2006)

$E = k(s/12)^a(W/3)^b * [(365 - P)/365]$ Particulate emission factor, lb/VMT

Where:

k (PM 10) = 1.5 constant for PM-10, lb/VMT
a = 0.9
b = 0.45
k (PM 30) = 4.9 constant for PM-30, lb/VMT
a = 0.7
b = 0.45

s = **6.4** surface material silt content, %
(from AP-42 Table 13.2.2.1 for MSW Landfill)
W = **34** Mean weight of vehicles, tons
(Truck weight: 25 tons empty, 25+18 tons full)
P = **115** (Figure 13.2.1.2 for days with >0.01 in precipitation)

EF = 1.7 PM-10 lb/VMT
EF = 6.4 PM-30 lb/VMT

Control Efficiency from watering = **0%**

Annual Emission Rates

Trips = 17,520 Vehicle trips per year (annual tons ash ÷ 18 ton/truck)
876 Additional trucks for refined ash (with precious metals)
Distance = 2,250 Distance per trip, feet
VMT = 7,839 Vehicle miles traveled per year

Uncontrolled		Controlled (with watering)	
6.8	tpy PM 10	6.8	tpy PM 10
25.3	tpy PM 30	25.3	tpy PM 30

Hourly Emission Rates

Trips = 4.0 Vehicle trips per hour
Distance = 2,250 Distance per trip, feet
VMT = 1.7 Vehicle miles traveled per hour

Uncontrolled		Controlled (with watering)	
3.0	lb/hr PM 10	3.0	lb/hr PM 10
11.0	lb/hr PM 30	11.0	lb/hr PM 30

Lab USA Ash Processing - Red Wing, MN

PM Emissions (assuming 25% moisture ash)

Process	Control	Daily Production	Safety Factor	Daily Production w/ Safety	Annual Capacity	PM Emission Rate	Hourly Emissions[1]	Annual Emissions	Comments on Emission Factors
		ton/day	%	ton/day	ton/yr	lb/ton	lb PM/hr	ton PM/yr	
					Bottom Ash Processing Plant				
F01 - Truck Unloading	Moisture Present in Ash	432	100%	864	315,360	0.00018	0.007	0.03	AP-42 13.2.4 (1): EF = k * 0.0032 * $(U/5)^{1.3}$ / $(M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 25%
F02 - Conveyor Transfer Points (assume 4)	Moisture Present in Ash			3456	1,261,440	0.00014	0.02	0.09	AP-42 Table 11.19.2-2. Controlled Crushing
F03 - Crusher	Moisture Present in Ash			864	315,360	0.0012	0.04	0.19	AP-42 Table 11.19.2-2. Tertiary Crushing (controlled)
F04A - Screen #1	Moisture Present in Ash			432	157,680	0.0022	0.04	0.17	AP-42 Table 11.19.2-2. Screening (controlled)
F04B - Screen #2 & #3	Moisture Present in Ash			864	315,360	0.0022	0.08	0.35	AP-42 Table 11.19.2-2. Screening (controlled)
F05 - Drop Points onto bin/piles	Moisture Present in Ash			864	315,360	0.00018	0.01	0.03	AP-42 13.2.4 (1): EF = k * 0.0032 * $(U/5)^{1.3}$ / $(M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 25%
F06 - Small Temporary Storage Piles	Moisture Present in Ash						0.19	0.83	See Table A.
F07 - Truck Loading	Moisture Present in Ash			864	315,360	0.00018	0.01	0.03	AP-42 13.2.4 (1): EF = k * 0.0032 * $(U/5)^{1.3}$ / $(M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 25%
Vehicle Traffic Unpaved	Natural Moisture + Wetting						11.0	25.3	See Table B.
						Totals =	**11.4**	**27.0**	

March 21, 2016

100 MPCA Air Permit threshold - PTE (ton/yr)

Lab USA Ash Processing - Red Wing, MN

PM_{10} Emissions (assuming 25% moisture ash)

Process	Control	Daily Production	Safety Factor	Daily Production w/ Safety	Annual Capacity	PM10 Emission Rate	Hourly Emissions[1]	Annual Emissions	Comments on Emission Factors
		ton/day	%	ton/day	ton/yr	lb/ton	lb PM10/hr	ton PM10/yr	
					Bottom Ash Processing Plant				
F01 - Truck Unloading	Moisture Present in Ash	432	100%	864	315,360	0.00009	0.003	0.01	AP-42 13.2.4 (1): EF = k * 0.0032 * $(U/5)^{1.3}$ / $(M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 25%
F02 - Conveyor Transfer Points (assume 4)	Moisture Present in Ash			3456	1,261,440	0.000046	0.01	0.03	AP-42 Table 11.19.2-2. Controlled Crushing
F03 - Crusher	Moisture Present in Ash			864	315,360	0.00054	0.02	0.09	AP-42 Table 11.19.2-2. Tertiary Crushing (controlled)
F04A - Screen #1	Moisture Present in Ash			432	157,680	0.00074	0.01	0.06	AP-42 Table 11.19.2-2. Screening (controlled)
F04B - Screen #2 & #3	Moisture Present in Ash			864	315,360	0.00074	0.03	0.12	AP-42 Table 11.19.2-2. Screening (controlled)
F05 - Drop Points onto bin/piles	Moisture Present in Ash			864	315,360	0.00009	0.00	0.01	AP-42 13.2.4 (1): EF = k * 0.0032 * $(U/5)^{1.3}$ / $(M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 25%
F06 - Small Temporary Storage Piles	Moisture Present in Ash						0.09	0.39	See Table A.
F07 - Truck Loading	Moisture Present in Ash			864	315,360	0.00009	0.00	0.01	AP-42 13.2.4 (1): EF = k * 0.0032 * $(U/5)^{1.3}$ / $(M/2)^{1.4}$ U = 10.5 mph; k = 0.74 (PM), k = 0.35 (PM10); M = 25%
Vehicle Traffic Unpaved	Natural Moisture + Wetting						3.0	6.8	See Table B.
						Totals =	**3.1**	**7.5**	

25 MPCA Air Permit threshold - PTE (ton/yr)

Table A
Storage Piles - Potential Fugitive PM Emissions

Material Handling factors (AP-42, Sect. 13.2.4, Aggregate Handling and Storage Piles, 2006)
Assume PM30 as presented in AP-42 equates to total PM.

k =	0.053	for PM 2.5
k =	0.35	for PM 10
k =	0.74	for PM 30

Emission Factors

Active Piles

Emission Factor = 0.72 * u lb PM 30/acre/hr (disturbed area)

From Fifth Edition of AP-42, Table 11.9-1, Chapter 11.9, "Western Surface Coal Mining", 1998

Note: No scaling factors available for PM 2.5 & 10; use ratio of 'k' factors (above)

u = 10.5 mph (average wind speed for Minneapolis-St. Paul, MN)
(from http://lwf.ncdc.noaa.gov/oa/climate/online/ccd/avgwind.html)

EF =	**0.54**	lb PM 2.5/acre/hr (uncontrolled)
EF =	**3.58**	lb PM 10/acre/hr (uncontrolled)
EF =	**7.56**	lb PM 30/acre/hr (uncontrolled)

Inactive Piles

Emission Factor = 0.38 ton PM/acre/yr (undisturbed area)

From Fifth Edition of AP-42, Table 11.9-4, Chapter 11.9, "Western Surface Coal Mining", 1998

Note: No scaling factors available for PM 2.5 & 10; use ratio of 'k' factors (above)

EF =	**0.03**	ton PM 2.5/acre/year (uncontrolled)
EF =	**0.18**	ton PM 10/acre/year (uncontrolled)
EF =	**0.38**	ton PM 30/acre/year (uncontrolled)

Emission Calculations

**Calculations assume a 75% control efficiency from natural moisture

Active Piles

Disturbed area = 0.1 acres

PM Emissions = Area * Active Storage Pile EF * Disturbed Hours/yr

PTE worst case: Disturbed hours = 24 hr/day x 365 day/yr = 8760 hr

PM 2.5 Emissions =	**0.01**	lb/hr	**0.06**	ton/yr
PM 10 Emissions =	**0.09**	lb/hr	**0.39**	ton/yr
PM 30 Emissions =	**0.19**	lb/hr	**0.83**	ton/yr

Inactive Piles

Inactive pile area = 0.00 acres

PM Emissions = Area * Inactive Storage Pile EF * yr

PM 2.5 Emissions =	**0.00**	lb/hr	**0.00**	ton/yr
PM 10 Emissions =	**0.00**	lb/hr	**0.00**	ton/yr
PM 30 Emissions =	**0.00**	lb/hr	**0.00**	ton/yr

ANNUAL EMISSIONS	ton PM 2.5/yr	ton PM 10/yr	ton PM 30/yr
Active Storage Piles =	0.06	0.39	0.83
Inactive Storage Piles =	0.00	0.00	0.00
SITE TOTALS =	**0.06**	**0.39**	**0.83**

HOURLY EMISSIONS	lb PM 2.5/hr	lb PM 10/hr	lb PM 30/hr
Active Storage Piles =	0.01	0.09	0.19
Inactive Storage Piles =	0.00	0.00	0.00
SITE TOTALS =	**0.01**	**0.09**	**0.19**

Table B
Vehicle Traffic on Unpaved Roads

(based on AP-42 Section 13.2.2 Unpaved Roads, 2006)

$E = k(s/12)^a(W/3)^b * [(365 - P)/365]$ Particulate emission factor, lb/VMT

Where:

k (PM 10) = 1.5 constant for PM-10, lb/VMT
a = 0.9
b = 0.45
k (PM 30) = 4.9 constant for PM-30, lb/VMT
a = 0.7
b = 0.45

s = **6.4** surface material silt content, %
(from AP-42 Table 13.2.2.1 for MSW Landfill)
W = **34** Mean weight of vehicles, tons
(Truck weight: 25 tons empty, 25+18 tons full)
P = **115** (Figure 13.2.1.2 for days with >0.01 in precipitation)

EF = 1.7 PM-10 lb/VMT
EF = 6.4 PM-30 lb/VMT

Control Efficiency from watering = **0%**

Annual Emission Rates

Trips = 17,520 Vehicle trips per year (annual tons ash ÷ 18 ton/truck)
876 Additional trucks for refined ash (with precious metals)
Distance = 2,250 Distance per trip, feet
VMT = 7,839 Vehicle miles traveled per year

Uncontrolled		Controlled (with watering)	
6.8	tpy PM 10	6.8	tpy PM 10
25.3	tpy PM 30	25.3	tpy PM 30

Hourly Emission Rates

Trips = 4.0 Vehicle trips per hour
Distance = 2,250 Distance per trip, feet
VMT = 1.7 Vehicle miles traveled per hour

Uncontrolled		Controlled (with watering)	
3.0	lb/hr PM 10	3.0	lb/hr PM 10
11.0	lb/hr PM 30	11.0	lb/hr PM 30

ATTACHMENT B

2009 through 2015 Annual Composite Combined Ash Analytical Data

(Source: 2015 Xcel Energy Annual Ash Testing Report for the Red Wing Ash Disposal Facility, MPCA Permit SW-307)

Table 3

Red Wing Ash Landfill
Total Composition Analysis
Combined Ash
2009 - 2015 Annual Composites

Parameters		2009 Ave	2009 Std	2010 Ave	2010 Std	2011 Ave	2011 Std	2012 Ave	2012 Std	2013 Ave	2013 Std	2014 Ave	2014 Std	2015 Ave	2015 Std
Aluminum	mg/kg	26,346	1,472	25,197	4,519	28,959	1,332	24,467	1,234	25,883	778	23,200	1,691	24,917	2,434
Arsenic	mg/kg	20.4	0.7	17.2	0.8	0.2	0.2	22.8	1.3	23.4	0.8	20.5	2.6	22.3	1.9
Barium	mg/kg	563	11	503	79	672	27	700	44	602	14	524	38	532	68
Boron	mg/kg	175	5	186	29	244	6	186	13	228	5	179	16	187	13
Cadmium	mg/kg	19.4	0.4	17.1	4.0	17.7	1.8	27.6	1.4	22.2	0.7	18.8	2.6	18.2	1.1
Calcium	mg/kg	107,268	2,732	117,686	17,362	101,117	2,418	151,500	5,089	108,167	2,483	97,750	8,335	87,883	38,561
Chloride	mg/L	1,376	174	3,368	41	3,144	127	4,118	177	3,610	141	1,284	477	390	55
Chromium	mg/kg	131	24	68	13	110	5	93	7	143	3	125	10	112	9
Copper	mg/kg	9,760	10,749	1,816	272	4,412	4,029	2,795	505	3,032	1,427	2,952	1,115	1,853	425
Iron	mg/kg	17,222	1,088	13,282	2,035	20,370	1,446	18,783	527	14,283	500	23,417	2,412	12,800	681
Lead	mg/kg	1,510	45	1,031	261	948	46	860	66	1,108	160	1,031	75	768	24
Magnesium	mg/kg	7,931	218	7,766	1,154	9,193	141	9,660	785	9,682	257	9,520	578	9,188	427
Manganese	mg/kg	879	10	869	135	1,527	50	1,074	67	951	41	936	122	887	184
Mercury	mg/kg	1.3	0.2	1.2	0.0	1.4	0.1	1.8	0.1	1.8	0.1	2.3	0.7	1.7	0.1
Nickel	mg/kg	109	22	82	21	107	14	203	282	95	9	120	17	102	29
Selenium	mg/kg	1.7	0.2	(2.5)	0.0	(2.5)	0.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.8	0.1	2.2	1.1
Silver	mg/kg	10.2	13.3	13.7	2.7	5.3	1.3	2.8	0.4	11.6	12.1	2.0	0.5	2.9	0.8
Sodium	mg/kg	11,353	272	11,768	1,733	11,562	322	13,833	463	13,567	427	12,617	1,212	12,567	674
Strontium	mg/kg	322	10	253	34	367	36	333	51	360	16	372	31	259	15
Sulfate	mg/L	137.8	20.2	54.3	9.0	8.8	18.6	155.8	17.1	60.8	13.4	167.2	49.4	54.0	6.1
Tin	mg/kg	96.2	7.7	94.8	6.1	213.9	89.1	192.8	15.0	209.8	151.1	227.3	30.0	112.9	9.0
Zinc	mg/kg	2,607	72	2,512	308	3,897	799	3,883	234	3,133	143	2,978	218	2,863	310

Air Dry Loss	%	16.43%
LOI	%	7.82%

#DIV?0!=all results were below Reporting Detection Limits of 2.48 mg/kg

ATTACHMENT C

Calculation of 2,3,7,8-TCDD TEQ

ATTACHMENT C
CALCULATION OF DIOXIN TOXIC EQUIVALENT CONCENTRATION
RED WING ASH LANDFILL
RED WING, MINNESOTA

Parameter	TEF	Red Wing Comb Ash 2/1/1996	
		Result	TEQ
Dioxins/Furans (pg/g) [a]			
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1	58	58
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	1	280	280
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1	400	40
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1	790	79
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1	600	60
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	0.01	6400	64
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	0.0003	13000	3.9
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	0.1	270	27
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	0.03	520	15.6
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	0.3	790	237
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	0.1	780	78
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.1	870	87
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	0.1	330	33
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.1	1100	110
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	0.01	3200	32
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	0.01	500	5
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	0.0003	1800	0.54
Total Tetrachlorodibenzo-p-dioxin (TCDD)		1800	
Total Pentachlorodibenzo-p-dioxin (PeCDD)		3900	
Total Hexachlorodibenzo-p-dioxin (HxCDD)		9100	
Total Heptachlorodibenzo-p-dioxin (HpCDD)		12000	
Total Tetrachlorodibenzofuran (TCDF)		6300	
Total Pentachlorodibenzofuran (PeCDF)		7900	
Total Hexachlorodibenzofuran (HxCDF)		7500	
Total Heptachlorodibenzofuran (HpCDF)		5200	
2,3,7,8-TCDD TEQ [b]			1210

Notes:

TEF: Toxicity Equivalency Factor
TEQ: Toxic Equivalent
pg/g: picogram per gram

[a] Analytical results represent the 1995 annual composite for combined ash. Data were obtained from the "1995 Annual Ash Testing Report for the Northern States Power Company's Red Wing Steam Plant".

[b] The TEQ is calculated by multiplying each dioxin and furan concentrations by its TEF to derive a TEQ, then summing the TEQs.

USEPA, 2010. Recommended Toxicity Equivalence Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8-Tetrachlorodibenzo-p-dioxin and Dioxin-Like Compounds. 100-R-10-005. December.

Appendix C

Waste Characterization Information

Red Wing Solid Waste Boiler Facility

Combined Ash Annual Test Results Statistical Summary

Annual Total Composition Testing Parameters for COMBINED Ash

Test Data in Accordance with Minn. Rules Part 7035.2910 Subp. 4 (A)(1) & (2) as amended by the 1996 MSW Combustor Ash Testing Variance

Test Parameter	1997 (mg/kg)	1998 (mg/kg)	1999 (mg/kg)	2000 (mg/kg)	2001 (mg/kg)	2002 (mg/kg)	2003 (mg/kg)	2004 (mg/kg)	2005 (mg/kg)	2006 (mg/kg)	2007 (mg/kg)	2008 (mg/kg)	2009 (mg/kg)	2010 (mg/kg)	2011 (mg/kg)	2012 (mg/kg)	2013 (mg/kg)		Maximum (mg/kg)	Minimum (mg/kg)	Std. Dev. (mg/kg)	Average (mg/kg)
Aluminum	50,667	43,500	41,333	47,333	24,667	27,667	22,667	28,833	20,850	25,050	43,450	25,817	23,717	31,200	26,917	22,017	61,800		61,800	20,850	11,795	33,381
Arsenic	10	9.0	12	17	7.3	9.5	8.6	12	12.3	7.4	13.1	8.8	27.9	26.4	19.8	111	2.7		111	2.7	24	19
Barium	670	653	353	472	323	348	383	548	309	340	338	343	443	415	518	589	481		670	309	114	443
Boron	115	110	95	167	66	83	64	121	75.6	94.9	69.8	94.7	109	85.2	73.8	78.1	96.1		167	64	25	94
Cadmium	9.2	5.5	9	29	32	27	30	59	26.9	32.1	47.4	24.3	22.0	23.4	29.1	34.2	40.8		59	5.5	13	28
Calcium	72,333	56,500	69,667	56,333	61,667	54,167	76,667	86,833	77,883	64,283	83,667	88,867	77,233	68,650	76,450	75,883	99,000		99,000	54,167	11,996	73,299
Chloride	8,750	8,300	6,133	3,633	6,633	8,367	12,500	14,500	17,683	17,350	14,633	17,517	9,537	7,523	12,883	18,250	13,817		18,250	3,633	4,489	11,648
Chromium	757	477	99	131	91	123	291	78	143	30.3	88.1	65.4	206	79.9	70.4	91.4	121		757	30.3	179	173
Copper	808	2,683	2,215	963	638	1,043	670	2,065	1,300	763	3,985	4,056	943	5,841	650	560	2,095		5,841	560	1,477	1,840
Iron	49,500	49,167	33,833	34,000	25,500	34,500	22,167	38,333	36,283	11,967	51,067	31,400	53,700	34,000	71,633	49,817	20,588		71,633	11,967	14,227	38,086
Lead	3,450	1,467	555	407	1,083	318	422	1,495	10,615	654	5,055	680	1,601	312	288	490	465		10,615	288	2,542	1,727
Magnesium	10,650	10,000	9,250	8,617	7,483	7,083	8,383	7,600	7,705	5,183	5,497	8,617	6,367	7,103	4,823	6,663	7,812		10,650	4,823	1,561	7,579
Manganese	600	808	530	792	347	508	330	417	351	281	587	409	481	550	617	755	455		808	281	156	519
Mercury	0.1	0.1	0.7	3.2	1.3	1.9	3.2	4.7	2.0	3.3	3.2	1.3	1.7	1.1	2.3	1.9	1.6		4.7	0.1	1	2
Nickel	140	132	56	210	64	107	68	43	70.9	27.8	90.9	54.4	91.1	74.7	57.7	58.4	43.3		210	27.8	44	82
Selenium	4.1	9.1	1.0	13	3.9	1.9	7.9	16	1.2	1.1	6.7	1.0	7.2	4.6	1.0	7.3	4.3		16	1.0	4	5
Silver	11	27	93	4.7	9.6	104	3.5	64	49.2	1.6	10.9	0.9	2.8	5.7	1.9	3.3	3.1		104	0.9	32	23
Sodium	25,167	7,900	29,167	8,900	8,033	10,267	7,900	9,000	6,257	6,677	7,697	8,563	7,453	7,362	8,010	9,397	9,558		29,167	6,257	6,229	10,430
Strontium	203	170	173	130	902	430	607	2,200	643	172	838	285	2,522	2,125	3,241	7,898	1,263		7,898	130	1,872	1,400
Sulfate	10,583	7,500	6,233	3,567	5,517	3,650	3,350	8,483	8,232	2,363	13,017	10,205	1,857	1,835	1,595	2,118	3,028		13,017	1,595	3,485	5,478
Tin	151	91	50	96	73	85	82	150	120	198	107	186	240	139	65.5	84.1	116		240	50	50	120
Zinc	4,517	4,417	2,833	6,617	3,167	6,883	4,767	6,000	9,670	2,657	3,525	8,285	3,398	3,285	3,510	2,857	5,678		9,670	2,657	2,006	4,827

Annual Physical Characteristics Testing Parameters for COMBINED Ash

Test Data in Accordance with Minn. Rules Part 7035.2910 Subp. 4 (C)(1) & (2) as amended by the 1996 MSW Combustor Ash Testing Variance

Test Parameter	1997 (%)	1998 (%)	1999 (%)	2000 (%)	2001 (%)	2002 (%)	2003 (%)	2004 (%)	2005 (%)	2006 (%)	2007 (%)	2008 (%)	2009 (%)	2010 (%)	2011 (%)	2012 (%)	2013 (%)		Maximum (%)	Minimum (%)	Std. Dev. (%)	Average (%)
% Moisture	34.8	33.2	40.7	39.3	48.9	42.0	42.8	39.8	25.6	37.6	29.3	28.4	34.7	29.6	25.8	31.4	17.0		48.9	17.0	7.6	34.2
% Combustible	17.2	14.8	34.9	32.7	41.7	33.8	32.3	28.0	21.5	18.8	14.5	16.5	20.1	22.7	20.9	27.4	28.4		41.7	14.5	7.8	25.1

Annual Total Composition Testing (Dioxins & Furans) Parameters for COMBINED Ash

Test Data in Accordance with Minn. Rules Part 7035.2910 Subp. 4 (A)(3) as amended by the 1996 MSW Combustor Ash Testing Variance

May Discontinue if Total 2,3,7,8-TCDD Equivalence Historically < 1 ppb

Test Parameter	1997	1998	1999 (pg/g) ppt	2000	2001 (pg/g) ppt	2002	2003 (pg/g) ppt	2004	2005 (ng/kg) ppt	2006	2007 (ng/kg) ppt	2008	2009 (ng/kg) ppt	2010	2011 (ng/kg) ppt	2012 (ng/kg) ppt	2013 (ng/kg) ppt		Maximum (ng/kg)	Minimum (ng/kg)	Std. Dev. (ng/kg)	Average (ng/kg)
Dioxins - TCDD (Total)			795		886		2,420		905		400		110		Discontinued	Discontinued	Discontinued		2,420	110	737	919
Furans - TCDF (Total)			2,550		4,075		16,400		5,300		2,050		795		Discontinued	Discontinued	Discontinued		16,400	795	4,911	5,195
Total 2,3,7,8-TCDD Equivs.			23		21		63		660		270		63		Discontinued	Discontinued	Discontinued		660	21	206	183

Summary of Detected Parameters in Leachate Tests
Red Wing Ash Disposal Facility
February 2011

		Discharge Limits		Water Quality Standards			1/6/2011	SPLP Results		
Parameter	**Units**	**Red Wing Discharge Limit**	**RCRA Hazardous Limit**	**IL**	**HRL**	**MCL**	**Curent Ash Leachate**	**MSW Ash**	**MSW Fines**	**MSW Fines/Ash**
Major Leachate Constituents										
Alkalinity, total as CaCO3	mg/L	--	--	--	--	--	--	136	236	325
Calcium, total	mg/L	--	--	--	--	--	678	158	148	153
Chloride	mg/L	--	--	--	--	--	4810	401	245	302
Magnesium, total	mg/L	--	--	--	--	--	186	52.5	25.3	50.1
Potassium, total	mg/L	--	--	--	--	--	509	39.9	89.3	47
Sodium, total	mg/L	--	--	--	--	--	1770	101	221	127
Sulfate	mg/L	--	--	--	--	--	105	174	341	204
Inorganics/Metals										
Aluminum, total	ug/L	--	--	--	--	--	7.3	<100	121	<100
Ammonia Nitrogen	ug/L	--	--	--	--	--	29900	<100	27300	<100
Arsenic, total	ug/L	--	5000	2.5	--	10	**2.8**	<5	<5	<5
Barium, total	ug/L	--	100000	500	2000	2000	**2570**	200	87	140
Boron	ug/L	--	--	150	600	--	**1680**	**685**	**1470**	**5530**
Cadmium, total	ug/L	200	1000	1	4	5	**3.7**	<0.5	<0.5	<0.5
Chromium, total	ug/L	2800	5000	25	100	100	<0.50	<5	21	<5
Copper, total	ug/L	3380	--	250	--	--	10.2	262	19.7	217
Iron, total	ug/L	--	--	--	--	--	776	<25	1250	<25
Lead, total	ug/L	400	5000	--	--	--	4.5	<1.5	2.8	<1.5
Manganese, total	ug/L	--	--	250	100	--	**3080**	101	518	204
Mercury, total	ug/L	100	200	0.5	--	2	<0.20	**0.76**	**2.3**	**0.79**
Nickel, total	ug/L	2980	--	25	100	--	20.4	**44.3**	**49.9**	**104**
Nitrate + Nitrite, as N	mg/L	--	--	2.5	10	10	0.91	3.8	7.88	3.45
Phosphorous	mg/L	--	--	--	--	--	--	<0.1	16.9	0.11
Selenium, total	ug/L	--	1000	7.5	30	50	0.55	<7.5	<7.5	<7.5
Silver, total	ug/L	430	5000	7.5	30	--	<0.50	<5	<5	<5
Tin, total	ug/L	--	--	1000	4000	--	<0.50	<37.5	<37.5	<37.5
Zinc, total	ug/L	2610	--	500	--	--	20.3	108	308	120
Other Parameters										
Organic Carbon, Total	mg/L	--	--	--	--	--	--	60.5	730	128
pH	SU	--	--	--	--	--	7.78	--	--	--
Phenols	ug/L	--	--	1000	4000	--	--	51	83.4	52.7
Volatile Organic Compounds										
Acetone	ug/L	--	--	175	700	--	--	507	683	<500
Methyl Ethyl Ketone	ug/L	--	200000	1000	4000	--	--	<200	3600	<200

Notes:	HRL	Minnesota Department of Health (MDH) Health Risk Limits (Minnesota Rules 4717.7500 and 4717.7860).
	MCL	Maximum Contaminant Level for Drinking Water Regulations and Health Advisories (U.S. EPA, May 2009).
	IL	Minnesota Pollution Control Agency Intervention Limit (Minnesota Rules 7035.2815); 25% of HRL where no IL has been established. Arsenic IL is listed at 2.5 ug/L consistent with most current permits.
	--	Not analyzed or no limit established.
	Bold	Value exceeds Intervention Limit.

Table 3

Red Wing Ash Landfill
Total Composition Analysis
Combined Ash
2009 - 2015 Annual Composites

Parameters		2009 Ave	2009 Std	2010 Ave	2010 Std	2011 Ave	2011 Std	2012 Ave	2012 Std	2013 Ave	2013 Std	2014 Ave	2014 Std	2015 Ave	2015 Std
Aluminum	mg/kg	26,346	1,472	25,197	4,519	28,959	1,332	24,467	1,234	25,883	778	23,200	1,691	24,917	2,434
Arsenic	mg/kg	20.4	0.7	17.2	0.8	0.2	0.2	22.8	1.3	23.4	0.8	20.5	2.6	22.3	1.9
Barium	mg/kg	563	11	503	79	672	27	700	44	602	14	524	38	532	68
Boron	mg/kg	175	5	186	29	244	6	186	13	228	5	179	16	187	13
Cadmium	mg/kg	19.4	0.4	17.1	4.0	17.7	1.8	27.6	1.4	22.2	0.7	18.8	2.6	18.2	1.1
Calcium	mg/kg	107,268	2,732	117,686	17,362	101,117	2,418	151,500	5,089	108,167	2,483	97,750	8,335	87,883	38,561
Chloride	mg/L	1,376	174	3,368	41	3,144	127	4,118	177	3,610	141	1,284	477	390	55
Chromium	mg/kg	131	24	68	13	110	5	93	7	143	3	125	10	112	9
Copper	mg/kg	9,760	10,749	1,816	272	4,412	4,029	2,795	505	3,032	1,427	2,952	1,115	1,853	425
Iron	mg/kg	17,222	1,088	13,282	2,035	20,370	1,446	18,783	527	14,283	500	23,417	2,412	12,800	681
Lead	mg/kg	1,510	45	1,031	261	948	46	860	66	1,108	160	1,031	75	768	24
Magnesium	mg/kg	7,931	218	7,766	1,154	9,193	141	9,660	785	9,682	257	9,520	578	9,188	427
Manganese	mg/kg	879	10	869	135	1,527	50	1,074	67	951	41	936	122	887	184
Mercury	mg/kg	1.3	0.2	1.2	0.0	1.4	0.1	1.8	0.1	1.8	0.1	2.3	0.7	1.7	0.1
Nickel	mg/kg	109	22	82	21	107	14	203	282	95	9	120	17	102	29
Selenium	mg/kg	1.7	0.2	(2.5)	0.0	(2.5)	0.0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.8	0.1	2.2	1.1
Silver	mg/kg	10.2	13.3	13.7	2.7	5.3	1.3	2.8	0.4	11.6	12.1	2.0	0.5	2.9	0.8
Sodium	mg/kg	11,353	272	11,768	1,733	11,562	322	13,833	463	13,567	427	12,617	1,212	12,567	674
Strontium	mg/kg	322	10	253	34	367	36	333	51	360	16	372	31	259	15
Sulfate	mg/L	137.8	20.2	54.3	9.0	8.8	18.6	155.8	17.1	60.8	13.4	167.2	49.4	54.0	6.1
Tin	mg/kg	96.2	7.7	94.8	6.1	213.9	89.1	192.8	15.0	209.8	151.1	227.3	30.0	112.9	9.0
Zinc	mg/kg	2,607	72	2,512	308	3,897	799	3,883	234	3,133	143	2,978	218	2,863	310

Air Dry Loss % 16.43%
LOI % 7.82%

#DIV?0!=all results were below Reporting Detection Limits of 2.48 mg/kg

ATTACHMENT C
CALCULATION OF DIOXIN TOXIC EQUIVALENT CONCENTRATION
RED WING ASH LANDFILL
RED WING, MINNESOTA

Parameter	TEF	Red Wing Comb Ash 2/1/1996 Result	TEQ
Dioxins/Furans (pg/g) [a]			
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1	58	58
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	1	280	280
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1	400	40
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1	790	79
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1	600	60
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	0.01	6400	64
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	0.0003	13000	3.9
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	0.1	270	27
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	0.03	520	15.6
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	0.3	790	237
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	0.1	780	78
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.1	870	87
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	0.1	330	33
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.1	1100	110
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	0.01	3200	32
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	0.01	500	5
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	0.0003	1800	0.54
Total Tetrachlorodibenzo-p-dioxin (TCDD)		1800	
Total Pentachlorodibenzo-p-dioxin (PeCDD)		3900	
Total Hexachlorodibenzo-p-dioxin (HxCDD)		9100	
Total Heptachlorodibenzo-p-dioxin (HpCDD)		12000	
Total Tetrachlorodibenzofuran (TCDF)		6300	
Total Pentachlorodibenzofuran (PeCDF)		7900	
Total Hexachlorodibenzofuran (HxCDF)		7500	
Total Heptachlorodibenzofuran (HpCDF)		5200	
2,3,7,8-TCDD TEQ [b]			1210

Notes:
TEF: Toxicity Equivalency Factor
TEQ: Toxic Equivalent
pg/g: picogram per gram
[a] Analytical results represent the 1995 annual composite for combined ash. Data were obtained from the "1995 Annual Ash Testing Report for the Northern States Power Company's Red Wing Steam Plant".
[b] The TEQ is calculated by multiplying each dioxin and furan concentrations by its TEF to derive a TEQ, then summing the TEQs.

USEPA, 2010. Recommended Toxicity Equivalence Factors (TEFs) for Human Health Risk Assessments of 2,3,7,8-Tetrachlorodibenzo-p-dioxin and Dioxin-Like Compounds. 100-R-10-005. December.

Appendix D

Facility Layout Information

SEH

Building a Better World
for All of Us®

MEMORANDUM

TO: Darryl Heaps, PE

FROM: Bryan Remer, PE, P.Eng.

DATE: May 10, 2016

RE: Lab USA Ash Processing Building
Site Design Basis Memo
SEH No. LABUS 136249 14.00

This memo describes the basis of the design for the Lab USA Ash Processing Building site.

Site Layout:

The building is located on the south western portion of the site. There are three existing or future items that restrict where the facility could be located.

1. The south edge of the site is made up of a wooded area that contains a scenic easement. The wooded area is not to be disturbed and is our southern limits of construction.
2. The east side of the site is to be saved for development by the City of Red Wing.
3. The northern portion of the site is to be saved for future Xcel Energy stormwater treatment ponds.

These constraints push the processing building as far to the south west as possible while still allowing room to slope up to the existing grade.

The processing building will have a gravel pad on the east and north sides. This pad is sized to allow trucks to back in to the building on the north side. The design truck used for the turning movements was a WB-67 (tractor with 53’ long trailer). Access to the pad will be via a 30’ wide gravel access road that will come from the north and allow trucks to enter the pad on the west side.

Site Grading

The site is located on a hillside that climbs as you travel south on the access road. The access road will climb up at a 10% grade until you reach the building pad. This slope closely matches the existing hill slope. This 10% is what limits the elevation of the building and pad. The building is the high point of the pad, with slopes draining away from the building generally towards the north. The site roads are all-weather and suitable for the volume and types of collection vehicles or other transportation equipment that will be used to move waste from the entrance to loading and unloading areas.

The south west corner of the building will require cutting the existing grade down to allow for a relatively flat pad. This cut will require up to 1.5H:1V slopes to the south of the building to ensure our grading doesn’t impact the wooded area to the south.

Bedrock

Based on our geotechnical exploration onsite, we have located areas of potential bedrock. The bedrock within our building footprint is approximately at Elevation 804.50. Approximately a 7’ separation between the finish floor elevation and the bedrock is needed for foundation design. The finish floor elevation of the building is set at

811.00, which is also the maximum possible elevation achievable while still remaining at 10% slope coming up on the access road.

Stormwater

All stormwater runoff drains from the pad or building will be diverted to the north where it will be directed east to a stormwater pond located north of a proposed City of Red Wing Laydown area. This stormwater pond will be sized to slow the post-development runoff rates to less than the pre-development runoff rates.

The pond outlet will discharge down the hill to lower elevations where it will continue to the east towards Bench Street. The pond will also provide sediment storage which will minimize any downstream migration of sediment from the site.

A diversion berm will be graded along the top of the cut south of the building to minimize runoff down the slope and separate flow further up the hill from runoff treated by the site stormwater basins. This will help minimize our stormwater pond size and provide separation from other properties.

Site Utilities

The site will require potable water, sanitary sewer, and electricity. These utilities are generally located north and east of our site.

Potable water will connect to the city water main at Bench Street to the northeast. Sanitary sewer will connect to the existing city sewer to the north. Electricity will connect to the existing electrical feeder at Bench Street.

Bjr/srp

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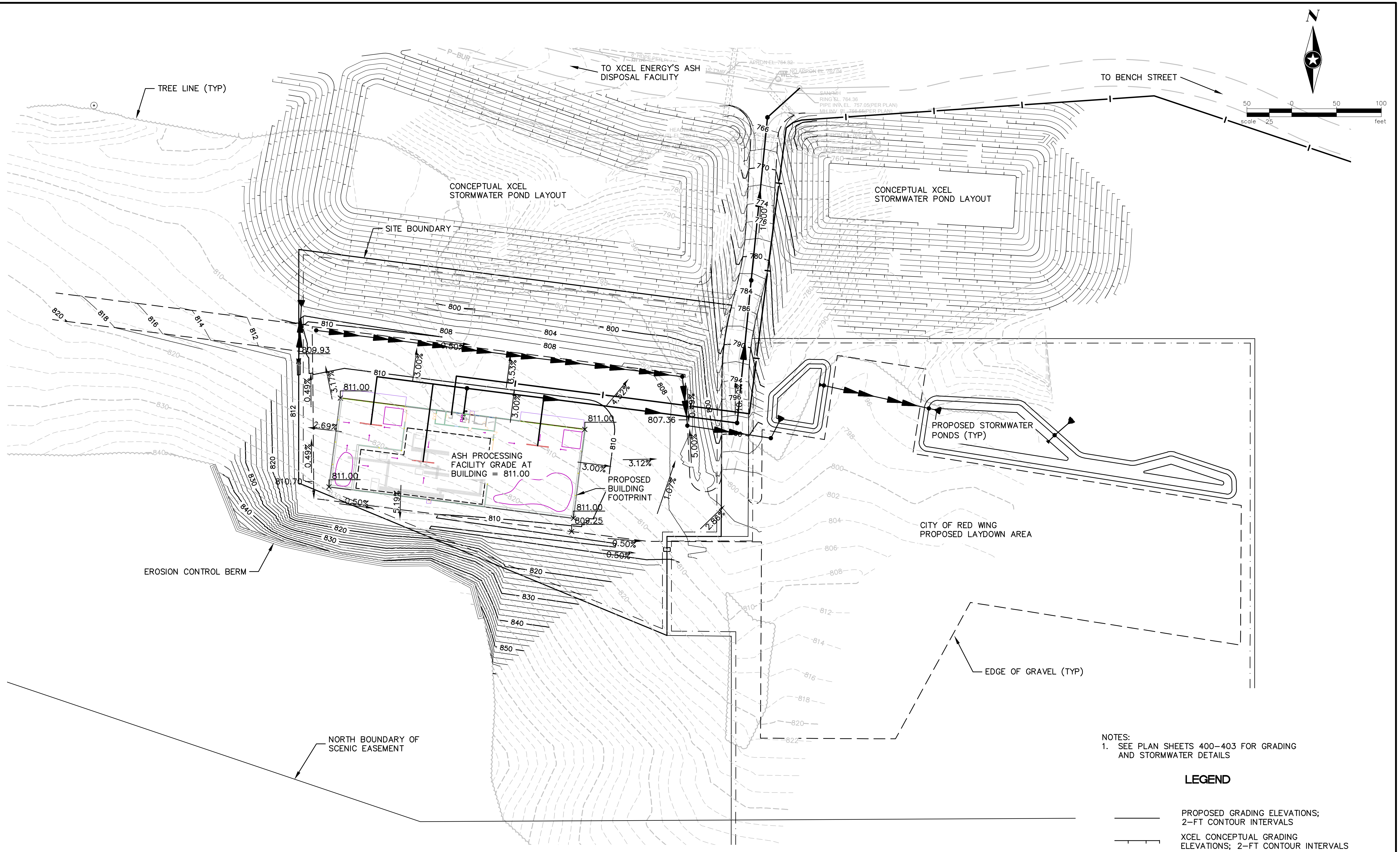

NOTES:
1. SEE PLAN SHEETS 400–403 FOR GRADING AND STORMWATER DETAILS

LEGEND

———	PROPOSED GRADING ELEVATIONS; 2–FT CONTOUR INTERVALS
—+—	XCEL CONCEPTUAL GRADING ELEVATIONS; 2–FT CONTOUR INTERVALS
– – –	EXISTING ELEVATIONS; 2–FT CONTOUR INTERVALS

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DRAWN BY:	DDL
DESIGNER:	BJR
CHECKED BY:	DRH
DESIGN TEAM	

NO.	BY	DATE	REVISIONS

PRELIMINARY:
NOT FOR CONSTRUCTION

SEH
651.490.2000
3535 VADNAIS CENTER DRIVE
ST. PAUL, MN 55110–5196
www.sehinc.com

Lab USA

LAB USA'S ASH PROCESSING FACILITY – RED WING

GRADING PLAN

FILE NO.
LABUS 136249

C300

Appendix E

Stormwater Information

SEH

Building a Better World
for All of Us®

MEMORANDUM

TO: Darryl Heaps

FROM: Dan Cazanacli

DATE: May 24, 2016

RE: Stormwater Pond Design for LAB USA Ash Processing Site - Red Wing, Minnesota
SEH No. LABUS 134253

Understanding

LAB USA plans to build an Ash Processing facility on a sublease parcel from the City of Red Wing which is in the process of leasing a larger parcel from XCEL Energy (XCEL) for material storage (Laydown Area).

Lab USA and the City of Red Wing will share the Access Road to their sites of operations, located west and east of the Access Road, respectively. Each site is bounded to the south by a steep, uphill area that will remain undisturbed and to the north by areas reserved for future XCEL ponds (one on each side of the Access Road).

A tentative agreement was reached with the City of Red Wing to build a single storm water pond that would provide water quality treatment and runoff control for both parcels to be developed (i.e., Lab USA processing site and City's Laydown Area). Completion of the design of the related stormwater pond will be performed following final design of the City's laydown area.

Storm Water Pond Location

The main stormwater pond would be constructed immediately north of the City Laydown Area. The pond would provide water quality treatment and runoff rate control. The location is dictated by the surrounding topography, the proposed City Laydown Area grading elevations, and the contours of the proposed XCEL (eastern) pond.

We also considered the option of constructing the pond within the ravine flowing west to east but that location would have conflicted with the lot limits and XCEL future pond. Furthermore, given the current topography, a pond at that location would have entailed placing a dam within the ravine, a scenario that would have triggered a more complex design given the potential for slope failure due to infiltration.

Drainage Configuration

Initially, it was planned to collect the drainage from the Lab USA site into a ditch that would drain, west to east, into the proposed pond. However, given the proposed XCEL (western) pond contours there is no room to excavate a ditch and still maintain the 3H:1V slope as desired by the XCEL. Therefore we propose collecting surface water from the full extent of the Lab USA site drainage into a pipe, routed first into a small pre-treatment basin, on the east side of the access road. The pre-treatment basin would in turn drain through a pipe into the main pond. The pre-treatment basin would enhance the water quality prior to entering the main pond.

Given the topography of the terrain, we propose that the runoff from the uphill area (that will remain undisturbed), be diverted around the Lab USA material processing areas, using a diversion berm per the request of the City and Lab USA and concurred to by Xcel. This element is essential so that the capacity of the proposed pond is not overwhelmed by a large volume of runoff from the steep, undeveloped area to the south. We make the same recommendation for the City Laydown Area. It is also the request of XCEL that no water from the City or Lab USA properties enter their stormwater basins.

Water Quality Sampling Location
We propose that a water quality sampling location be established at the outlet from the pre-treatment basin, just upstream of the main pond.

Storm Water Considerations
The proposed site is not part of a floodplain zone or in an otherwise flood designated area.
In accordance with the City of Red Wing Zoning Ordinance 57 - Stormwater Management Regulations, new developments disturbing over one acre require a Stormwater Management Plan. Per Ordinance 57, the key requirements applicable to this development are:

1. Provide rate control, specifically no increase in peak discharge rate for 2, 10, and 100-year 24-hour rainfall events.
2. Provide runoff volume control. Specifically, if possible, new developments are required to retain the runoff volume from rainfall events of up to 1-inch depth.

1. A HydroCAD model was developed to assess the performance of the pond and the runoff reduction under the following assumptions:

    - An overall drainage area of approximately 4 acres, each site (Lab USA and City Laydown Area) contributing roughly equal amounts.
    - Curve Number of 65 for existing conditions (grass/wood, fair condition) and a composite Curve Number of 82 for proposed conditions, reflecting approximately half of the drainage area remaining undeveloped (uphill, sloped surface) while the other half will be converted a gravel surface plus the processing building.
    - A time of concentration (TC) of 5 minutes (minimum value typically used for small surfaces) was employed for both existing and proposed conditions.

    The HydroCAD model and grading of the stormwater pond will be finalized once the drainage details for the City Laydown Area are known. The preliminary HydroCAD model results are summarized below:

Flow Rates(cfs)	Existing	Proposed
2-yr Peak	4.0	3.6
10-yr Peak	15.4	10.7
100-year Peak	45.3	19.2

    The results indicate that the proposed provides sufficient storage volume to reduce the outflow peak rates to values below the existing runoff peaks for 2, 10, and 100-year storms (24-hour, Atlas 14 distribution).

2. Typically, the runoff control involves some form of infiltration. However, given the presence of bedrock on site, infiltration may not advisable in this case. The bedrock within the Lab USA building footprint is approximately at Elevation 804.50. While it appears that at the proposed pond location the bedrock is lower there is, nonetheless a possibility that the bottom of the pond may intrude into the bedrock.

The MPCA Stormwater Construction Permit (MN R10001) recommends that in places where infiltration is not feasible, water quality volume be provided in form of a permanent pool, with a bottom located minimum 3 feet below the outlet with a minimum volume greater than 1,800 cubic feet per acre drained. The proposed pond meets and exceeds these criteria.

dc

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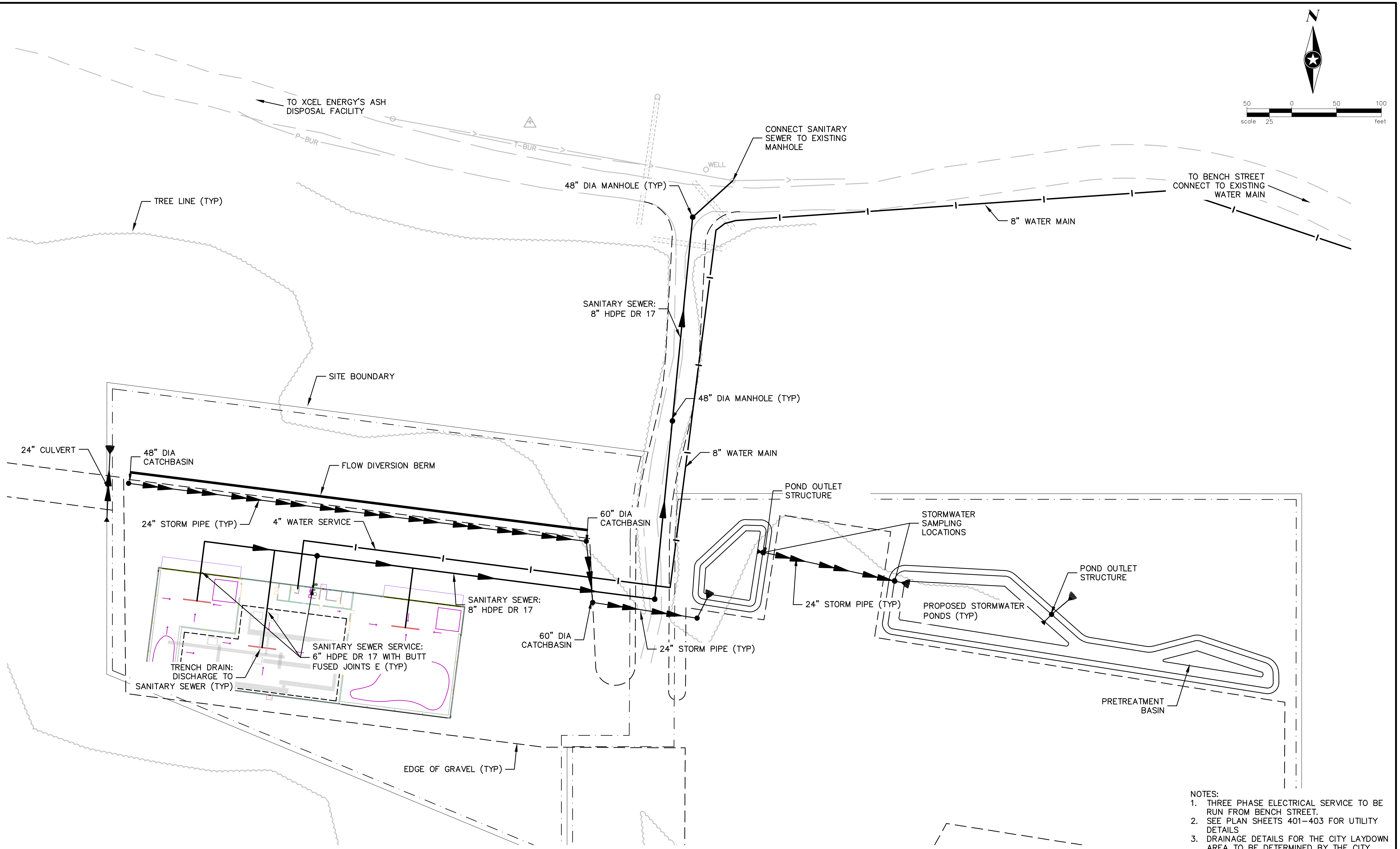


NOTES:

1. THREE PHASE ELECTRICAL SERVICE TO BE RUN FROM BENCH STREET.
2. SEE PLAN SHEETS 401–403 FOR UTILITY DETAILS
3. DRAINAGE DETAILS FOR THE CITY LAYDOWN AREA TO BE DETERMINED BY THE CITY.
4. A FLOW DIVERSION BERM NEEDS TO BE IMPLEMENTED TO DIVERT UPGRADIENT FLOW PRIOR TO REACHING CITY LAYDOWN AREA

P:\KO\L\LABUS\136249\5-final-dsgn\51-drawings\10-Civil\cad\dwg\plnshts\Permit Plan Set\LA136249_UT.dwg 5/24/2016 9:03 AM dlandrus

DRAWN BY: DDL
DESIGNER: BJR
CHECKED BY: DRH
DESIGN TEAM

NO.	BY	DATE	REVISIONS

**PRELIMINARY:
NOT FOR CONSTRUCTION**

SEH
651.490.2000
3535 VADNAIS CENTER DRIVE
ST. PAUL, MN 55110–5196
www.sehinc.com

Lab USA

LAB USA'S ASH PROCESSING
FACILITY - RED WING

SITE AND UTILITY LAYOUT

FILE NO.
LABUS 136249

C200

Appendix F

Subsurface Investigation Report

NTI
NORTHERN TECHNOLOGIES, LLC

6160 Carmen Avenue East
Inver Grove Heights, MN 55076
P: 651.389.4191 F: 651.389.4190

www.NTIgeo.com

Unearthing confidence™

May 16, 2016

SEH
Attention: Brent Theroux, P.E.
3535 Vadnais Center Drive
St. Paul, MN 55110

Subject: Geotechnical Data Report
Lab USA Ash Processing Building
Red Wing, Minnesota
NTI Project No. 16.61343.100

Northern Technologies, LLC (NTI) has completed a total of eleven (11) soil borings for the Lab USA Ash Processing Building project in the City of Red Wing, Minnesota.

The scope of services included performing the soil borings and laboratory testing, as requested, on select samples. Our services were performed in accordance with our proposal dated February 15, 2016.

SUBSURFACE EXPLORATION SUMMARY

NTI performed the subsurface exploration program on March 18 through March 24, 2016 with a two-person crew using a truck-mounted Dedrich D-50 drill rig. Samples were generally collected in accordance with ASTM D 1586 “Standard Test Method for Standard Penetration Testing (SPT) and Split-Barrel Sampling of Soils.”

The boring locations and depths were determined and staked in the field by a representative of the client. Please refer to the Boring Location Diagram and the Boring Logs in Appendix C.

LABORATORY TEST PROGRAM

An NTI geotechnical engineer described the available soil samples in general accordance with the NTI Soil Classification System, which is generally based on the Unified Soil Classification System (USCS) outlined in ASTM D 2488. The soil descriptions were determined by visual observations made by the engineer, the driller’s field notes, the SPT information, and the field and laboratory test results. Details of the NTI classification system are included in Appendix A.

CLOSURE

As the widely spaced, small diameter borings provide only a limited amount of data regarding the overall subsurface at the project site. Consequently, the area coverage of borings in relation to the entire project is very small. For this and other reasons, we do not warrant conditions below the depth of our borings, or that the strata logged from our borings are necessarily typical of the site.

The scope of services for this project does not include either specifically or by implication any environmental or biological assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This data report has been prepared for the exclusive use of SEH and its agents for specific application to the Lab USA Ash Processing Building project, in Red Wing, Minnesota. Northern Technologies, LLC has endeavored to comply with generally accepted geotechnical engineering practice common to the local area. Northern Technologies, LLC makes no other warranty, express or implied.

Northern Technologies, LLC

Debra A. Schroeder, P.E.
Project Geotechnical Engineer

Steven D. Gerber, P.E.
Senior Engineer

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.

Steven D. Gerber

Date: 5/16/2016 Reg. No. 45298

DAS/sdg

Attachments
Appendix A - General Notes
Appendix B – Laboratory Test Results
Appendix C - Attachments: Boring Location Diagram (1), Soil Boring Logs (11)

APPENDIX A

GEOTECHNICAL EVALUATION OF RECOVERED SOIL SAMPLES

We visually examined recovered soil samples to estimate distribution of grain sizes, plasticity, consistency, moisture condition, color, presence of lenses and seams, and apparent geologic origin. We then classified the soils according using the Unified Soil Classification System (ASTM D2488). A chart describing this classification system and general notes explaining soil sampling procedures are presented within appendices attachments.

The stratification depth lines between soil types on the logs are estimated based on the available data. In-situ, the transition between type(s) may be distinct or gradual in either the horizontal or vertical directions. The soil conditions have been established at our specific boring locations only. Variations in the soil stratigraphy may occur between and around the borings, with the nature and extent of such change not readily evident until exposed by excavation. These variations must be properly assessed when utilizing information presented on the boring logs.

We request that you, your design team or contractors contact NTI immediately if local conditions differ from those assumed by this report, as we would need to review how such changes impact our recommendations. Such contact would also allow us to revise our recommendations as necessary to account for the changed site conditions.

FIELD EXPLORATION PROCEDURES

Soil Sampling – Standard Penetration Boring:

Soil sampling was performed according to the procedures described by ASTM D-1586. Using this procedure, a 2 inch O.D. split barrel sampler is driven into the soil by a 140 pound weight falling 30 inches. After an initial set of six inches, the number of blows required to drive the sampler an additional 12 inches is recorded (known as the penetration resistance (i.e. “N-value”) of the soil at the point of sampling. The N-value is an index of the relative density of cohesionless soils and an approximation of the consistency of cohesive soils.

Soil Sampling – Power Auger Boring:

The boring(s) was/were advanced with a 6 inch nominal diameter continuous flight auger. As a result, samples recovered from the boring are disturbed, and our determination of the depth, extend of various stratum and layers, and relative density or consistency of the soils is approximate.

Soil Classification:

Soil samples were visually and manually classified in general conformance with ASTM D-2488 as they were removed from the sampler(s). Representative fractions of soil samples were then sealed within respective containers and returned to the laboratory for further examination and verification of the field classification. In addition, select samples were submitted for laboratory tests. Individual sample information, identification of sampling methods, method of advancement of the samples and other pertinent information concerning the soil samples are presented on boring logs and related report attachments.

General Notes

DRILLING & SAMPLING SYMBOLS

SYMBOL	DEFINITION
C.S.	Continuous Sampling
P.D.	2-3/8" Pipe Drill
C.O.	Cleanout Tube
3 HSA	3 ¼" I.D. Hollow Stem Auger
4 FA	4" Diameter Flight Auger
6 FA	6" Diameter Flight Auger
2 ½ C	2 ½" Casing
4 C	4" Casing
D.M.	Drilling Mud
J.W.	Jet Water
H.A.	Hand Auger
NXC	Size NX Casing
BXC	Size BX Casing
AXC	Size AX casing
SS	2" O.D. Split Spoon Sample
2T	2" Thin Wall Tube Sample
3T	3" Thin Wall Tube Sample

LABORATORY TEST SYMBOLS

SYMBOL	DEFINITION
W	Moisture content-percent of dry weight
D	Dry Density-pounds per cubic foot
LL, PL	Liquid and plastic limits determined in accordance with ASTM D 423 and D 424
Q_u	Unconfined compressive strength-pounds per square foot in accordance with ASTM D 2166-66
	Additional insertions in Qu Column
Qp	Penetrometer reading-tons/square foot
S	Torvane reading-tons/square foot
G	Specific Gravity – ASTM D 854-58
SL	Shrinkage limit – ASTM 427-61
pH	Hydrogen ion content-meter method
O	Organic content-combustion method
M.A.*	Grain size analysis
C*	One dimensional consolidation
Q_c^*	Triaxial Compression

* See attached data Sheet and/or graph

Water Level Symbol

Water levels shown on the boring logs are the levels measured in the borings at the time and under the conditions indicated. In sand, the indicated levels can be considered reliable ground water levels. In clay soils, it is not possible to determine the ground water level within the normal scope of a test boring investigation, except where lenses or layers of more pervious water bearing soil is present and then a long period of time may be necessary to reach equilibrium. Therefore, the position of the water level symbol for cohesive or mixed soils may not indicate the true level of the ground water table. The available water level information is given at the bottom of the log sheet.

Descriptive Terminology

DENSITY

TERM	"N" VALUE
Very Loose	0-4
Loose	5-8
Medium Dense	9 – 15
Dense	16 – 30
Very Dense	Over 30

CONSISTENCY

TERM	"N" VALUE
Soft	0-4
Medium	5-8
Rather Stiff	9 – 15
Stiff	16 – 30
Very Stiff	Over 30

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch OD split spoon.

Relative Proportions

TERMS	RANGE
Trace	0-5%
A little	5-15%
Some	15-30%
With	30-50%

Particle Sizes

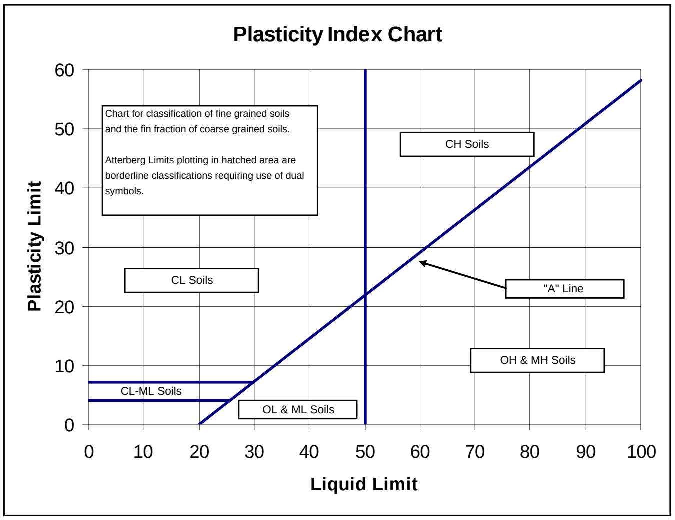
Boulders		Over 3"
Gravel -	Coarse	¾" – 3"
	Medium	#4 – ¾"
Sand -	Coarse	#4 - #10
	Medium	#10 - #40
	Fine	#40 - #200
Silt and Clay		Determined by plasticity characteristics.

Note: Sieve sizes are U.S. Standard.

Classification of Soils for Engineering Purposes

ASTM Designation D-2487 and D 2488 (Unified Soil Classification System)

Major Divisions			**Group Symbols**	**Typical Names**	**Classification Criteria**		
Course Grained Soils More than 50% retained on No. 200 sieve *	***Gravels*** 50% or more of coarse fraction retained on No. 4 sieve.	Clean Gravels	**GW**	Well –graded gravels and gravel-sand mixtures, little or no fines.	***Classification on basis of percentage of fines.*** Less than 5% passing No. 200 Sieve: GW, GP, SW, SP More than 12% passing No. 200 Sieve: GM, GC, SM, SC From 5% to 12% passing No. 200 Sieve: Borderline Classification requiring use of dual symbols.	$C_u = D_{60} / D_{10}$ greater than 4. $C_z = (D_{30})^2 / (D_{10} \times D_{60})$ between 1 & 3.	
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines.		Not meeting both criteria for GW materials.	
		Gravels with Fines	**GM**	Silty gravels, gravel-sand-silt mixtures.		Atterberg limits below “A” line, or P.I. less than 4.	Atterberg limits plotting in hatched area are *borderline* classifications requiring use of dual symbols.
			GC	Clayey gravels, gravel-sand-clay mixtures.		Atterberg limits above “A” line with P.I. greater than 7.	
	Sands More than 50% of coarse fraction passes No 4 sieve.	Clean Sands	**SW**	Well-graded sands and gravelly sands, little or no fines.		$C_u = D_{60} / D_{10}$ greater than 6. $C_z = (D_{30})^2 / (D_{10} \times D_{60})$ between 1 & 3.	
			SP	Poorly-graded sands and gravelly sands, little or no fines.		Not meeting both criteria for SW materials.	
		Sands with Fines	**SM**	Silty sands, sand-silt mixtures.		Atterberg limits below “A” line, or P.I. less than 4.	Atterberg limits plotting in hatched area are *borderline* classifications requiring use of dual symbols.
			SC	Clayey sands, sand-clay mixtures.		Atterberg limits above “A” line with P.I. greater than 7.	
Fine Grained Soils More than 50% passes No. 200 sieve *	***Silts and Clays***	Liquid Limit of 50% or less	**ML**	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands.			
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.			
			OL	Organic silts and organic silty clays of low plasticity.			
	Silts and Clays	Liquid Limit greater than 50%.	**MH**	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts.			
			CH	Inorganic clays of high plasticity, fat clays.			
			OH	Organic clays of medium to high plasticity.			
	Highly Organic Soils		**Pt**	Peat, muck and other highly organic soils.			



APPENDIX B

Northern Technologies Inc.
6160 Carmen Ave. E
Inver Grove Heights, MN, 55076
P: 651-389-4191

GRAIN SIZE DISTRIBUTION

ASTM C136 & D422

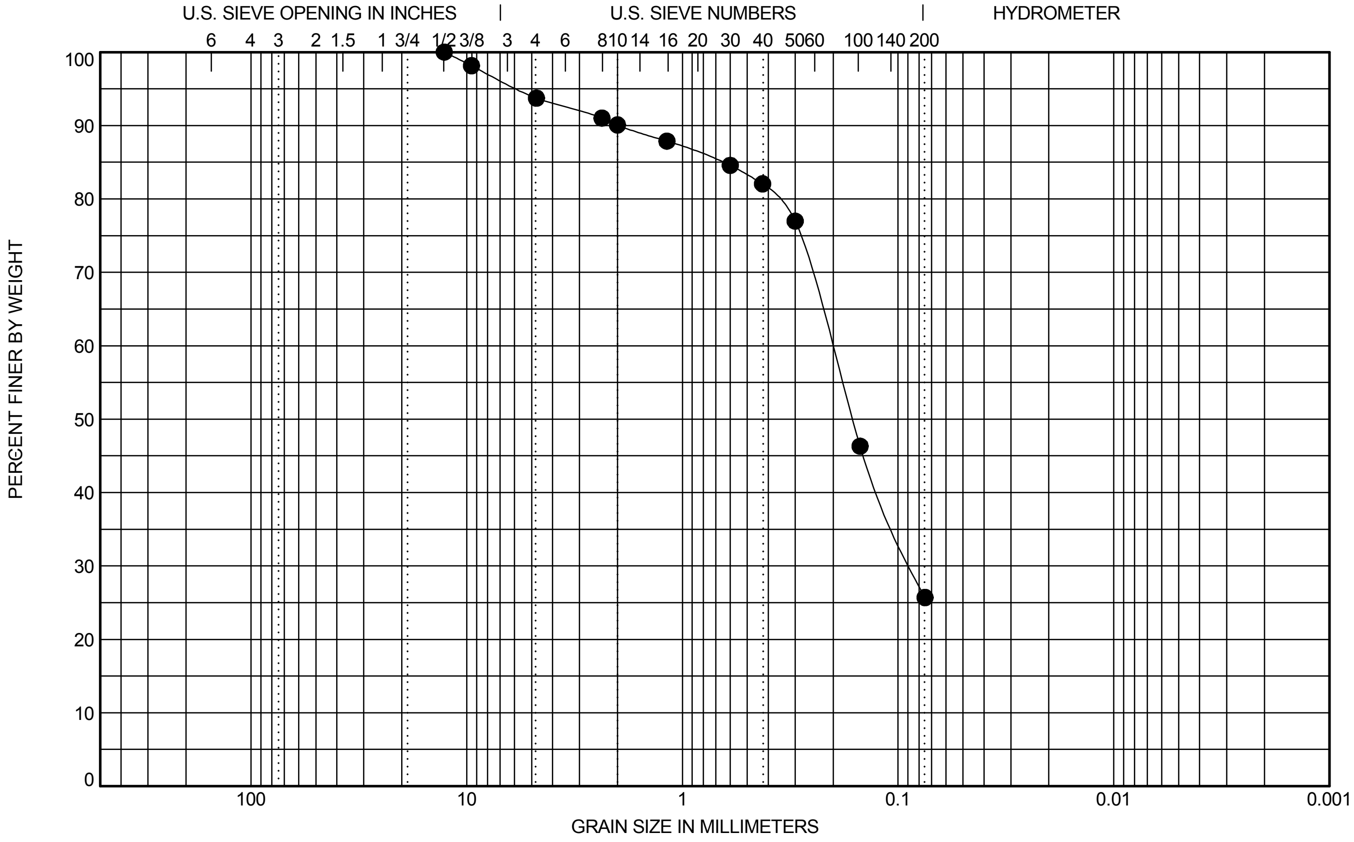
Report To:	SEH	Project:	Lab USA Ash Processing Building
		Project Number:	16.61343.100
Attention:		Location:	Red Wing, MN

Sample Information

Boring Number:	SB-1	Date Sampled:	3/22/2016
Sample Number:	10	Sampled By:	NTI
Sample Depth:	22	Sample Type:	SS
Classification:			

Sample Data

Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
		12.7	0.204	0.087		6.3	68.0	25.7	



Comments: Elevations provided by SEH.

Cc:

Submitted by,
Northern Technologies, LLC

(4/7/16)

Northern Technologies Inc.
6160 Carmen Ave. E
Inver Grove Heights, MN, 55076
P: 651-389-4191

GRAIN SIZE DISTRIBUTION

ASTM C136 & D422

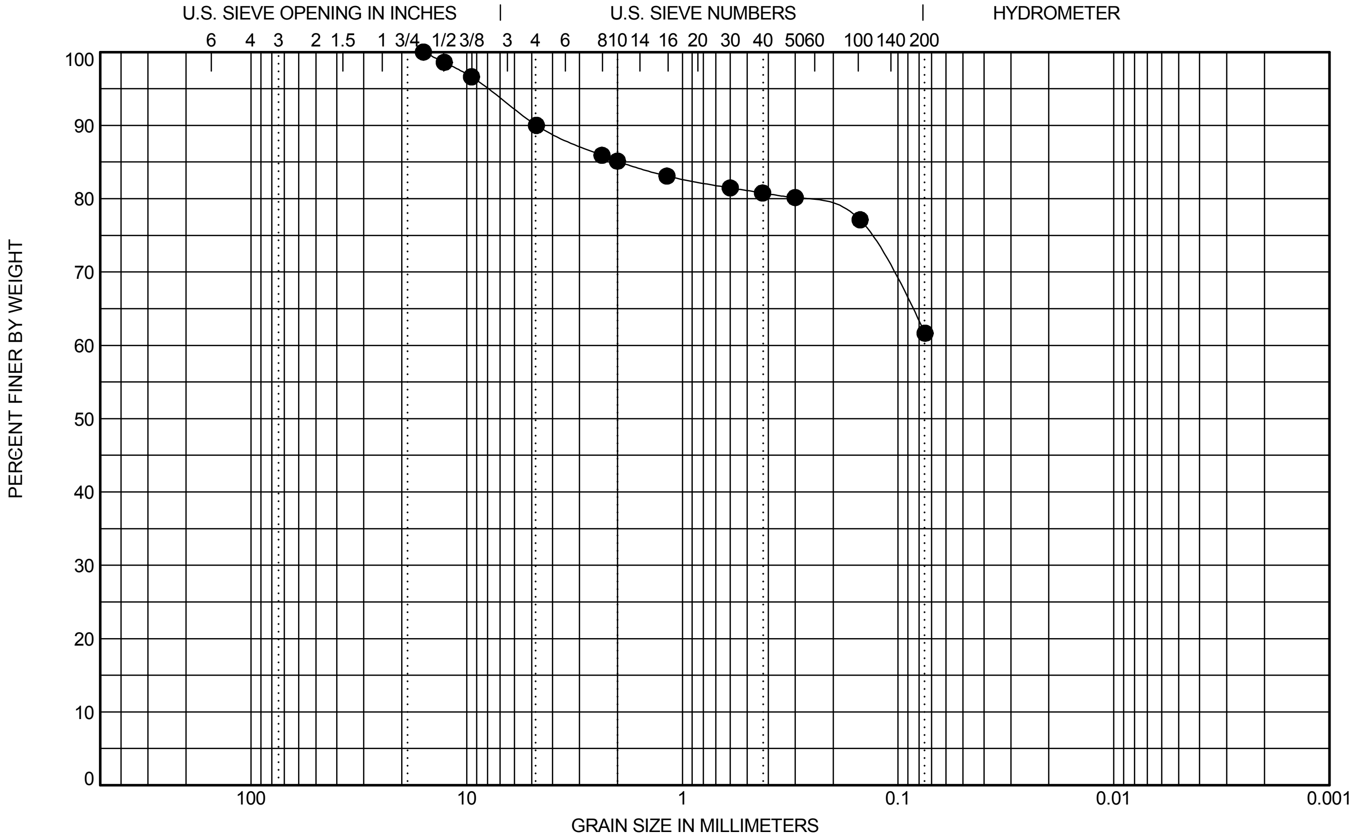
Report To:	SEH	Project:	Lab USA Ash Processing Building
		Project Number:	16.61343.100
Attention:		Location:	Red Wing, MN

Sample Information

Boring Number:	SB-3	Date Sampled:	3/22/2016
Sample Number:	6	Sampled By:	NTI
Sample Depth:	12	Sample Type:	SS
Classification:			

Sample Data

Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
		15.875				10.0	28.3	61.6	



Comments: Elevations provided by SEH.

Cc:

Submitted by,
Northern Technologies, LLC

(4/7/16)

Northern Technologies Inc.
6160 Carmen Ave. E
Inver Grove Heights, MN, 55076
P: 651-389-4191

GRAIN SIZE DISTRIBUTION

ASTM C136 & D422

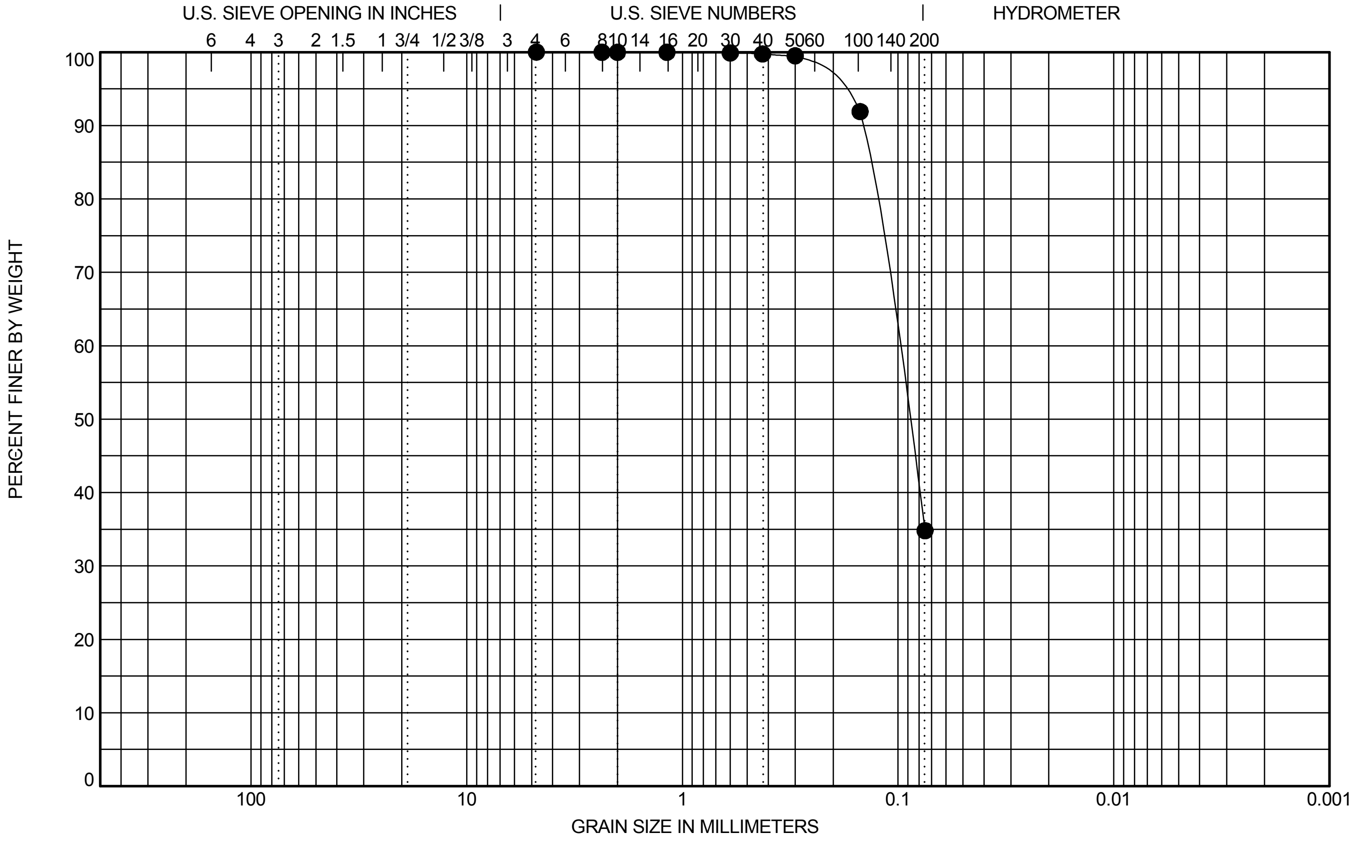
Report To:	SEH	Project:	Lab USA Ash Processing Building
		Project Number:	16.61343.100
Attention:		Location:	Red Wing, MN

Sample Information

Boring Number:	SB-5	Date Sampled:	3/24/2016
Sample Number:	11	Sampled By:	NTI
Sample Depth:	24.5	Sample Type:	SS
Classification:			

Sample Data

Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
		4.75	0.102			0.0	65.2	34.8	



Comments: Elevations provided by SEH.

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Northern Technologies, LLC

(4/7/16)

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Inver Grove Heights, MN, 55076
P: 651-389-4191

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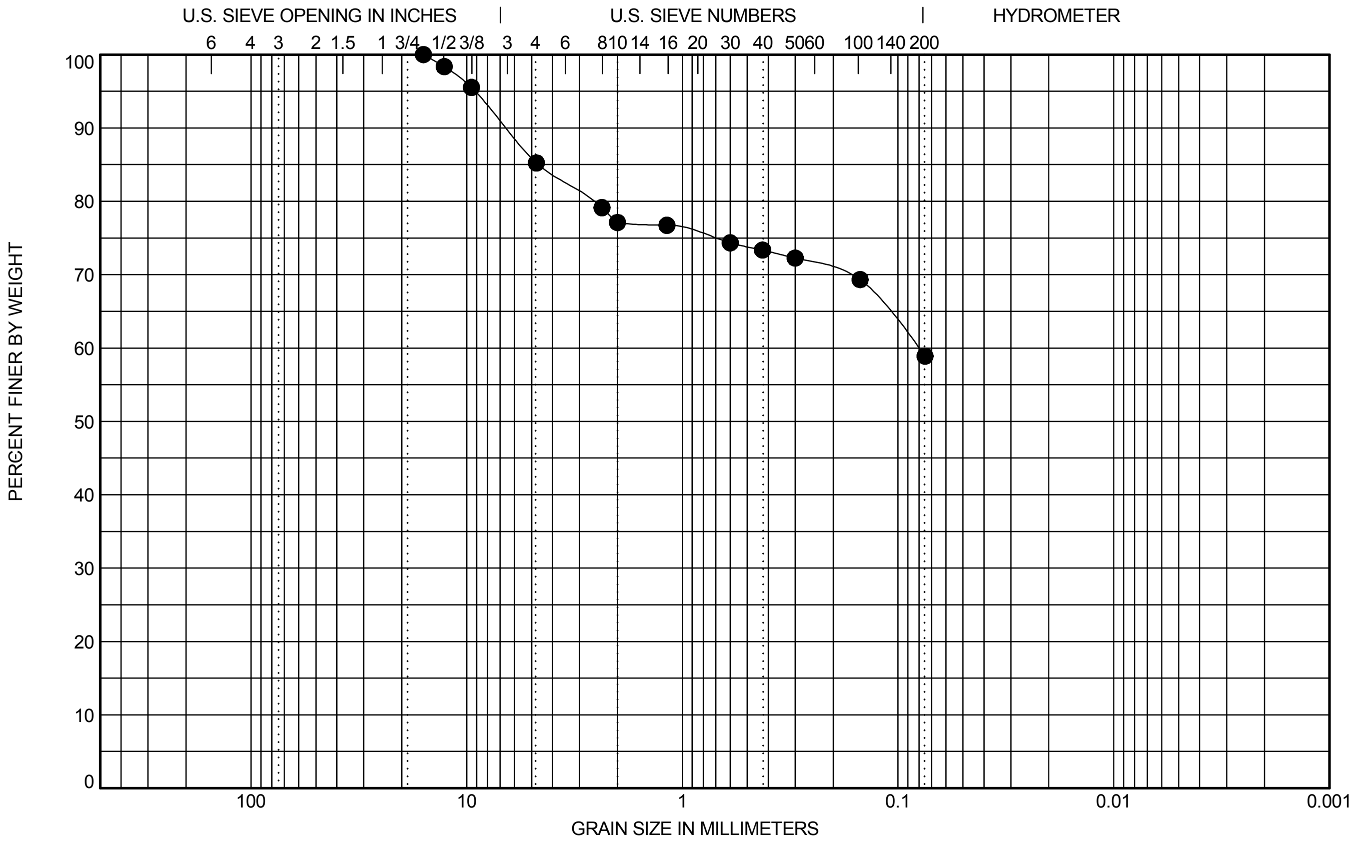
Report To:	SEH	Project:	Lab USA Ash Processing Building
		Project Number:	16.61343.100
Attention:		Location:	Red Wing, MN

Sample Information

Boring Number:	SB-6	Date Sampled:	3/18/2016
Sample Number:	9	Sampled By:	NTI
Sample Depth:	24.5	Sample Type:	SS
Classification:			

Sample Data

Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
		15.875	0.081			14.8	26.3	58.9	



Comments: Elevations provided by SEH.

Cc:

Submitted by,
Northern Technologies, LLC

(4/7/16)

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Northern Technologies Inc.
6160 Carmen Ave. E
Inver Grove Heights, MN, 55076
P: 651-389-4191

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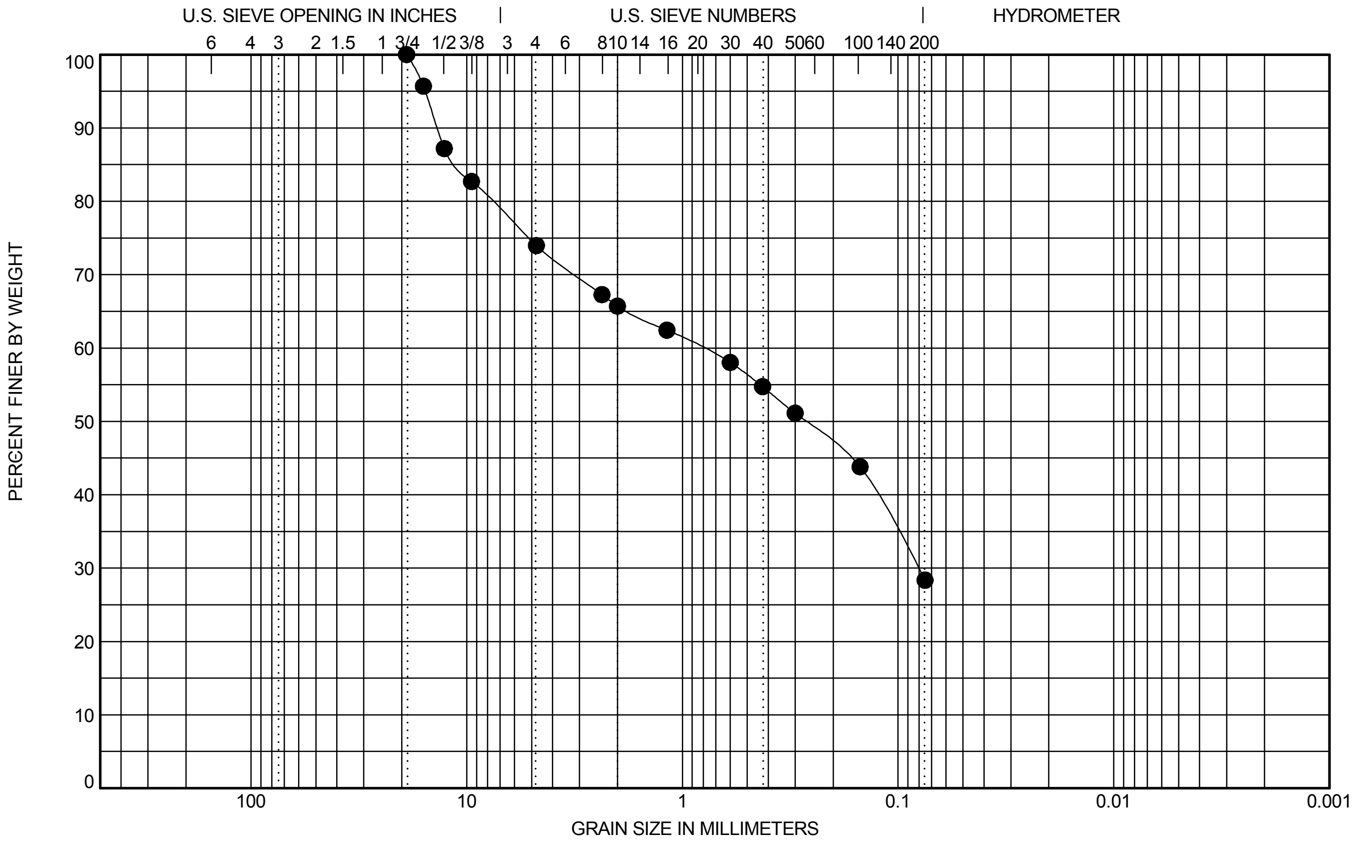
Report To:	SEH	Project:	Lab USA Ash Processing Building
		Project Number:	16.61343.100
Attention:		Location:	Red Wing, MN

Sample Information

Boring Number:	SB-7	Date Sampled:	3/22/2016
Sample Number:	10	Sampled By:	NTI
Sample Depth:	22	Sample Type:	SS
Classification:			

Sample Data

Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
		19	0.813	0.081		26.0	45.6	28.4	



Comments: Elevations provided by SEH.

Cc:

Submitted by,
Northern Technologies, LLC

(4/7/16)

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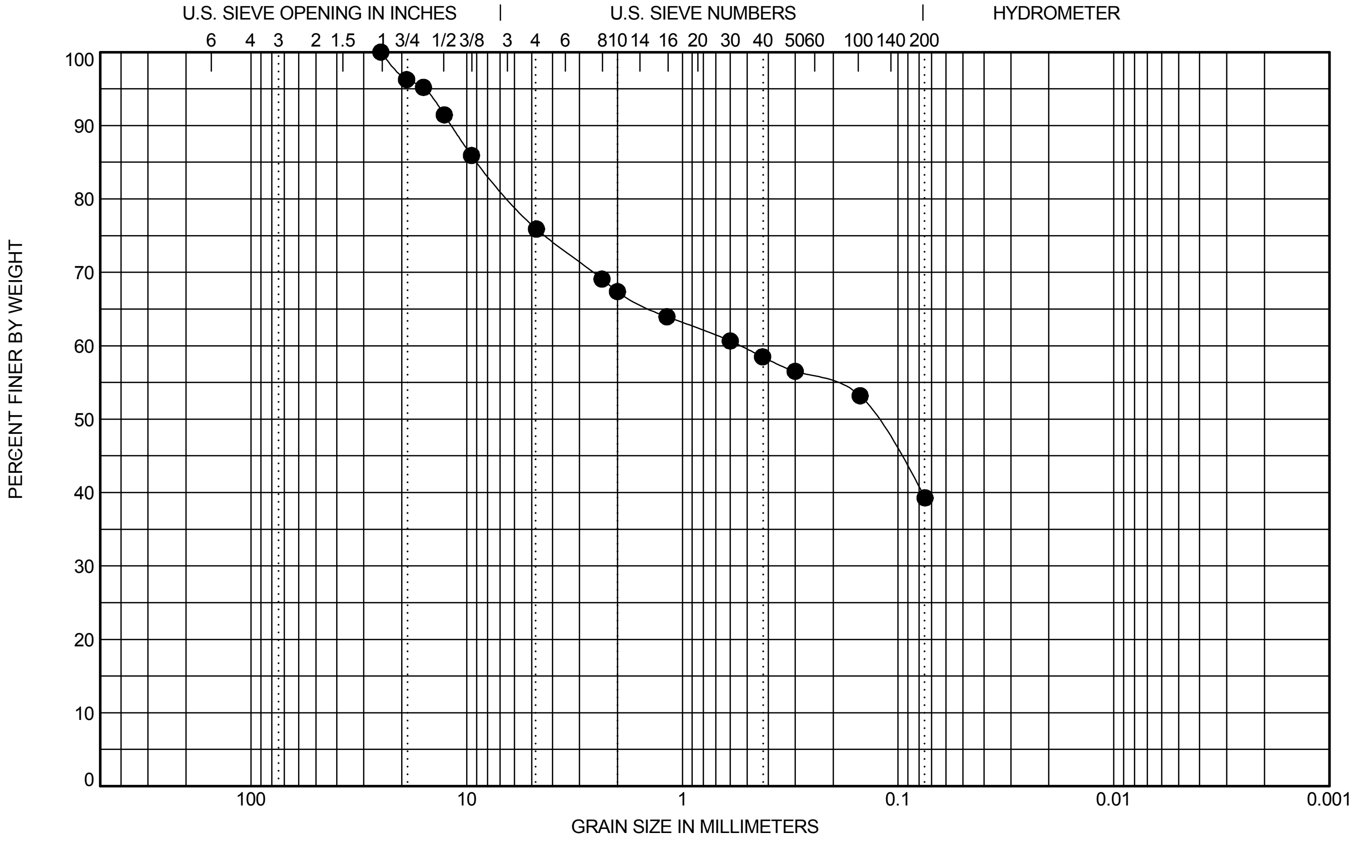
Report To:	SEH	Project:	Lab USA Ash Processing Building
		Project Number:	16.61343.100
Attention:		Location:	Red Wing, MN

Sample Information

Boring Number:	SB-7	Date Sampled:	3/22/2016
Sample Number:	12	Sampled By:	NTI
Sample Depth:	29.5	Sample Type:	SS
Classification:			

Sample Data

Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
		25	0.541			24.1	36.6	39.3	



Comments: Elevations provided by SEH.

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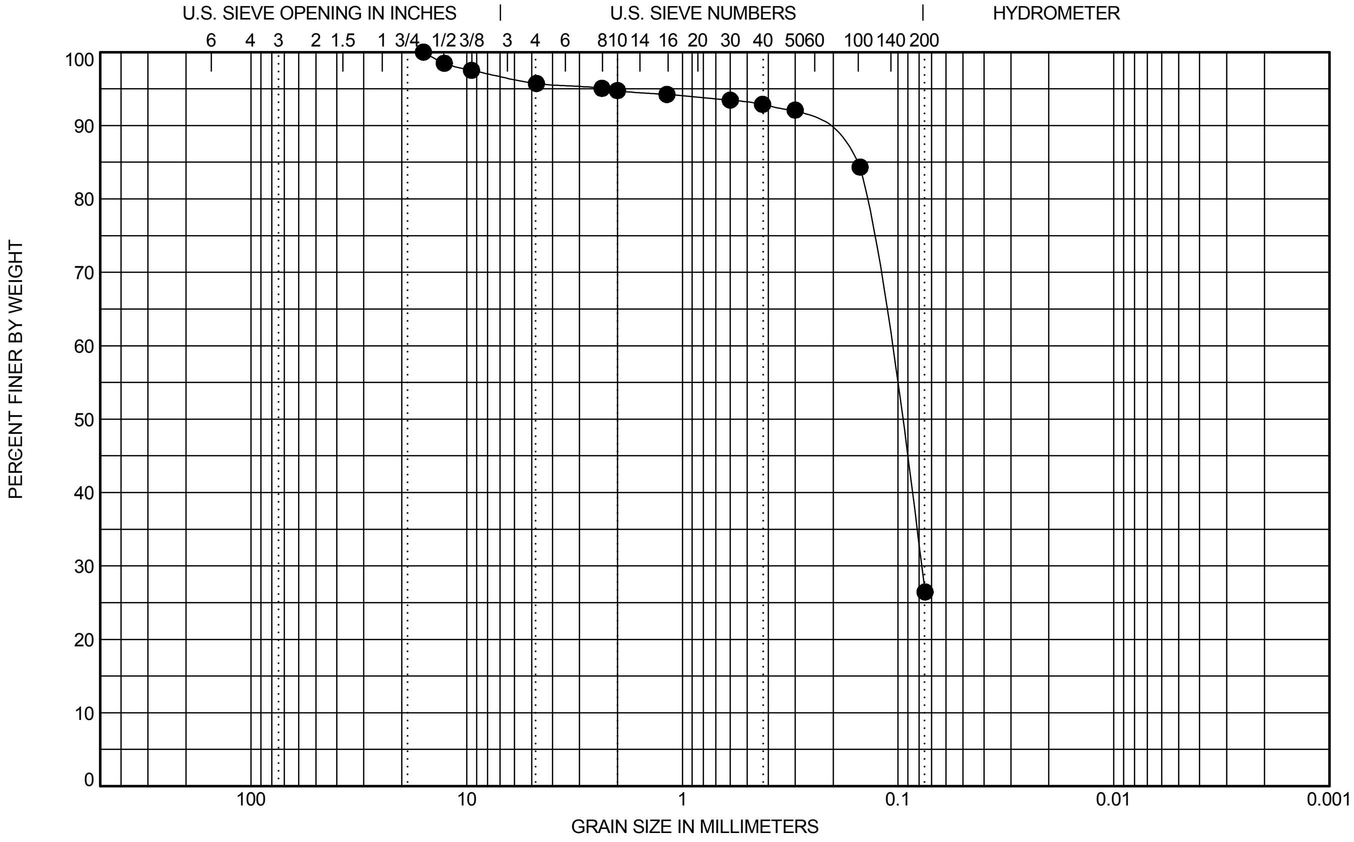
Report To:	SEH	Project:	Lab USA Ash Processing Building
		Project Number:	16.61343.100
Attention:		Location:	Red Wing, MN

Sample Information

Boring Number:	SB-7	Date Sampled:	3/22/2016
Sample Number:	13	Sampled By:	NTI
Sample Depth:	34.5	Sample Type:	SS
Classification:			

Sample Data

Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
		15.875	0.112	0.078		4.3	69.3	26.4	



Comments: Elevations provided by SEH.

Cc:

Submitted by,
Northern Technologies, LLC

(4/7/16)

Northern Technologies Inc.
6160 Carmen Ave. E
Inver Grove Heights, MN, 55076
P: 651-389-4191

GRAIN SIZE DISTRIBUTION

ASTM C136 & D422

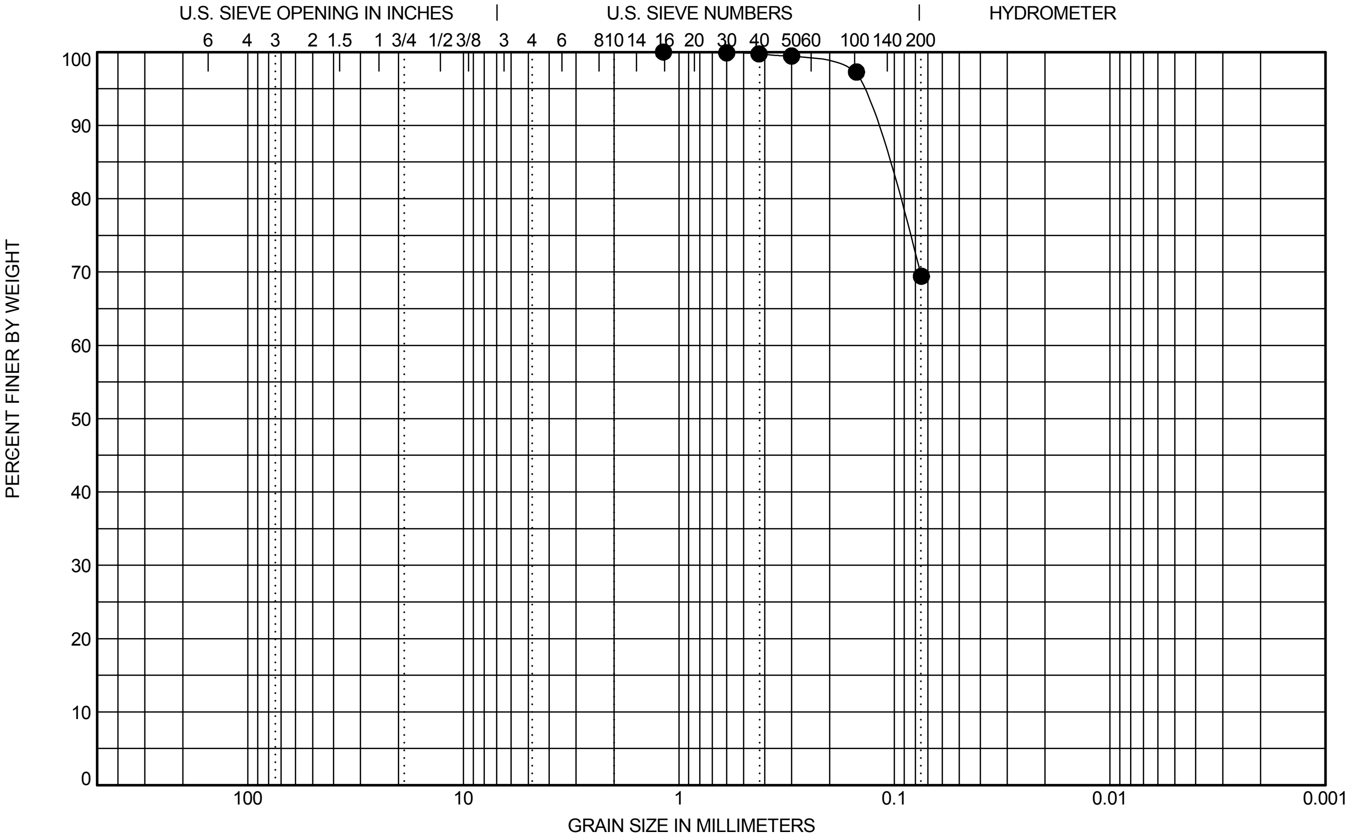
Report To:	SEH	Project:	Lab USA Ash Processing Building
		Project Number:	16.61343.100
Attention:		Location:	Red Wing, MN

Sample Information

Boring Number:	SB-9	Date Sampled:	3/21/2016
Sample Number:	10	Sampled By:	NTI
Sample Depth:	22	Sample Type:	SS
Classification:			

Sample Data

Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
		1.18				0.0	30.6	69.4	



Comments: Elevations provided by SEH.

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GRAIN SIZE DISTRIBUTION

ASTM C136 & D422

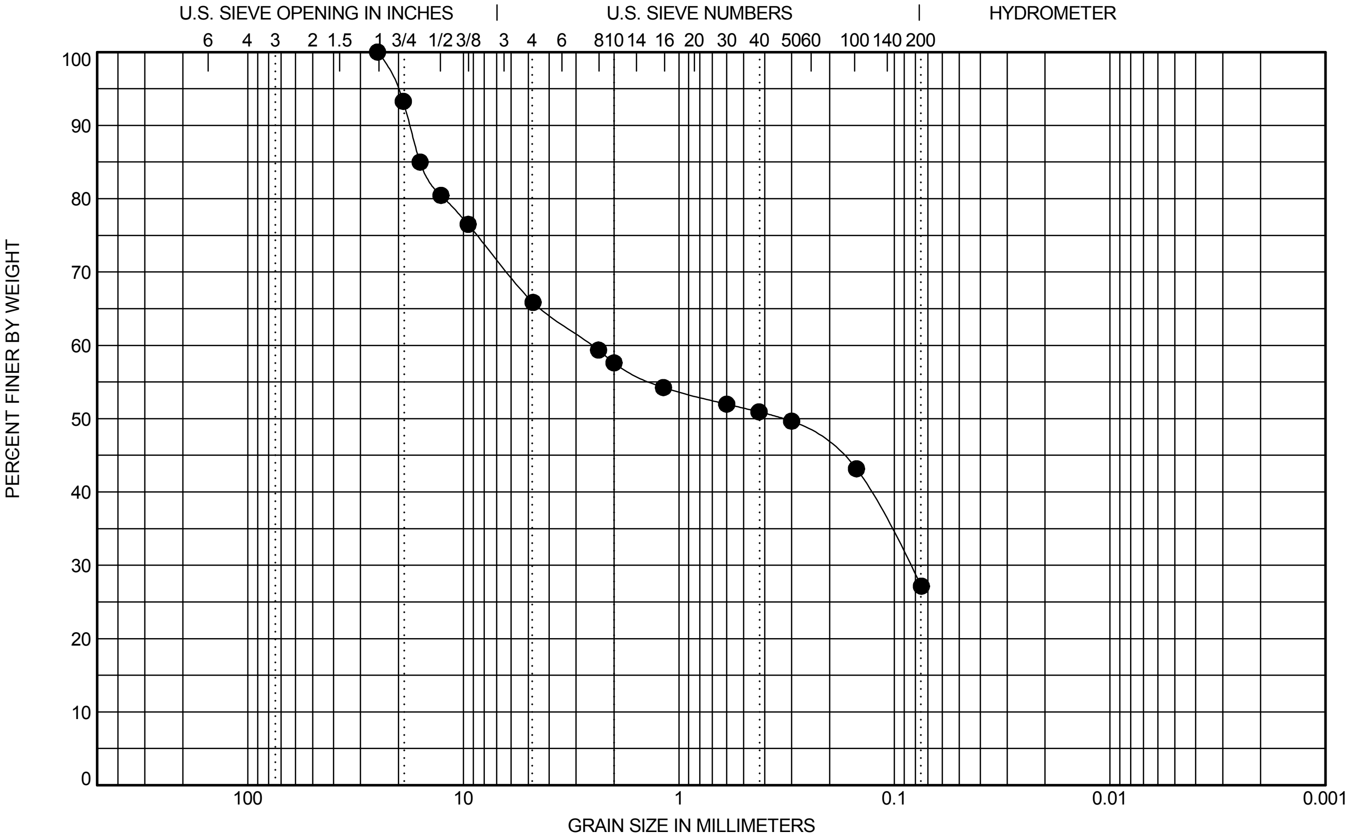
Report To:	SEH	Project:	Lab USA Ash Processing Building
		Project Number:	16.61343.100
Attention:		Location:	Red Wing, MN

Sample Information

Boring Number:	SB-9	Date Sampled:	3/21/2016
Sample Number:	12	Sampled By:	NTI
Sample Depth:	29.5	Sample Type:	SS
Classification:			

Sample Data

Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
		25	2.532	0.085		34.2	38.7	27.1	



Comments: Elevations provided by SEH.

Cc:

Submitted by,
Northern Technologies, LLC

(4/7/16)

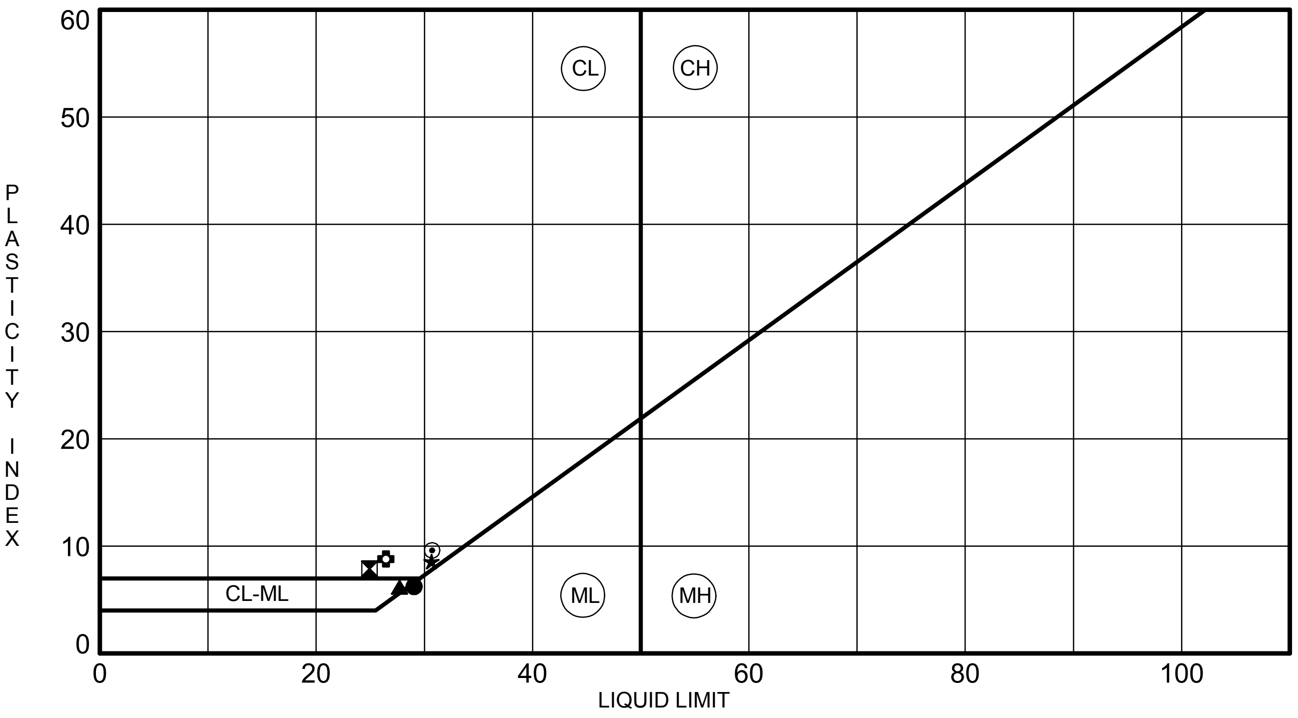
Northern Technologies Inc.
6160 Carmen Ave. E
Inver Grove Heights, MN, 55076
P: 651-389-4191

ATTERBERG LIMITS' RESULTS
ASTM D4318

Report To:	SEH	Project:	Lab USA Ash Processing Building
		Project Number:	16.61343.100
Attention:		Location:	Red Wing, MN

Sample Data

	BOREHOLE	SAMPLE #	DEPTH	LL	PL	PI	Fines	Classification
●	SB-6	8	19.5	29	23	6		
⧗	SB-8	5	9.5	25	17	8		
▲	SB-8	7	14.5	28	22	6		
★	SB-9	7	14.5	31	22	9		
⊙	SB-11	3	4.5	31	21	10		
✿	SB-11	7	14.5	26	18	8		



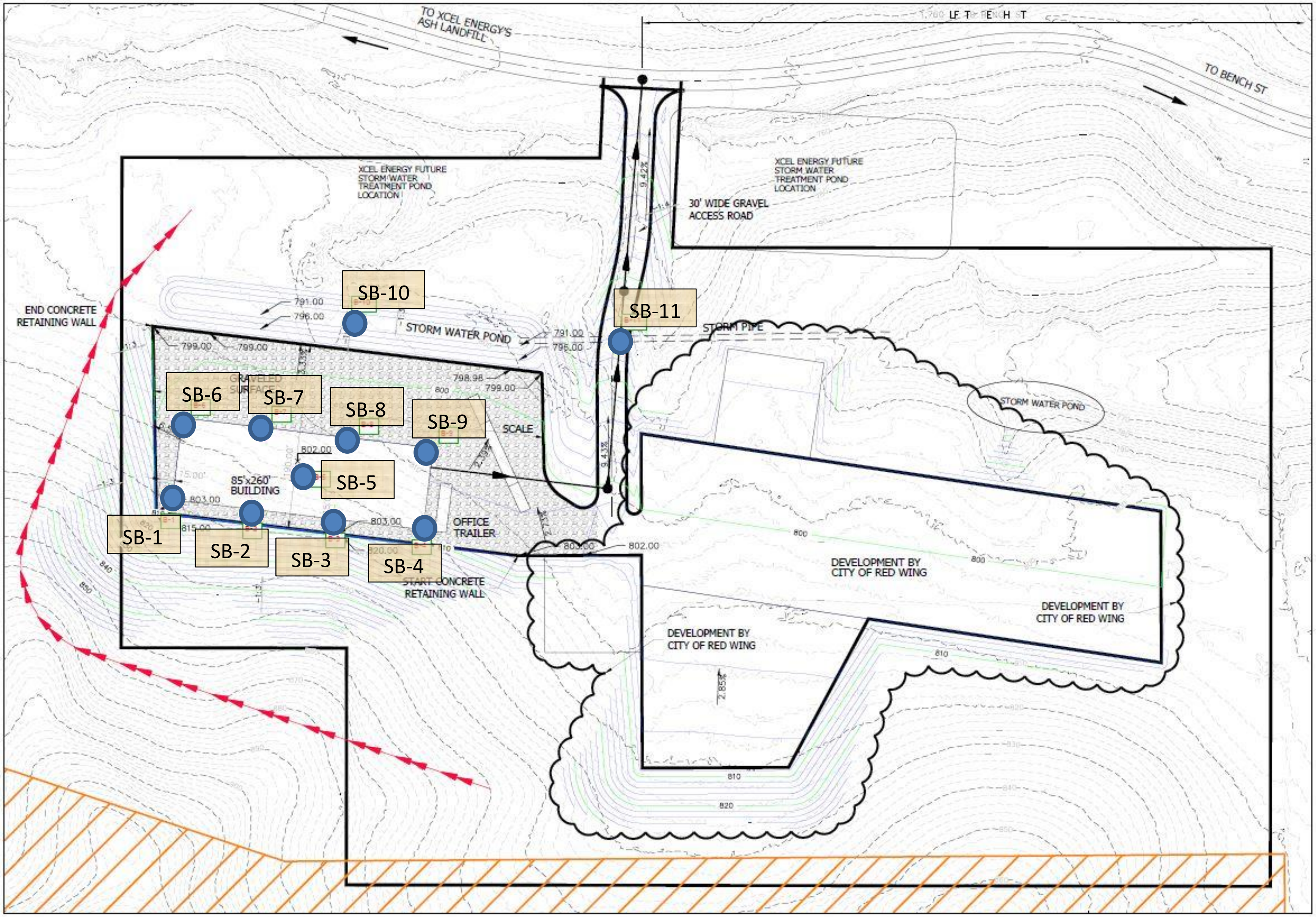
Cc:

Submitted by,
Northern Technologies, LLC

(4/7/16)

GEO ATTERBERG LIMITS - GINT STD US LAB MAY 2012.GDT - 4/7/16 13:14 - Z:\1-PROJECTS\2016 PROJECTS\RED WING CONTRACT DRILLING - GEO - (16.61343.100)\ENGINEERING\ENGINEERING REPORTS\GINT\SEH CONTRACT.GPJ

APPENDIX C



N

Boring Location Diagram
Lab USA Ash Processing Building
Red Wing, Minnesota
NTI Project #: 16.61343.100

NOTE: Boring locations are approximate.

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BORING NUMBER SB-1

PAGE 1 OF 1

CLIENT SEH
PROJECT NAME Lab USA Ash Processing Building
PROJECT NUMBER 16.61343.100
PROJECT LOCATION Red Wing, MN
DATE STARTED 3/22/16 **COMPLETED** 3/22/16
GROUND ELEVATION 829.4 ft **HOLE SIZE** 6 1/2 inches
DRILLING CONTRACTOR NTI
GROUND WATER LEVELS:
DRILLING METHOD 3 1/4 in H.S.A
AT TIME OF DRILLING --- No groundwater encountered
LOGGED BY Robert Hawkins **CHECKED BY** Steve Gerber
AT END OF DRILLING ---
NOTES Elevations provided by SEH.
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0	▨	SANDY LEAN CLAY, (CL) brown, moist, soft to medium, trace gravel (Glaciofluvium)	SS 1	44	2-3-2 (5)							
	▨		SS 2	56	2-2-2 (4)							
		4.5 824.9										
5	⁘	SILTY SAND, (SM) light brown, fine grained, moist, loose to medium dense, trace gravel (Glaciofluvium)	SS 3	89	5-7-7 (14)							
	⁘		SS 4	89	3-4-4 (8)							
10	⁘	NOTE: Occasional clay (CL) layers below 9.5 feet.	SS 5	89	4-5-6 (11)							
	⁘		SS 6	78	11-13-12 (25)							
15	⁘		SS 7	78	11-12-15 (27)							
		17.0 812.4										
	⁚	SANDSTONE, highly weathered, brown to light brown, occasional glauconite seams (Weathered Sandstone)	SS 8	78	11-14-15 (29)							
20	⁚		SS 9	120	27-52/4"							
	⁚		SS 10	150	50/4"							26
25	⁚		SS 11	150	50/4"							
		29.8 799.7	SS 12		50/3"							

Rock Identification based on highly weathered samples.
A petrographic analysis may yield different results.
Apparent auger refusal encountered at 29.8 feet.
Bottom of borehole at 29.8 feet.

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BORING NUMBER SB-2

PAGE 1 OF 1

CLIENT SEH

PROJECT NAME Lab USA Ash Processing Building

PROJECT NUMBER 16.61343.100

PROJECT LOCATION Red Wing, MN

DATE STARTED 3/24/16 **COMPLETED** 3/24/16

GROUND ELEVATION 825.2 ft **HOLE SIZE** 6 1/2 inches

DRILLING CONTRACTOR NTI

GROUND WATER LEVELS:

DRILLING METHOD 3 1/4 in H.S.A

AT TIME OF DRILLING --- No groundwater encountered

LOGGED BY Robert Hawkins **CHECKED BY** Steve Gerber

AT END OF DRILLING ---

NOTES Elevations provided by SEH.

AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES
										LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		SANDY LEAN CLAY, (CL) brown, moist, soft, trace gravel (Glaciofluvium)		SS 1	44	1-1-2 (3)							
				SS 2	33	2-2-2 (4)							
5				SS 3	22	2-1-2 (3)							
		7.0	818.2										
		SILTY SAND, (SM) light brown, fine grained, moist, medium dense, trace gravel (Glaciofluvium)		SH 4									
10				SS 5	89	5-5-7 (12)							
		12.0	813.2										
		SANDSTONE, highly weathered, light brown to brown (Weathered Sandstone)		SS 6	56	17-25-23 (48)							
		14.5	810.7										
15		SANDSTONE, highly weathered, light brown to brown, occasional glauconite seams (Weathered Sandstone)		SS 7	56	14-21-23 (44)							
				SS 8		12-50/5"							
20				SS 9		40-50/4"							
		22.6	802.6	SS 10		21-50/2"							

Rock Identification based on highly weathered samples.
A petrographic analysis may yield different results.
Apparent auger refusal encounterd at 22.6 feet.
Bottom of borehole at 22.6 feet.

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BORING NUMBER SB-3

PAGE 1 OF 1

CLIENT SEH

PROJECT NAME Lab USA Ash Processing Building

PROJECT NUMBER 16.61343.100

PROJECT LOCATION Red Wing, MN

DATE STARTED 3/22/16 **COMPLETED** 3/22/16

GROUND ELEVATION 824.4 ft **HOLE SIZE** 6 1/2 inches

DRILLING CONTRACTOR NTI

GROUND WATER LEVELS:

DRILLING METHOD 3 1/4 in H.S.A

AT TIME OF DRILLING --- No groundwater encountered

LOGGED BY Robert Hawkins **CHECKED BY** Steve Gerber

AT END OF DRILLING ---

NOTES Elevations provided by SEH.

AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTIC LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	FINES
0		SANDY LEAN CLAY, (CL) brown, moist, medium, trace gravel (Glaciofluvium)	SS 1	44	2-3-3 (6)							
2.0		822.4										
		SILTY SAND, (SM) light brown, fine grained, moist, loose to medium dense, trace gravel, occasional clay (CL) layers (Glaciofluvium)	SS 2	67	2-3-4 (7)							
5			SS 3	89	5-6-7 (13)							
7.0		817.4										
		SANDSTONE, highly weathered, light brown to brown, occasional glauconite seams (Weathered Sandstone)	SS 4		13-50/4"							
10			SS 5		23-50/3"							
			SS 6		45-50/4"							62
15			SS 7		50/4"							
			SS 8		50/2"							
19.9		804.5	SS 9		120/5"							

Rock Identification based on highly weathered samples.
A petrographic analysis may yield different results.
Apparent auger refusal encounterd at 19.9 feet.
Bottom of borehole at 19.9 feet.

NTI GEOTECH COLUMNS - GINT STD US LAB MAY 2012.GDT - 5/26/16 09:28 - H:\RAMSEY\1-PROJECTS\2016 PROJECTS\RED WING CONTRACT DRILLING - GEO - (16.61343.100)\ENGINEERING\ENGINEERING REPORTS\GINT\SEH CONTRACT.GPJ

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BORING NUMBER SB-4

PAGE 1 OF 1

CLIENT SEH

PROJECT NAME Lab USA Ash Processing Building

PROJECT NUMBER 16.61343.100

PROJECT LOCATION Red Wing, MN

DATE STARTED 3/22/16 **COMPLETED** 3/22/16

GROUND ELEVATION 818.9 ft **HOLE SIZE** 6 1/2 inches

DRILLING CONTRACTOR NTI

GROUND WATER LEVELS:

DRILLING METHOD 3 1/4 in H.S.A

AT TIME OF DRILLING --- No groundwater encountered

LOGGED BY Robert Hawkins **CHECKED BY** Steve Gerber

AT END OF DRILLING ---

NOTES Elevations provided by SEH.

AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		SANDY LEAN CLAY, (CL) brown, moist, medium, trace gravel (Glaciofluvium)	SS 1	56	3-3-3 (6)							
2.0		816.9										
		SILTY SAND, (SM) light brown, fine grained, moist, medium dense to very dense, trace gravel (Glaciofluvium)	SS 2	78	5-6-5 (11)							
5			SS 3	56	6-8-8 (16)							
			SS 4	89	10-17-19 (36)							
10			SS 5	89	12-20-27 (47)							
12.0		806.9										
		SANDSTONE, highly weathered, light brown to brown, occasional glauconite seams (Weathered Sandstone)	SS 6	56	8-6-6 (12)							
15			SS 7	73	22-50/5"							
			SS 8	73	42-50/5"							
20			SS 9	100	50/4"							
22.8		796.1	SS 10		50/4"							

Rock Identification based on highly weathered samples.
A petrographic analysis may yield different results.
Apparent auger refusal encounterd at 22.8 feet.
Bottom of borehole at 22.8 feet.

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BORING NUMBER SB-5

PAGE 1 OF 1

CLIENT SEH

PROJECT NAME Lab USA Ash Processing Building

PROJECT NUMBER 16.61343.100

PROJECT LOCATION Red Wing, MN

DATE STARTED 3/24/16 **COMPLETED** 3/24/16

GROUND ELEVATION 818.5 ft **HOLE SIZE** 6 1/2 inches

DRILLING CONTRACTOR NTI

GROUND WATER LEVELS:

DRILLING METHOD 3 1/4 in H.S.A

AT TIME OF DRILLING --- No groundwater encountered

LOGGED BY Robert Hawkins **CHECKED BY** Steve Gerber

AT END OF DRILLING ---

NOTES Elevations provided by SEH.

AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES
										LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		SANDY LEAN CLAY, (CL) brown, moist, medium to soft, trace gravel (Glaciofluvium)		SS 1	44	4-4-3 (7)							
				SS 2	56	2-2-2 (4)							
4.5			814.0										
5		POORLY GRADED SAND WITH SILT, (SP-SM) brown, fine to medium grained, moist, medium dense, trace gravel (Glacial Outwash)		SS 3	67	3-4-5 (9)							
7.0			811.5										
		SILTY SAND, (SM) light brown, fine grained, moist, dense, trace gravel (Glaciofluvium)		SS 4	56	8-10-13 (23)							
10		NOTE: Occasional clay (CL) layers below 9.5 feet.		SS 5	67	7-8-10 (18)							
12.0			806.5										
		SANDSTONE, highly weathered, light brown to brown, occasional glauconite seams (Weathered Sandstone)		SS 6	78	9-9-11 (20)							
15				SS 7	67	7-7-9 (16)							
				SS 8		50/4"							
20				SS 9		30-50/3"							
				SS 10		50/4"							
25				SS 11		30-50/5"							35
				SS 12		50/4"							
28.0			790.5										

Rock Identification based on highly weathered samples.
A petrographic analysis may yield different results.
Apparent auger refusal encountered at 28.0 feet.
Bottom of borehole at 28.0 feet.

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BORING NUMBER SB-6

PAGE 1 OF 2

CLIENT SEH

PROJECT NAME Lab USA Ash Processing Building

PROJECT NUMBER 16.61343.100

PROJECT LOCATION Red Wing, MN

DATE STARTED 3/18/16 **COMPLETED** 3/18/16

GROUND ELEVATION 817.1 ft **HOLE SIZE** 6 1/2 inches

DRILLING CONTRACTOR NTI

GROUND WATER LEVELS:

DRILLING METHOD 3 1/4 in H.S.A

▽ **AT TIME OF DRILLING** 19.50 ft / Elev 797.60 ft

LOGGED BY Robert Hawkins **CHECKED BY** Steve Gerber

AT END OF DRILLING ---

NOTES Elevations provided by SEH.

AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTIC LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	FINES
0		SANDY LEAN CLAY, (CL) brown, moist, soft, trace gravel (Glaciofluvium)	SS 1									
			SS 2	38	2-1-1 (2)							
4.5		812.6										
5		CLAYEY SAND, (SC) brown, fine to medium grained, moist, loose, trace gravel (Glaciofluvium)	SS 3	46	1-2-4 (6)							
			SS 4	67	1-3-3 (6)							
9.5		807.6										
10		SILTY SAND, (SM) light brown, fine grained, moist, medium dense, trace gravel (Glaciofluvium)	SS 5	67	3-6-5 (11)							
		NOTE: Occasional clay (CL) layers below 12 feet.	SS 6	75	2-7-7 (14)							
15			SS 7	79	4-8-9 (17)			5				
19.5 ▽		797.6										
20		SANDY SILT, (ML) light brown, wet, medium, trace gravel (Glaciofluvium)	SS 8	63	3-3-6 (9)			25	29	23	6	
24.5		792.6										
25		SANDSTONE, highly weathered, light brown to brown (Weathered Sandstone)	SS 9	83	12-20-21 (41)							59
29.5		787.6										
30		SANDSTONE, highly weathered, light brown to brown, occasional glauconite seams (Weathered Sandstone)	SS 10	79	10-13-17 (30)							

(Continued Next Page)

BORING NUMBER SB-6

CLIENT SEH

PROJECT NAME Lab USA Ash Processing Building

PROJECT NUMBER 16.61343.100

PROJECT LOCATION Red Wing, MN

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
35		SANDSTONE, highly weathered, light brown to brown, occasional glauconite seams (Weathered Sandstone) *(continued)*	☒ SS 11	63	78-10-11 (21)							
40		40.1 777.0	☒ SS 12	72	17-50/1"							

Rock Identification based on highly weathered samples.
A petrographic analysis may yield different results.
Apparent auger refusal encountered at 40.1 feet.
Bottom of borehole at 40.1 feet.

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BORING NUMBER SB-7

PAGE 1 OF 2

CLIENT SEH
PROJECT NAME Lab USA Ash Processing Building
PROJECT NUMBER 16.61343.100
PROJECT LOCATION Red Wing, MN
DATE STARTED 3/22/16 **COMPLETED** 3/22/16
GROUND ELEVATION 814.8 ft **HOLE SIZE** 6 1/2 inches
DRILLING CONTRACTOR NTI
GROUND WATER LEVELS:
DRILLING METHOD 3 1/4 in H.S.A
AT TIME OF DRILLING --- No groundwater encountered
LOGGED BY Robert Hawkins **CHECKED BY** Steve Gerber
AT END OF DRILLING ---
NOTES Elevations provided by SEH.
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTIC LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	FINES
0		SANDY LEAN CLAY, (CL) brown, moist, medium to soft, trace gravel (Glaciofluvium)	SS 1	44	2-3-2 (5)							
		2.0 812.8										
		SILTY SAND, (SM) brown, fine grained, moist, very loose, trace gravel (Glaciofluvium)	SS 2	44	1-1-2 (3)							
5			SH 3									
		7.0 807.8										
		SANDY LEAN CLAY, (CL) brown, moist, rather stiff, trace gravel (Glaciofluvium)	SS 4	67	4-4-5 (9)							
10			SS 5	78	4-5-6 (11)							
		12.0 802.8										
		SILTY SAND, (SM) brown, fine grained, moist, dense to medium dense, trace gravel, occasional clay (CL) seams (Glaciofluvium)	SS 6	100	7-9-11 (20)							
15			SS 7	100	8-8-9 (17)							
			SH 8									
20			SS 9	100	6-7-6 (13)			23				
		22.0 792.8										
		SANDSTONE, highly weathered, light brown to brown (Weathered Sandstone)	SS 10	100	12-18-21 (39)							28
25			SS 11	100	13-19-22 (41)							
30			SS 12	100	22-26-32 (58)							39

(Continued Next Page)

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BORING NUMBER SB-7

PAGE 2 OF 2

CLIENT SEH
PROJECT NAME Lab USA Ash Processing Building
PROJECT NUMBER 16.61343.100
PROJECT LOCATION Red Wing, MN

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
		SANDSTONE, highly weathered, light brown to brown (Weathered Sandstone) *(continued)*										
		34.5 780.3										
35		SANDSTONE, highly weathered, light brown to brown, occasional glauconite seams (Weathered Sandstone)	SS 13	89	7-9-8 (17)							26
40			SS 14		21-52/2"							
		42.0 772.8										

Rock Identification based on highly weathered samples.
A petrographic analysis may yield different results.
Apparent auger refusal encountered at 42.0 feet.
Bottom of borehole at 42.0 feet.

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BORING NUMBER SB-8

PAGE 1 OF 2

CLIENT SEH
PROJECT NAME Lab USA Ash Processing Building
PROJECT NUMBER 16.61343.100
PROJECT LOCATION Red Wing, MN
DATE STARTED 3/21/16 **COMPLETED** 3/21/16
GROUND ELEVATION 810.2 ft **HOLE SIZE** 6 1/2 inches
DRILLING CONTRACTOR NTI
GROUND WATER LEVELS:
DRILLING METHOD 3 1/4 in H.S.A
AT TIME OF DRILLING --- No groundwater encountered
LOGGED BY Robert Hawkins **CHECKED BY** Steve Gerber
AT END OF DRILLING ---
NOTES Elevations provided by SEH.
AFTER DRILLING ---

DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	FINES
0	SANDY LEAN CLAY, (CL) brown, moist, rather stiff, trace gravel (Glaciofluvium)	SS 1	67	3-4-5 (9)							
2.0	808.2										
	SILTY SAND, (SM) brown, fine grained, moist, dense, trace gravel (Glaciofluvium)	SS 2	67	5-8-9 (17)							
5		SS 3	78	12-11-5 (16)							
7.0	803.2										
	SANDY LEAN CLAY, (CL) brown, medium to rather stiff, trace gravel (Glaciofluvium)	SS 4	89	4-4-5 (9)							
10		SS 5	67	3-4-5 (9)			15	25	17	8	
		SS 6	67	3-4-4 (8)							
14.5	795.7										
15	SILTY LEAN CLAY, (CL-ML) brown, moist, medium, trace gravel (Glaciofluvium)	SS 7	67	1-2-5 (7)			26	28	22	6	
		SS 8	100	2-3-5 (8)			27				
19.5	790.7										
20	SANDY LEAN CLAY, (CL) brown, rather stiff, trace gravel (Glaciofluvium)	SS 9	67	4-4-5 (9)			18				
22.0	788.2										
	SILTY SAND, (SM) brown, fine grained, moist, medium dense, trace gravel, occasional clay (CL) layers (Glaciofluvium)	SS 10	56	5-7-5 (12)							
25		SS 11	33	7-7-6 (13)							
29.5	780.7										
30	SANDSTONE, highly weathered, light brown to brown, occasional glauconite seams (Weathered Sandstone)	SS 12	100	8-10-11 (21)							

(Continued Next Page)

BORING NUMBER SB-8

CLIENT SEH
PROJECT NAME Lab USA Ash Processing Building
PROJECT NUMBER 16.61343.100
PROJECT LOCATION Red Wing, MN

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
35		SANDSTONE, highly weathered, light brown to brown, occasional glauconite seams (Weathered Sandstone) *(continued)*	SS 13	44	10-9-12 (21)							
40		41.0 769.2	SS 14	56	12-16-17 (33)							

Rock Identification based on highly weathered samples.
A petrographic analysis may yield different results.
Bottom of borehole at 41.0 feet.

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BORING NUMBER SB-9

PAGE 1 OF 2

CLIENT SEH
PROJECT NAME Lab USA Ash Processing Building
PROJECT NUMBER 16.61343.100
PROJECT LOCATION Red Wing, MN
DATE STARTED 3/21/16 **COMPLETED** 3/21/16
GROUND ELEVATION 806.9 ft **HOLE SIZE** 6 1/2 inches
DRILLING CONTRACTOR NTI
GROUND WATER LEVELS:
DRILLING METHOD 3 1/4 in H.S.A
▽ **AT TIME OF DRILLING** 14.50 ft / Elev 792.40 ft
LOGGED BY Robert Hawkins **CHECKED BY** Steve Gerber
AT END OF DRILLING ---
NOTES Elevations provided by SEH.
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTIC LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	FINES
0		SANDY LEAN CLAY, (CL) brown, moist, medium, trace gravel (Glaciofluvium) 2.0 804.9	SS 1	44	4-3-3 (6)							
		SILTY SAND, (SM) brown, fine grained, moist, medium dense to dense, trace gravel (Glaciofluvium)	SS 2	56	3-4-7 (11)							
5		7.0 799.9	SS 3	67	8-9-11 (20)							
		CLAYEY SAND, (SC) brown, fine grained, moist, medium dense, trace gravel (Glaciofluvium) 9.5 797.4	SS 4	89	3-4-5 (9)							
10		SANDY LEAN CLAY, (CL) brown, moist to wet, soft to stiff, trace gravel, occasional silt (ML) seams (Glaciofluvium)	SS 5	56	2-2-2 (4)			23				
		▽	SS 6	100	2-2-4 (6)							
15			SS 7	67	2-3-4 (7)			26	31	22	9	
			SS 8	100	3-5-6 (11)							
20		22.0 784.9	SS 9	100	3-4-6 (10)			22				
		SANDY SILT WITH GRAVEL, (ML) brown, saturated, rather stiff to stiff (Glaciofluvium)	SS 10	100	6-6-9 (15)							69
25		29.5 777.4	SS 11	89	8-10-10 (20)							
30		SANDSTONE, highly weathered, light brown to brown, occasional glauconite seams (Weathered Sandstone)	SS 12	100	20-22-21 (43)							27

(Continued Next Page)

BORING NUMBER SB-9

CLIENT SEH
PROJECT NAME Lab USA Ash Processing Building
PROJECT NUMBER 16.61343.100
PROJECT LOCATION Red Wing, MN

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
35		SANDSTONE, highly weathered, light brown to brown, occasional glauconite seams (Weathered Sandstone) *(continued)*	SS 13	78	6-6-7 (13)							
40		41.0 765.9	SS 14	56	15-17-18 (35)							

Rock Identification based on highly weathered samples.
A petrographic analysis may yield different results.
Bottom of borehole at 41.0 feet.

NTI NORTHERN TECHNOLOGIES, LLC

Inver Grove Heights
6160 Carmen Ave. E
Inver Grove Heights, MN, 55076
P: 651-389-4191
www.NTIGeo.com

BORING NUMBER SB-10

PAGE 1 OF 1

CLIENT SEH

PROJECT NAME Lab USA Ash Processing Building

PROJECT NUMBER 16.61343.100

PROJECT LOCATION Red Wing, MN

DATE STARTED 3/21/16 **COMPLETED** 3/22/16

GROUND ELEVATION 801.7 ft **HOLE SIZE** 6 1/2 inches

DRILLING CONTRACTOR NTI

GROUND WATER LEVELS:

DRILLING METHOD 3 1/4 in H.S.A

∇ **AT TIME OF DRILLING** 24.50 ft / Elev 777.20 ft

LOGGED BY Robert Hawkins **CHECKED BY** Steve Gerber

AT END OF DRILLING ---

NOTES Elevations provided by SEH.

AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		SANDY LEAN CLAY, (CL) brown, moist, medium, trace gravel (Glaciofluvium)	SS 1	67	3-3-3 (6)							
2.0		799.7										
		SILTY SAND, (SM) brown, fine grained, moist, loose to medium dense, trace gravel (Glaciofluvium)	SS 2	67	3-3-4 (7)							
5			SS 3	56	4-6-7 (13)							
			SS 4	78	6-5-6 (11)							
9.5		792.2										
10		SANDY LEAN CLAY, (CL) light brown, moist to wet, medium to rather stiff, trace gravel, occasional silt (ML) seams (Glaciofluvium)	SS 5	67	3-4-5 (9)							
			SS 6	100	2-2-3 (5)			24				
15			SS 7	67	3-4-6 (10)							
			SH 8					28				
20		NOTE: Gray below 19.5 feet.	SS 9	89	2-2-3 (5)			26				
			SS 10	89	3-4-6 (10)			28				
25		∇	SH 11					29				
29.5		772.2										
30		SILTY SAND, (SM) light brown, fine grained, saturated, medium dense, trace gravel (Glaciofluvium)	SS 12	78	4-6-6 (12)							
31.0		770.7										

Bottom of borehole at 31.0 feet.

Inver Grove Heights
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P: 651-389-4191
www.NTIGeo.com

BORING NUMBER SB-11

PAGE 1 OF 1

CLIENT SEH

PROJECT NAME Lab USA Ash Processing Building

PROJECT NUMBER 16.61343.100

PROJECT LOCATION Red Wing, MN

DATE STARTED 3/24/16 **COMPLETED** 3/24/16

GROUND ELEVATION 782.8 ft **HOLE SIZE** 6 1/2 inches

DRILLING CONTRACTOR NTI

GROUND WATER LEVELS:

DRILLING METHOD 3 1/4 in H.S.A

▽ **AT TIME OF DRILLING** 12.00 ft / Elev 770.80 ft

LOGGED BY Robert Hawkins **CHECKED BY** Steve Gerber

AT END OF DRILLING ---

NOTES Elevations provided by SEH.

AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES
										LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0	⁘	SILTY SAND, (SM) brown, fine grained, moist, medium dense, trace gravel, occasional silt (ML) seams (Glaciofluvium)		SS 1	67	4-4-5 (9)							
		2.0	780.8										
	▨	SANDY LEAN CLAY, (CL) light brown, moist, medium to rather stiff, trace gravel (Glaciofluvium)		SS 2	78	2-2-4 (6)							
5	▨			SH 3					28	31	21	10	
	▨			SS 4	100	3-3-5 (8)			32				
		9.5	773.3										
10	⁘	SILTY SAND, (SM) brown, fine grained, moist, medium dense, trace gravel (Glaciofluvium)		SS 5	100	5-7-7 (14)							
		12.0 ▽	770.8										
	▨	SANDY LEAN CLAY, (CL) brown, wet, medium, trace gravel, occasional silt (ML) layers (Glaciofluvium)		SS 6	67	2-3-3 (6)			22				
15	▨			SS 7	100	2-2-3 (5)			28	26	18	8	
	▨	NOTE: Gray below 17 feet.		SS 8	89	3-3-4 (7)			25				
		18.5	764.3										

Bottom of borehole at 18.5 feet.

NTI GEOTECH COLUMNS - GINT STD US LAB MAY 2012.GDT - 5/26/16 09:28 - H:\RAMSEY\1-PROJECTS\2016 PROJECTS\RED WING CONTRACT DRILLING - GEO - (16.61343.100)\ENGINEERING\ENGINEERING REPORTS\GINT\SEH CONTRACT.GPJ

Appendix G

Geotechnical Evaluation

Geotechnical Report

Lab USA Ash Processing Facility

Red Wing, Minnesota

SEH No. LABUS 136249 4.00

May 26, 2016

Building a Better World
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May 26, 2016

RE: Lab USA Ash Processing Facility
Geotechnical Report
Red Wing, Minnesota
SEH No. LABUS 136249

Mr. Darryl Heaps, PE
SEH
3535 Vadnais Center Drive
St. Paul, MN 55110

Dear Darryl:

Enclosed is the Geotechnical Report for the proposed Lab USA Ash Processing Facility in Red Wing, Minnesota. The report provides a summary of the subsurface investigation, geotechnical evaluation and recommendations for final design.

Subsurface investigation at the proposed site generally found alluvium of glacial origin overlying weathered sandstone. Some borings encountered drilling refusal within the weathered sandstone. The depth of drilling refusal has been interpreted in the report as the apparent top of bedrock, although further investigation is recommended to verify the actual top of bedrock and bedrock formation. Groundwater levels, where encountered, are believed to be mostly perched except for the lower elevation areas along the site’s northern portion.

Geotechnical recommendations are provided for the proposed building foundations, site excavation and grading, general drainage and utility work. Recommendations include the implementation of a load distribution platform to help mitigate anticipated differential settlement and improve bearing capacity beneath the building footings and concrete slab. Anchored turf reinforcement mats are recommended for final grading of slopes steeper than 2H:1V.

If you have any questions or require clarification on information presented in this report, please do not hesitate to contact me at 651.490.2082.

Sincerely,

Brent Theroux, PE
Sr. Geotechnical Engineer

ah
s:\ko\l\labus\136249\5-final-dsgn\50-final-dsgn\45-geo\geotech report\geotech rpt 2016 5 25_draft.docx

Engineers | Architects | Planners | Scientists

Short Elliott Hendrickson Inc., 3535 Vadnais Center Drive, St. Paul, MN 55110-5196
SEH is 100% employee-owned | **sehinc.com** | 651.490.2000 | 800.325.2055 | 888.908.8166 fax

Lab USA Ash Processing Facility
Geotechnical Report
Red Wing, Minnesota

SEH No. LABUS 136249

May 26, 2016

I hereby certify that this 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.

Brent Theroux, PE
Sr. Geotechnical Engineer

Date: May 26, 2016 Lic. No.: 44276

Reviewed By: Wayne S. Wambold Date: May 26, 2016

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St. Paul, MN 55110-5196
651.490.2000

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May 2016

Geotechnical Report

Lab USA Ash Processing Facility

Prepared for Lab USA and the City of Red Wing

1.0 Introduction

A site in Red Wing, Minnesota is proposed to receive a new recycled ash processing facility. The facility's purpose would be to recover ferrous and nonferrous metals from ash. The proposed ash processing facility would be operated by Lab USA, Inc. under a lease with the City of Red Wing.

The site is currently owned by Xcel Energy. It is located along the south side of an unpaved road that provides access to Xcel Energy's existing ash landfill. The unpaved road extends west from the intersection of Bench Street and Featherstone Road in Red Wing.

Development of the site is proposed to include:

- 275-ft by 100-ft ash process building
- Storm water pond
- Outlet pipe from pond
- Re-graded soil slopes as steep as 1.5H:1V
- Buried utility pipe

This report presents the results of the subsurface investigation and geotechnical evaluations performed for the site. Geotechnical recommendations for final design and site development are also included.

1.1 Scope of Services

This report was prepared in accordance with the April 15, 2016 contract between SEH and Lab USA. The scope of work for preparing this report included drilling soil borings and performing geotechnical laboratory tests. These services were provided by Northern Technologies, Inc. (NTI) under subcontract to SEH. Further details of these services are contained in Section 2.0 (Subsurface Investigation Program). The final factual data report prepared by NTI is included in the Appendix.

1.2 Background Information

SEH used the following documents to prepare geotechnical recommendations for the facility:

- NTI Geotechnical Data Report for proposed Lab USA ash processing facility ([May 16, 2016])
- Geologic Atlas of Goodhue County, Minnesota, from University of Minnesota and Minnesota Geological Survey (1998)
- Minnesota Soil Atlas, University of Minnesota (1973)

2.0 Subsurface Investigation Program

Soil borings and laboratory testing were performed by NTI of Inver Grove Heights, Minnesota. Soil borings were performed from March 18 to 24, 2016. Locations for soil borings, as well as the boring depths and sampling intervals, were determined by SEH. Soil borings consisted of standard penetration test (SPT) borings in accordance with ASTM D 1586. Soils were classified in accordance with ASTM D 2487 and 2488. Laboratory tests were assigned to selected samples by SEH.

The final soil boring logs, boring location map, and laboratory testing results are contained in the NTI report, which is included in the Appendix. The ground surface elevation at each boring location was surveyed by SEH and is presented on the final logs.

2.1 Drilling

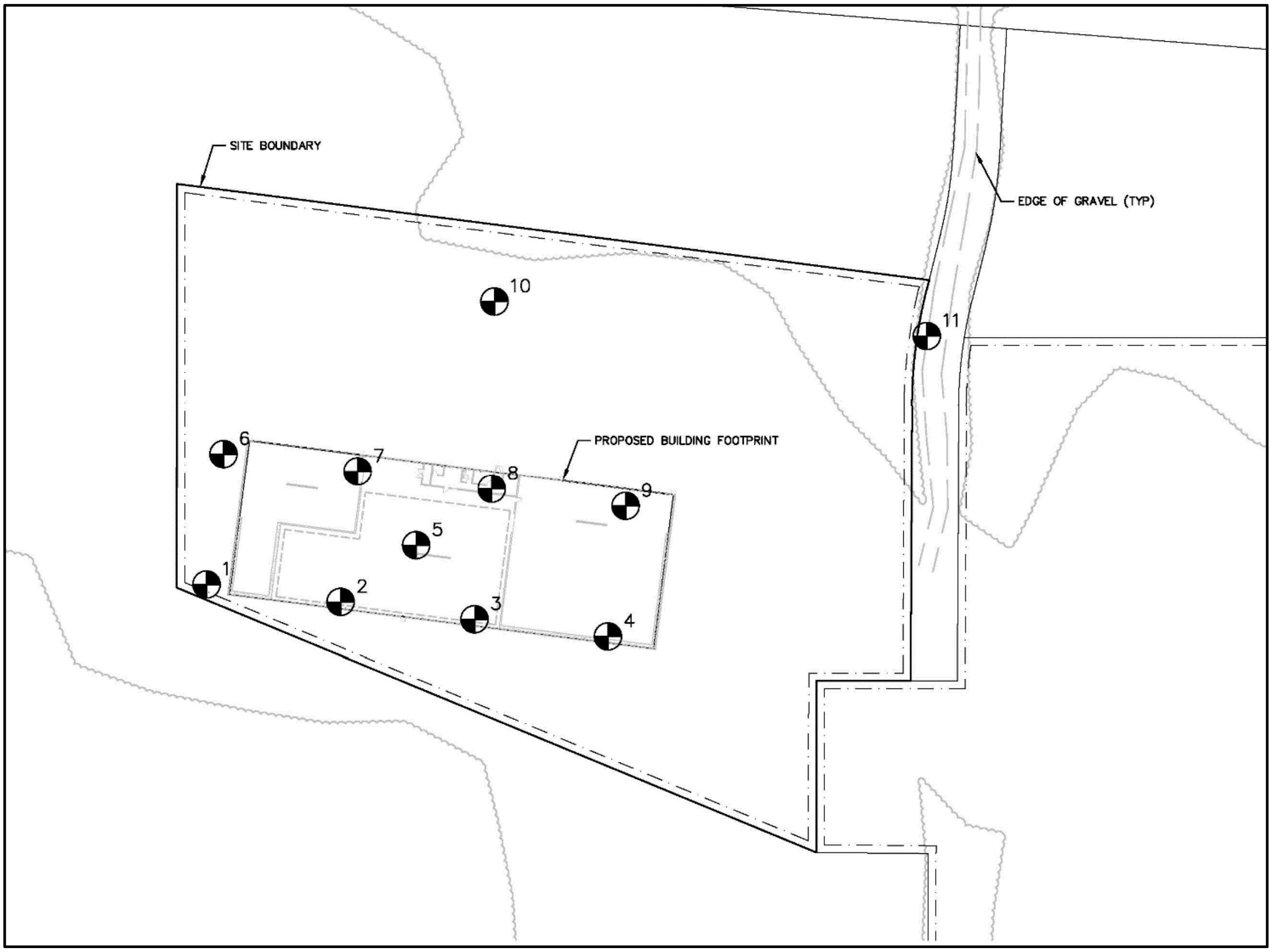
The soil borings performed for this investigation are summarized in Table 1. Approximate boring locations are shown on Figure 1 and included in the Appendix. Borings B-1 to B-5 encountered auger refusal prior to their target depths. Auger refusal may be indicative of the top of bedrock, which is reported on the Goodhue Geologic Atlas as being within 50 feet of the ground surface in the project area. Rock coring was not included as part of the investigation scope for preparing this report.

Table 1 – Summary of Soil Borings

Boring	**Location**	**Ground Elevation (ft)**	**Depth (ft)**
B-1	Bldg, SW corner	829.4	29.8*
B-2	Bldg, South	825.2	22.7*
B-3	Bldg, South	824.4	19.9*
B-4	Bldg, SE corner	818.9	22.8*
B-5	Bldg, Center	818.5	28.0*
B-6	Bldg, NW corner	817.1	41.0
B-7	Bldg, North	814.8	42.0
B-8	Bldg, North	810.2	41.0
B-9	Bldg, NE corner	806.9	41.0
B-10	Pond	801.7	31.0
B-11	Driveway, Utilities	782.8	18.5

* Auger refusal

Figure 1 – Soil Boring Locations



2.2 Laboratory Testing

Laboratory testing was performed on selected soil samples. Testing consisted of moisture content, Atterberg limits, sieve analysis, and consolidation.

3.0 Site Conditions

3.1 General Site Description

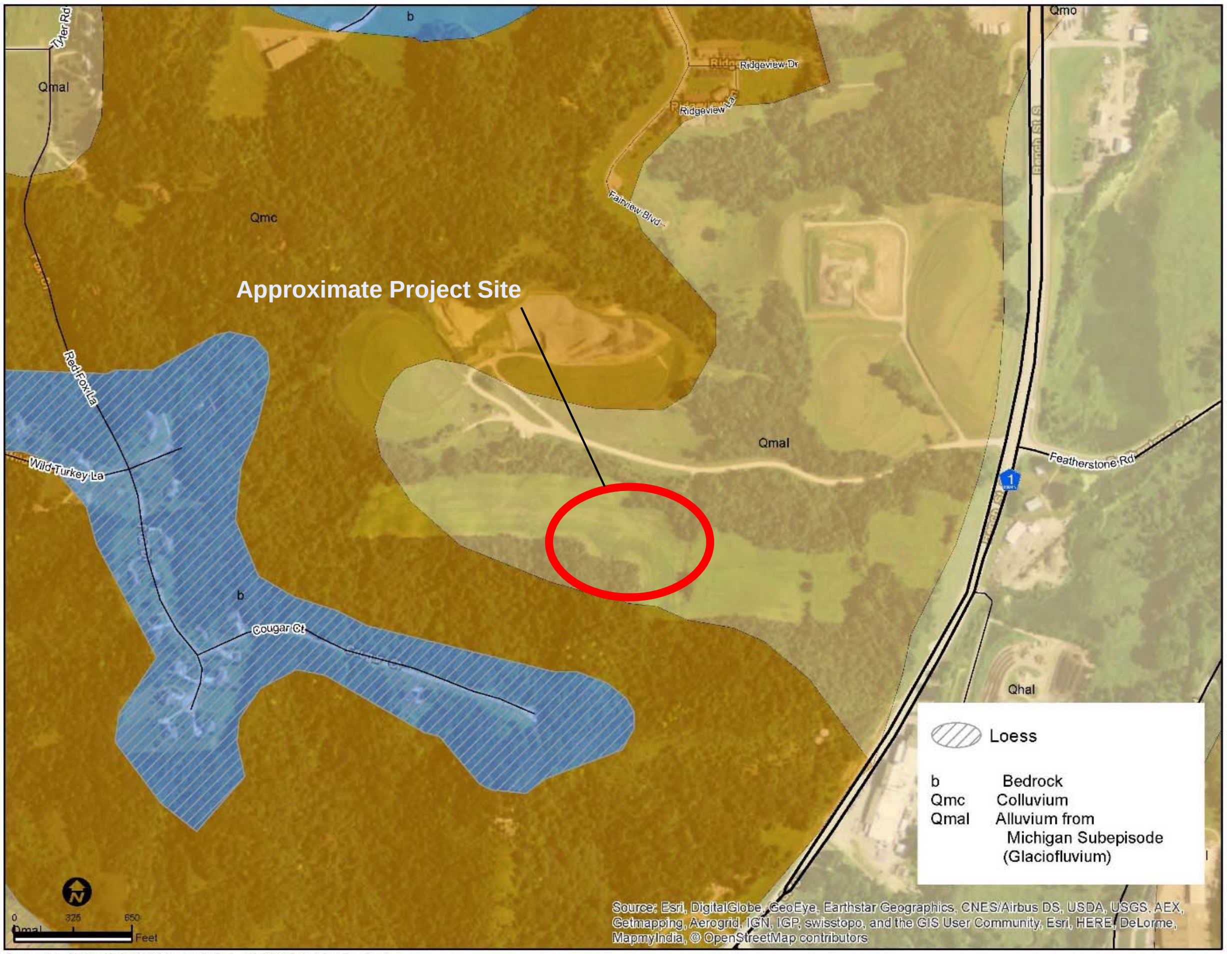
The project site is located in the upland bluff area south of Red Wing. The terrain is characterized by gently to sharply sloping ridges and valleys. Land use is generally agricultural mixed with areas of hardwood forest.

The project site is situated between the Xcel Energy Ash Landfill (approximately 1000 feet to the northwest) and Bench Street (approximately 2000 feet to the east). Total elevation relief is approximately 70 feet, which ranges from the highest point (approx. el. 830) near the southwest corner of the proposed building to the lowest point (approx. el. 760) along the unpaved road providing access from Bench Street. The south portion of the site, which includes the proposed building footprint, is currently a field with some agricultural use. A dirt path provides access to the field from the unpaved road. The north portion of the site, between the field and the unpaved road, is mostly wooded with upland hardwoods and brush. A drainage gully passes through a wooded portion of the site, beneath the dirt path and between the field and the unpaved road. A small corrugated metal culvert extends beneath the dirt path and conveys gully drainage. The gully appears to slope from west to east and likely conveys runoff flow that sheets off of the field from the south.

3.2 Soil Conditions

The soils in the project area are mapped in the Goodhue County Geologic Atlas as either A) alluvium deposited by glacial flows (referred to as “glaciofluvium” in this report), or B) colluvium derived from eroded bedrock and/or loess (see Figure 2). In general, the glaciofluvium occupies the valley floors and the colluvium resides on the ridges and upland slopes. The glaciofluvium is mapped as primarily sand, but also fine-grained and silty in some areas. At shallow depths, the colluvium is primarily silt with clay and representative of reworked loess.

Figure 2 – Surficial Geology



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community, Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors

Document Path: S:\KO\L\LABUS\136249\5-final-dsgn\51-drawings\90-GIS\MXDs\Surf_Geol_Figure1.mxd

In general, the site soils consisted of varying, but distinct layers of silty sand and sandy lean clay overlying a fine-grained granular material, interpreted as weathered sandstone. The silty sand ranged from loose to dense, and was generally fine- to very fine-grained. The sandy lean clay was interbedded with lenses of sandy silt and silty lean clay. The weathered sandstone material was generally dense to very dense with some medium dense zones occurring at the top of the formation.

3.3 Rock Conditions

Weathered sandstone was encountered at each of the nine borings within the proposed building footprint. Seven of the borings met auger refusal prior to reaching their target depth. The auger refusal elevation in five of the borings was shallower than the depth of stress influence beneath the proposed foundation. For the purposes of this report, the depth of auger refusal was interpreted as the apparent top of bedrock. Further investigation below this depth using rock core or other methods would be needed to verify the actual top of bedrock elevation, as well as the bedrock formation[1] and competency. Additional investigation would also reveal the extent of potential loose zones in the sandstone or abrupt changes in bedrock formation that could affect foundation performance.

Table 2 – Rock Conditions

Boring	Weathered Sandstone		Auger Refusal	
	Depth (ft)	Elevation (ft)	Depth (ft)	Elevation (ft)
B-1	17.0	812.4	29.8	799.7
B-2	12.0	813.2	22.6	802.6
B-3	7.0	817.4	19.9	804.5
B-4	12.0	806.9	22.8	796.1
B-5	12.0	806.5	28.0	790.5
B-6	24.5	792.6	40.1	777.0
B-7	22.0	792.8	42.0	772.8
B-8	29.5	780.7	*	*
B-9	29.5	777.4	*	*

* Auger refusal

3.4 Groundwater Conditions

Groundwater was encountered in 4 of the 11 borings. Groundwater levels are likely perched on top of, or within, silt and clay layers. Groundwater movement at the site is likely transient owing to transport through silty sand and silt seams across the sloping topography. A summary of the groundwater measurements at each boring during drilling is presented in Table 3.

Groundwater was encountered in sandy lean clay soils in borings B-10 and B-11 at approximate elevations 777 and 771 feet, respectively. The sandy lean clay was noted as “gray” below approximate elevation 782 feet in B-10 and 766 feet in B-11. Although most of the groundwater encountered in the borings is believed to be perched, it is possible that the gray clay in B-10 and B-11, which are located at lower elevations than the other borings, reflects a more static water table, possibly as high as elevation 782 feet.

---

[1] Occasional seams of glauconitic material were encountered at depth within the weathered sandstone and may point to Franconia Formation sandstone.

Table 3 – Groundwater Measurements

Boring	Ground Elevation (ft)	Depth (ft)	Elevation (ft)
B-1	829.4	*	*
B-2	825.2	*	*
B-3	824.4	*	*
B-4	818.9	*	*
B-5	818.5	*	*
B-6	817.1	19.5	797.6
B-7	814.8	*	*
B-8	810.2	*	*
B-9	806.9	14.5	792.4
B-10	801.7	24.5	777.2
B-11	782.8	12.0	770.8

*Groundwater not encountered.

4.0 Geotechnical Evaluation

The evaluations and recommendations presented in this report are based on the proposed project layout, results of the subsurface investigation, discussions with other SEH staff, and review of other relevant information made available to us. SEH reserves the right to review and modify the report's analyses and conclusions if new or different information becomes available.

4.1 Site Preparation and Excavation

Proposed development at the site will include excavation of existing slopes and re-grading the excavated material to establish a flat pad for the building and facility exteriors, suitable access from the unpaved road and a storm water pond. In general, soil material will be excavated from the south and west areas and re-graded to the north and east. Excavation at the exterior southwest corner of the proposed building is anticipated to be at least 25 feet to achieve final grade.

Existing topsoil is primarily brown sandy lean clay with trace roots and other organic material. The on-site topsoil is likely not suitable for re-use in new turf establishment. The existing topsoil within the construction limits is recommended to be stripped to a minimum depth of 6 inches and replaced with topsoil borrow.

4.1.1 Excavation

Site excavation is anticipated to encounter very dense weathered sandstone. It is expected that excavating in the weathered sandstone can be accomplished with traditional methods. Potholing in prior to initiating major site excavation is recommended to confirm extent of weathered sandstone, particularly upslope of the proposed building footprint, and whether the equipment planned for excavating the weathered sandstone is suitable.

All excavations should comply with the requirements of OSHA 29 CFR, Park 1926, Subpart P "Excavations and Trenches". Excavated soils are recommended to be considered a Type C soil per OSHA with unsupported excavations limited to 1.5H:1V. Excavations in excess of

20 feet require appropriate sloping, benching and/or structural support designed by a licensed engineer.

Groundwater encountered in the borings is likely perched and not reflective of a long-term static water table. Where excavations encounter perched groundwater, appropriate measures such as shoring and/or sumps with drainage rock and pumps are recommended to maintain integrity of the excavation and backslopes. Construction grades are recommended to be sloped in order to direct runoff away from excavations. Temporary erosion protection is recommended where any excavated silty sand and sandstone slopes will be left exposed for longer than 24 hours.

4.2 Processing Building

The ash processing building is proposed to cover a rectangular footprint approximately 275 feet by 100 feet. The building is proposed to be a prefabricated structure with steel frames secured to paired spread footings along the perimeter. One continuous reinforced concrete slab will provide the finished floor within the perimeter of footings. The finished floor elevation is proposed to be 811.0 feet. Column loads for steel frame members on spread footings are assumed to be 2,000 psf. Floor loads on the concrete slab are assumed to be 3,000 psf.

4.2.1 Foundation Analysis

Shallow foundations for support of the steel frame members are proposed to be square spread footings. A continuous reinforced concrete slab, approximately 10-inches thick and not tied to the footings, will extend between footings for the full remaining footprint. With a finished floor elevation of 811 feet, the footings are anticipated to bear on very dense weathered sandstone along the south perimeter. Along the north perimeter, foundation soils are anticipated to range from medium dense silty sand to firm to stiff sandy lean clay.

Foundation settlements were evaluated for two cases. Case 1 considered foundation conditions at the northeast corner of the proposed building where sandy lean clay soils were encountered (see borings B-8 and B-9) and where grades will be raised approximately 4 feet above existing ground. Case 2 considered foundations supported directly over weathered sandstone along the south perimeter. Case 1 settlement was assumed to consist of A) immediate elastic deformation within silty and clayey sand and clayey sand, and B) consolidation of the sandy lean clay. Case 2 settlement was assumed to consist of only immediate elastic deformation of the weathered sandstone. Settlement parameters were developed using soil boring and laboratory data.

Up to 3 inches of total settlement was estimated beneath foundations at the northeast corner of the building. By comparison, less than ¼ inch of settlement is estimated for foundations directly over weathered sandstone. Therefore differential settlement between foundations footings along the south perimeter and at the northeast corner, and across the concrete slab, could approach 3 inches, which is not desired for structural design..

4.2.2 Load Distribution Platform

Given the variability within foundation soils, a load distribution platform (LDP) is recommended beneath the northeast quadrant of the building to mitigate the risk of differential settlement between footings and the concrete slab and to enhance the allowable bearing capacity. Similar to a stiff beam or platform, an LDP serves to more evenly distribute foundation loads within the subgrade. A typical LDP consists of 2-4 layers of geosynthetic reinforcement placed between compacted lifts of well-graded granular fill. Small differential settlement of underlying soils generate small strains and tension forces in the geosynthetic reinforcement layers. Because the geosynthetics are confined by the compacted fill, the tension forces act to stiffen the fill, limit differential settlement and help transmit loads throughout the platform.

A 2-foot thick LDP is recommended beneath the footings and concrete slab. The LDP is recommended to consist of three 8-inch lifts of compacted crushed aggregate fill meeting the gradation criteria of MnDOT 3138 (Class 5). Each lift of aggregate fill is recommended to be compacted to no less than 95 percent of the standard Proctor dry density (per ASTM D 698). The geosynthetic reinforcement layers are recommended to be biaxial geogrid products with specified properties as presented in Table 4. The geogrids are recommended to be placed at the bottom of each lift and aligned so that their roll direction is perpendicular to the layer above and below. Overlap of adjacent geogrid panels is recommended to be a minimum of 24 inches.

Table 4 – Recommended Properties for LDP Geogrids

Biaxial Geogrid Properties	**Machine Direction**	**Cross Direction**	**Units**	**Test Method**
Minimum Tensile Strength at 2% Strain	600	600	pounds per foot	ASTM D 6637
Minimum Tensile Strength at 5% Strain	400	400	pounds per foot	ASTM D 6637
Minimum Coefficient of Interaction, Ci	0.8		n/a	ASTM D 6706

The top lift of the LDP is recommended to extend a minimum of 1 foot laterally beyond the outer edge of the footings. The middle lift should be over-sized a minimum of 1 foot laterally outside of the top lift. The bottom lift should be over-sized a minimum of 1 foot laterally outside of the middle lift. A conceptual detail of the LDP is included in the Appendix.

LDP construction is recommended to include a 2-foot subcut beneath the LDP to remove and replace sandy lean clay soil. Subcut backfill is recommended to consist of on-site silty sand and sand material placed in lifts not exceeding 8 inches thick. The subcut backfill is recommended to be compacted to 95 percent of the standard Proctor dry density.

4.2.3 Foundation Preparation and Design

Structural backfill above the LDP, around the footings and beneath the concrete slab is recommended to consist of material meeting the requirements of MnDOT 3149.2B.2 (Select Granular). The silty sand encountered on-site does not meet this requirement. A 6-inch thick gravel pad consisting of MnDOT 3138 (Class 5) aggregate is recommended immediately beneath the concrete slab. The structural backfill and gravel pad are recommended to be placed in loose lifts not exceeding 8 inches thick and compacted to no less than 100 percent of the standard Proctor dry density.

Provided the LDP is constructed and the subgrade prepared as recommended, allowable bearing pressures of 2000 psf for design of spread footings and 3000 psf for support of concrete slab are recommended. Total settlement is estimated to be less than 1 ½ inches with much of that occurring as differential settlement between the north and south sides of the building. Differential settlement between adjacent footings in the east-west direction is estimated to be less than ¼ inch.

4.2.4 Alternative Foundation System

An alternative to the LDP and subcut recommendations could be to support the footings and slab on a deep foundation system. Such a system that may be feasible at this site is a

Geopier[2] system. The Geopier system uses Rammed Aggregate Piers® within a design-build soil reinforcement system commonly used as a potential cost-saving alternative to soil correction and deep foundations (piles and caissons). They have been used successfully in the Midwest on over 2,000 projects in poor soil conditions.

Geopier elements are installed by drilling 20 to 30-inch diameter holes, and ramming thin lifts of well-graded aggregate within the holes to form very stiff, high-density aggregate piers. The drilled holes typically extend from 10 to 20 feet or more below structural foundations. The first lift of aggregate forms a bulb below the bottoms of the piers, thereby pre-stressing and pre-straining the soils to a depth equal to at least one pier diameter below drill depths. Subsequent lifts are typically about 12 inches in thickness.

Ramming takes place with a high-energy beveled tamper that both densifies the aggregate and forces the aggregate laterally into the sidewalls of the hole. This action increases the lateral stress in surrounding soil; thereby further stiffening the stabilized composites soil mass. The result of Geopier installation is a significant strengthening and stiffening of subsurface soils that then support floor slabs and high-capacity footings.

With a Geopier system, foundations may be designed as conventional spread footings and typically sized for allowable bearing pressures up to approximately 4,500 to 6,000 pounds per square foot. The floor slab may also be designed as a conventional concrete slab-on-grade. When Geopier systems are used, a rigorous Quality Assurance Testing program is typically implemented during construction, which includes documentation of the soil conditions encountered, the shaft lengths, amount of aggregate used, verification of the modulus test readings, and tests on the compacted aggregate lifts.

4.3 Finished Slopes

Up to 23 feet of excavation is proposed at the southwest corner of the site. Finished slopes at the southwest corner are proposed to be graded at 1.5H:1V to 2H:1V back up to existing grades. While soil slopes at 1.5H:1V can hold up in the short term, they are typically not sustainable as permanent grades without mechanical reinforcement and engineered turf establishment. Such slopes, particularly those comprised of fine and silty sands, are at risk from erosive runoff events. These events typically cause localized loss-of-ground that often leads to progressive sloughing and repeated shallow slope failures during subsequent runoff events.

An anchored turf reinforcement mat (TRM) system is recommended for finished slopes steeper than 2H:1V. These systems generally consist of shallow anchors (4 to 6 feet long, though longer lengths are also available) installed using manual or percussive methods at regular intervals across the slope. A TRM is placed over the anchors and affixed to the anchor head. The anchors are tensioned to a prescribed design load to help the TRM maintain intimate contact with the slope soils. Hydromulch and seed are then applied across the entirety of the mat. The system acts to improve the slope stability factor of safety with respect to shallow, infinite slope-type failures. Currently available anchored TRM systems

---

[2] Geopier designs are based on a two-layer settlement analysis. Settlements within the “upper zone” (zone of soil that is reinforced with Geopier elements) are computed using a weighted modulus method that accounts for the stiffness of the Geopier elements, the stiffness of the matrix soil, and the area coverage of Geopier elements below supported footings. Settlements within the “lower zone” (zone of soils beneath the upper zone which receives lower intensity footing stresses) are computed using conventional geotechnical settlement methods.

are proprietary, such as the Armormax® system by Propex and the suite of systems offered by Platipus Anchors.

Preliminary design requirements for an anchored TRM system are listed below. These requirements are recommended to be evaluated and confirmed during final design once the site grading plan is finalized. Final design of an anchored TRM system is recommended to provide a minimum slope stability factor of safety of 1.3.

• Minimum anchor embedment length	5 ft
• Maximum anchor spacing, center to center	5 ft
• Minimum allowable design load	1,000 lb

Establishing permanent vegetation can often take more than a single growing season due to construction schedule, variability in seasonal weather and precipitation, site grading and direction relative to the sun, and other factors. It is recommended to include provisions for additional hydroseeding to be performed during the next growing season after construction is complete.

4.4 Grading and Drainage

A storm water pond is proposed north of the ash processing building. Soils in the proposed pond area consist of discrete layers of medium dense silty sand and firm sandy lean clay (with occasional silt seams, see boring B-10). Silty sand layers and silt seams exposed in the pond slopes may seep water during high runoff events. Pond slope faces are recommended to have appropriate protection such as riprap or equivalent armoring system to accommodate potential seeping conditions. Filter protections such as a granular filter layer or geotextile filter per MnDOT 3602.3B (filter material) are recommended. Pond slopes are recommended to be no steeper than 3H:1V.

4.5 Utility

Utility bedding and backfill is recommended to meet the recommendations of structural backfill in Section 4.2.3. Where installed in trenches, backfill and bedding for utilities are recommended to be placed in loose lifts not more than 6 inches thick from the bottom of the trench to top of utility. Backfill above the utility is recommended to be placed in loose lifts not more than 8 inches thick.

The storm water pond outlet pipe is recommended to be bedded on material meeting MnDOT 3149 (Fine Aggregate Bedding). Outlet pipe bedding is recommended to be a minimum of 12-inches thick. Compaction of bedding to a minimum of 95 percent of the standard proctor dry density is recommended. A granular filter layer or geotextile filter is recommended around the bedding.

4.6 Construction Observation and Testing

A geotechnical engineer or qualified soils technician is recommended to observe earthwork activity to evaluate if the site soils are consistent with the results of the subsurface investigation. These observations should be conducted prior to any placement of backfill in excavations and prior to construction of any structural foundation elements.

Sampling and testing for standard Proctor compaction (per ASTM D 698) is recommended a minimum of three days prior to field density testing. Field density testing of dry unit weight and moisture content should occur at the following rates:

- Base of excavation: minimum 5 tests
- Backfill under footings and slabs: minimum 2 tests per lift
- Backfill around structural walls: minimum 2 tests per lift
- Backfill in utility excavations: 1 test per 300 cubic yards of in-placed backfill

4.7 Summary of Recommendations

1. Perform additional investigation to verify the upslope extent of weathered sandstone and the interpreted top of bedrock elevation and in-situ bedrock conditions in areas where borings encountered auger refusal. Perform two additional borings to a minimum depth of 20 feet below auger refusal elevations along the proposed building's south perimeter.
2. Strip existing topsoil a minimum of 6 inches and replace with topsoil borrow.
3. Slope unsupported excavations to 1.5H:1V or shallower (consistent with OSHA Type C soil type). Provide temporary erosion protection for excavation backslopes exposed longer than 24 hours.
4. Provide sumps and drainage rock or other measures as necessary to maintain a dewatered excavation. Direct surface runoff away from all excavations.
5. Construct Load Distribution Platform beneath spread footings and reinforced concrete slab under northeast quadrant of building. Perform minimum 2-foot replacement subcut of sandy lean clay below LDP.
6. Design spread footings using an allowable bearing pressure of 2000 psf.
7. Design concrete slab using an allowable bearing pressure of 3000 psf.
8. Provide and place structural backfill as recommended for foundations and utilities.
9. Install anchored turf reinforcement mat system on finished slopes steeper than 2H:1V. Evaluate and confirm preliminary design requirements for anchored turf reinforcement mat system during final design.
10. Grade pond slopes no steeper than 3H:1V. Provide riprap or equivalent armoring and filter protections along pond slopes to accommodate seepage conditions.
11. Provide recommended bedding and filter protection for pond outlet pipe.

5.0 General

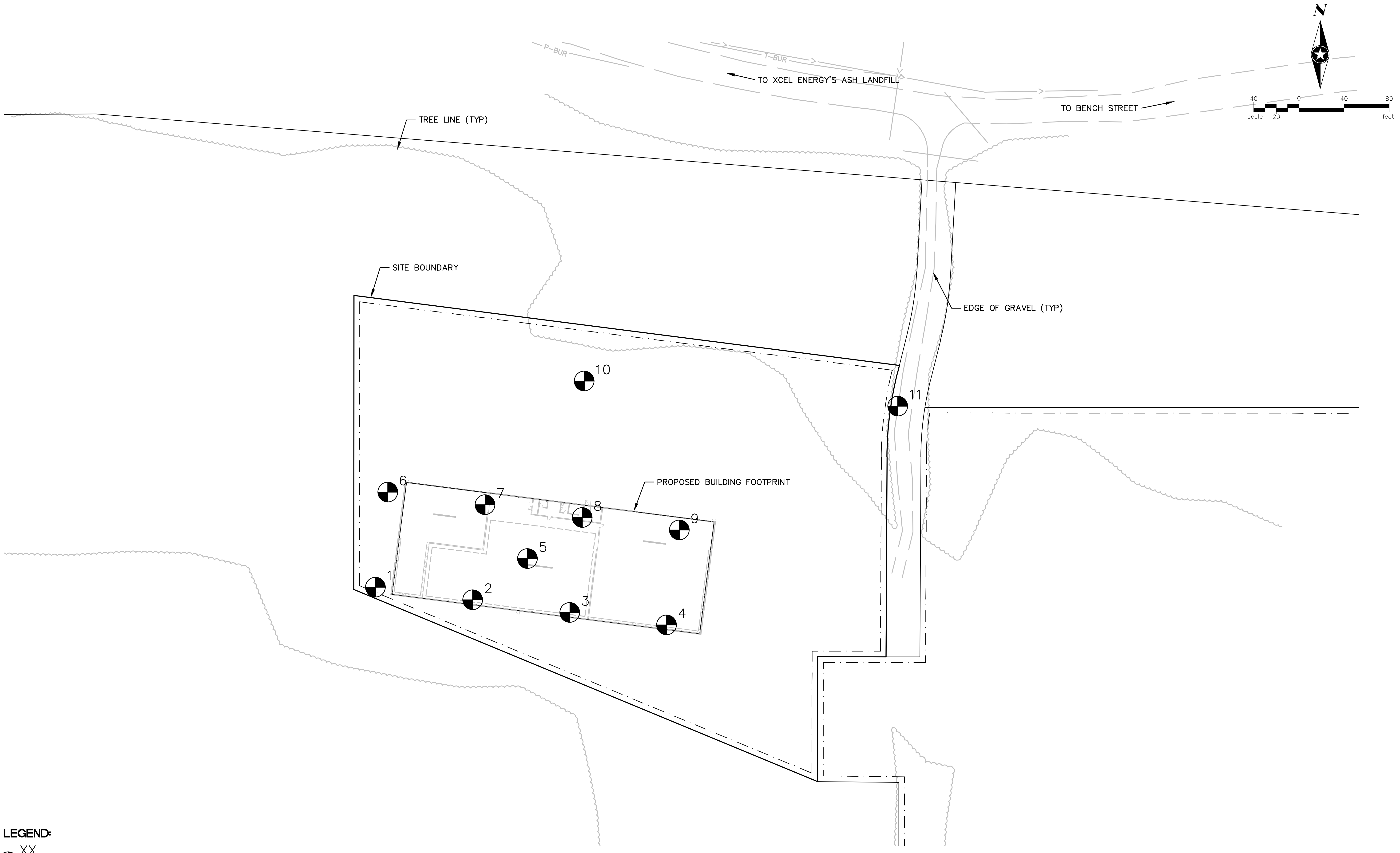
This report has been prepared to assist Lab USA, SEH and the City of Red Wing in the planning and design of the proposed ash processing facility. The scope is limited to the specific project and location described herein, and the description of the project represents the report's understanding of the site and project features relevant to its geotechnical characteristics. In the event that any changes in the proposed project are planned, SEH should be retained to review and modify the analyses and recommendations in this report as appropriate.

The analyses and recommendations contained in this report are based, in part, on the data obtained from individual soil borings performed at discrete locations and from other available information as described herein. This report does not reflect any variations that may occur between borings, variations that may occur outside of accessible areas, or variations occurring near existing structures or facilities.

During a subsurface exploration, specific information is obtained at specific locations and at specific times. Variations in soil, rock, and groundwater conditions may not become evident until the course of construction. If variations do become evident, it is recommended that SEH be retained to perform on-site observations during construction, note the characteristics of any variations and review and modify the analyses and recommendations of this report as appropriate.

Appendix A

Soil Boring Locations



LEGEND:

XX SOIL BORING LOCATION

DRAWN BY: DDL	NO.	BY	DATE
DESIGNER: BJR			
CHECKED BY: DRH			
DESIGN TEAM	NO.	BY	DATE

REVISIONS

PRELIMINARY:
NOT FOR CONSTRUCTION

SEH
651.490.2000
3535 VADNAIS CENTER DRIVE
ST. PAUL, MN 55110-5196
www.sehinc.com

Lab USA

LAB USA'S ASH PROCESSING
FACILITY - RED WING

SOIL BORING LOCATIONS

FILE NO.
LABUS 136249

APP. A

P:\KO\L\LABUS\136249\5-final-dsgn\51-drawings\10-Civil\cad\dwg\plnshts\Permit Plan Set\LA136249_BL.dwg 5/19/2016 1:41 PM dlandrus

Appendix B

NTI Geotechnical Data Report

NTI
NORTHERN TECHNOLOGIES, LLC
6160 Carmen Avenue East
Inver Grove Heights, MN 55076
P: 651.389.4191 F: 651.389.4190
www.NTIgeo.com
Unearthing confidence™

May 16, 2016

SEH
Attention: Brent Theroux, P.E.
3535 Vadnais Center Drive
St. Paul, MN 55110

Subject: Geotechnical Data Report
Lab USA Ash Processing Building
Red Wing, Minnesota
NTI Project No. 16.61343.100

Northern Technologies, LLC (NTI) has completed a total of eleven (11) soil borings for the Lab USA Ash Processing Building project in the City of Red Wing, Minnesota.

The scope of services included performing the soil borings and laboratory testing, as requested, on select samples. Our services were performed in accordance with our proposal dated February 15, 2016.

SUBSURFACE EXPLORATION SUMMARY

NTI performed the subsurface exploration program on March 18 through March 24, 2016 with a two-person crew using a truck-mounted Dedrich D-50 drill rig. Samples were generally collected in accordance with ASTM D 1586 “Standard Test Method for Standard Penetration Testing (SPT) and Split-Barrel Sampling of Soils.”

The boring locations and depths were determined and staked in the field by a representative of the client. Please refer to the Boring Location Diagram and the Boring Logs in Appendix C.

LABORATORY TEST PROGRAM

An NTI geotechnical engineer described the available soil samples in general accordance with the NTI Soil Classification System, which is generally based on the Unified Soil Classification System (USCS) outlined in ASTM D 2488. The soil descriptions were determined by visual observations made by the engineer, the driller’s field notes, the SPT information, and the field and laboratory test results. Details of the NTI classification system are included in Appendix A.

CLOSURE

As the widely spaced, small diameter borings provide only a limited amount of data regarding the overall subsurface at the project site. Consequently, the area coverage of borings in relation to the entire project is very small. For this and other reasons, we do not warrant conditions below the depth of our borings, or that the strata logged from our borings are necessarily typical of the site.

The scope of services for this project does not include either specifically or by implication any environmental or biological assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This data report has been prepared for the exclusive use of SEH and its agents for specific application to the Lab USA Ash Processing Building project, in Red Wing, Minnesota. Northern Technologies, LLC has endeavored to comply with generally accepted geotechnical engineering practice common to the local area. Northern Technologies, LLC makes no other warranty, express or implied.

Northern Technologies, LLC

Debra A. Schroeder, P.E.
Project Geotechnical Engineer

Steven D. Gerber, P.E.
Senior Engineer

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.

Steven D. Gerber

Date: 5/16/2016 Reg. No. 45298

DAS/sdg

Attachments
Appendix A - General Notes
Appendix B – Laboratory Test Results
Appendix C - Attachments: Boring Location Diagram (1), Soil Boring Logs (11)

APPENDIX A

GEOTECHNICAL EVALUATION OF RECOVERED SOIL SAMPLES

We visually examined recovered soil samples to estimate distribution of grain sizes, plasticity, consistency, moisture condition, color, presence of lenses and seams, and apparent geologic origin. We then classified the soils according using the Unified Soil Classification System (ASTM D2488). A chart describing this classification system and general notes explaining soil sampling procedures are presented within appendices attachments.

The stratification depth lines between soil types on the logs are estimated based on the available data. In-situ, the transition between type(s) may be distinct or gradual in either the horizontal or vertical directions. The soil conditions have been established at our specific boring locations only. Variations in the soil stratigraphy may occur between and around the borings, with the nature and extent of such change not readily evident until exposed by excavation. These variations must be properly assessed when utilizing information presented on the boring logs.

We request that you, your design team or contractors contact NTI immediately if local conditions differ from those assumed by this report, as we would need to review how such changes impact our recommendations. Such contact would also allow us to revise our recommendations as necessary to account for the changed site conditions.

FIELD EXPLORATION PROCEDURES

Soil Sampling – Standard Penetration Boring:

Soil sampling was performed according to the procedures described by ASTM D-1586. Using this procedure, a 2 inch O.D. split barrel sampler is driven into the soil by a 140 pound weight falling 30 inches. After an initial set of six inches, the number of blows required to drive the sampler an additional 12 inches is recorded (known as the penetration resistance (i.e. "N-value") of the soil at the point of sampling. The N-value is an index of the relative density of cohesionless soils and an approximation of the consistency of cohesive soils.

Soil Sampling – Power Auger Boring:

The boring(s) was/were advanced with a 6 inch nominal diameter continuous flight auger. As a result, samples recovered from the boring are disturbed, and our determination of the depth, extend of various stratum and layers, and relative density or consistency of the soils is approximate.

Soil Classification:

Soil samples were visually and manually classified in general conformance with ASTM D-2488 as they were removed from the sampler(s). Representative fractions of soil samples were then sealed within respective containers and returned to the laboratory for further examination and verification of the field classification. In addition, select samples were submitted for laboratory tests. Individual sample information, identification of sampling methods, method of advancement of the samples and other pertinent information concerning the soil samples are presented on boring logs and related report attachments.

General Notes

DRILLING & SAMPLING SYMBOLS

SYMBOL	DEFINITION
C.S.	Continuous Sampling
P.D.	2-3/8” Pipe Drill
C.O.	Cleanout Tube
3 HSA	3 ¼” I.D. Hollow Stem Auger
4 FA	4” Diameter Flight Auger
6 FA	6” Diameter Flight Auger
2 ½ C	2 ½” Casing
4 C	4” Casing
D.M.	Drilling Mud
J.W.	Jet Water
H.A.	Hand Auger
NXC	Size NX Casing
BXC	Size BX Casing
AXC	Size AX casing
SS	2” O.D. Split Spoon Sample
2T	2” Thin Wall Tube Sample
3T	3” Thin Wall Tube Sample

LABORATORY TEST SYMBOLS

SYMBOL	DEFINITION
W	Moisture content-percent of dry weight
D	Dry Density-pounds per cubic foot
LL, PL	Liquid and plastic limits determined in accordance with ASTM D 423 and D 424
Q_u	Unconfined compressive strength-pounds per square foot in accordance with ASTM D 2166-66
	Additional insertions in Qu Column
Qp	Penetrometer reading-tons/square foot
S	Torvane reading-tons/square foot
G	Specific Gravity – ASTM D 854-58
SL	Shrinkage limit – ASTM 427-61
pH	Hydrogen ion content-meter method
O	Organic content-combustion method
M.A.*	Grain size analysis
C*	One dimensional consolidation
Q_c^*	Triaxial Compression

* See attached data Sheet and/or graph

Water Level Symbol

Water levels shown on the boring logs are the levels measured in the borings at the time and under the conditions indicated. In sand, the indicated levels can be considered reliable ground water levels. In clay soils, it is not possible to determine the ground water level within the normal scope of a test boring investigation, except where lenses or layers of more pervious water bearing soil is present and then a long period of time may be necessary to reach equilibrium. Therefore, the position of the water level symbol for cohesive or mixed soils may not indicate the true level of the ground water table. The available water level information is given at the bottom of the log sheet.

Descriptive Terminology

DENSITY

TERM	“N” VALUE
Very Loose	0-4
Loose	5-8
Medium Dense	9 – 15
Dense	16 – 30
Very Dense	Over 30

CONSISTENCY

TERM	“N” VALUE
Soft	0-4
Medium	5-8
Rather Stiff	9 – 15
Stiff	16 – 30
Very Stiff	Over 30

Standard “N” Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch OD split spoon.

Relative Proportions

TERMS	RANGE
Trace	0-5%
A little	5-15%
Some	15-30%
With	30-50%

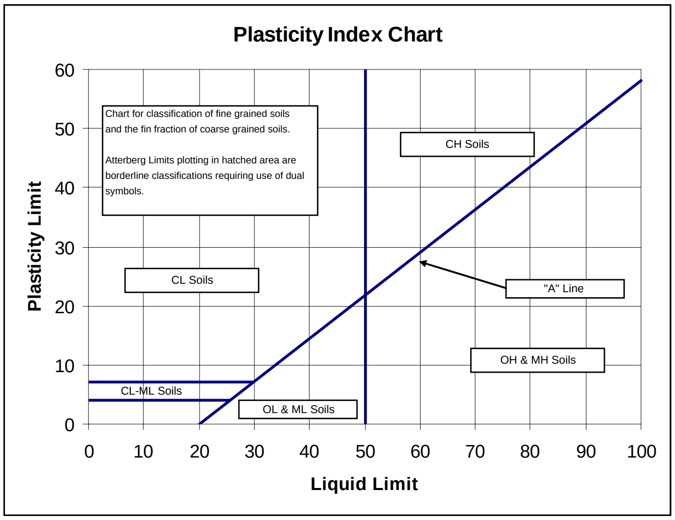
Particle Sizes

Boulders		Over 3”
Gravel -	Coarse	¾” – 3”
	Medium	#4 – ¾”
Sand -	Coarse	#4 - #10
	Medium	#10 - #40
	Fine	#40 - #200
Silt and Clay		Determined by plasticity characteristics.

Note: Sieve sizes are U.S. Standard.

Classification of Soils for Engineering Purposes

ASTM Designation D-2487 and D 2488 (Unified Soil Classification System)

Major Divisions			**Group Symbols**	**Typical Names**	**Classification Criteria**		
Course Grained Soils More than 50% retained on No. 200 sieve *	***Gravels*** 50% or more of coarse fraction retained on No. 4 sieve.	Clean Gravels	**GW**	Well –graded gravels and gravel-sand mixtures, little or no fines.	***Classification on basis of percentage of fines.*** Less than 5% passing No. 200 Sieve: GW, GP, SW, SP More than 12% passing No. 200 Sieve: GM, GC, SM, SC From 5% to 12% passing No. 200 Sieve: Borderline Classification requiring use of duel symbols.	$C_u = D_{60} / D_{10}$ $C_z = (D_{30})^2 / (D_{10} \times D_{60})$	greater than 4. between 1 & 3.
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines.		Not meeting both criteria for GW materials.	
		Gravels with Fines	**GM**	Silty gravels, gravel-sand-silt mixtures.		Atterberg limits below “A” line, or P.I. less than 4.	Atterberg limits plotting in hatched area are *borderline* classifications requiring use of dual symbols.
			GC	Clayey gravels, gravel-sand-clay mixtures.		Atterberg limits above “A” line with P.I. greater than 7.	
	Sands More than 50% of coarse fraction passes No 4 sieve.	Clean Sands	**SW**	Well-graded sands and gravelly sands, little or no fines.		$C_u = D_{60} / D_{10}$ greater than 6. $C_z = (D_{30})^2 / (D_{10} \times D_{60})$ between 1 & 3.	
			SP	Poorly-graded sands and gravelly sands, little or no fines.		Not meeting both criteria for SW materials.	
		Sands with Fines	**SM**	Silty sands, sand-silt mixtures.		Atterberg limits below “A” line, or P.I. less than 4.	Atterberg limits plotting in hatched area are *borderline* classifications requiring use of dual symbols.
			SC	Clayey sands, sand-clay mixtures.		Atterberg limits above “A” line with P.I. greater than 7.	
Fine Grained Soils More than 50% passes No. 200 sieve *	***Silts and Clays*** Liquid Limit of 50% or less		**ML**	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands.			
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.			
			OL	Organic silts and organic silty clays of low plasticity.			
	Silts and Clays Liquid Limit greater than 50%.		**MH**	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts.			
			CH	Inorganic clays of high plasticity, fat clays.			
			OH	Organic clays of medium to high plasticity.			
	Highly Organic Soils		**Pt**	Peat, muck and other highly organic soils.			

APPENDIX B

Northern Technologies Inc.
6160 Carmen Ave. E
Inver Grove Heights, MN, 55076
P: 651-389-4191

GRAIN SIZE DISTRIBUTION

ASTM C136 & D422

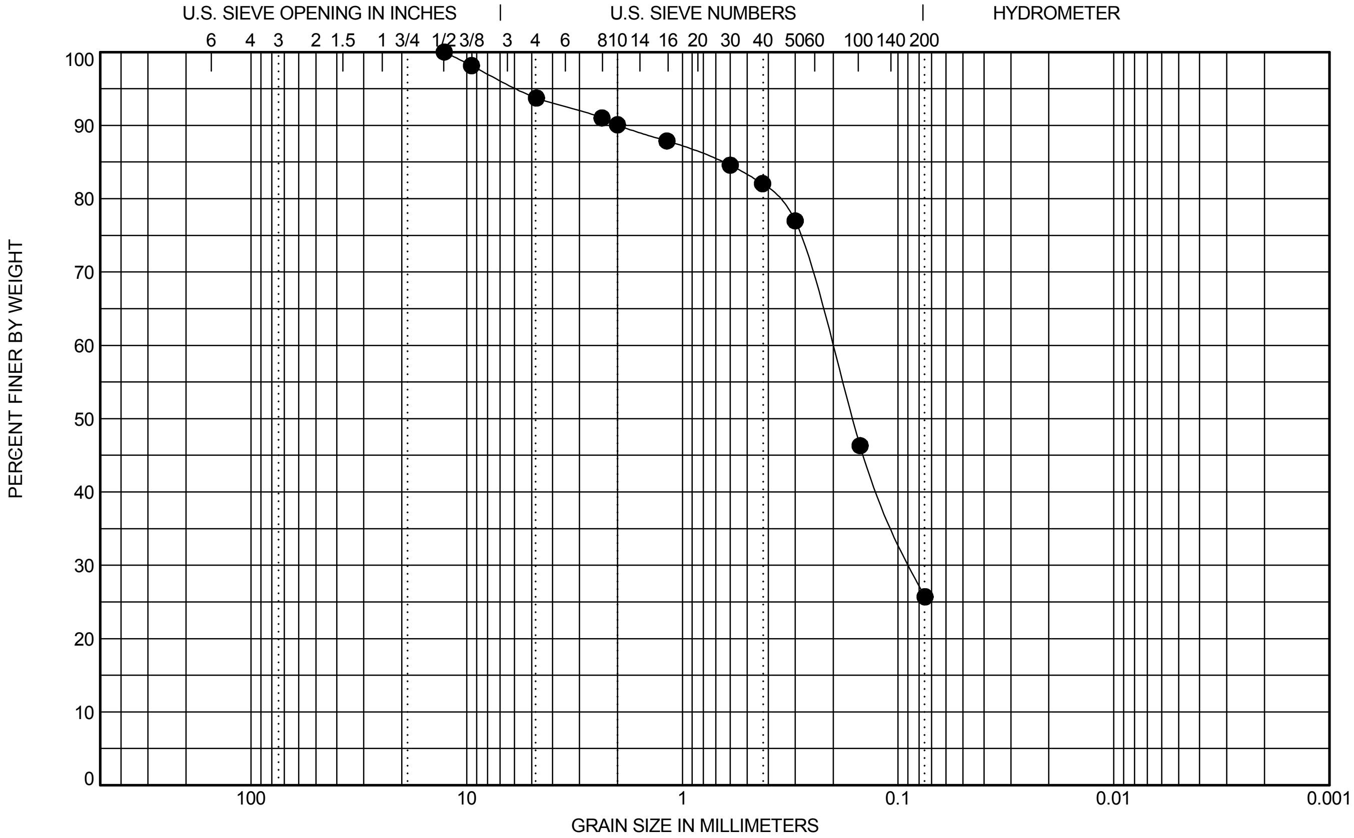
Report To:	SEH	Project:	Lab USA Ash Processing Building
		Project Number:	16.61343.100
Attention:		Location:	Red Wing, MN

Sample Information

Boring Number:	SB-1	Date Sampled:	3/22/2016
Sample Number:	10	Sampled By:	NTI
Sample Depth:	22	Sample Type:	SS
Classification:			

Sample Data

Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
		12.7	0.204	0.087		6.3	68.0	25.7	



Comments: Elevations provided by SEH.

Cc:

Submitted by,
Northern Technologies, LLC

(4/7/16)

Northern Technologies Inc.
6160 Carmen Ave. E
Inver Grove Heights, MN, 55076
P: 651-389-4191

GRAIN SIZE DISTRIBUTION

ASTM C136 & D422

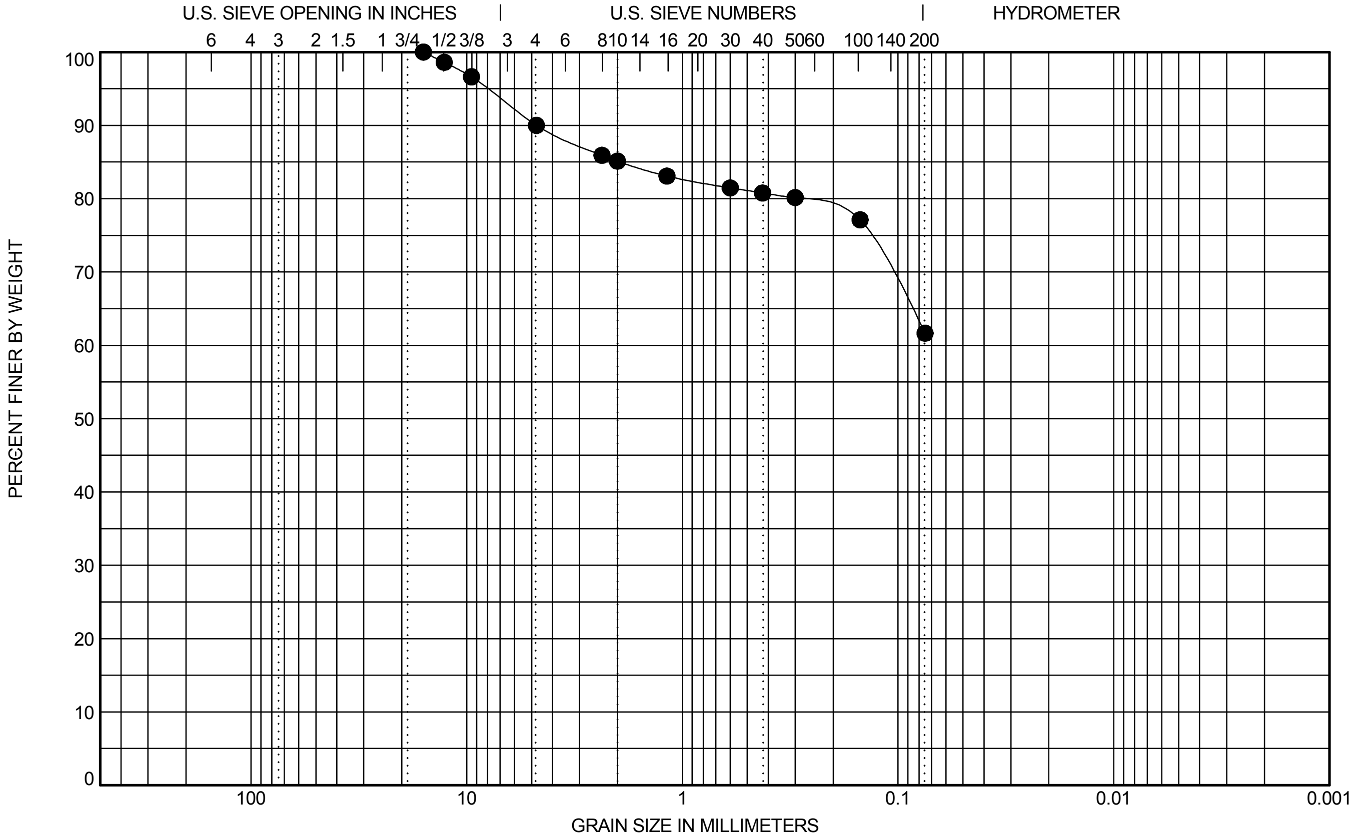
Report To:	SEH	Project:	Lab USA Ash Processing Building
		Project Number:	16.61343.100
Attention:		Location:	Red Wing, MN

Sample Information

Boring Number:	SB-3	Date Sampled:	3/22/2016
Sample Number:	6	Sampled By:	NTI
Sample Depth:	12	Sample Type:	SS
Classification:			

Sample Data

Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
		15.875				10.0	28.3	61.6	



Comments: Elevations provided by SEH.

Cc:

Submitted by,
Northern Technologies, LLC

(4/7/16)

Northern Technologies Inc.
6160 Carmen Ave. E
Inver Grove Heights, MN, 55076
P: 651-389-4191

GRAIN SIZE DISTRIBUTION

ASTM C136 & D422

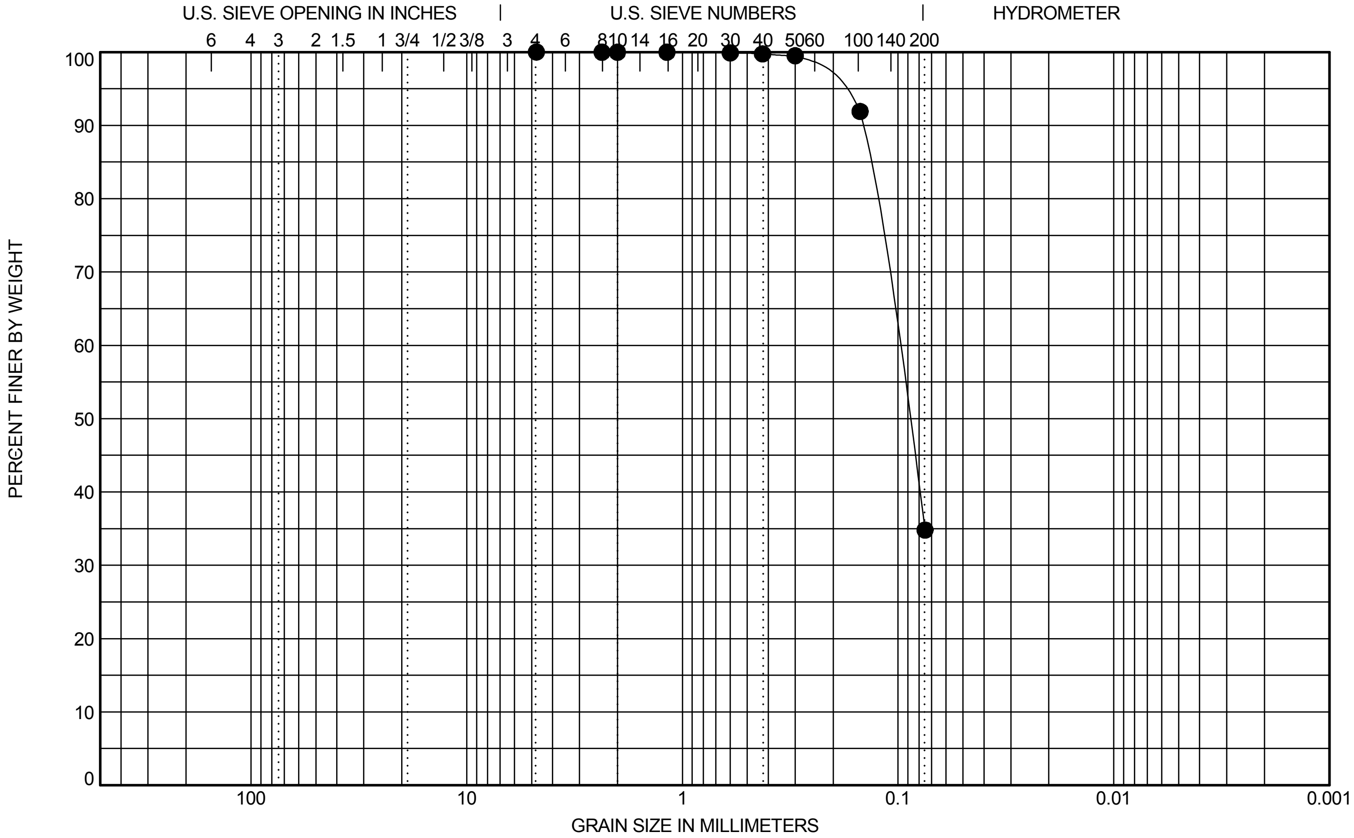
Report To:	SEH	Project:	Lab USA Ash Processing Building
		Project Number:	16.61343.100
Attention:		Location:	Red Wing, MN

Sample Information

Boring Number:	SB-5	Date Sampled:	3/24/2016
Sample Number:	11	Sampled By:	NTI
Sample Depth:	24.5	Sample Type:	SS
Classification:			

Sample Data

Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
		4.75	0.102			0.0	65.2	34.8	



Comments: Elevations provided by SEH.

Cc:

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Northern Technologies, LLC

(4/7/16)

Northern Technologies Inc.
6160 Carmen Ave. E
Inver Grove Heights, MN, 55076
P: 651-389-4191

GRAIN SIZE DISTRIBUTION

ASTM C136 & D422

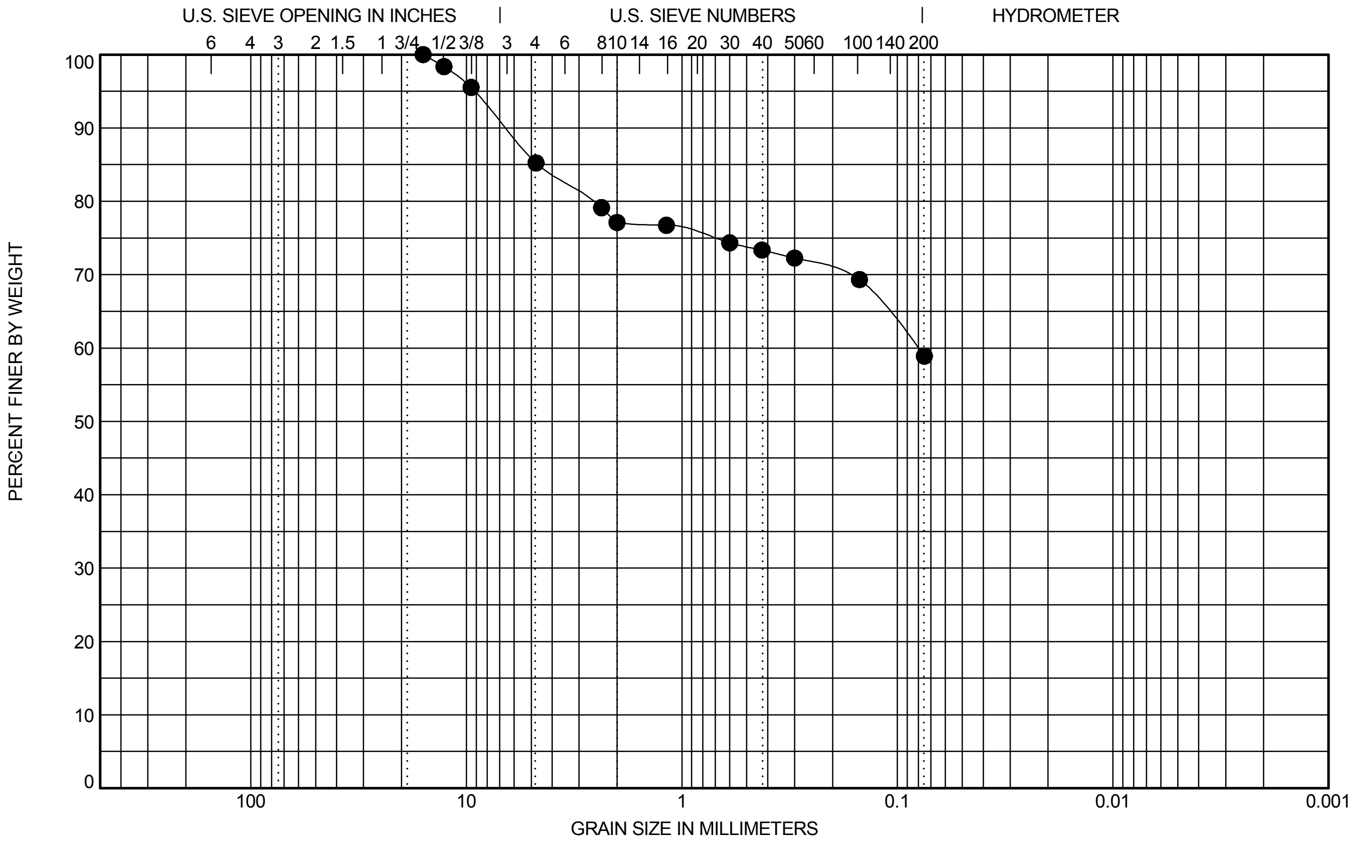
Report To:	SEH	Project:	Lab USA Ash Processing Building
		Project Number:	16.61343.100
Attention:		Location:	Red Wing, MN

Sample Information

Boring Number:	SB-6	Date Sampled:	3/18/2016
Sample Number:	9	Sampled By:	NTI
Sample Depth:	24.5	Sample Type:	SS
Classification:			

Sample Data

Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
		15.875	0.081			14.8	26.3	58.9	



Comments: Elevations provided by SEH.

Cc:

Submitted by,
Northern Technologies, LLC

(4/7/16)

NTI NORTHERN TECHNOLOGIES, LLC

Northern Technologies Inc.
6160 Carmen Ave. E
Inver Grove Heights, MN, 55076
P: 651-389-4191

GRAIN SIZE DISTRIBUTION
ASTM C136 & D422

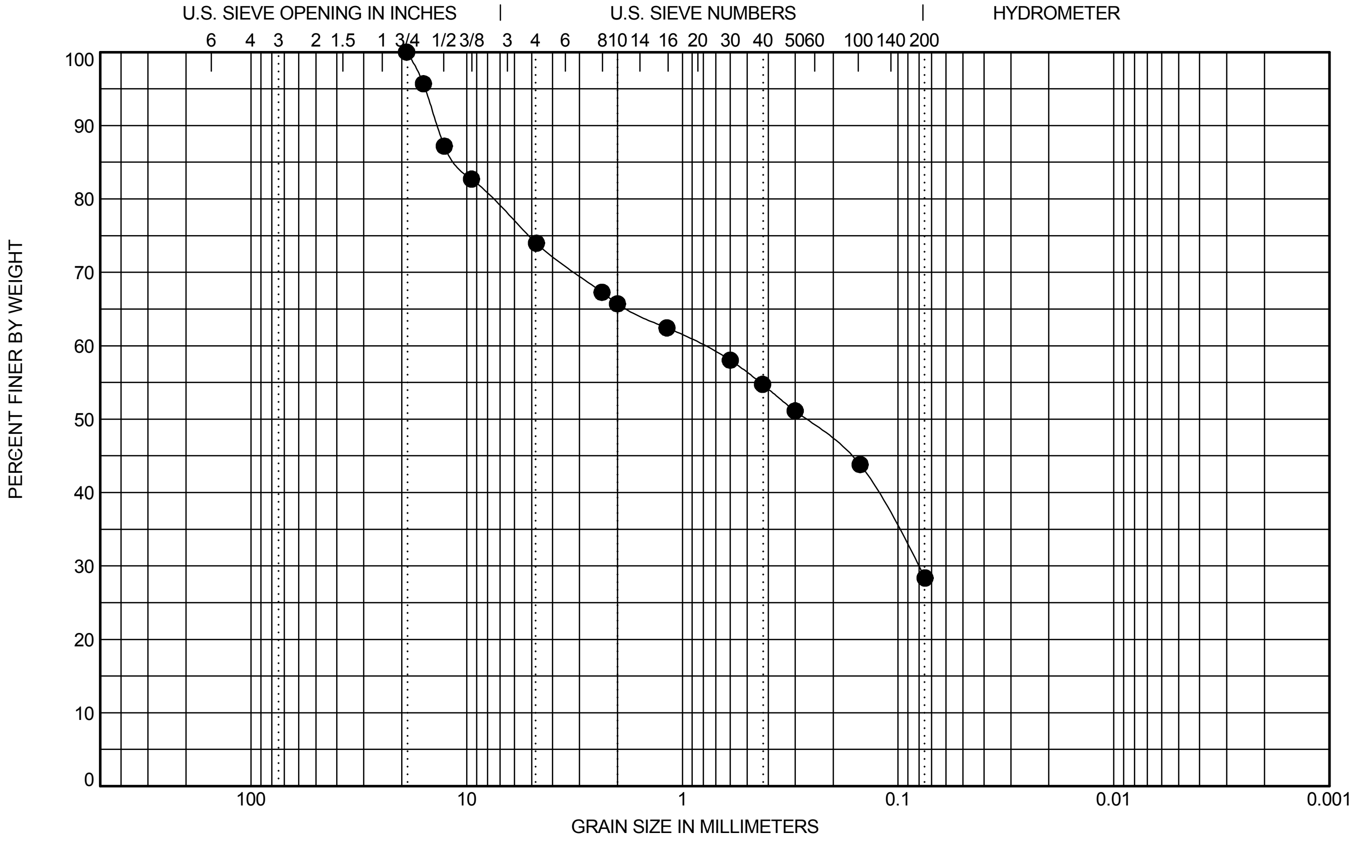
Report To:	SEH	Project:	Lab USA Ash Processing Building
		Project Number:	16.61343.100
Attention:		Location:	Red Wing, MN

Sample Information

Boring Number:	SB-7	Date Sampled:	3/22/2016
Sample Number:	10	Sampled By:	NTI
Sample Depth:	22	Sample Type:	SS
Classification:			

Sample Data

Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
		19	0.813	0.081		26.0	45.6	28.4	



Comments: Elevations provided by SEH.

Cc:

Submitted by,
Northern Technologies, LLC

(4/7/16)

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Inver Grove Heights, MN, 55076
P: 651-389-4191

GRAIN SIZE DISTRIBUTION

ASTM C136 & D422

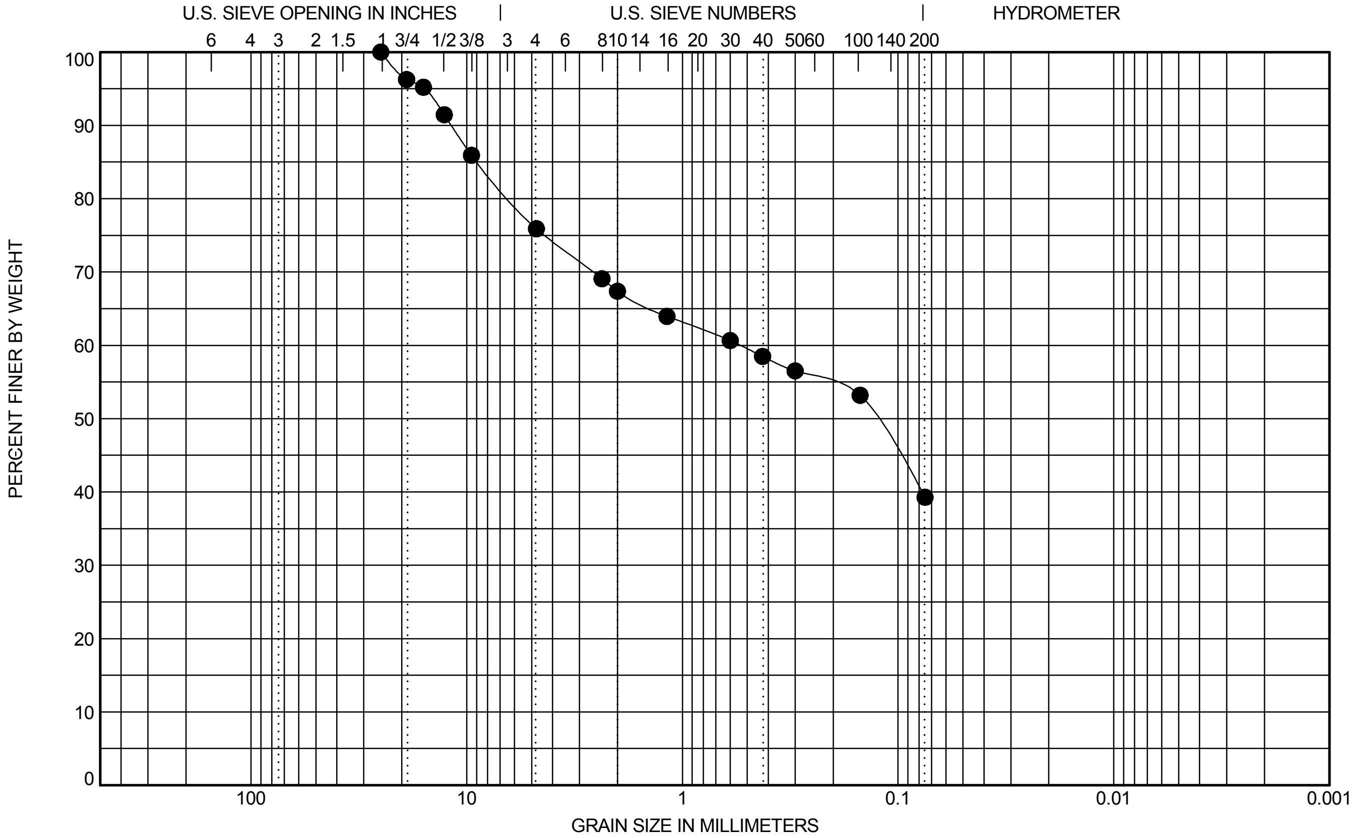
Report To:	SEH	Project:	Lab USA Ash Processing Building
		Project Number:	16.61343.100
Attention:		Location:	Red Wing, MN

Sample Information

Boring Number:	SB-7	Date Sampled:	3/22/2016
Sample Number:	12	Sampled By:	NTI
Sample Depth:	29.5	Sample Type:	SS
Classification:			

Sample Data

Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
		25	0.541			24.1	36.6	39.3	



Comments: Elevations provided by SEH.

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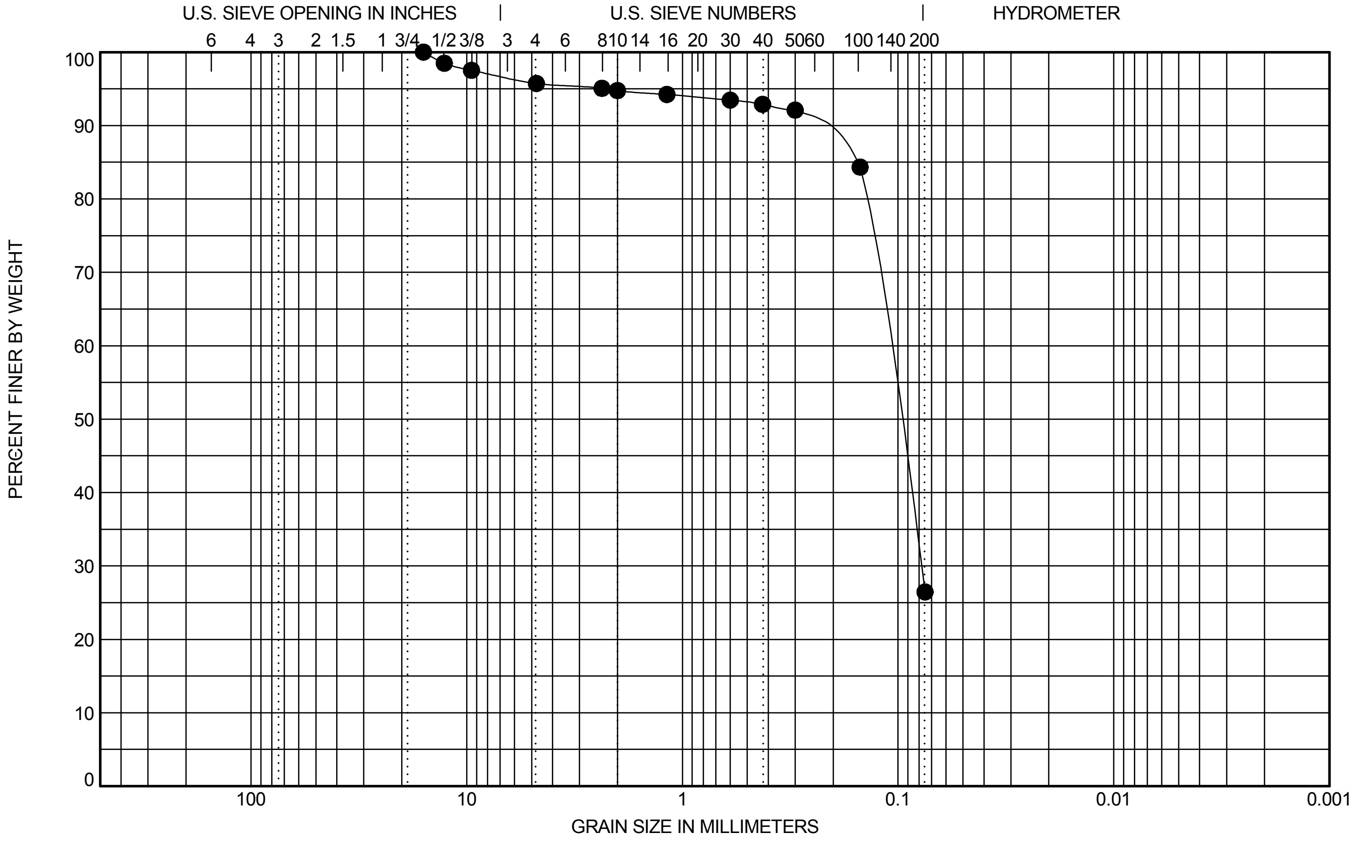
Report To:	SEH	Project:	Lab USA Ash Processing Building
		Project Number:	16.61343.100
Attention:		Location:	Red Wing, MN

Sample Information

Boring Number:	SB-7	Date Sampled:	3/22/2016
Sample Number:	13	Sampled By:	NTI
Sample Depth:	34.5	Sample Type:	SS
Classification:			

Sample Data

Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
		15.875	0.112	0.078		4.3	69.3	26.4	



Comments: Elevations provided by SEH.

Cc:

Submitted by,
Northern Technologies, LLC

(4/7/16)

Northern Technologies Inc.
6160 Carmen Ave. E
Inver Grove Heights, MN, 55076
P: 651-389-4191

GRAIN SIZE DISTRIBUTION
ASTM C136 & D422

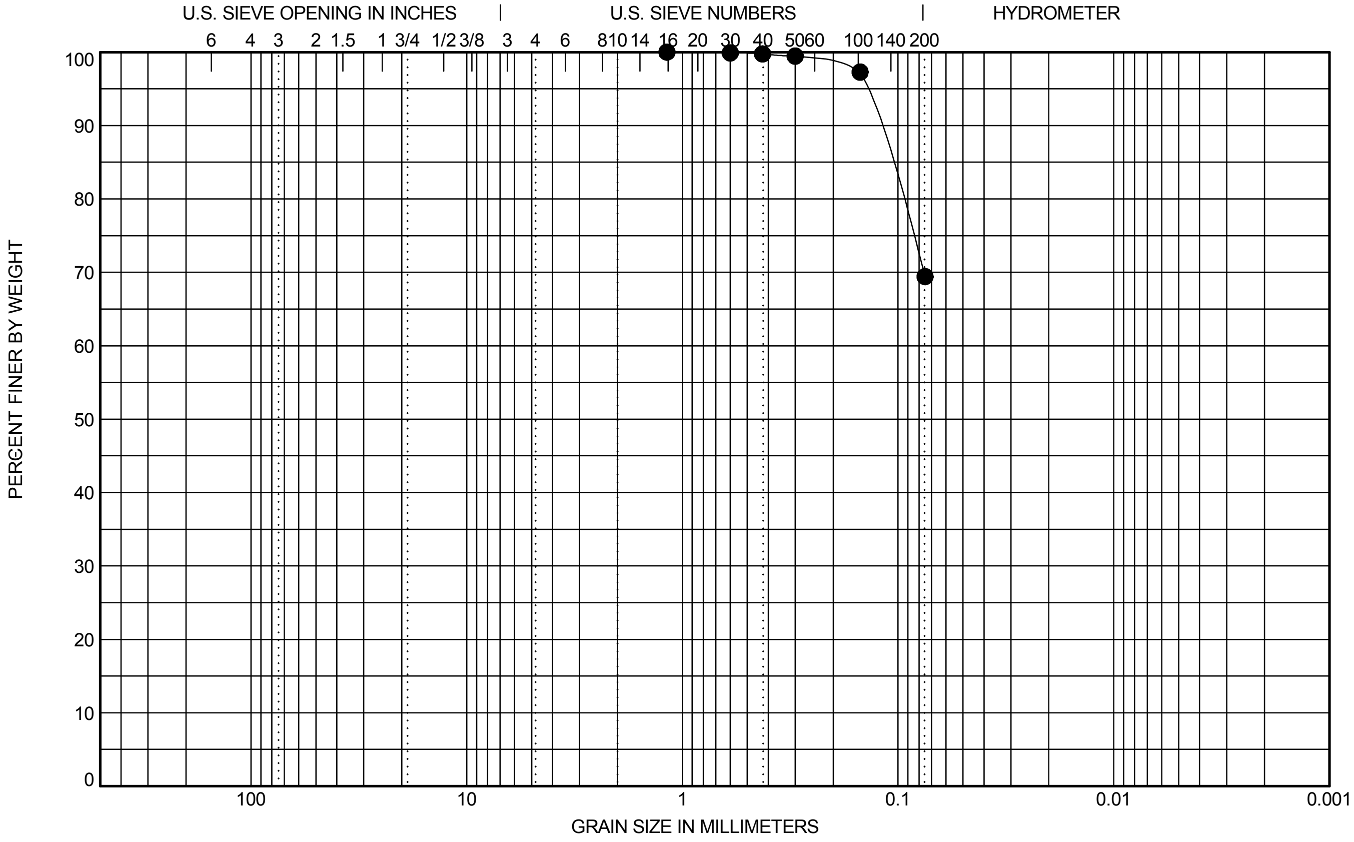
Report To:	SEH	Project:	Lab USA Ash Processing Building
		Project Number:	16.61343.100
Attention:		Location:	Red Wing, MN

Sample Information

Boring Number:	SB-9	Date Sampled:	3/21/2016
Sample Number:	10	Sampled By:	NTI
Sample Depth:	22	Sample Type:	SS
Classification:			

Sample Data

Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
		1.18				0.0	30.6	69.4	



Comments: Elevations provided by SEH.

Cc:

Submitted by,
Northern Technologies, LLC

(4/7/16)

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GRAIN SIZE DISTRIBUTION

ASTM C136 & D422

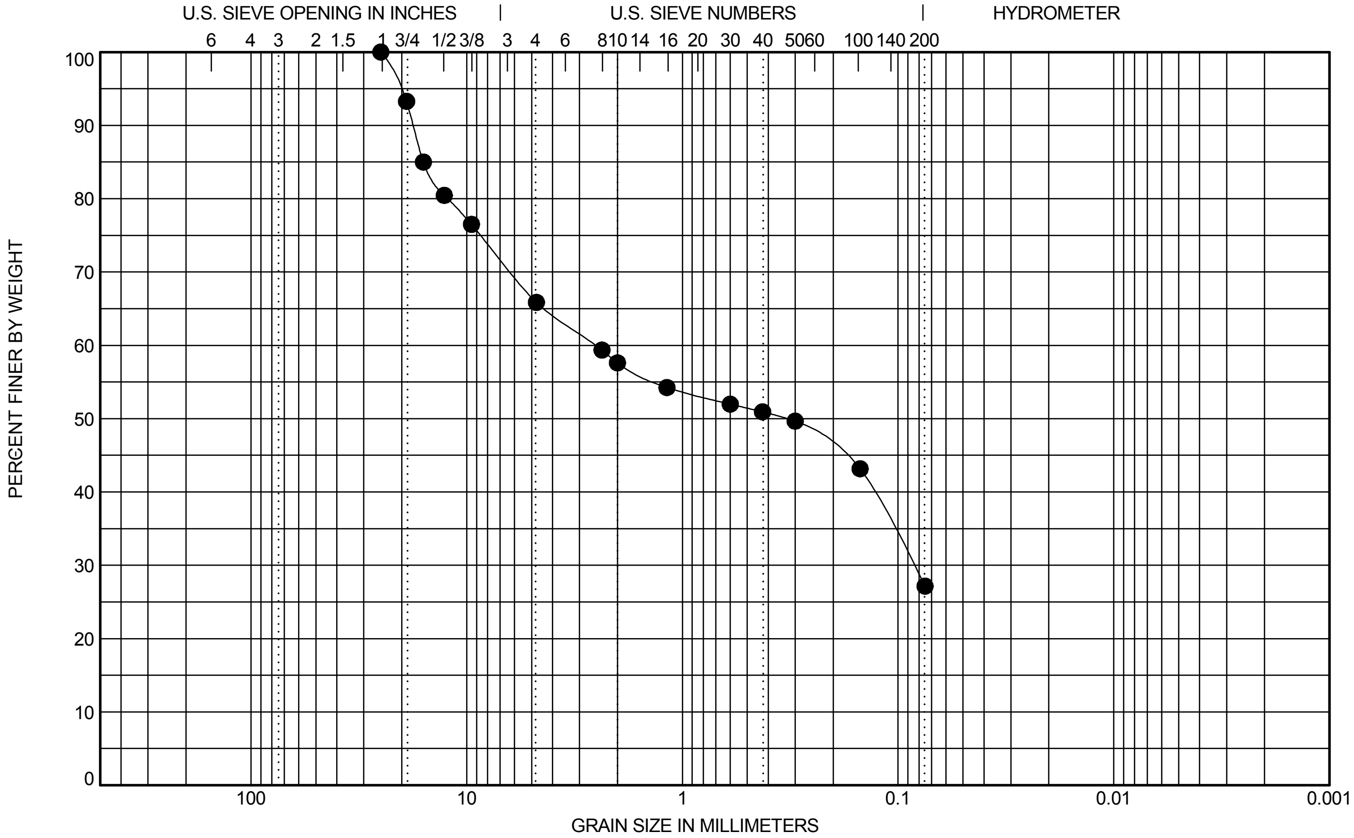
Report To:	SEH	Project:	Lab USA Ash Processing Building
		Project Number:	16.61343.100
Attention:		Location:	Red Wing, MN

Sample Information

Boring Number:	SB-9	Date Sampled:	3/21/2016
Sample Number:	12	Sampled By:	NTI
Sample Depth:	29.5	Sample Type:	SS
Classification:			

Sample Data

Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
		25	2.532	0.085		34.2	38.7	27.1	



Comments: Elevations provided by SEH.

Cc:

Submitted by,

Northern Technologies, LLC

(4/7/16)

GEO MA - NTI 2015-01-15.GDT - 4/7/16 13:13 - Z:\1-PROJECTS\2016 PROJECTS\RED WING CONTRACT DRILLING - GEO - (16.61343.100)\ENGINEERING\ENGINEERING REPORTS\GINT\SEH CONTRACT.GPJ

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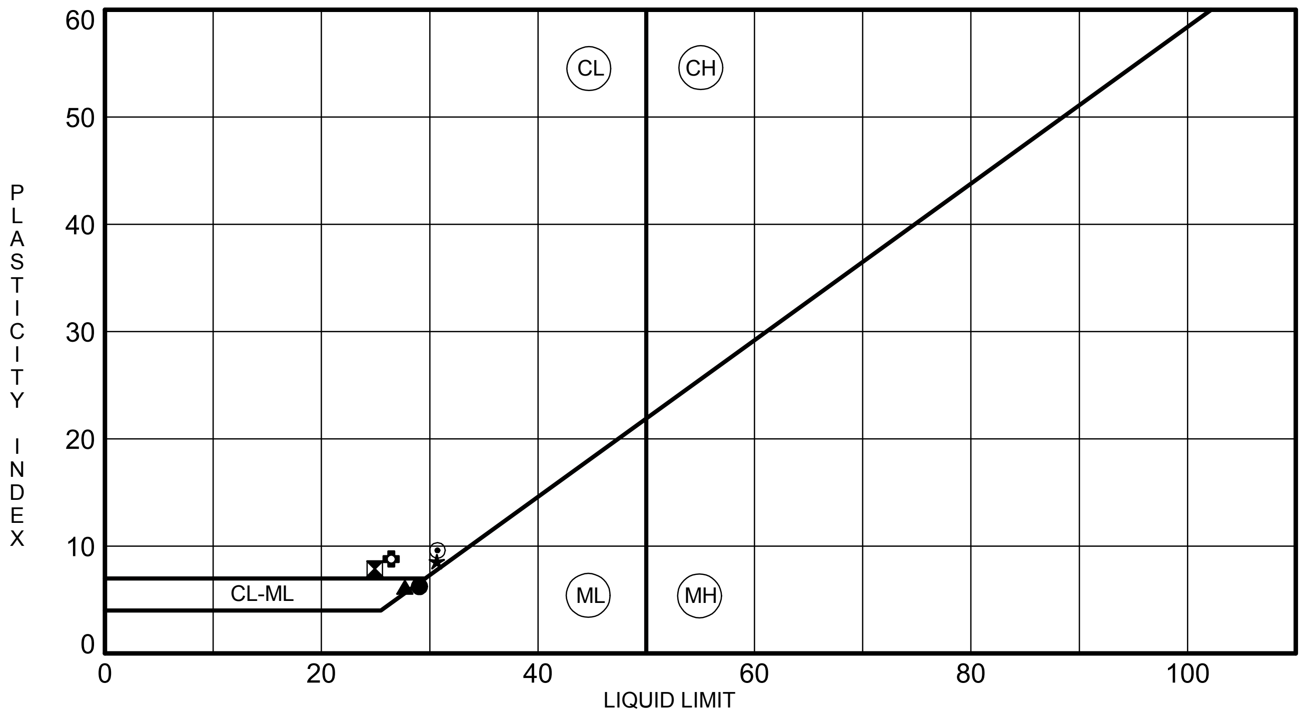
ATTERBERG LIMITS' RESULTS

ASTM D4318

Report To:	SEH	Project:	Lab USA Ash Processing Building
Attention:		Project Number:	16.61343.100
		Location:	Red Wing, MN

Sample Data

	BOREHOLE	SAMPLE #	DEPTH	LL	PL	PI	Fines	Classification
●	SB-6	8	19.5	29	23	6		
⧗	SB-8	5	9.5	25	17	8		
▲	SB-8	7	14.5	28	22	6		
★	SB-9	7	14.5	31	22	9		
⊙	SB-11	3	4.5	31	21	10		
✿	SB-11	7	14.5	26	18	8		

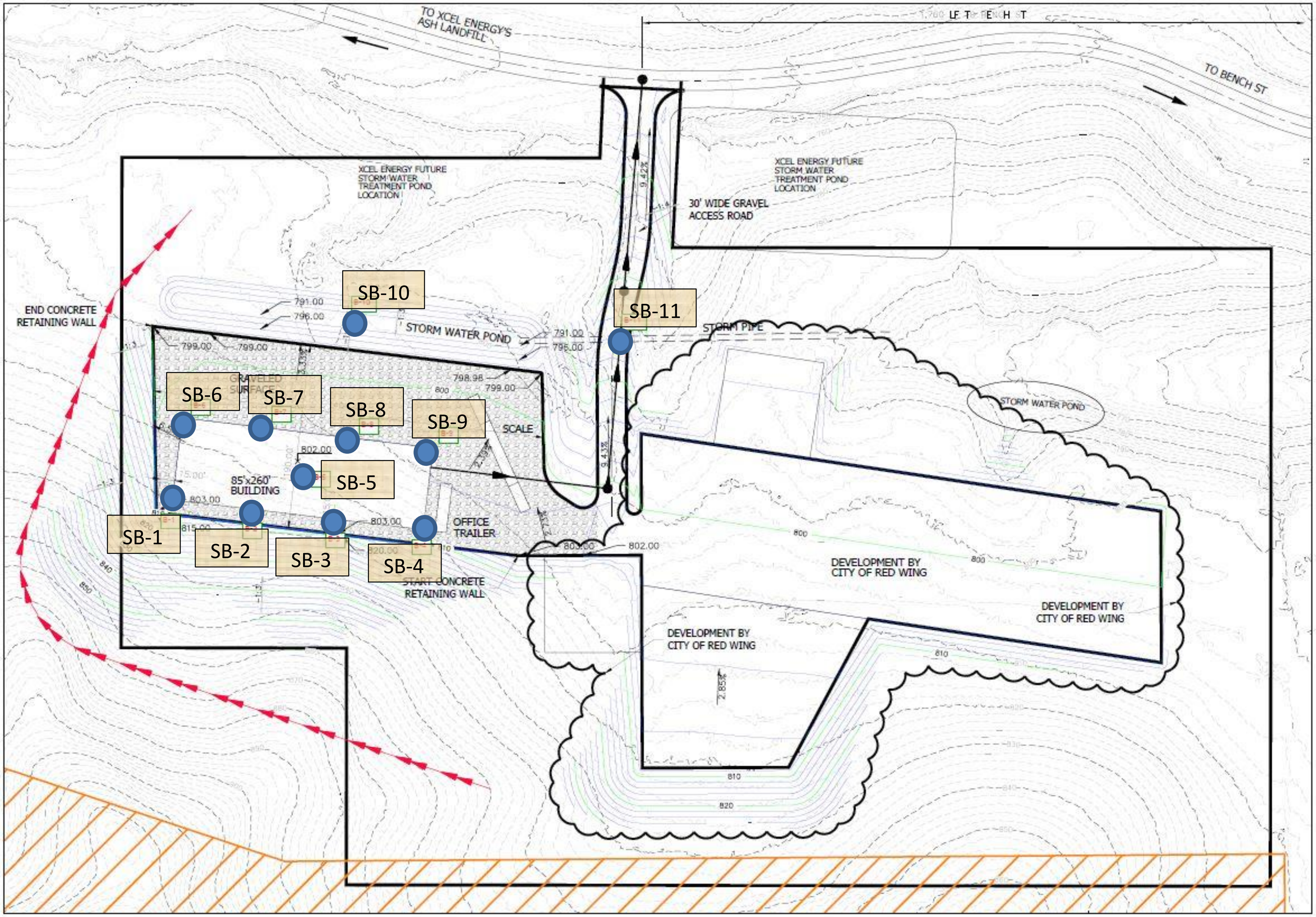


Cc:

Submitted by,
Northern Technologies, LLC

(4/7/16)

APPENDIX C



Boring Location Diagram
Lab USA Ash Processing Building
Red Wing, Minnesota
NTI Project #: 16.61343.100

NOTE: Boring locations are approximate.

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BORING NUMBER SB-1

CLIENT SEH
PROJECT NAME Lab USA Ash Processing Building
PROJECT NUMBER 16.61343.100
PROJECT LOCATION Red Wing, MN
DATE STARTED 3/22/16 **COMPLETED** 3/22/16
GROUND ELEVATION 829.4 ft **HOLE SIZE** 6 1/2 inches
DRILLING CONTRACTOR NTI
GROUND WATER LEVELS:
DRILLING METHOD 3 1/4 in H.S.A
AT TIME OF DRILLING --- No groundwater encountered
LOGGED BY Robert Hawkins **CHECKED BY** Steve Gerber
AT END OF DRILLING ---
NOTES Elevations provided by SEH.
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0	▨	SANDY LEAN CLAY, (CL) brown, moist, soft to medium, trace gravel (Glaciofluvium)	SS 1	44	2-3-2 (5)							
	▨		SS 2	56	2-2-2 (4)							
4.5		824.9										
5	░	SILTY SAND, (SM) light brown, fine grained, moist, loose to medium dense, trace gravel (Glaciofluvium)	SS 3	89	5-7-7 (14)							
	░		SS 4	89	3-4-4 (8)							
10	░	NOTE: Occasional clay (CL) layers below 9.5 feet.	SS 5	89	4-5-6 (11)							
	░		SS 6	78	11-13-12 (25)							
15	░		SS 7	78	11-12-15 (27)							
17.0		812.4										
	⁚	SANDSTONE, highly weathered, brown to light brown, occasional glauconite seams (Weathered Sandstone)	SS 8	78	11-14-15 (29)							
20	⁚		SS 9	120	27-52/4"							
	⁚		SS 10	150	50/4"							26
25	⁚		SS 11	150	50/4"							
29.8		799.7	SS 12		50/3"							

Rock Identification based on highly weathered samples.
A petrographic analysis may yield different results.
Apparent auger refusal encountered at 29.8 feet.
Bottom of borehole at 29.8 feet.

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BORING NUMBER SB-2

PAGE 1 OF 1

CLIENT SEH

PROJECT NAME Lab USA Ash Processing Building

PROJECT NUMBER 16.61343.100

PROJECT LOCATION Red Wing, MN

DATE STARTED 3/24/16 **COMPLETED** 3/24/16

GROUND ELEVATION 825.2 ft **HOLE SIZE** 6 1/2 inches

DRILLING CONTRACTOR NTI

GROUND WATER LEVELS:

DRILLING METHOD 3 1/4 in H.S.A

AT TIME OF DRILLING --- No groundwater encountered

LOGGED BY Robert Hawkins **CHECKED BY** Steve Gerber

AT END OF DRILLING ---

NOTES Elevations provided by SEH.

AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0	▨	SANDY LEAN CLAY, (CL) brown, moist, soft, trace gravel (Glaciofluvium)	SS 1	44	1-1-2 (3)							
			SS 2	33	2-2-2 (4)							
5			SS 3	22	2-1-2 (3)							
7.0		818.2										
	⁘	SILTY SAND, (SM) light brown, fine grained, moist, medium dense, trace gravel (Glaciofluvium)	SH 4									
10			SS 5	89	5-5-7 (12)							
12.0		813.2										
	⁘	SANDSTONE, highly weathered, light brown to brown (Weathered Sandstone)	SS 6	56	17-25-23 (48)							
14.5		810.7										
15	⁘	SANDSTONE, highly weathered, light brown to brown, occasional glauconite seams (Weathered Sandstone)	SS 7	56	14-21-23 (44)							
			SS 8		12-50/5"							
20			SS 9		40-50/4"							
22.6		802.6	SS 10		21-50/2"							

Rock Identification based on highly weathered samples.
A petrographic analysis may yield different results.
Apparent auger refusal encounterd at 22.6 feet.
Bottom of borehole at 22.6 feet.

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BORING NUMBER SB-3

PAGE 1 OF 1

CLIENT SEH
PROJECT NAME Lab USA Ash Processing Building
PROJECT NUMBER 16.61343.100
PROJECT LOCATION Red Wing, MN
DATE STARTED 3/22/16 **COMPLETED** 3/22/16
GROUND ELEVATION 824.4 ft **HOLE SIZE** 6 1/2 inches
DRILLING CONTRACTOR NTI
GROUND WATER LEVELS:
DRILLING METHOD 3 1/4 in H.S.A
AT TIME OF DRILLING --- No groundwater encountered
LOGGED BY Robert Hawkins **CHECKED BY** Steve Gerber
AT END OF DRILLING ---
NOTES Elevations provided by SEH.
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES
										LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		SANDY LEAN CLAY, (CL) brown, moist, medium, trace gravel (Glaciofluvium)		SS 1	44	2-3-3 (6)							
2.0			822.4										
		SILTY SAND, (SM) light brown, fine grained, moist, loose to medium dense, trace gravel, occasional clay (CL) layers (Glaciofluvium)		SS 2	67	2-3-4 (7)							
5				SS 3	89	5-6-7 (13)							
7.0			817.4										
		SANDSTONE, highly weathered, light brown to brown, occasional glauconite seams (Weathered Sandstone)		SS 4		13-50/4"							
10				SS 5		23-50/3"							
				SS 6		45-50/4"							62
15				SS 7		50/4"							
				SS 8		50/2"							
19.9			804.5	SS 9		120/5"							

Rock Identification based on highly weathered samples.
A petrographic analysis may yield different results.
Apparent auger refusal encounterd at 19.9 feet.
Bottom of borehole at 19.9 feet.

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BORING NUMBER SB-4

PAGE 1 OF 1

CLIENT SEH

PROJECT NAME Lab USA Ash Processing Building

PROJECT NUMBER 16.61343.100

PROJECT LOCATION Red Wing, MN

DATE STARTED 3/22/16 **COMPLETED** 3/22/16

GROUND ELEVATION 818.9 ft **HOLE SIZE** 6 1/2 inches

DRILLING CONTRACTOR NTI

GROUND WATER LEVELS:

DRILLING METHOD 3 1/4 in H.S.A

AT TIME OF DRILLING --- No groundwater encountered

LOGGED BY Robert Hawkins **CHECKED BY** Steve Gerber

AT END OF DRILLING ---

NOTES Elevations provided by SEH.

AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTIC LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	FINES
0		SANDY LEAN CLAY, (CL) brown, moist, medium, trace gravel (Glaciofluvium)	SS 1	56	3-3-3 (6)							
2.0		816.9										
		SILTY SAND, (SM) light brown, fine grained, moist, medium dense to very dense, trace gravel (Glaciofluvium)	SS 2	78	5-6-5 (11)							
5			SS 3	56	6-8-8 (16)							
			SS 4	89	10-17-19 (36)							
10			SS 5	89	12-20-27 (47)							
12.0		806.9										
		SANDSTONE, highly weathered, light brown to brown, occasional glauconite seams (Weathered Sandstone)	SS 6	56	8-6-6 (12)							
15			SS 7	73	22-50/5"							
			SS 8	73	42-50/5"							
20			SS 9	100	50/4"							
22.8		796.1	SS 10		50/4"							

Rock Identification based on highly weathered samples.
A petrographic analysis may yield different results.
Apparent auger refusal encounterd at 22.8 feet.
Bottom of borehole at 22.8 feet.

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BORING NUMBER SB-5

PAGE 1 OF 1

CLIENT SEH
PROJECT NAME Lab USA Ash Processing Building
PROJECT NUMBER 16.61343.100
PROJECT LOCATION Red Wing, MN
DATE STARTED 3/24/16 **COMPLETED** 3/24/16
GROUND ELEVATION 818.5 ft **HOLE SIZE** 6 1/2 inches
DRILLING CONTRACTOR NTI
GROUND WATER LEVELS:
DRILLING METHOD 3 1/4 in H.S.A
AT TIME OF DRILLING --- No groundwater encountered
LOGGED BY Robert Hawkins **CHECKED BY** Steve Gerber
AT END OF DRILLING ---
NOTES Elevations provided by SEH.
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		SANDY LEAN CLAY, (CL) brown, moist, medium to soft, trace gravel (Glaciofluvium)	SS 1	44	4-4-3 (7)							
			SS 2	56	2-2-2 (4)							
	4.5	814.0										
5		POORLY GRADED SAND WITH SILT, (SP-SM) brown, fine to medium grained, moist, medium dense, trace gravel (Glacial Outwash)	SS 3	67	3-4-5 (9)							
	7.0	811.5										
		SILTY SAND, (SM) light brown, fine grained, moist, dense, trace gravel (Glaciofluvium)	SS 4	56	8-10-13 (23)							
10		NOTE: Occasional clay (CL) layers below 9.5 feet.	SS 5	67	7-8-10 (18)							
	12.0	806.5										
		SANDSTONE, highly weathered, light brown to brown, occasional glauconite seams (Weathered Sandstone)	SS 6	78	9-9-11 (20)							
15			SS 7	67	7-7-9 (16)							
			SS 8		50/4"							
20			SS 9		30-50/3"							
			SS 10		50/4"							
25			SS 11		30-50/5"							35
	28.0	790.5	SS 12		50/4"							

Rock Identification based on highly weathered samples.
A petrographic analysis may yield different results.
Apparent auger refusal encountered at 28.0 feet.
Bottom of borehole at 28.0 feet.

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BORING NUMBER SB-6

CLIENT SEH
PROJECT NAME Lab USA Ash Processing Building
PROJECT NUMBER 16.61343.100
PROJECT LOCATION Red Wing, MN
DATE STARTED 3/18/16 **COMPLETED** 3/18/16
GROUND ELEVATION 817.1 ft **HOLE SIZE** 6 1/2 inches
DRILLING CONTRACTOR NTI
GROUND WATER LEVELS:
DRILLING METHOD 3 1/4 in H.S.A
▽ **AT TIME OF DRILLING** 19.50 ft / Elev 797.60 ft
LOGGED BY Robert Hawkins **CHECKED BY** Steve Gerber
AT END OF DRILLING ---
NOTES Elevations provided by SEH.
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES
0		SANDY LEAN CLAY, (CL) brown, moist, soft, trace gravel (Glaciofluvium)	SS 1									
			SS 2	38	2-1-1 (2)							
5		4.5 — 812.6 CLAYEY SAND, (SC) brown, fine to medium grained, moist, loose, trace gravel (Glaciofluvium)	SS 3	46	1-2-4 (6)							
			SS 4	67	1-3-3 (6)							
10		9.5 — 807.6 SILTY SAND, (SM) light brown, fine grained, moist, medium dense, trace gravel (Glaciofluvium)	SS 5	67	3-6-5 (11)							
		NOTE: Occasional clay (CL) layers below 12 feet.	SS 6	75	2-7-7 (14)							
15			SS 7	79	4-8-9 (17)			5				
20		19.5 ▽ — 797.6 SANDY SILT, (ML) light brown, wet, medium, trace gravel (Glaciofluvium)	SS 8	63	3-3-6 (9)			25	29	23	6	
25		24.5 — 792.6 SANDSTONE, highly weathered, light brown to brown (Weathered Sandstone)	SS 9	83	12-20-21 (41)							59
30		29.5 — 787.6 SANDSTONE, highly weathered, light brown to brown, occasional glauconite seams (Weathered Sandstone)	SS 10	79	10-13-17 (30)							

(Continued Next Page)

BORING NUMBER SB-6

PAGE 2 OF 2

CLIENT SEH

PROJECT NAME Lab USA Ash Processing Building

PROJECT NUMBER 16.61343.100

PROJECT LOCATION Red Wing, MN

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
35		SANDSTONE, highly weathered, light brown to brown, occasional glauconite seams (Weathered Sandstone) *(continued)*	SS 11	63	78-10-11 (21)							
40		40.1 777.0	SS 12	72	17-50/1"							

Rock Identification based on highly weathered samples.
A petrographic analysis may yield different results.
Apparent auger refusal encountered at 40.1 feet.
Bottom of borehole at 40.1 feet.

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BORING NUMBER SB-7

PAGE 1 OF 2

CLIENT SEH
PROJECT NAME Lab USA Ash Processing Building
PROJECT NUMBER 16.61343.100
PROJECT LOCATION Red Wing, MN
DATE STARTED 3/22/16 **COMPLETED** 3/22/16
GROUND ELEVATION 814.8 ft **HOLE SIZE** 6 1/2 inches
DRILLING CONTRACTOR NTI
GROUND WATER LEVELS:
DRILLING METHOD 3 1/4 in H.S.A
AT TIME OF DRILLING --- No groundwater encountered
LOGGED BY Robert Hawkins **CHECKED BY** Steve Gerber
AT END OF DRILLING ---
NOTES Elevations provided by SEH.
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTIC LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	FINES
0		SANDY LEAN CLAY, (CL) brown, moist, medium to soft, trace gravel (Glaciofluvium)	SS 1	44	2-3-2 (5)							
2.0		812.8										
		SILTY SAND, (SM) brown, fine grained, moist, very loose, trace gravel (Glaciofluvium)	SS 2	44	1-1-2 (3)							
5			SH 3									
7.0		807.8										
		SANDY LEAN CLAY, (CL) brown, moist, rather stiff, trace gravel (Glaciofluvium)	SS 4	67	4-4-5 (9)							
10			SS 5	78	4-5-6 (11)							
12.0		802.8										
		SILTY SAND, (SM) brown, fine grained, moist, dense to medium dense, trace gravel, occasional clay (CL) seams (Glaciofluvium)	SS 6	100	7-9-11 (20)							
15			SS 7	100	8-8-9 (17)							
			SH 8									
20			SS 9	100	6-7-6 (13)			23				
22.0		792.8										
		SANDSTONE, highly weathered, light brown to brown (Weathered Sandstone)	SS 10	100	12-18-21 (39)							28
25			SS 11	100	13-19-22 (41)							
30			SS 12	100	22-26-32 (58)							39

(Continued Next Page)

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BORING NUMBER SB-7

CLIENT SEH
PROJECT NAME Lab USA Ash Processing Building
PROJECT NUMBER 16.61343.100
PROJECT LOCATION Red Wing, MN

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTIC LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	FINES
		SANDSTONE, highly weathered, light brown to brown (Weathered Sandstone) *(continued)* 34.5 780.3										
35		SANDSTONE, highly weathered, light brown to brown, occasional glauconite seams (Weathered Sandstone)	SS 13	89	7-9-8 (17)							26
40			SS 14		21-52/2"							
		42.0 772.8										

Rock Identification based on highly weathered samples.
A petrographic analysis may yield different results.
Apparent auger refusal encountered at 42.0 feet.
Bottom of borehole at 42.0 feet.

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BORING NUMBER SB-8

PAGE 1 OF 2

CLIENT SEH
PROJECT NAME Lab USA Ash Processing Building
PROJECT NUMBER 16.61343.100
PROJECT LOCATION Red Wing, MN
DATE STARTED 3/21/16 **COMPLETED** 3/21/16
GROUND ELEVATION 810.2 ft **HOLE SIZE** 6 1/2 inches
DRILLING CONTRACTOR NTI
GROUND WATER LEVELS:
DRILLING METHOD 3 1/4 in H.S.A
AT TIME OF DRILLING --- No groundwater encountered
LOGGED BY Robert Hawkins **CHECKED BY** Steve Gerber
AT END OF DRILLING ---
NOTES Elevations provided by SEH.
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES
										LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		SANDY LEAN CLAY, (CL) brown, moist, rather stiff, trace gravel (Glaciofluvium)		SS 1	67	3-4-5 (9)							
2.0			808.2										
		SILTY SAND, (SM) brown, fine grained, moist, dense, trace gravel (Glaciofluvium)		SS 2	67	5-8-9 (17)							
5				SS 3	78	12-11-5 (16)							
7.0			803.2										
		SANDY LEAN CLAY, (CL) brown, medium to rather stiff, trace gravel (Glaciofluvium)		SS 4	89	4-4-5 (9)							
10				SS 5	67	3-4-5 (9)			15	25	17	8	
				SS 6	67	3-4-4 (8)							
14.5			795.7										
15		SILTY LEAN CLAY, (CL-ML) brown, moist, medium, trace gravel (Glaciofluvium)		SS 7	67	1-2-5 (7)			26	28	22	6	
				SS 8	100	2-3-5 (8)			27				
19.5			790.7										
20		SANDY LEAN CLAY, (CL) brown, rather stiff, trace gravel (Glaciofluvium)		SS 9	67	4-4-5 (9)			18				
22.0			788.2										
		SILTY SAND, (SM) brown, fine grained, moist, medium dense, trace gravel, occasional clay (CL) layers (Glaciofluvium)		SS 10	56	5-7-5 (12)							
25				SS 11	33	7-7-6 (13)							
29.5			780.7										
30		SANDSTONE, highly weathered, light brown to brown, occasional glauconite seams (Weathered Sandstone)		SS 12	100	8-10-11 (21)							

(Continued Next Page)

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BORING NUMBER SB-8

CLIENT SEH
PROJECT NAME Lab USA Ash Processing Building
PROJECT NUMBER 16.61343.100
PROJECT LOCATION Red Wing, MN

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
		SANDSTONE, highly weathered, light brown to brown, occasional glauconite seams (Weathered Sandstone) *(continued)*										
35			☒ SS 13	44	10-9-12 (21)							
40			☒ SS 14	56	12-16-17 (33)							
		41.0 769.2										

Rock Identification based on highly weathered samples.
A petrographic analysis may yield different results.
Bottom of borehole at 41.0 feet.

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BORING NUMBER SB-9

PAGE 1 OF 2

CLIENT SEH

PROJECT NAME Lab USA Ash Processing Building

PROJECT NUMBER 16.61343.100

PROJECT LOCATION Red Wing, MN

DATE STARTED 3/21/16 **COMPLETED** 3/21/16

GROUND ELEVATION 806.9 ft **HOLE SIZE** 6 1/2 inches

DRILLING CONTRACTOR NTI

GROUND WATER LEVELS:

DRILLING METHOD 3 1/4 in H.S.A

▽ **AT TIME OF DRILLING** 14.50 ft / Elev 792.40 ft

LOGGED BY Robert Hawkins **CHECKED BY** Steve Gerber

AT END OF DRILLING ---

NOTES Elevations provided by SEH.

AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		SANDY LEAN CLAY, (CL) brown, moist, medium, trace gravel (Glaciofluvium) 2.0 804.9	SS 1	44	4-3-3 (6)							
		SILTY SAND, (SM) brown, fine grained, moist, medium dense to dense, trace gravel (Glaciofluvium)	SS 2	56	3-4-7 (11)							
5		7.0 799.9	SS 3	67	8-9-11 (20)							
		CLAYEY SAND, (SC) brown, fine grained, moist, medium dense, trace gravel (Glaciofluvium) 9.5 797.4	SS 4	89	3-4-5 (9)							
10		SANDY LEAN CLAY, (CL) brown, moist to wet, soft to stiff, trace gravel, occasional silt (ML) seams (Glaciofluvium)	SS 5	56	2-2-2 (4)			23				
			SS 6	100	2-2-4 (6)							
15		▽	SS 7	67	2-3-4 (7)			26	31	22	9	
			SS 8	100	3-5-6 (11)							
20		22.0 784.9	SS 9	100	3-4-6 (10)			22				
		SANDY SILT WITH GRAVEL, (ML) brown, saturated, rather stiff to stiff (Glaciofluvium)	SS 10	100	6-6-9 (15)							69
25		29.5 777.4	SS 11	89	8-10-10 (20)							
30		SANDSTONE, highly weathered, light brown to brown, occasional glauconite seams (Weathered Sandstone)	SS 12	100	20-22-21 (43)							27

(Continued Next Page)

BORING NUMBER SB-9

CLIENT SEH
PROJECT NAME Lab USA Ash Processing Building
PROJECT NUMBER 16.61343.100
PROJECT LOCATION Red Wing, MN

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
		SANDSTONE, highly weathered, light brown to brown, occasional glauconite seams (Weathered Sandstone) *(continued)*										
35			SS 13	78	6-6-7 (13)							
40		41.0 765.9	SS 14	56	15-17-18 (35)							

Rock Identification based on highly weathered samples.
A petrographic analysis may yield different results.
Bottom of borehole at 41.0 feet.

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BORING NUMBER SB-10

PAGE 1 OF 1

CLIENT SEH

PROJECT NAME Lab USA Ash Processing Building

PROJECT NUMBER 16.61343.100

PROJECT LOCATION Red Wing, MN

DATE STARTED 3/21/16 **COMPLETED** 3/22/16

GROUND ELEVATION 801.7 ft **HOLE SIZE** 6 1/2 inches

DRILLING CONTRACTOR NTI

GROUND WATER LEVELS:

DRILLING METHOD 3 1/4 in H.S.A

▽ **AT TIME OF DRILLING** 24.50 ft / Elev 777.20 ft

LOGGED BY Robert Hawkins **CHECKED BY** Steve Gerber

AT END OF DRILLING ---

NOTES Elevations provided by SEH.

AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	FINES
0		SANDY LEAN CLAY, (CL) brown, moist, medium, trace gravel (Glaciofluvium)		SS 1	67	3-3-3 (6)							
2.0		SILTY SAND, (SM) brown, fine grained, moist, loose to medium dense, trace gravel (Glaciofluvium)	799.7	SS 2	67	3-3-4 (7)							
5				SS 3	56	4-6-7 (13)							
				SS 4	78	6-5-6 (11)							
9.5		SANDY LEAN CLAY, (CL) light brown, moist to wet, medium to rather stiff, trace gravel, occasional silt (ML) seams (Glaciofluvium)	792.2	SS 5	67	3-4-5 (9)							
10				SS 6	100	2-2-3 (5)			24				
15				SS 7	67	3-4-6 (10)							
				SH 8					28				
20		NOTE: Gray below 19.5 feet.		SS 9	89	2-2-3 (5)			26				
				SS 10	89	3-4-6 (10)			28				
25		▽		SH 11					29				
29.5		SILTY SAND, (SM) light brown, fine grained, saturated, medium dense, trace gravel (Glaciofluvium)	772.2	SS 12	78	4-6-6 (12)							
30													
31.0			770.7										

Bottom of borehole at 31.0 feet.

NTI GEOTECH COLUMNS - GINT STD US LAB MAY 2012.GDT - 5/26/16 09:28 - H:\RAMSEY\1-PROJECTS\2016 PROJECTS\RED WING CONTRACT DRILLING - GEO - (16.61343.100)\ENGINEERING\ENGINEERING REPORTS\GINT\SEH CONTRACT.GPJ

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BORING NUMBER SB-11

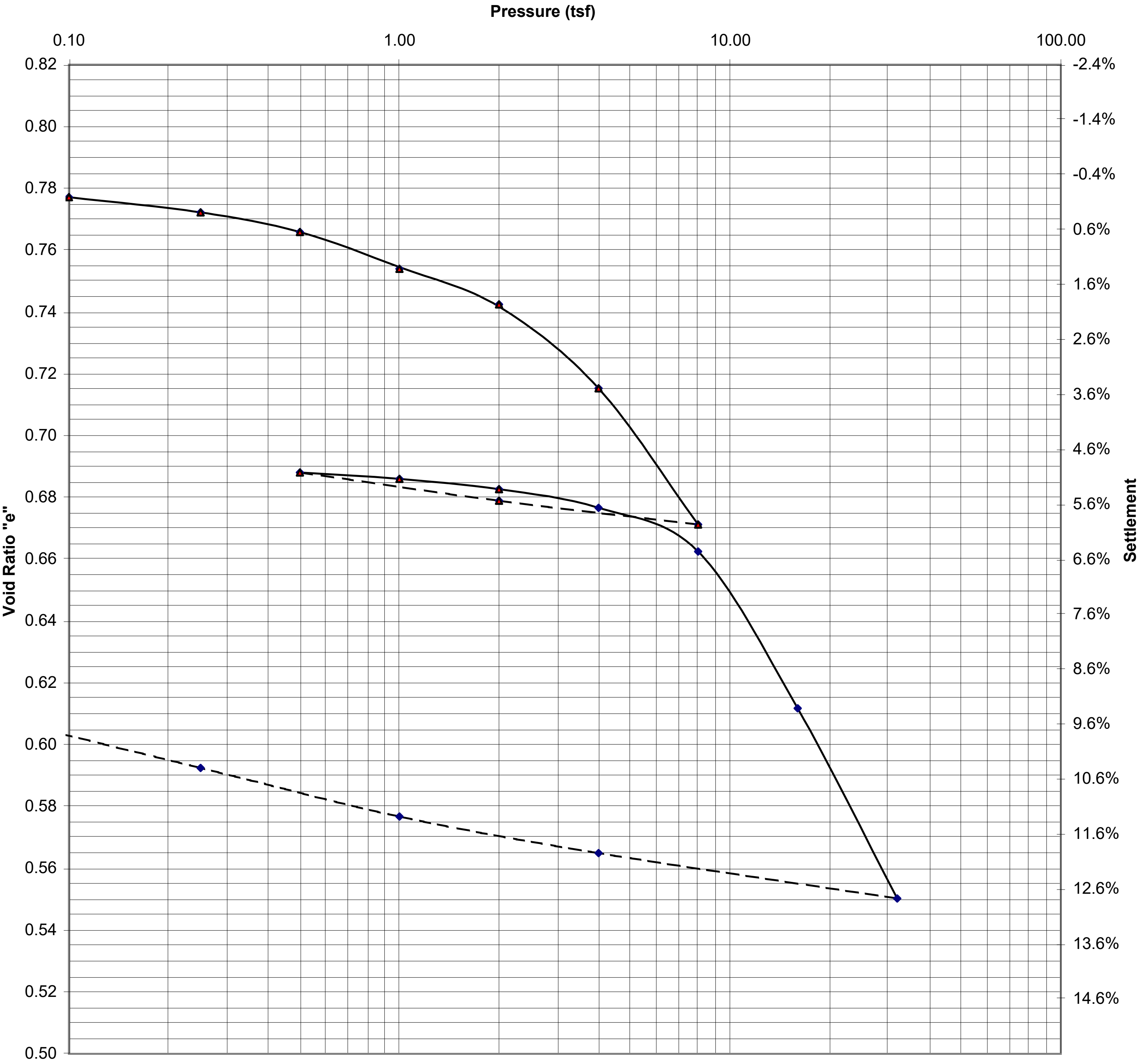
PAGE 1 OF 1

CLIENT SEH
PROJECT NAME Lab USA Ash Processing Building
PROJECT NUMBER 16.61343.100
PROJECT LOCATION Red Wing, MN
DATE STARTED 3/24/16 **COMPLETED** 3/24/16
GROUND ELEVATION 782.8 ft **HOLE SIZE** 6 1/2 inches
DRILLING CONTRACTOR NTI
GROUND WATER LEVELS:
DRILLING METHOD 3 1/4 in H.S.A
▽ **AT TIME OF DRILLING** 12.00 ft / Elev 770.80 ft
LOGGED BY Robert Hawkins **CHECKED BY** Steve Gerber
AT END OF DRILLING ---
NOTES Elevations provided by SEH.
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION		SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES
										LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0	░	SILTY SAND, (SM) brown, fine grained, moist, medium dense, trace gravel, occasional silt (ML) seams (Glaciofluvium)		SS 1	67	4-4-5 (9)							
2.0			780.8										
	▨	SANDY LEAN CLAY, (CL) light brown, moist, medium to rather stiff, trace gravel (Glaciofluvium)		SS 2	78	2-2-4 (6)							
5	▨			SH 3					28	31	21	10	
	▨			SS 4	100	3-3-5 (8)			32				
9.5			773.3										
10	░	SILTY SAND, (SM) brown, fine grained, moist, medium dense, trace gravel (Glaciofluvium)		SS 5	100	5-7-7 (14)							
12.0 ▽			770.8										
	▨	SANDY LEAN CLAY, (CL) brown, wet, medium, trace gravel, occasional silt (ML) layers (Glaciofluvium)		SS 6	67	2-3-3 (6)			22				
15	▨			SS 7	100	2-2-3 (5)			28	26	18	8	
	▨	NOTE: Gray below 17 feet.		SS 8	89	3-3-4 (7)			25				
18.5			764.3										

Bottom of borehole at 18.5 feet.

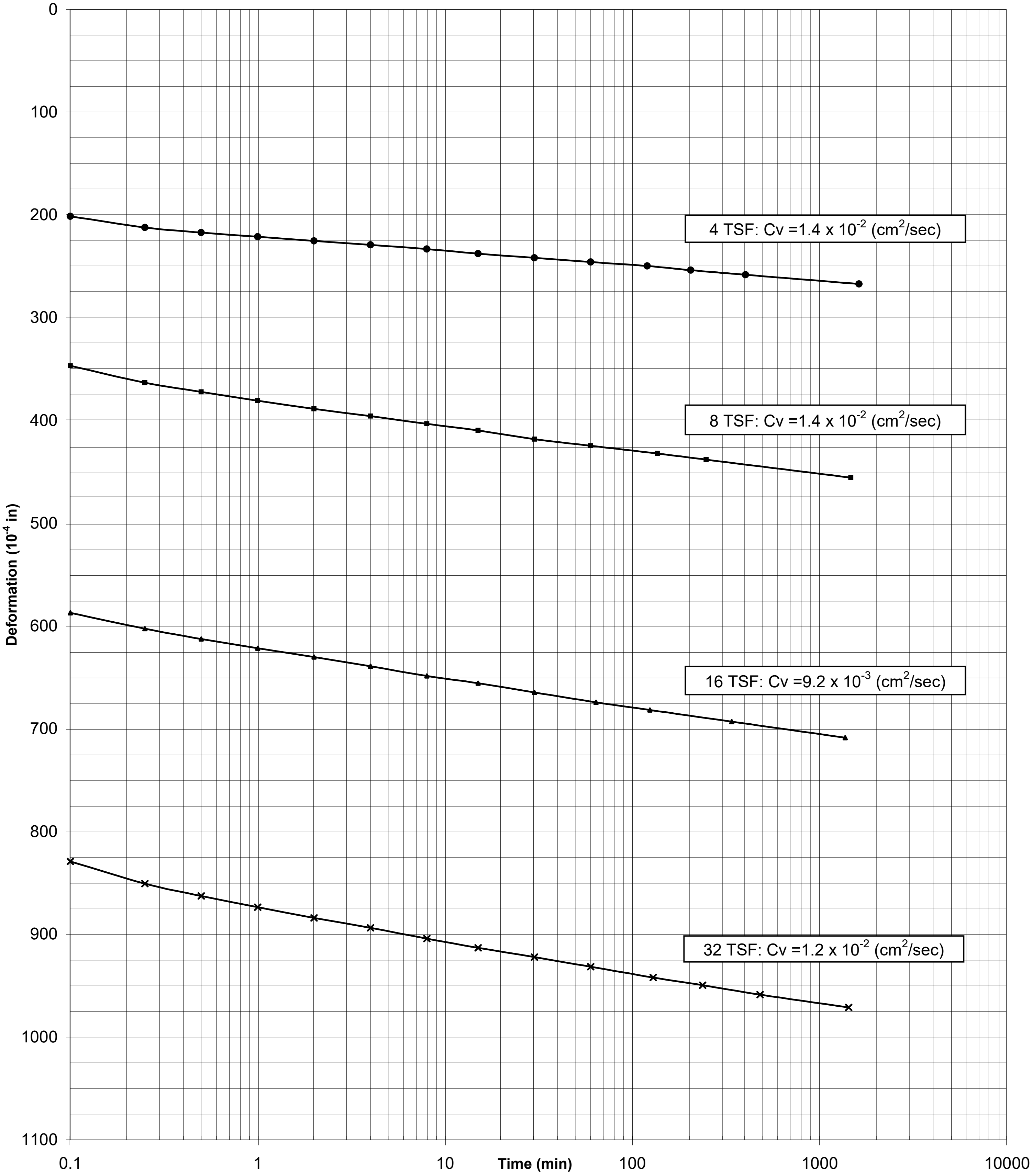
Void Ratio and % Settlement vs. Log of Pressure



Project: #136249			Date: 5/9/16
Sample #:	Boring #: 10	Depth ft: 17-18.5	Job #: 10301
Soil Type: Silt w/occasional lenses of silty sand and sandy silt (ML)			
Initial W/C (%): 29.1	Dry Density (pcf): 94.5	LL: PL: PI:	Gs: 2.69 (Assumed)
Organic Content (%):	Initial Height (in.): 0.759	Diameter (in.): 2.505	e_o= 0.778
Preconsolidation Pressure (Pc): 4.2 tsf	Compression Index (Cc): 0.20		Recompression Index (Cr): 0.02

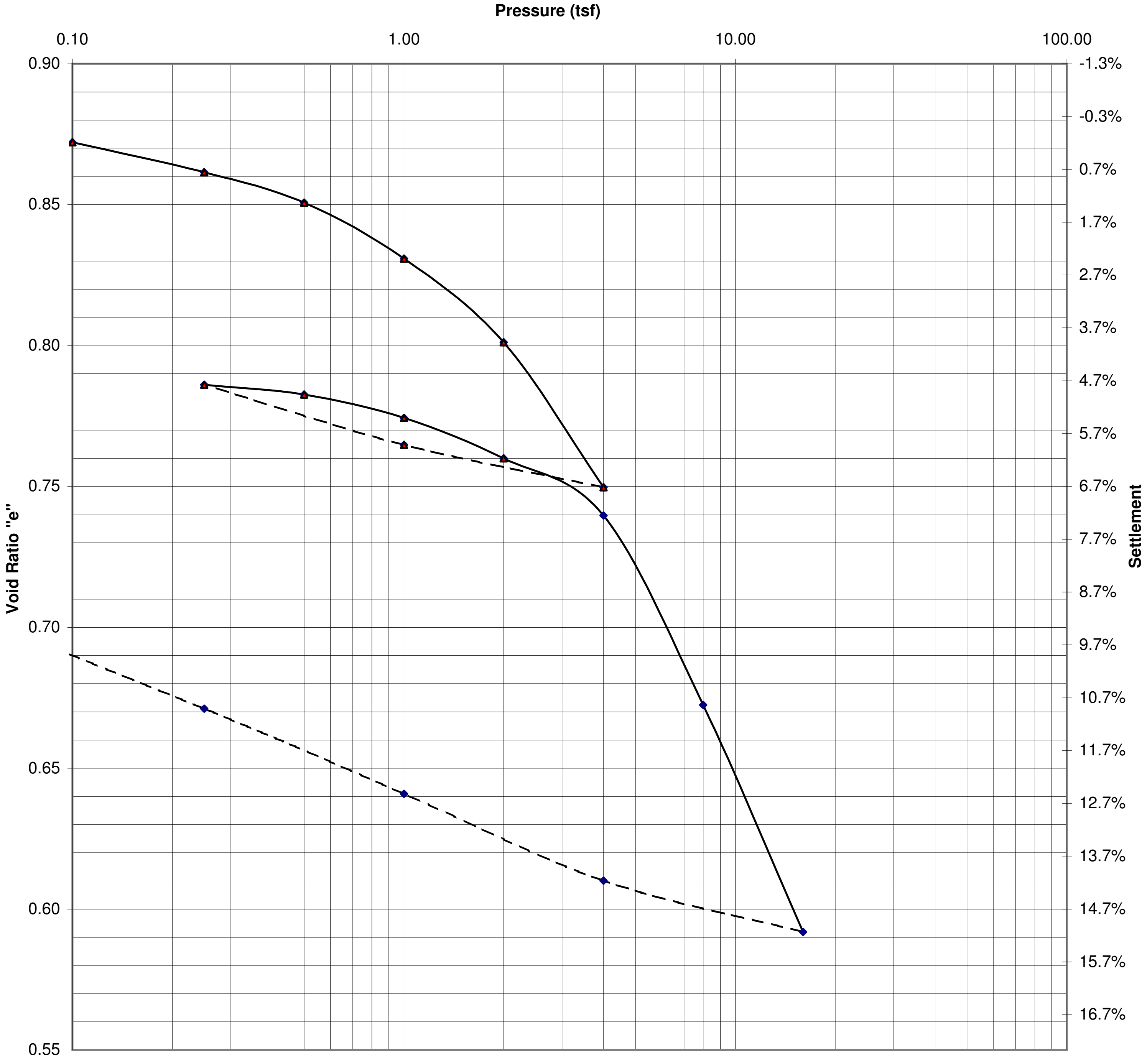
Remarks: Testing performed in general accordance with ASTM:D2435

Consolidation Log of Time Curves



Project: #136249			Date: 5/9/16
Sample #:	Boring #: 10	Depth ft: 17-18.5	Job #: 10301

Void Ratio and % Settlement vs. Log of Pressure



Project: #136249
Date: 5/6/16

Sample #:
Boring #: 10
Depth ft: 24.5-26
Job #: 10301

Soil Type: Fat Clay w/some laminations of silt (CH)

Initial W/C (%): 32.7
Dry Density (pcf): 89.2
LL:
PL:
PI:
Gs: 2.68 (Assumed)

Organic Content (%):
Initial Height (in.): 0.746
Diameter (in.): 2.506
e_o= 0.875

Preconsolidation Pressure (Pc): 2.5 tsf
Compression Index (Cc): 0.27
Recompression Index (Cr): 0.04

Remarks: Testing performed in general accordance with ASTM:D2435

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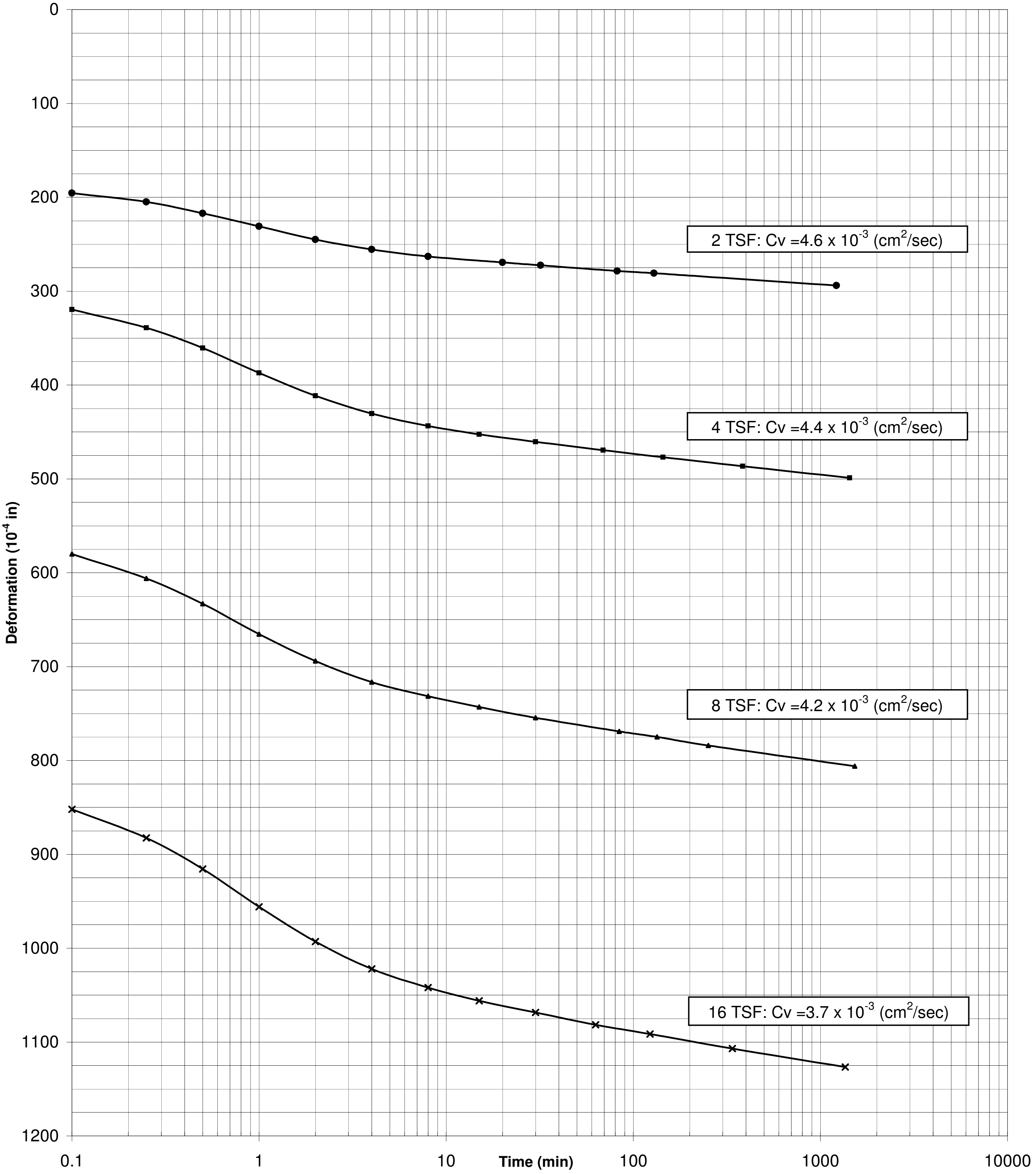
Consolidation Log of Time Curves



Project: #136249			Date: 5/6/16
Sample #:	Boring #: 10	Depth ft: 24.5-26	Job #: 10301

9530 James Avenue South

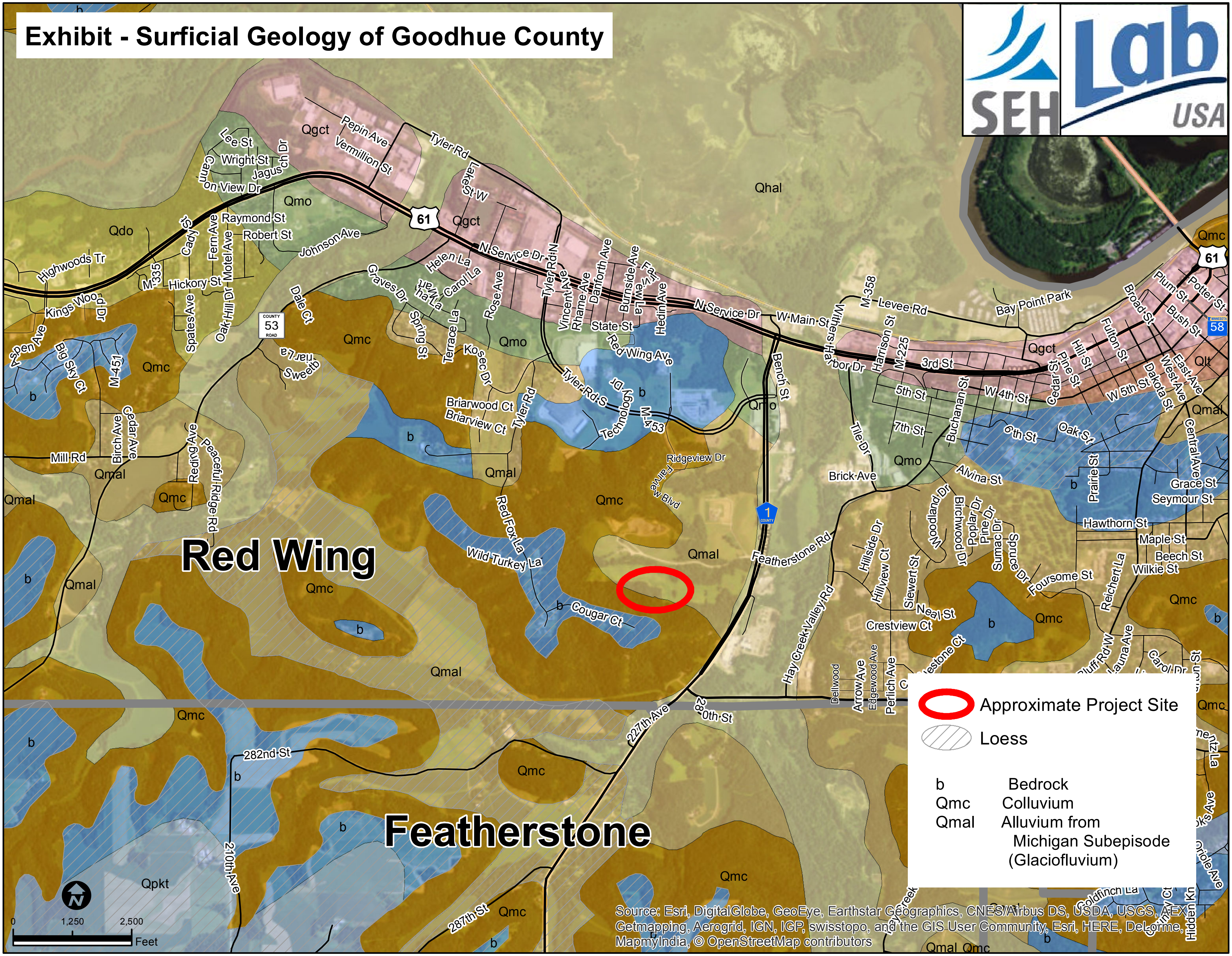
SOIL
ENGINEERING
TESTING, INC.

Bloomington, Minnesota 55431

Appendix C

Regional Surficial Geology

Exhibit - Surficial Geology of Goodhue County



○	Approximate Project Site
▨	Loess
b	Bedrock
Qmc	Colluvium
Qmal	Alluvium from Michigan Subepisode (Glaciofluvium)

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community, Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors

Document Path: S:\KO\L\LABUS\136249\5-final-dsgn\51-drawings\90-GIS\MXDs\Surf_Geol_Exhibit1.mxd

Appendix D

Load Distribution Platform

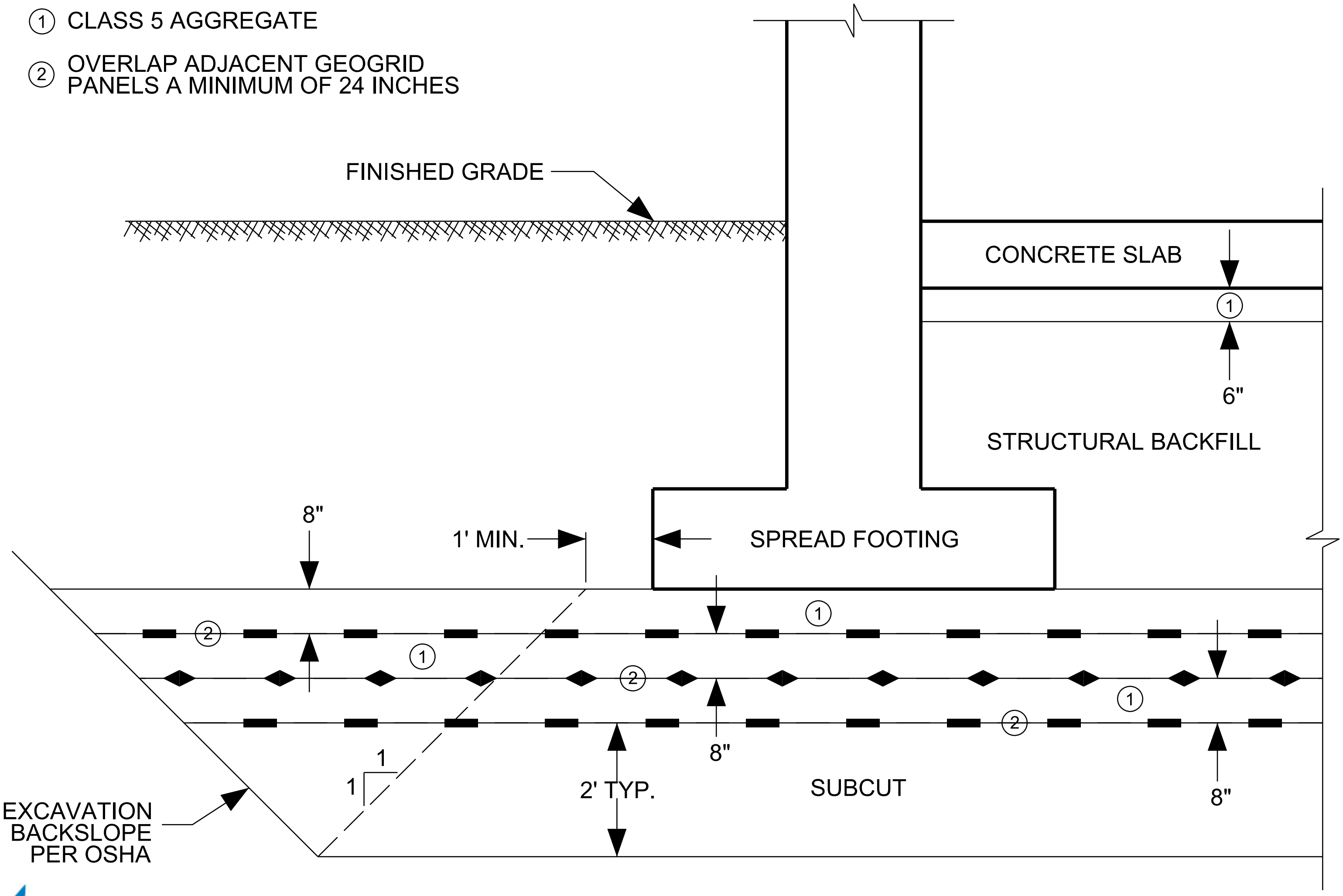
NOTES:

— ◆ — BIAXIAL GEOGRID

— ▬ — BIAXIAL GEOGRID PLACED PERPENDICULAR TO — ◆ —

① CLASS 5 AGGREGATE

② OVERLAP ADJACENT GEOGRID PANELS A MINIMUM OF 24 INCHES



LOAD DISTRIBUTION PLATFORM (LDP)

(NOT TO SCALE)

Appendix H

Structural Evaluation and Preliminary Building Design

SEH

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MEMORANDUM

TO: Darryl Heaps

FROM: Jason Burns & Justin Mankowski

DATE: May 6, 2016

RE: Architectural and Structural Building Components
SEH No. LABUS 136249 14.00

The structure will be designed to ACI 318-11 and ASCE 7-10 standards in addition to the Minnesota State Building Code as detailed in herein.

A Pre-Engineered Metal Building (PEMB) will be utilized to maximize space and construction efficiency. The foundation system for the building will be cast-in-place (CIP) concrete piers with spread footings, adequately sized to accomplish the bearing capacity requirements detailed within the geotechnical report. The pushwalls and floor slab will be CIP concrete, designed to withstand the pressures from the waste material and the operating equipment that will be used to move the material. Floor slabs will be sloped to drain, treated (to reduce absorption), and have control joints with waterstops to ensure leachate containment. All CIP concrete will be constructed of high strength (5,000 psi) concrete. A containment curb poured monolithically with the floor will be installed around the building perimeter.

The 27,500 square foot facility will be enclosed on the south, east and west sides. The north side will have two openings (70’-0” wide x 25’-0” high) on each end to accommodate heavy equipment movement in and out of the building. The roof will be an un-insulated prefinished metal standing seam system over a PEMB frame. The exterior walls will be un-insulated prefinished metal wall panel system over a PEMB frame.

There will be an office space located on in the inside face of the north wall. It will be insulated steel stud construction with prefinished metal liner panels on the production side and gypsum board walls to the interior. The space will contain 2 private offices, and ADA restroom, break area, locker area, mechanical room and electrical room. The space will be heated and air conditioned.

ah/JMB
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SECTION 01 41 13

CODE REVIEW- MINNESOTA

Project: **LAB USA**
Building: **Ash Processing Building**
Client: **Red Wing, Minnesota**
SEH No.: **LABUS 133967**
DATE: **May 6, 2016**

Referenced Codes

- **2015** Minnesota State Building Code (Chapter 1305)
  - **2012** International Building Code (IBC)
  - MN Administrative Rules 7035.2870 Solid Waste Transfer Facilities
- **2015** Minnesota Plumbing Code (Chapter 4715)
- **2015** Minnesota Mechanical and Fuel Gas Codes (Chapter 1346)
  - **2012** International Mechanical Code (IMC)
  - **2012** International Fuel Gas Code (IFGC)
- **2015** Minnesota Electrical Code (Chapter 1315)
  - **2014** NFPA 70 National Electrical Code (NEC)
- **2007** Minnesota State Fire Code (Chapter 7511)
  - **2006** International Fire Code (IFC)

I. IBC CHAPTER 3 - OCCUPANCY TYPE

A. Occupancy Type F-2 – Factory/Industrial, Low-Hazard – Reference IBC 306

II. IBC CHAPTER 5 - BUILDING AREA

A. Construction Type: II-B, Non-Sprinkled, Single-Use Occupancy – Single-Story building is of non-combustible construction materials (Reference IBC Table 503)

B. Occupancy Type F-2
1. Permitted Area/Floor (Reference IBC Table 503): 23,000 sf / 3 Story
2. Permitted Building Height (Reference IBC Table 503): 55 feet
3. Allowable Area Increases (Reference IBC 506.2 and 506.3)
   a) Frontage Increase: If = 0.75
4. Total Allowable Area: Aa = {23,000 + [23,000 x 0.75]} = 40,250 sf
5. Actual Building Area: **27,500 sf**
6. Actual Building Height: **35’-0” feet**

C. Accessory Occupancies – Those occupancies that are ancillary to the main occupancy of the building or portion thereof. (Reference IBC 508.2.1)
1. B - Business Occupancy 840 sf < 10% of building area (Reference IBC 508.2.1)
2. No separation is required between accessory occupancies and the main occupancy. (Reference IBC 508.2.4)

III. IBC CHAPTER 6 – TYPE OF CONSTRUCTION

A. Fire Resistive Requirements: Type II-B Building
1. Reference IBC Table 601, Table 602, Table 705.8

Exterior Bearing Walls	0 Hours

Interior Bearing Walls	0 Hours
Exterior Non-Bearing Walls	X ≥ 30ft = 0 Hours (see note #1 below)
Structural Frame	0 Hours
Partitions - Permanent	0 Hours
Shaft Enclosures	No shafts
Floors - Ceilings/Floors	0 Hours
Roofs - Ceilings/Roofs	0 Hours
Exterior Wall Openings	>30-feet No Limit

Notes:

a) Fire separation distance (X) from table 602 is greater than 30 feet for all sides of the building when measured in accordance with IBC 705.3. Measurement from face of building to lot line, imaginary lot line or centerline of street per IBC 705.3

B. Combustible construction in Type II Buildings (Reference IBC 603)

IV. IBC CHAPTER 7 – FIRE AND SMOKE PROTECTION

A. Fire Walls
   1. No Fire Walls are required and the building area is within allowable area limits of an F-2 Occupancy.

B. Fire Barriers
   1. No Fire Barriers are required (no occupancy separation)

V. IBC CHAPTER 8 – INTERIOR FINISHES

A. Allowable Finishes – F-2 Occupancy
   1. Wall and Ceiling Finishes, Non - Sprinklered Building (Reference IBC Table 803.9)
      a) Exit Enclosures and Passageways – Class B per ASTM E84
      b) Corridors – Class C per ASTM E84
      c) Enclosed Rooms or Spaces – Class C per ASTM E84

VI. IBC CHAPTER 9 - FIRE PROTECTION SYSTEMS: NOT APPLICABLE

VII. IBC CHAPTER 10 – MEANS OF EGRESS

A. Occupant Load (Reference IBC Table 1004.1.2 Maximum Floor Area Allowances per Occupant)
   1. Total Building Occupant Load
      a) F-2 Occupancy 92 Occupants (Industrial areas - 300 sf/Occ)
      b) See Code Plan Drawings for Occupant Load distribution throughout the building

B. Egress Distance/Width
   1. Travel Distance
      a) F-2 Occupancy: 300 feet (Reference IBC Table 1016.2, without Automatic Sprinkler System)
      b) Travel distance measured from most remote location on a level to exit discharge on grade
   2. Common Path of Egress Travel (Reference IBC Section 1014.3)
      a) Occupancy F-2: 75 feet
   3. Egress Width (Reference IBC Section 1005.1)
      a) Minimum width of egress components shall be determined by multiplying the occupant load by 0.3 for stairs and 0.2 for all other components

        b) See Code Plan for actual Occupant Loads and minimum egress width required per door.

C. Doors
    1. Width: Clear width of egress doors shall be a minimum of 32 inches (Reference IBC Section 1008.1.1)
    2. Panic Exit Hardware: Exit doors in electrical rooms with equipment over 1,200 amperes and over 6 feet wide. Doors shall swing in the direction of egress travel (Reference IBC Section 1008.1.10)

D. Exit Doorways
    1. Each story shall have a minimum of two independent exits based on Occupant Load (Reference IBC Table 1021.2)
    2. Minimum quantity of Exits per Occupant Load (Reference IBC Section 1015.1):
        a) Occupancy F-2: 2 Exits
        b) Motor Control Center Rooms: 1 Exit per Room, based on Occupant Load less than 50

VIII. IBC CHAPTER 12 - INTERIOR ENVIRONMENT: NOT APPLICABLE

IX. IBC CHAPTER 29 – PLUMBING SYSTEMS

A. Fixture Requirements (Reference IBC Table 2902.1, Min. Number of Required Plumbing Fixtures)

Use	**Occupant Load**	**Water Closets/Urinals**			**Lavatories**		
		Ratio	# req'd	# provided	Ratio	# req'd	# provided
F-2 Occupancy	92	1 per 100	0.92	1 provided	1 per 100	0.92	1 provided

Use	**Occupant Load**	**Drinking fountains**			**Service Sinks**	
		Ratio	# req'd	# provided	# req'd	# provided
F-2 Occupancy	92	1 per 400	0.23	0 provided	1	1 provided

Use	**Occupant Load**	**Bathtubs / Showers**				
		Ratio	# req'd	# provided		
F-2 Occupancy	92	1 per 15 persons exposed to excessive heat or to skin contamination with poisonous, infectious or irritating material	0	0		

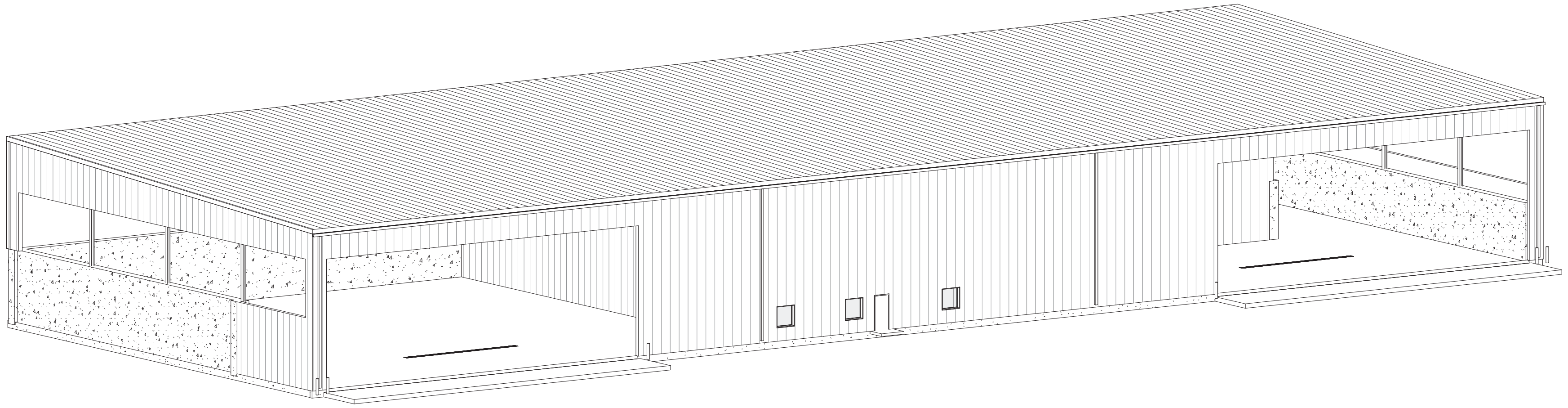
Section 2902.2 Separate Facilities – Exception #2: Separate facilities for each sex shall not be required in structures or tenant spaces with a total occupant load, including employees and customers, of 20 or less. Actual occupant load on site is less than 20 per acceptance by AHJ.

X. MINNESOTA ADMINISTRATIVE RULES – 7035.2870 SOLID WASTE TRANSFER FACILITIES

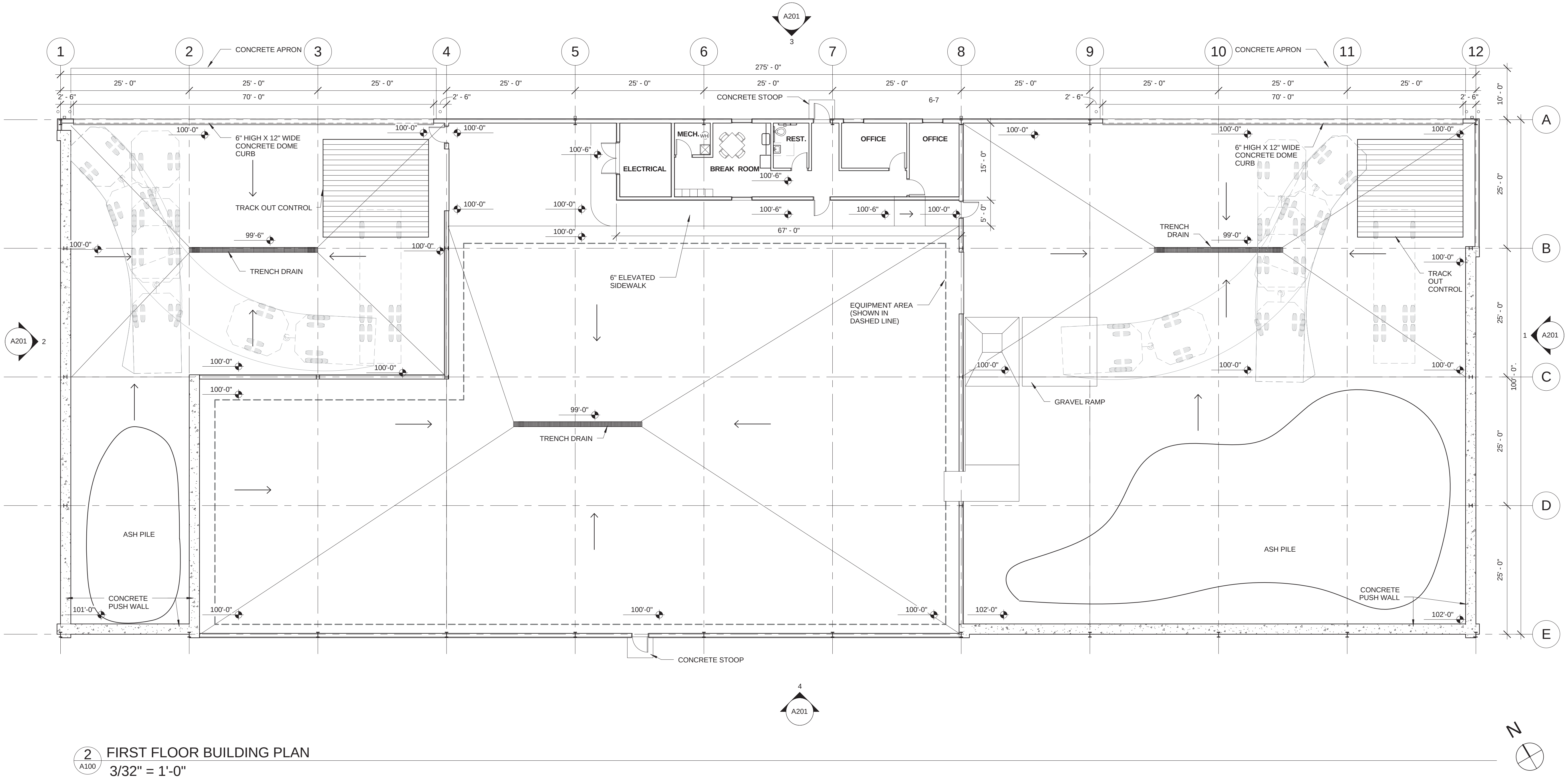
A. Design Standards

1. If the facility will use walls, pushwalls, or barriers for the management or containment of waste, the structures must be designed so that failure will not occur, taking into account the type of waste, bearing pressure, and the method of operation, including the equipment that will be used to move waste at the facility.
2. The facility must be designed to control litter.
3. If waste management activities will take place within a structure, the structure must meet the following criteria:
    a. The minimum interior clearance height must be 28 feet, unless the commissioner approves a different height based on the equipment that is anticipated to be used at the facility during its expected life;
    b. The building door must be a minimum width of 16 feet and a minimum height of 25 feet to allow safe passage of traffic exiting or entering the facility in the unloaded position, unless the commissioner approves a different dimension based on the equipment that is anticipated to be used at the facility during its expected life;
    c. The facility must include floors constructed of high strength concrete capable of bearing 5,000 pounds per square inch as verified by ASTM C 1074-98, ASTM C 39/C 39M-01, or an equivalent test method, unless the commissioner approves an alternative design in the permit. The commissioner shall approve a floor consisting of lower strength concrete provided the owner and operator demonstrate that its durability is consistent with the operational goals of the facility;
    d. The facility floor must include floor joints adequate to prevent cracking of the slab, but floor joints using compressible filler must be minimized and located so as to prevent joint deterioration and release of leachate through the compressible filler. The floor must be treated to increase durability and extend wear life by using a concrete hardener or other accepted methods that decrease water absorption and increase compressive strength and curing time (see ASTM C 642-97, ASTM C 140-02a, and ASTM C 309-98a);
    e. All surfaces coming into contact with waste must be constructed of a material that is readily cleanable;
    f. If a periodic facility wash-down is specified or identified under the facility's approved operation and maintenance plan, the facility floor must include a trap to collect solids and a sump that has been adequately sized to collect and contain liquids at the facility;
    g. All floors must be sloped such that free moisture from the waste operations is confined to the tipping floor and liquids applied to the surface for cleaning purposes can be collected for treatment or disposal from the tipping floor or from the sump, if present; and
    h. Storm water must be routed away from the structure through the use of a leakproof roof, adequate gutters and down spouts, and the building apron must be graded to promote positive drainage away from the building.

END OF SECTION



1 A100 3D PERSPECTIVE



2 A100 FIRST FLOOR BUILDING PLAN
3/32" = 1'-0"

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3535 Vadnais Center Drive
St. Paul, MN 55110-5196

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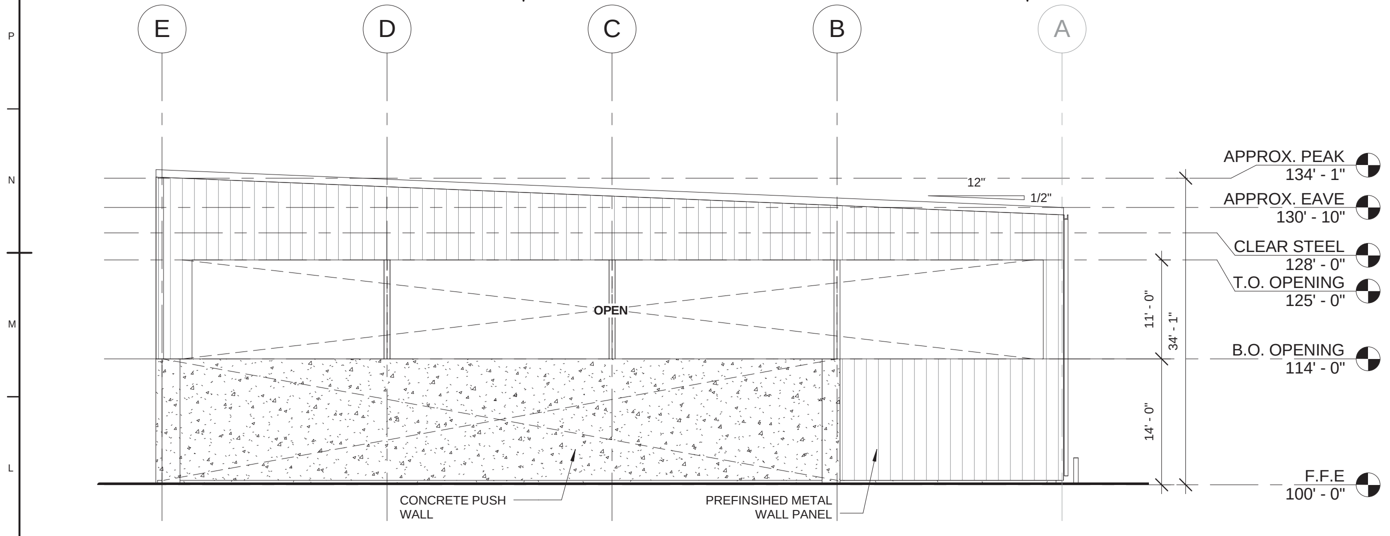
MARK	DATE	DESCRIPTION

LAB USA'S
ASH
PROCESSING
BUILDING
RED WING, MN

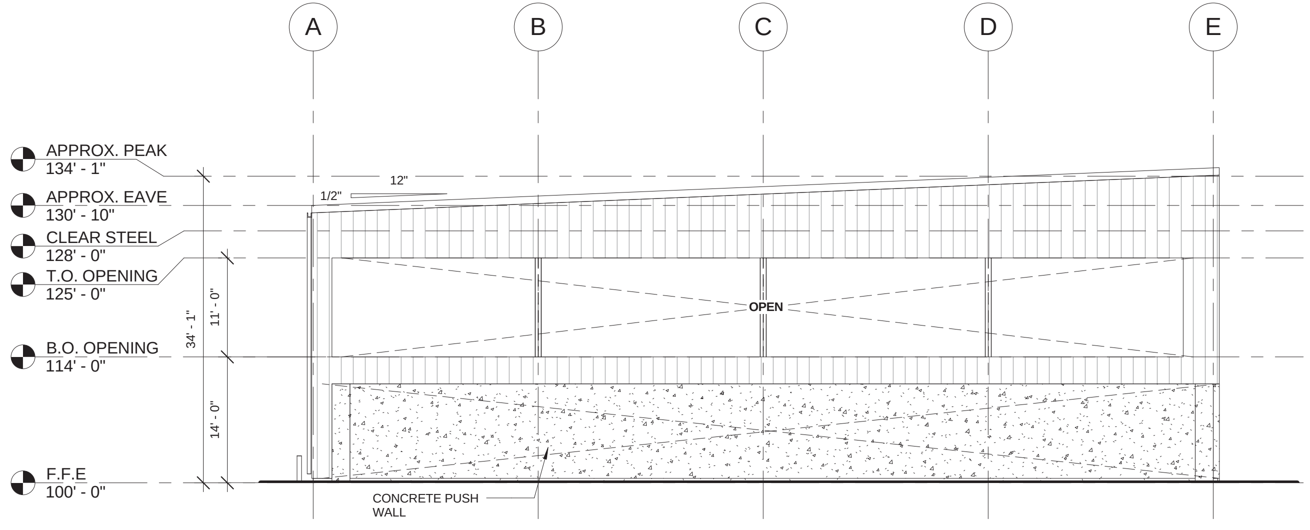
SEH FILE NO.	LABUS 133967
ISSUE DATE	05.27.2016
DESIGN BY	JM
DRAWN BY	KX
PROJECT MGR	BR

SHEET CONTENTS
FLOOR PLAN AND
PERSPECTIVE

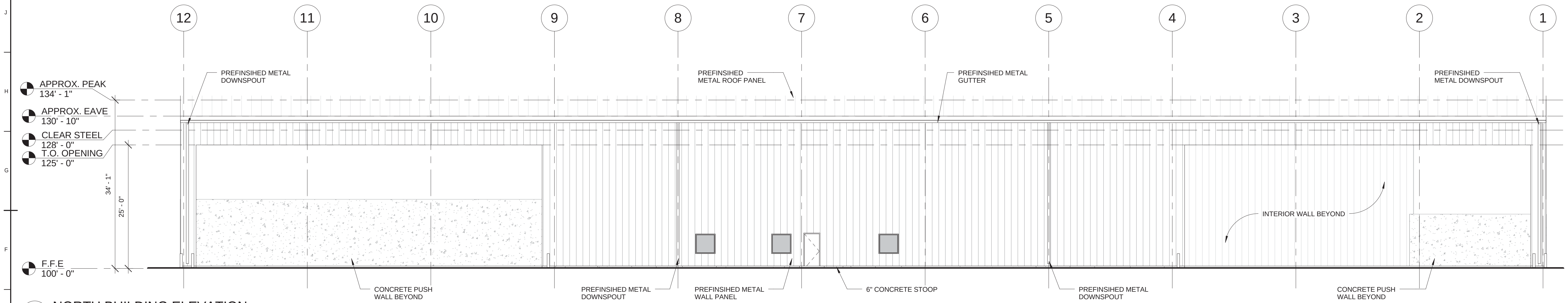
A100



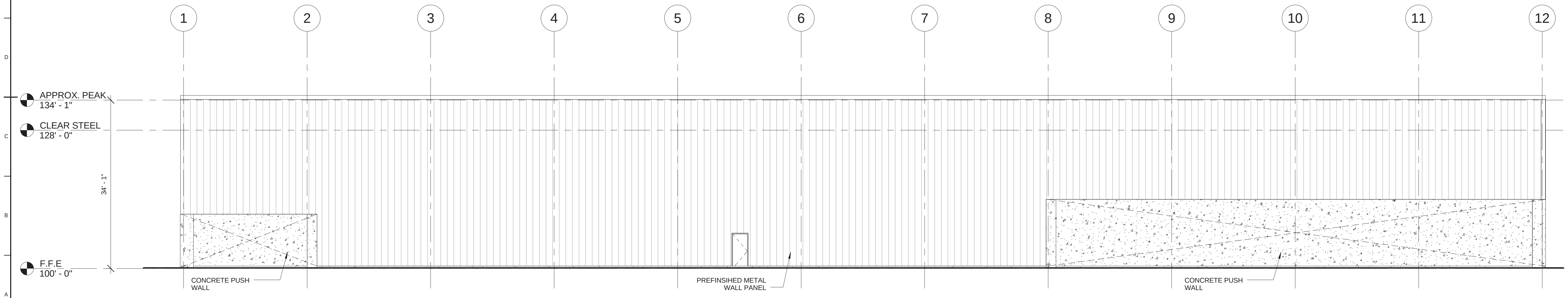
1 A201 EAST BUILDING ELEVATION
3/32" = 1'-0"



2 A201 WEST BUILDING ELEVATION
3/32" = 1'-0"



3 A201 NORTH BUILDING ELEVATION
3/32" = 1'-0"



4 A201 SOUTH BUILDING ELEVATION
3/32" = 1'-0"

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EXTERIOR ELEVATIONS

A201