Air Modeling of Project Alternatives Evaluation Report

Resource Document for Environmental Impact Statement

Prepared for
Merriam Junction Sands, LLC

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Contents

Executive Summary ... 1
1.0 Introduction ... 4
1.1 Project Location and Significant Features ... 4
1.2 Scope of Work ... 4
1.3 Modeling Objectives, Assumptions, and Limitations ... 4
2.0 Project Emissions ... 6
2.1 Project Alternatives and Operations ... 6
2.1.1 Alternatives ... 6
2.1.2 Operations at Mine ... 6
2.1.2.1 Mining ... 6
2.1.2.2 Crushing and Screening ... 7
2.1.2.3 Wet Plant ... 7
2.1.3 Winter Pile System ... 7
2.1.4 Operations at Dry Plant ... 7
2.1.4.1 Dry Plant ... 7
2.1.5 Storage Operations ... 8
2.1.6 Load Out Activities ... 9
2.2 Emission Source Types Summary and Calculation Methods ... 9
2.2.1 Point Source Emission Types and Calculations Methods ... 9
2.2.1.1 Sand Plant Dryers ... 9
2.2.1.2 Sand Plant Particulate Point Sources ... 10
2.2.1.3 Generators ... 11
2.2.2 Fugitive Emission Types & Calculations Methods ... 13
2.2.2.1 Basis for Truck Traffic Emissions Calculation ... 13
2.2.2.2 Basis for Storage Piles Emissions Calculations ... 16
2.2.2.3 Basis for Overburden Removal Operations Calculations ... 19
2.2.2.4 Sandstone Mining and Material Handling ... 21
2.2.2.5 Basis for Winter Pile Operations Calculations ... 21

2.2.2.6 Limestone Plant Material Handling 22
2.2.2.7 Sand and Gravel Mining 24
2.2.2.8 Mulch and Soils Operations 26
2.2.3 Total Facility Summary 27
3.0 Air Modeling Methodology 29
3.1 Model Selection and Options 29
3.2 Emission Source Characterizations 29
3.2.1 Modeling Operational Restrictions 30
3.2.2 Variable Emission Scalars 31
3.3 Receptors 31
3.4 Meteorological Data 32
3.5 Background Values and Nearby Sources 32
4.0 Results and Discussion 34
4.1 Renaissance Festival Results 35
4.1.1 Alternative 1 Model Results 35
4.1.2 Alternative 2 Model Results 35
4.1.3 Alternative 3 and 6 Model Results 35
4.1.4 Alternative 4 Model Results 35
4.1.5 Alternative 5 Model Results 36
4.2 Results with no Renaissance Festival 36
5.0 Cumulative Potential Effects 38
6.0 Draft Ambient Air Monitoring Plan 40
6.1 Methods 40
6.1.1 Monitor Location 40
6.1.2 Data Collection 41
6.2 Implementation 41
6.2.1 Monitor location 41
6.2.2 Data Collection 42
7.0 Fugitive Dust Control Plan 43
7.1 Applicability 43
7.2 Implementation 43
7.2.1 Open Storage Piles 43
7.2.2 Vehicle-related activities 44
7.2.3 Reporting and record keeping 45

8.0 Summary and Conclusions....46
9.0 References....47

List of Tables

Table 1	Operating Limits	5
Table 2	Planned Stockpiles	8
Table 3	Dryer #1 and Dryer #2 – Emission Unit Information	10
Table 4	Dryer #1 and #2 Combustion Emissions Summary	10
Table 5	Alternative 1-2 Baghouse Stack Flow Information	11
Table 6	Alternative 3-6 Baghouse Stack Flow Information	11
Table 7	Diesel Generator Emission Unit Information	12
Table 8	Limestone and Gravel Diesel Generator Combustion Emissions Summary	12
Table 9	Sandstone Mining Diesel Generator Combustion Emissions Summary	13
Table 10	Summary of Modeled Unpaved Haul Road Emissions	14
Table 11	Summary of Storage Pile Wind Erosion Emissions for Alternatives 1-2	18
Table 12	Summary of Storage Pile Wind Erosion Emissions for Alternatives 3-6	19
Table 13	Overburden Removal Operations Emissions Summary	20
Table 14	Winter Pile Operations Emissions Summary	22
Table 15	Limestone Plant Operations Emissions Summary	22
Table 16	Gravel Mining Operations Emissions Summary	25
Table 17	Mulch and Soils Operations Emissions Summary	26
Table 18	Annual Emissions Summary	28
Table 19	Particulate Background Values	33
Table 20	Alternative-Specific Model Results	34
Table 21	Model Results - No Renaissance Festival	37
Table 22	Siting Guidelines	41
Table 23	Sample Collection Instrumentation Details	41

List of Figures

Figure 1	Project Location EIS Alternative Options
Figure 2	EIS Alternative 1 Layout
Figure 3	EIS Alternative 2 Layout
Figure 4	EIS Alternative 3 and 6 Layouts
Figure 5	EIS Alternative 4 Layout
Figure 6	EIS Alternative 5 Layout
Figure 7	Haul Roads EIS Alternative Options
Figure 8	Process Flow EIS Alternative Options
Figure 9	Receptor Grid EIS Alternative Options
Figure 10	SQMD PM_{10} Nearby Sources EIS Alternative Options
Figure 11	SQMD $PM_{2.5}$ Nearby Sources EIS Alternative Options
Figure 12	24-Hour PM_{10} Results EIS Alternative 1
Figure 13	Annual PM_{10} Results EIS Alternative 1

Figure 14 24-Hour $PM_{2.5}$ Results EIS Alternative 1
Figure 15 Annual $PM_{2.5}$ Results EIS Alternative 1
Figure 16 24-Hour PM_{10} Results EIS Alternative 2
Figure 17 Annual PM_{10} Results EIS Alternative 2
Figure 18 24-Hour $PM_{2.5}$ Results EIS Alternative 2
Figure 19 Annual $PM_{2.5}$ Results EIS Alternative 2
Figure 20 24-Hour PM_{10} Results EIS Alternative 3 and 6
Figure 21 Annual PM_{10} Results EIS Alternative 3 and 6
Figure 22 24-Hour $PM_{2.5}$ Results EIS Alternatives 3 and 6
Figure 23 Annual $PM_{2.5}$ Results EIS Alternative 3 and 6
Figure 24 24-Hour PM_{10} Results EIS Alternative 4
Figure 25 Annual PM_{10} Results EIS Alternative 4
Figure 26 24-Hour $PM_{2.5}$ Results EIS Alternative 4
Figure 27 Annual $PM_{2.5}$ Results EIS Alternative 4
Figure 28 24-Hour PM_{10} Results West Gravel Pit EIS Alternative 4
Figure 29 Annual PM_{10} Results West Gravel Pit EIS Alternative 4
Figure 30 24-Hour $PM_{2.5}$ Results West Gravel Pit EIS Alternative 4
Figure 31 Annual $PM_{2.5}$ Results West Gravel Pit EIS Alternative 4
Figure 32 24-Hour PM_{10} Results EIS Alternative 5
Figure 33 Annual PM_{10} Results EIS Alternative 5
Figure 34 24-Hour $PM_{2.5}$ Results EIS Alternative 5
Figure 35 Annual $PM_{2.5}$ Results EIS Alternative 5
Figure 36 24-Hour PM_{10} Results No Festival EIS Alternative 2
Figure 37 Annual PM_{10} Results No Festival EIS Alternative 2
Figure 38 24-Hour $PM_{2.5}$ Results No Festival EIS Alternative 2
Figure 39 Annual $PM_{2.5}$ Results No Festival EIS Alternative 2
Figure 40 24-Hour PM_{10} Results No Festival EIS Alternative 5
Figure 41 Annual PM_{10} Results No Festival EIS Alternative 5
Figure 42 24-Hour $PM_{2.5}$ Results No Festival EIS Alternative 5
Figure 43 Annual $PM_{2.5}$ Results No Festival EIS Alternative 5
Figure 44 Conceptual Ambient Monitoring Locations

Acronyms, Abbreviations, and Units

AAB	ambient air boundary
BRP	Bryan Rock Products, Inc.
EPA	U.S. Environmental Protection Agency
FDCP	Fugitive Dust Control Plan
gr/dscf	grains per dry standard cubic foot
MJS	Merriam Junction Sands, LLC
MPCA	Minnesota Pollution Control Agency
MS	Malkerson Sales, Inc.
MTPY	million tons per year
NAAQS	National Ambient Air Quality Standards
NWS	National Weather Service
PM	Particulate matter
$PM_{2.5}$	Particles less than 2.5 micrometers in diameter
PM_4	Particles less than 4 micrometers in diameter
PM_{10}	Particles less than 10 micrometers in diameter
PSD	Prevention of Significant Deterioration
SEAW	Scoping Environmental Assessment Worksheet
SIA	Significant Impact Area
SIL	Significant Impact Level
SWRMD	Square Root Mean Distance
VMT	vehicle miles travelled

Executive Summary

This report describes potential air emission calculations and associated air dispersion modeling methods and results for a number of potential plant configurations and phasing sequences (alternatives) of the sandstone, limestone, and gravel mining project (Project) proposed by Merriam Junction Sands, LLC (MJS). The Project is located on 682 acres in Scott County, MN (Site). The air emission calculations and air dispersion modeling were performed to assess the potential for environmental impacts from the proposed project alternatives described in the Scoping Environmental Assessment Worksheet (SEAW) for the Project (reference (1)). The purpose of the analysis was to assess the area that may be impacted by air emissions, identify the potential quantity, type and source of air emissions, and identify pollution prevention techniques and controls on the processing equipment. A fugitive dust control plan and a draft ambient air monitoring plan are included in the report. The information developed in this analysis will also be used to prepare the air permit application for the Site.

The Site will be mined for industrial sand and processed at a planned maximum annual production goal of 2.4 million tons per year (MTPY) of processed sand. The Project will consist of stripping overburden, excavating sand, and conveying it to a processing area where it will be washed and sized, dried and sorted and then loaded out by rail or truck. The Project also includes the continuation of sand and gravel and limestone mining and processing, and an existing mulching operation.

The existing sand and gravel and limestone mining and processing operations currently operate under a Minnesota State General Permit Nonmetallic Mineral Processing (General Permit) Permit. As agreed upon with the Minnesota Pollution Control Agency (MPCA), the Site will continue to operate under the General Permit until construction of an industrial sand plant (sand plant) and sandstone mining is initiated. Prior to sand plant construction, an air emissions permit application will be prepared and submitted to the MPCA based on the production level and plant location alternative selected.

The analysis is based on maximum sand and gravel, limestone, and sandstone mining and production levels in order to assess the worst-case potential impacts of the Project. Federal and State ambient air standards are applicable at the property line or anywhere public exposure may occur (Ambient Air). The modelling results indicate that because of the short distance between the Project sources and ambient air boundary (AAB), operating limitations may be required during sand plant operations in order to comply with State and Federal ambient air standards at the AAB. An additional spatial constraint is the existence of a temporary lease agreement with the Minnesota Renaissance Festivals (Renaissance Festival) on the western portion of the Site that is owned by Malkerson Sales (MS). The lease agreement results in the need to place ambient receptors within the MJS property boundary. As a result, additional operational restrictions need to be made for operations on the MS property to accommodate sand plant operations while the Renaissance Festival lease agreement is in effect. After the lease agreement is terminated, the AAB can return to the property boundary and restrictions necessary to attain the NAAQS within the Site can be removed.

Assumed operating limitations for a sand production level of 2.4 MTPY are described in the report. These restrictions are applied to all six EIS alternatives and are applicable only once sandstone mining and processing begins at the site.

Annual emissions for the entire facility were calculated based on the equipment and mining plans specific to a plant design. Particulate emissions vary among the alternatives depending on if the alternative has one sand plant or two, and also because of changes in haul road distances due to plant locations. Calculated emissions range from 99.4 (4/6) – 173.7 (2) tons per year (associated alternative) for PM, 40.0 (4/6) – 57.8 (2) for PM_{10} and 20.5 (4/6) – 27.9 (2) for $PM_{2.5}$ respectively. Calculated emissions for CO and NO_X are 99 and 63 tons per year respectively. None of these emission levels trigger New Source Review Prevention of Significant Deterioration (PSD) thresholds. However, the PM levels for some of the alternatives do exceed the Title V permitting thresholds. During the air permitting process, if an alternative that exceeds Title V permit thresholds is selected to build, MJS will refine the plant layout, production capacity, emissions estimates and/or accept additional limitations as needed to ensure the potential to emit is below Title V major source thresholds, otherwise a Title V permit will be pursued in exchange for more flexibility in operations. In any case, potential emissions will not exceed PSD major source thresholds.

Environmental Impact Statement (EIS) Alternatives 1 through 6 were modeled for comparison with the 24-hour and Annual PM_{10} and $PM_{2.5}$ National Ambient Air Quality Standards (NAAQS). Modeling methods used were consistent with current methodology applied to mining within Minnesota. The modeling results provided are very conservative, as no credit has been taken for plume depletion, which represents particulate settling, within the model runs. The modeled results, including the background concentrations, were compared to the applicable standards and demonstrated compliance. Until the Renaissance Festival lease is terminated, the more restrictive operating conditions will be required. The results are described as follows. Alternative 2, with two sand plants, both located in the southern portion of the site, had the most restrictive modeled results. For Alternative 2, the maximum annual $PM_{2.5}$ NAAQS concentration was 97% of the standard and was located along the railroad boundary receptors. While all Alternatives demonstrated compliance with the applicable NAAQS, Alternative 5 had the highest modeled impacts compared to the applicable NAAQS for all averaging periods evaluated for PM_{10} and $PM_{2.5}$.

Based on these results, Barr chose Alternatives 2 and 5 for reevaluation modeling of the termination of the Renaissance Festival lease by removing the associated Renaissance Festival ambient receptors along with adding emissions from the additional limestone production at MS and BRP and expanding the MS open pit dimensions. This revised configuration passed for Alternative 5 showing the ability of the MJS facility to comply with the NAAQS both with and without the Renaissance Festival with the associated production restrictions for this alternative. Alternative 2 air impacts were 101% of the annual $PM_{2.5}$ NAAQS at receptors along the railroad right of way boundary. The main sources influencing these air concentrations are the BRP and MS sand plants and the in-pit limestone haul traffic. While an issue, in practical terms, the public cannot occupy the railroad tracks for an extended period of time, especially for an entire year, making these impacts unrepresentative of actual exposure and less concerning. If Alternative 2 is chosen for the Project and associated air permitting, the results are near enough the standards that design changes will be implemented to eliminate the modeled exceedances along the railroad receptors.

Upon completion of construction of the sand plant, MJS will conduct ambient air monitoring to address concerns regarding silica dust emissions from the Site. There is no ambient air quality standard set for silica, and control of silica dust is the same control typically used for particulate matter. MJS will conduct ambient air monitoring for particulate matter representative of silica dust. Particulate matter less than 4 microns (PM_4) will be collected and analyzed for silica. MJS plans to operate the fence-line monitoring system for two years after start up. MJS will provide information to the Minnesota Pollution Control Agency (MPCA) after 2 years justifying the end of monitoring proving compliance with standards for pollutants of concern. Proposed ambient air monitoring reflects industry practices and draft recommendations currently under consideration by the MPCA for industrial sand sector rules.

Mining in general, including industrial sand facilities, includes a number of emission sources that will generate fugitive emissions. Therefore, MJS has developed a draft Fugitive Dust Control Plan (FDCP). This FDCP covers emissions from sources such as drilling and blasting, mobile equipment operations, material handling, outdoor product storage, crushing and conveying, truck loading, truck hauling and employee vehicle traffic at the proposed mine and processing facility. The FDCP will be further developed with source and Site specifics during air permitting when a specific alternative and associated design will be selected. The elements contained in this FDCP reflect industry practices and draft recommendations currently under consideration by the MPCA for industrial sand sector rules.

1.0 Introduction

This report describes the air emission calculations and associated air dispersion modeling methods and results for six potential plant configurations and phasing sequences (alternatives) of the industrial sand, limestone, and gravel mining project (Project) proposed by Merriam Junction Sands, LLC (MJS). The air emission calculations and air dispersion modeling were performed to assess the potential for environmental impacts from the proposed alternatives described in the Scoping Environmental Assessment Worksheet (SEAW) for the Project (reference (1)). Methodology for monitoring particulate emissions from this facility is also described. Placement of receptors is typically an outcome of the air modeling results and proposed locations are described. Another significant component of particulate control is development of a fugitive dust control plan. Proposed methods of dust control are described later in this document.

The Site will be mined for industrial sand and processed at a planned maximum annual production goal of 2.4 million tons per year (MTPY) of processed sand. The Project will consist of stripping overburden, excavating sand, and conveying it to a processing area where it will be washed and sized, dried and sorted and then Site loaded out by rail or truck. The Project also includes active gravel and limestone mining and processing from the existing Malkerson Sales, Inc. (MS) and Bryan Rock Products, Inc. (BRP) operations, respectively, as well as the existing mulching operation by MN Mulch and Soils.

1.1 Project Location and Significant Features

The proposed Project is located in Shakopee, MN in northwestern Scott County, Minnesota. The Project is located on 682 acres consisting of several parcels (Site) owned by Malkerson Sales, Inc, (MS) and Bryan Rock Products, Inc. (BRP). Currently, the Minnesota Renaissance Festival (Renaissance Festival) operates within the Site. The Site is bounded on the east by Highway 169 and the west by the Minnesota River Valley. Figure 1 shows the Project location and associated property boundary.

1.2 Scope of Work

Emissions were calculated and air dispersion modeling was conducted for each alternative. Each alternative assumed the Renaissance Festival would continue to operate at the current location and have access from Highway 41 to the north and 145th Street west to the south. As a result, the booth site, campground, parking areas, Trail of Terror, and associated access roads (Renaissance Festival grounds) reflect ambient air and required placement of receptors inside the property boundary to evaluate areas where the public has access. Section 3.3 of this report details the receptor grids modeled for this analysis. Variations in the alternatives included multiple locations for a single 2.4 MTPY sand plant and multiple locations for dual 1.2 MTPY sand plants. The plant locations primarily impact the haul route distances for each alternative, meaning that overall emissions are greater due to longer vehicle miles travelled (VMT) for some alternatives than others.

1.3 Modeling Objectives, Assumptions, and Limitations

This report describes the modeling methodology that was followed for demonstrating compliance with the PM_{10} and $PM_{2.5}$ National Ambient Air Quality Standards (NAAQS) as identified in the Environmental

Impact Statement (EIS). Particulate matter is the most significant pollutant emitted from the Project. The modeling analysis compared the Project's 24-hour and annual $PM_{2.5}$ and PM_{10} ambient air concentrations to their respective NAAQS. The 24-hour $PM_{2.5}$ NAAQS is 35 µg/m^3 and the annual NAAQS is 12 µg/m^3. The 24-hour PM_{10} NAAQS is 150 µg/m^3. Results demonstrate that each of the alternatives will maintain the 24-hour and Annual PM_{10} and $PM_{2.5}$ NAAQS in ambient air, including at the Renaissance Festival grounds.

The NAAQS modeling analysis used U.S. Environmental Protection Agency (EPA) regulatory model AERMOD v15181. The 5-year meteorological dataset modeled was provided by the Minnesota Pollution Control Agency (MPCA) for 2009-2013 and processed using AERMET v14134. The surface data was from Flying Cloud Airport with upper air data from the Chanhassen National Weather Service (NWS). A recent development in the AERMOD/AERMET model is a default option called adjusted U*, which has been demonstrated to improve model performance for surface based fugitive sources during low wind, stable conditions. This option was selected for this Project's modeling analysis because the majority of emissions are surface based fugitives with the maximum modeled concentrations occurring during low wind, stable conditions. Receptors were set up at the property boundary and beyond following standard MPCA practice with the addition of receptors on the Renaissance Festival and along the access road. Further details on the modeling analysis are provided in Section 3 of this report.

Consistent with current operating conditions and because of the short distance between the Project sources and property boundary, operating limitations are assumed during the sand mining and processing operations. These restrictions are listed in Table 1 and apply to all six EIS alternatives.

Table 1 Operating Limits

Operations	Renaissance Festival Lease in Effect Additional Restrictions
Overburden Removal	Material handling allowed 6am-10pm (no operations 10 pm-6am)
Limestone Processing	Single Limestone plant operating in Bryan Rock Products pit at 700 tons/hr
Limestone Plant Hauling (within quarry)	No hauling 2am-6am year round Winter months (Dec-Feb) no hauling from 7pm-7am
Limestone Product Delivery (Commercial Hauling)	No hauling 2am-6am year round Winter months (Dec-Feb) no hauling from 10pm-6am
Gravel Product Delivery (Commercial Hauling)	No hauling 2am-6am year round
Mulching Operations	No activities (Dec-March) April-November activities limited to 6am-10pm
Operations	**Renaissance Festival Lease Terminated**
Total Facility	2.4 MTPY Production limit
Limestone Processing	2 Limestone plants each operating at 700 tons/hr Located in Bryan Rock Products Pit and Malkerson Pit
Limestone Product Delivery (Commercial Hauling)	Hauling from Malkerson Pit plant limited to 37 truck trips per hour

2.0 Project Emissions

The Project design basis was used in combination with emission factors, primarily from AP-42, to estimate emissions. These are used for model inputs and permit applicability determinations.

2.1 Project Alternatives and Operations

Six alternatives were considered. Three of the alternatives involve a single sand plant with a 2.4 MTPY capacity and the rest posit two 1.2 MTPY plants with one on the MS property and the other on the BRP property.

2.1.1 Alternatives

Alternatives 1 and 2 are shown in Figure 2 and Figure 3, respectively. The alternatives are identical in the phasing of the sandstone mining operations with Phase 1 beginning in the northern half of the MS and BRP mining areas and Phase 2 shifting to the southernmost portions of those properties. For both alternatives, the 1.2 MTPY sand plant located on the BRP property is identical. In Alternative 1, the 1.2 MTPY sand plant on MS property is located north of the Renaissance Festival booth site and campground and a further distance from sandstone mining. For Alternative 2, the sand plant is located further south, near the current Renaissance Festival booth site and campground within the existing MS limestone quarry.

Alternatives 3 and 6 are shown in Figure 4. The plant Sites are identical—the 2.4 MTPY sand plant layouts are located on the BRP property. The difference between these two alternatives is the phasing of the mining operations. Alternative 3 sets up the mining phases in the southern MS property first, then the BRP property, then lastly in the northern MS property. Alternative 6 starts the first two mining phases on the MS property and moves to the BRP property for the final phases.

Alternatives 4 and 5 are shown in Figure 5 and Figure 6, respectively. Both alternatives have a single 2.4 MTPY sand plant located on the MS property, but the Alternative 4 sand plant location is on the northern half of the property and the Alternative 5 sand plant location is on the southern half of the property.

2.1.2 Operations at Mine

2.1.2.1 Mining

Bulldozers and excavators will be used to remove any remaining material overlying the target material (overburden) to be mined. Most of the soils on the Site have only one foot or less of topsoil. Topsoil will be used to construct berms along the operational boundary of the Site. Because this is an existing mining operation, much of the area has been previously stripped and perimeter berms have been established.

Once the mining operations have excavated a sufficient amount of sandstone, overburden and wet plant process fines will be used to backfill previous mining areas in order to reach the designated reclamation grade. The reclaimed upland areas will be seeded and mulched in order to increase stability and prevent erosion.

Typical mobile equipment will be utilized during mining activities. These consist of, but are not limited to mine haul trucks, loaders, bulldozers, dredges, and excavators. Water will be utilized to control dust. The mine trucks will operate primarily on the haul roads within the mine. Figure 7 shows the basic Site layout and conceptual roads.

2.1.2.2 Crushing and Screening

Typical crushing circuit equipment will be utilized during the initial stage of sandstone processing, as well as limestone processing for BRP and MS and sand and gravel processing for MS. These consist of, but are not limited to, mobile/stationary crushers, grizzly feeders, sand scalpers/screens, conveyors, and loaders. Up to 1,500 tons of sand per hour, 700 tons of limestone per hour at each BRP plant, and 500 tons of gravel per hour will be processed through the crushing circuits. The sandstone is expected to have relatively high moisture content but spray bars may also be utilized to control dust. Overland conveyors or slurry lines will transfer sand and crushed sandstone material from the mine to the sand processing facility

2.1.2.3 Wet Plant

The excavated sandstone will be transported from the active excavation area to the wet plant(s) by conveyor or slurry. Wet plants clean the sand and perform initial sizing operations by separating finer sand and silt from coarser sand. Equipment within the wet plant(s) will include scalping screens to remove oversized materials, hydrocyclones and hydrosizers to separate the sand by size, and dewatering screens. In addition, attrition scrubbers to loosen and remove certain impurities may be utilized depending upon variations encountered throughout the deposit. After dewatering, the sand will be transferred by conveyor to the dry plant(s) where it will be stockpiled in decanting piles for further dewatering and subsequent processing.

2.1.3 Winter Pile System

There will be a stockpile of washed sand established near the wet plant to feed the dry plant during the winter months when mining is not active and the wet plant is not operating. Conveyors will transport the sand from the wet plant to the winter pile. The sand will be transported from the winter pile to the dry plant by loaders loading it onto conveyors and conveying it to the plant.

2.1.4 Operations at Dry Plant

2.1.4.1 Dry Plant

The proposed dry plant location will vary based on the alternative as described in section 2.1.1. The dry plant(s) will include a rotary drum dryer(s) or a fluidized bed dryer(s) which will feed into an enclosed building to a series of screens to produce the necessary gradations of marketable silica sand product. Finished product will be conveyed into a series of storage silos. The storage silos will feed into the rail load loadout or truck loadout by conveyor. Finished product will be transferred into covered railcars or enclosed trucks for shipment to market. The dry plant(s) will be equipped with state of the art pollution control equipment. Natural gas will be brought to the Site as fuel for the dryer(s). Propane may serve as back up fuel to allow uninterrupted processing during peak demand periods. The dry plant(s) will be operated year-round.

The dry plant receives sand from the decanting piles via conveyor which feeds sand into a large hopper at a maximum rate of 1,500 ton/hr. Particulate emissions from each dryer are controlled by a baghouse.

Material handling operations (screens/shakers/etc.) and building pickup points are also controlled by a baghouse at each plant.

2.1.5 Storage Operations

Dry and sorted sand is transferred into enclosed storage silos and/or the fine product bin by conveyors and bucket elevators. The material handling operations and building pickup points are controlled by a baghouse. Sand, limestone, gravel, and mulching materials are also stored in stockpiles on Site. See Table 2 for a list of planned stockpiles.

Table 2 Planned Stockpiles

Source Potential to Emit (PTE) Emissions	Material	Pile Area Acres
Alternatives 1-2		
PLANT 1 Pit Edge Raw Sand Pile Erosion	sand	0.30
PLANT 1 Wet Plant Raw Sand Pile Erosion	sand	0.30
PLANT 1 Oversize Wet Sand Pile Erosion	sand	0.12
PLANT 1 Wet Sand (From Conveyor C06) Wind Erosion	sand	0.12
PLANT 1 Decanting Pile Wind Erosion	sand	2.32
PLANT 2 Pit Edge Raw Sand Pile Erosion	sand	0.30
PLANT 2 Wet Plant Raw Sand Pile Erosion	sand	0.30
PLANT 2 Oversize Wet Sand Pile Erosion	sand	0.12
PLANT 2 Wet Sand (From Conveyor C06) Wind Erosion	sand	0.12
PLANT 2 Decanting Pile Wind Erosion	sand	2.32
Winter Pile Wind Erosion	sand	6.93
Pile 1 from Screen #3	limestone	0.24
Pile 2 from Screen #3	limestone	0.24
Pile 3 from Screen #4	limestone	0.24
Pile 4 from Screen #6	limestone	0.24
Pile 5 from Screen #6	limestone	0.24
Pile 1 from Screen #3	limestone	0.24
Pile 2 from Screen #4	limestone	0.24
Long Term Stock Pile	gravel	0.24
Compost stockpile	compost	0.14
Unscreened soil stockpile	soil	0.07
Product stockpile	mulch	0.81
Alternatives 3-6		
Pit Edge Raw Sand Pile Erosion	sand	0.60
Wet Plant Raw Sand Pile Erosion	sand	0.60
Oversize Wet Sand Pile Erosion	sand	0.24
Wet Sand (From Conveyor C06) Wind Erosion	sand	0.24
Decanting Pile Wind Erosion	sand	4.64
Winter Pile Wind Erosion	sand	6.93

Source Potential to Emit (PTE) Emissions	Material	Pile Area Acres
Pile 1 from Screen #3	limestone	0.24
Pile 2 from Screen #3	limestone	0.24
Pile 3 from Screen #4	limestone	0.24
Pile 4 from Screen #6	limestone	0.24
Pile 5 from Screen #6	limestone	0.24
Pile 1 from Screen #3	limestone	0.24
Pile 2 from Screen #4	limestone	0.24
Long Term Stock Pile	gravel	0.24
Compost stockpile	compost	0.14
Unscreened soil stockpile	soil	0.07
Product stockpile	mulch	0.81

2.1.6 Load Out Activities

The finished product is transferred from the storage operations by conveyor to the loadout system where it is weighed and loaded out via rail car or truck. The loadout activities will be controlled by a baghouse. Figure 8a and Figure 8b show the basic process flow of facility operations.

2.2 Emission Source Types Summary and Calculation Methods

Process units associated with the operation are defined and associated operational assumptions are identified in the following section. Emissions consist of those that can readily be collected and discharged from a stack (point source) and others that are not readily collected such as those associated with wind-related stockpile erosion or haul roads. Section 2.2.1 describes methodologies used to calculate both Project-related fugitive and point source emissions.

2.2.1 Point Source Emission Types and Calculations Methods

2.2.1.1 Sand Plant Dryers

All alternatives include two dryers. Dryer equipment includes the equipment located around the dryer that helps to feed in the sand and control the emissions. Each dryer is controlled by a baghouse and is located indoors. Dryer specifications are shown in Table 3.

Table 3 Dryer #1 and Dryer #2 – Emission Unit Information

Process Parameter	Dryer #1	Dryer #2
Unit Description:	Dryer #1 – Fluid bed dryer	Dryer #2 – Fluid bed dryer
Control Technology:	Baghouse	Baghouse
Maximum continuous heat input rating (MMBtu/hr) (HHV):	40 MMBtu/hr	40 MMBtu/hr
Hourly Throughput (ton/hr):	225	225
Annual Throughput (ton/yr):	1,971,000	1,971,000
Fuel:	Natural Gas	Natural Gas
Higher heating value:	1,020 Btu/scf	1,020 Btu/scf
Exhaust flow rate, maximum (acfm)	67,000	67,000

Particulate emissions from the dryer are calculated using an assumed grain-loading factor of 0.002 grains per dry standard cubic foot (gr/dscf). The exhaust flow rate in dscf is estimated to be 59,183 dcfm per dryer. Dryer combustion emissions are based on a natural gas fired burner with a capacity of 40 MMBtu/hr per dryer. Emission factors are taken from U.S. EPA's AP-42 (reference (2), Fifth Edition, Volume 1, Chapter 1.4: Natural Gas Combustion). A heat content of 1,020 Btu/scf was assumed for natural gas per AP-42 guidance. Table 4 provides a summary of dryer emission rates.

Table 4 Dryer #1 and #2 Combustion Emissions Summary

Pollutant	Emission Factor	Units	Hourly Rate per Dryer	Control Method	Control Efficiency	Potential Emissions (lb/hr)
PM	0.002	gr/dscf	3.55 MMscf/hr	Baghouse	(include in EF)	1.01
PM_{10}	0.002	gr/dscf	3.55 MMscf/hr	Baghouse	(include in EF)	1.01
$PM_{2.5}$	0.002	gr/dscf	3.55 MMscf/hr	Baghouse	(include in EF)	1.01
SO_2	0.60	lb/MMcf	0.04 MMscf/hr	None	0%	0.05
NO_X	0.17	lb/MMBtu	40 MMBtu/hr	None	0%	13.6
CO	0.25	lb/MMBtu	40 MMBtu/hr	None	0%	20.0
VOC	5.50	lb/MMscf	0.04 MMscf/hr	None	0%	0.43
CO_2	117	lb/MMBtu	40 MMBtu/hr	None	0%	9,358
Total HAP	1.89	lb/MMscf	0.04 MMscf/hr	None	0%	0.15

2.2.1.2 Sand Plant Particulate Point Sources

The dryers are the only stationary combustion sources at the sand plant. The remaining sand plant point sources are particulate emitting equipment, which are controlled by baghouses. Sand plant equipment includes the equipment located after the dryers and before being transported to storage. Storage system equipment includes six storage silos. Loadout activities equipment includes the equipment used to loadout the industrial sand by rail or truck and capture the emissions generated by the finished sand product. The vacuum system is the equipment used to control dust in the plant. Each of these processes are controlled by a baghouse in Alternatives 3-6. Since Alternatives 1-2 involve two separate sand plants, there are two of each process – one at each plant – with a baghouse on each of the separate processes.

Emissions from the sand plant particulate point sources are calculated using an assumed grain-loading factor of 0.002 gr/dscf which reflects vendor performance guarantees. Baghouse stack flows and resulting estimated potential emissions are shown in Table 5 for Alternatives 1-2 and in Table 6 for Alternatives 3-6.

Table 5 Alternative 1-2 Baghouse Stack Flow Information

Process Description	Baghouse Stack Flow	PM Potential Emissions (lb/hr)	PM_{10} Potential Emissions (lb/hr)	$PM_{2.5}$ Potential Emissions (lb/hr)
Dry Plant 1	10,000 acfm	0.16	0.16	0.16
Dry Plant 2	10,000 acfm	0.16	0.16	0.16
Storage Systems 1	12,000 acfm	0.19	0.19	0.19
Storage Systems 2	12,000 acfm	0.19	0.19	0.19
Rail Loadout 1	2,000 acfm	0.03	0.03	0.03
Rail Loadout 2	2,000 acfm	0.03	0.03	0.03
Truck Loadout 1	2,000 acfm	0.03	0.03	0.03
Truck Loadout 2	2,000 acfm	0.03	0.03	0.03
Vacuum System 1	1,000 acfm	0.02	0.02	0.02
Vacuum System 2	1,000 acfm	0.02	0.02	0.02

Table 6 Alternative 3-6 Baghouse Stack Flow Information

Process Description	Baghouse Stack Flow	PM Potential Emissions (lb/hr)	PM_{10} Potential Emissions (lb/hr)	$PM_{2.5}$ Potential Emissions (lb/hr)
Dry Plant	10,000 acfm	0.16	0.16	0.16
Storage Systems	12,000 acfm	0.19	0.19	0.19
Rail Loadout	2,000 acfm	0.03	0.03	0.03
Truck Loadout	2,000 acfm	0.03	0.03	0.03
Vacuum System	1,000 acfm	0.02	0.02	0.02

2.2.1.3 Generators

There are four diesel generators at the facility: one associated with sandstone mining, two at the limestone plants, and one associated with gravel mining. Generator descriptions and capacities are listed in Table 7.

Table 7 Diesel Generator Emission Unit Information

Diesel Generator Description	Capacity (kW)	Capacity (MMBtu/hr)
Dredge Generator	2000	6.8
Rip Rap Plant Generator	600	2.0
Scalping Screen Generator	600	2.0
Gravel Mining Generator	1760	6.0

Diesel generator combustion emissions are based on diesel combustion emission factors taken from U.S. EPA's AP-42 (reference (2), 40 CFR Part 98, manufacturer's guarantee, and/or Tier 4 emissions standards). The calculated emission rates for limestone and gravel and sand generators are shown in Table 8 and Table 9, respectively.

Table 8 Limestone and Gravel Diesel Generator Combustion Emissions Summary

Pollutant	Emission Factors	Units	Emission Factor Reference	Rip Rap Plant Generator Potential Emissions (lb/hr)	Scalping Screen Generator Potential Emissions (lb/hr)	Gravel Mining Generator Potential Emissions (lb/hr)
PM	0.10	g/kWh	[1]	0.13	0.13	0.39
PM_{10}	0.10	g/kWh	[1]	0.13	0.13	0.39
$PM_{2.5}$	0.10	g/kWh	[1]	0.13	0.13	0.39
SO_2	0.00001	kg/kWh	[2]	0.01	0.01	0.03
NO_X	0.67	g/kWh	[1]	0.88	0.88	2.59
CO	3.50	g/kWh	[1]	4.62	4.62	13.55
VOC	0.09	lb/MMBtu	[2]	0.18	0.18	0.54
CO_2	73.96	kg/MMBtu	[3]	334	334	978
Total HAP	0.0065	lb/MMBtu		0.01	0.01	0.04

[1] Tier 4 emissions standards for engine power of >560 kW. Assume $PM=PM_{10}=PM_{2.5}$.
[2] Assume ultra-low sulfur diesel, which has a max sulfur content of 15 ppm (0.0015%) (reference (2))
[3] U.S. EPA 40 CFR 98, Mandatory Greenhouse Gas Reporting, Table C-1, Distillate Fuel Oil No. 2.
[4] U.S. EPA AP-42 Emission Factors for Gasoline and Diesel Industrial Engines, Table 3.3-2 (Oct 1996)

Table 9 Sandstone Mining Diesel Generator Combustion Emissions Summary

Pollutant	Emission Factors	Units	Emission Factor Reference	Dredge Generator Potential Emissions (lb/hr)
PM	0.20	lb/hr	[1]	0.20
PM_{10}	0.20	lb/hr	[1]	0.20
$PM_{2.5}$	0.20	lb/hr	[1]	0.20
SO_2	0.00001	kg/kW-hr	[2]	0.03
NO_X	4.06	lb/hr	[1]	4.06
CO	0.81	lb/hr	[1]	0.81
VOC	0.21	lb/hr	[1]	0.21
CO_2	73.96	kg/MMBtu	[3]	1,112
Total HAP	0.0065	lb/MMBtu	[4]	0.04

[1] Emission rates per manufacturer's guarantee
[2] Assume ultra-low sulfur diesel, which has a max sulfur content of 15 ppm (0.0015%) (reference (2))
[3] U.S. EPA 40 CFR 98, Mandatory Greenhouse Gas Reporting, Table C-1, Distillate Fuel Oil No. 2.
[4] U.S. EPA AP-42 Emission Factors for Gasoline and Diesel Industrial Engines, Table 3.3-2 (Oct 1996)

2.2.2 Fugitive Emission Types & Calculations Methods

2.2.2.1 Basis for Truck Traffic Emissions Calculation

Sandstone mining and processing operations require haul trucks for transporting overburden, raw sand, winter sand, and the finished sand product. Additionally, water trucks are needed to control the unpaved haul road dust. See Table 10 for a summary of potential emissions and information used to calculate emissions, including haul capacity and roundtrip distance for each type of vehicle traffic.

Table 10 Summary of Modeled Unpaved Haul Road Emissions

Traffic Description	Surface	Vehicle distance per round-trip (ft)	Empty truck weight (tons)	Weight transported per truck (tons)	Mean Vehicle Weight [4] (Tons)	Hourly Vehicle Rate (trip/hr)	Note	Vehicle Emission Factor (lb/VMT)			Control Eff. (%)	Controlled Potential to Emit Emissions (lb/hr)		
								PM	PM_{10}	$PM_{2.5}$		PM	PM_{10}	$PM_{2.5}$
Overburden Hauling - Malkerson	Unpaved	2,000	38	40	58	20	[1]	74.08	18.88	1.89	93%	4.88	1.24	0.12
Crude Sand Hauling: Alternatives 1 (per plant), 3, 4, 6	Unpaved	1,000	38	40	58	38	[1]	70.37	17.94	1.79	91%	6.60	1.68	0.17
Crude Sand Hauling: Alternatives 2 (per plant), 5	Unpaved	500	38	40	58	38	[1]	35.19	8.97	0.90	91%	3.30	0.84	0.08
Winter Sand Hauling: Alternative 1	Unpaved	27,456	38	40	58	1	[2]	50.85	12.96	1.30	95%	2.54	0.65	0.06
Winter Sand Hauling: Alternative 2	Unpaved	7,603	38	40	58	1	[2]	14.08	3.59	0.36	95%	0.70	0.18	0.02
Winter Sand Hauling: Alternative 3, 5	Unpaved	3,802	38	40	58	1	[2]	7.04	1.79	0.18	95%	0.35	0.09	0.01
Winter Sand Hauling: Alternative 4, 6	Unpaved	20,000	38	40	58	1	[2]	37.04	9.44	0.94	95%	1.85	0.47	0.05
Overburden Water Truck	Unpaved	1,000	10	31	30	1	[3]	1.16	0.30	0.03	95%	0.06	0.01	0.00
Crude Sand Water Truck: Alternatives 1, 3, 4, 6	Unpaved	500	10	31	30	1	[3]	0.58	0.15	0.01	95%	0.03	0.01	0.00
Crude Sand Water Truck: Alternatives, 2, 5	Unpaved	250	10	31	20	1	[3]	0.29	0.07	0.01	95%	0.01	0.00	0.00
Winter Sand Water Truck: Alternative 1	Unpaved	13,728	10	31	20	1	[3]	15.91	4.05	0.41	95%	0.80	0.20	0.02
Winter Sand Water Truck: Alternative 2	Unpaved	3,802	10	31	20	1	[3]	4.40	1.12	0.11	95%	0.22	0.06	0.01
Winter Sand Water Truck: Alternatives 4, 6	Unpaved	10,000	10	31	20	1	[3]	11.59	2.95	0.30	95%	0.58	0.15	0.01
Winter Sand Water Truck: Alternatives 3, 5	Unpaved	1,907	10	31	20	1	[3]	2.20	0.56	0.06	95%	0.11	0.03	0.00

Traffic Description	Surface	Vehicle distance per round-trip (ft)	Empty truck weight (tons)	Weight transported per truck (tons)	Mean Vehicle Weight [4] (Tons)	Hourly Vehicle Rate (trip/hr)	Note	Vehicle Emission Factor (lb/VMT)			Control Eff. (%)	Controlled Potential to Emit Emissions (lb/hr)		
								PM	PM_{10}	$PM_{2.5}$		PM	PM_{10}	$PM_{2.5}$
Overburden Hauling – Bryan Rock	Unpaved	2000	38	40	58	25	[1]	9.78	2.49	0.25	92%	7.62	1.94	0.19
Limestone Haul Trucks	Unpaved	3000	38	40	58	18	[1]	9.78	2.49	0.25	94%	5.93	1.51	0.15
Limestone Loaders	Unpaved	1000	43	19	52	38	[1]	9.33	2.38	0.24	91%	6.30	1.61	0.16
Commercial Limestone Trucks - Plant 1	Unpaved	6336	5-15	15-25	20	75	[2]	6.04	1.54	0.15	94%	33.57	8.56	0.86
Commercial Limestone Trucks - Plant 2 *(Post Renaissance Festival only)*	Unpaved	7498	5-15	15-25	20	37	[2]	6.04	1.54	0.15	95%	15.87	4.05	0.40
Overburden water truck	Unpaved	1000	10	31	20	1	[3]	6.12	1.56	0.16	95%	0.06	0.01	0.00
Limestone water truck	Unpaved	5284	10	31	20	1	[3]	6.12	1.56	0.16	95%	0.31	0.08	0.01
Gravel Haul Trucks	Unpaved	2000	38	40	58	13	[1]	48.15	12.27	1.23	95%	2.41	0.61	0.06
Commercial Gravel Trucks	Unpaved	1314	5-15	15-25	20	20	[2]	32.47	8.27	0.83	93%	2.14	0.54	0.05
Gravel & Mulch water truck	Unpaved	2201	10	31	20	1	[3]	2.55	0.65	0.06	95%	0.13	0.03	0.00
Compost hauled in truck traffic	Unpaved	1088	20	22	42	3	[2]	5.23	1.33	0.13	95%	0.26	0.07	0.01
Compost trucks leaving	Unpaved	4615	20	0	20	3	[2]	[5]	[5]	[5]	[5]	[5]	[5]	[5]
Soil hauled in truck traffic	Unpaved	1088	20	18	38	7	[2]	11.66	2.97	0.30	95%	0.58	0.15	0.01
Soil Trucks leaving	Unpaved	4615	20	0	20	7	[2]	37.07	9.45	0.94	95%	1.85	0.47	0.05
Mulch product trucks arriving	Unpaved	1088	20	0	20	7	[2]	8.74	2.23	0.22	95%	0.44	0.11	0.01
Mulch Product hauled out truck traffic	Unpaved	4615	20	15	35	7	[2]	47.68	12.15	1.22	95%	2.38	0.61	0.06

[1] Hourly rate based on weight transported per truck and hourly throughput rate.
[2] Maximum hourly truck frequency set by MJS.
[3] Water spray not required more than once per hour to provide sufficient control.
[4] Average weight for haul trucks based on carrying a full load for one way of the route and empty for one way of the route. Average weight for water trucks based on starting with a full tank and watering until empty.
[5] Compost trucks never leave empty; they always take mulch product. Therefore, these emissions are already covered with the mulch product hauled out line items.

Individual calculations were performed for each type of traffic using the different haul weights and lengths applicable and the AP-42 equation (reference (2)), below.

Equation for Unpaved Road Calculations

$$E_U = k\ (s/12)^a * (W/3)^b * [(365-P)/365]$$

E_U = Vehicle Emission Factor for unpaved roads (lb/VMT)
s = surface material silt content (%) = 4.8%
W = mean vehicle weight (tons) based on an empty truck weight and a truck capacity weight
k = constant (lb/VMT) = 4.9 for PM, 1.5 for PM_{10}, 0.15 for $PM_{2.5}$
a = constant = 0.7 for PM, 0.9 for PM_{10}, 0.9 for $PM_{2.5}$
b = constant = 0.45 for PM, PM_{10}, $PM_{2.5}$
P = days >0.01" of precipitation (when calculating emissions for modeling, P=0 since precipitation is already accounted for in the model)

AP-42 (reference (2), Section 13.2.2, Equation 1a, November 2006). The silt content of 4.8% was taken from Table 13.2.2-1 "Typical Silt Content Values of Surface Material on Industrial Unpaved Roads." The distances used below were either provided by MJS or measured using ArcGIS.

Equation for Paved Road Calculations

$$E_P = k\ (sL)^{0.91} * (W)^{1.02} * (1-P/4N)$$

E_P = Vehicle Emission Factor for paved roads (lb/VMT)
sL = road surface silt loading (g/m^2) = 70
W = mean vehicle weight (tons) based on an empty truck weight and a truck capacity weight
k = constant (lb/VMT) = 0.11 for PM, 0.0022 for PM_{10}, 0.00054 for $PM_{2.5}$
P = days >0.01" of precipitation (when calculating emissions for modeling, P=0 since precipitation is already accounted for in the model)
N =number of days in the averaging period = 365

AP-42 (reference (2), Section 13.2.1, Equation 1a, January 2011). The silt loading of 70 g/m^2 was taken from Table 13.2.1-3 for sand and gravel processing. The distances used below were either provided by MJS or measured using ArcGIS.

Control efficiency is calculated based on the Estimation of Control Effectiveness - Wet Suppression in Air Pollution Engineering Manual, AWMA, 1992. Application intensity and frequency of application are factored into the estimated control value and will be included in the Site's dust control plan. In any case, the maximum control efficiency assumed is 95%.

2.2.2.2 Basis for Storage Piles Emissions Calculations

Storing material in piles exposed to wind erosion produces fugitive particulate emissions. Individual calculations were performed for each type of material storage using the material size, pile surface area, and the AP-42 (reference (2) Section 13.2.5 equations), below.

$$\textbf{Emission Factor } (g/m^2) = N(k)P$$

N = number of disturbances

P= erosion potential

k = particle size multiplier; PM = 1.0, PM_{10} = 0.5, $PM_{2.5}$ = 0.075

$$P = 58(u^*-u_t^*)^2 + 25(u^*-u_t^*)$$

$$u^* = 0.53u_{10}^+$$

u^* = friction velocity (m/s)

u_t = threshold friction velocity (m/s)

$u_{10}+$ = fastest mile wind velocity (m/s)

Threshold friction velocity for the sand is based on the EPA document Control of Open Fugitive Dust Sources, Figure 4-2 (page 4-12) and particle size distribution analysis from the facility. Threshold friction velocity used for the limestone is the overburden threshold from Table 13.2.5-2 of AP-42 (reference (2)). Threshold friction velocity for the mulch is a conservative estimate.

Wind speed data is from the Flying Cloud Airport meteorological station. Wind data was collected from 2009-2013 and the maximum daily wind speed was used.

Piles, pile sizes, and pile materials were provided by MJS.

Calculated storage pile emissions are shown in Table 11 for Alternatives 1-2 and in Table 12 for Alternatives 3-6.

Table 11 Summary of Storage Pile Wind Erosion Emissions for Alternatives 1-2

Source Potential to Emit (PTE) Emissions	Material	Pile Area Acres	Control Efficiency	PM (lb/hr)	PM_{10} (lb/hr)	$PM_{2.5}$ (lb/hr)
PLANT 1 Pit Edge Raw Sand Pile Erosion	sand	0.30	91%	0.04	0.02	0.003
PLANT 1 Wet Plant Raw Sand Pile Erosion	sand	0.30	91%	0.04	0.02	0.003
PLANT 1 Oversize Wet Sand Pile Erosion	sand	0.12	91%	0.02	0.01	0.001
PLANT 1 Wet Sand (From Conveyor C06) Wind Erosion	sand	0.12	91%	0.02	0.01	0.001
PLANT 1 Decanting Pile Wind Erosion	sand	2.32	91%	0.35	0.17	0.03
PLANT 2 Pit Edge Raw Sand Pile Erosion	sand	0.30	91%	0.04	0.02	0.003
PLANT 2 Wet Plant Raw Sand Pile Erosion	sand	0.30	91%	0.04	0.02	0.003
PLANT 2 Oversize Wet Sand Pile Erosion	sand	0.12	91%	0.02	0.01	0.001
PLANT 2 Wet Sand (From Conveyor C06) Wind Erosion	sand	0.12	91%	0.02	0.01	0.001
PLANT 2 Decanting Pile Wind Erosion	sand	2.32	91%	0.35	0.17	0.03
Winter Pile Wind Erosion	sand	6.93	91%	1.04	0.52	0.08
Pile 1 from Screen #3	limestone	0.24	91%	8.07E-04	4.03E-04	6.05E-05
Pile 2 from Screen #3	limestone	0.24	91%	8.07E-04	4.03E-04	6.05E-05
Pile 3 from Screen #4	limestone	0.24	91%	8.07E-04	4.03E-04	6.05E-05
Pile 4 from Screen #6	limestone	0.24	91%	8.07E-04	4.03E-04	6.05E-05
Pile 5 from Screen #6	limestone	0.24	91%	8.07E-04	4.03E-04	6.05E-05
Pile 1 from Screen #3	limestone	0.24	91%	8.07E-04	4.03E-04	6.05E-05
Pile 2 from Screen #4	limestone	0.24	91%	8.07E-04	4.03E-04	6.05E-05
Long Term Stock Pile	gravel	0.24	91%	8.07E-04	4.03E-04	6.05E-05
Compost stockpile	compost	0.14	91%	0.01	6.15E-03	9.22E-04
Unscreened soil stockpile	soil	0.07	91%	0.01	0.003	4.66E-04
Product stockpile	mulch	0.81	91%	0.07	0.04	0.01

Table 12 Summary of Storage Pile Wind Erosion Emissions for Alternatives 3-6

Source Potential to Emit (PTE) Emissions	Material	Pile Area Acres	Control Efficiency	PM (lb/hr)	PM_{10} (lb/hr)	$PM_{2.5}$ (lb/hr)
Pit Edge Raw Sand Pile Erosion	sand	0.60	91%	0.09	0.04	0.01
Wet Plant Raw Sand Pile Erosion	sand	0.60	91%	0.09	0.04	0.01
Oversize Wet Sand Pile Erosion	sand	0.24	91%	0.04	0.02	0.00
Wet Sand (From Conveyor C06) Wind Erosion	sand	0.24	91%	0.04	0.02	0.00
Decanting Pile Wind Erosion	sand	4.64	91%	0.69	0.35	0.05
Winter Pile Wind Erosion	sand	6.93	91%	1.04	0.52	0.08
Pile 1 from Screen #3	limestone	0.24	91%	8.07E-04	4.03E-04	6.05E-05
Pile 2 from Screen #3	limestone	0.24	91%	8.07E-04	4.03E-04	6.05E-05
Pile 3 from Screen #4	limestone	0.24	91%	8.07E-04	4.03E-04	6.05E-05
Pile 4 from Screen #6	limestone	0.24	91%	8.07E-04	4.03E-04	6.05E-05
Pile 5 from Screen #6	limestone	0.24	91%	8.07E-04	4.03E-04	6.05E-05
Pile 1 from Screen #3	limestone	0.24	91%	8.07E-04	4.03E-04	6.05E-05
Pile 2 from Screen #4	limestone	0.24	91%	8.07E-04	4.03E-04	6.05E-05
Long Term Stock Pile	gravel	0.24	91%	8.07E-04	4.03E-04	6.05E-05
Compost stockpile	compost	0.14	91%	0.01	6.15E-03	9.22E-04
Unscreened soil stockpile	soil	0.07	91%	0.01	0.003	4.66E-04
Product stockpile	mulch	0.81	91%	0.07	0.04	0.01

2.2.2.3 Basis for Overburden Removal Operations Calculations

Overburden removal will occur at both the northern and southern portions of MS for sandstone mining; however, overburden removal at the northern portion of MS will not be occurring concurrently with overburden removal at the southern portion of MS. MS south overburden removal is worst case between the two.

Similarly, overburden removal will occur at northern and southern portions of BRP for limestone mining; however, overburden removal at southern BRP will not be occurring concurrently with overburden removal at northern BRP. BRP northern overburden removal is worst case between the two, but is substantially complete due to past mining activity.

Total emissions for overburden-related operations are shown in Table 13. Calculation details are described in the following sections.

Table 13 Overburden Removal Operations Emissions Summary

Source	Pollutant	Emission Factor	Units	Control Efficiency	Emission Rate (lb/hr)
Wet Drilling - MS	PM	8.00E-05	lb/ton sand	0%	0.12
	PM_{10}	8.00E-05	lb/ton sand	0%	0.12
	$PM_{2.5}$	8.00E-05	lb/ton sand	0%	0.12
Wet Drilling - BRP	PM	8.00E-05	lb/ton sand	0%	0.12
	PM_{10}	8.00E-05	lb/ton sand	0%	0.12
	$PM_{2.5}$	8.00E-05	lb/ton sand	0%	0.12
Bulldozing - MS	PM	3.94	lbs/hr	0%	3.94
	PM_{10}	0.75	lbs/hr	0%	0.75
	$PM_{2.5}$	0.41	lbs/hr	0%	0.41
Bulldozing - BRP	PM	3.94	lbs/hr	0%	3.94
	PM_{10}	0.75	lbs/hr	0%	0.75
	$PM_{2.5}$	0.41	lbs/hr	0%	0.41
Front End Loading – MS	PM	1.00E-04	lb/ton sand	0%	0.02
	PM_{10}	1.00E-04	lb/ton sand	0%	0.02
	$PM_{2.5}$	1.00E-04	lb/ton sand	0%	0.02
Front End Loading - BRP	PM	1.00E-04	lb/ton sand	0%	0.02
	PM_{10}	1.00E-04	lb/ton sand	0%	0.02
	$PM_{2.5}$	1.00E-04	lb/ton sand	0%	0.02
Excavator Loading Trucks - MS	PM	2.00E-05	lb/ton sand	0%	0.02
	PM_{10}	2.00E-05	lb/ton sand	0%	0.02
	$PM_{2.5}$	2.00E-05	lb/ton sand	0%	0.02
Excavator Loading Trucks - BRP	PM	2.00E-05	lb/ton sand	0%	0.02
	PM_{10}	2.00E-05	lb/ton sand	0%	0.02
	$PM_{2.5}$	2.00E-05	lb/ton sand	0%	0.02
Trucks Dumping - MS	PM	2.00E-05	lb/ton sand	0%	0.02
	PM_{10}	2.00E-05	lb/ton sand	0%	0.02
	$PM_{2.5}$	2.00E-05	lb/ton sand	0%	0.02
Trucks Dumping - BRP	PM	2.00E-05	lb/ton sand	0%	0.02
	PM_{10}	2.00E-05	lb/ton sand	0%	0.02
	$PM_{2.5}$	2.00E-05	lb/ton sand	0%	0.02

Drilling

Particulate emissions from drilling are based on a sand throughput of 1,500 tons per hour. The wet drilling-unfragmented stone emission factor was taken from AP-42 (reference (2) Chapter 11.19, Table 11.19.2-2 "Emission Factors for Crushed Stone Processing Operations", 8/04). Because there is no data available for PM, the PM_{10} emission factor was scaled up by 100% to conservatively account for PM emissions. There is also no data available for $PM_{2.5}$ and so was set to equal the PM_{10} emission factor. No control factor was included.

Bulldozers

Bulldozing will be utilized for overburden removal/berm construction. Emission factors are taken fromAP-42 (reference (2), Chapter 11.9, Table 11.9-1 "Emission Factors For Uncontrolled Open Dust Sources at Western Surface Coal Mines, 7/98).

$$E_{PM} = 5.7*S^{1.2}/M^{1.3}, \qquad E_{PM10} = 0.75*1*S^{1.5}/M^{1.4}, \qquad E_{PM2.5} = 0.105*5.7*S^{1.2}/M^{1.3}$$

E_{PM} = PM emissions (lb/hr), E_{PM10} = PM_{10} emissions (lb/hr), $E_{PM2.5}$ = $PM_{2.5}$ emissions (lb/hr)
S = Material Silt Content = 6.9% based on AP-42 Table 11.9-3
M = Material Moisture Content = 7.9% based on AP-42 Table 11.9-3

These factors were utilized because of the unavailability of emission factors for overburden bulldozing from non-metallic mineral processing facilities. The mean value for overburden silt and moisture content was taken from AP-42 (reference (2), Table 11.9-3).

Truck Loading and Unloading

Particulate emissions from overburden material handling include front-end loading, excavator loading, haul trucks, and haul trucks dumping the overburden. The front-end loading rate is 160 ton/hr and the hauling rate is based on an overburden throughput of 1,500 tons per hour. The truck unloading - fragmented stone emission factor was taken from AP-42 (reference (2) Chapter 11.19, Table 11.19.2-2 "Emission Factors for Crushed Stone Processing Operations," 8/04). The truck loading - crushed stone emission factor was taken from AP-42 (reference (2), Chapter 11.19, Table 11.19.2-2 "Emission Factors for Crushed Stone Processing Operations," 8/04). Because there is no data available for PM, the PM_{10}, emission factors are scaled up by 100% to conservatively account for PM emissions. There is also no data available for $PM_{2.5}$ and so it was set equal to the PM_{10} emission factor. No control factor was included.

2.2.2.4 Sandstone Mining and Material Handling

The mined sand is expected to have relatively high moisture content and, if required, spray bars will be utilized at the material handling equipment to control dust; therefore, there are no particulate emissions from sandstone mining and material-handling activities other than what has been described in other sections.

2.2.2.5 Basis for Winter Pile Operations Calculations

A front-end loader and a series of seven conveyors are used to reclaim sand from the winter pile during winter months. The maximum hourly rate is 900 tons per hour. Conveying emissions are estimated using AP-42 (reference (2), 5th Edition, Volume I, 8/04, Section 11.19.2 'Crushed Stone Processing and Pulverized Mineral Processing', Table 11.19.2-2, Conveyor Transfer Point [controlled). Calculated winter pile emissions are shown in Table 14.

Table 14 Winter Pile Operations Emissions Summary

Source	Pollutant	Emission Factor	Units	Control Efficiency	Emission Rate (lb/hr)
Each conveyor (7 total)	PM	1.4E-04	lb/ton sand	0%	0.13
	PM_{10}	4.6E-05	lb/ton sand	0%	0.04
	$PM_{2.5}$	1.3E-05	lb/ton sand	0%	0.01
Front End Loading	PM	1.00E-04	lbs/ton	0%	0.09
	PM_{10}	1.00E-04	lbs/ton	0%	0.09
	$PM_{2.5}$	1.00E-04	lbs/ton	0%	0.09

2.2.2.6 Limestone Plant Material Handling

The primary sources of particulate emissions at the limestone plants are truck traffic emissions, which were included above. Emissions from the limestone plant stockpiles and generators were also included above. Emissions for other operations associated with the limestone plant are shown in Table 15. Calculation details are described in the following sections.

Table 15 Limestone Plant Operations Emissions Summary

Source	Pollutant	Emission Factor	Units	Control Efficiency	Emission Rate (lb/hr)
Wet Drilling	PM	8.00E-05	lb/ton	0%	0.12
	PM_{10}	8.00E-05	lb/ton	0%	0.12
	$PM_{2.5}$	8.00E-05	lb/ton	0%	0.12
Bulldozing	PM	3.94	lb/hr	0%	3.94
	PM_{10}	0.75	Lb/hr	0%	0.75
	$PM_{2.5}$	0.41	lb/hr	0%	0.41
Excavator Loading Trucks	PM	2.00E-05	lb/ton	0%	0.02
	PM_{10}	2.00E-05	lb/ton	0%	0.02
	$PM_{2.5}$	2.00E-05	lb/ton	0%	0.02
Trucks Dumping	PM	2.00E-05	lb/ton	0%	0.02
	PM_{10}	2.00E-05	lb/ton	0%	0.02
	$PM_{2.5}$	2.00E-05	lb/ton	0%	0.02
Scalping Screen Conveying, each (2 total)	PM	1.40E-04	lb/ton	0%	0.08
	PM_{10}	4.60E-05	lb/ton	0%	0.03
	$PM_{2.5}$	1.30E-05	lb/ton	0%	0.01
Scalping Screen	PM	2.20E-03	lb/ton	0%	1.32
	PM_{10}	7.40E-04	lb/ton	0%	0.44
	$PM_{2.5}$	5.00E-05	lb/ton	0%	0.03
Front End Loader – BRP1	PM	1.00E-04	lb/ton	0%	0.02
	PM_{10}	1.00E-04	lb/ton	0%	0.02
	$PM_{2.5}$	1.00E-04	lb/ton	0%	0.02

Source	Pollutant	Emission Factor	Units	Control Efficiency	Emission Rate (lb/hr)
Front End Loaders – Rip Rap Plant, each (3 total)	PM	1.00E-04	lb/ton	0%	0.02
	PM_{10}	1.00E-04	lb/ton	0%	0.02
	$PM_{2.5}$	1.00E-04	lb/ton	0%	0.02
Electric Vibrating Feeder	PM	1.40E-04	lb/ton	0%	0.07
	PM_{10}	4.60E-05	lb/ton	0%	0.02
	$PM_{2.5}$	1.30E-05	lb/ton	0%	0.01
Conveyor to 2 Deck Screening Plant	PM	1.40E-04	lb/ton	0%	0.04
	PM_{10}	4.60E-05	lb/ton	0%	0.01
	$PM_{2.5}$	1.30E-05	lb/ton	0%	3.64E-03
2 Deck Screening Plant	PM	2.20E-03	lb/ton	0%	0.62
	PM_{10}	7.40E-04	lb/ton	0%	0.21
	$PM_{2.5}$	5.00E-05	lb/ton	0%	0.01
Conveyor From 2 Deck Screening Plant	PM	1.40E-04	lb/ton	0%	0.03
	PM_{10}	4.60E-05	lb/ton	0%	0.01
	$PM_{2.5}$	1.30E-05	lb/ton	0%	2.34E-03
Conveyor to Electric Vibrating Pan Feeder	PM	1.40E-04	lb/ton	0%	0.01
	PM_{10}	4.60E-05	lb/ton	0%	4.60E-03
	$PM_{2.5}$	1.30E-05	lb/ton	0%	1.30E-03
Electric Vibrating Pan Feeder	PM	1.40E-04	lb/ton	0%	0.01
	PM_{10}	4.60E-05	lb/ton	0%	4.60E-03
	$PM_{2.5}$	1.30E-05	lb/ton	0%	1.30E-03
Front End Loader – Haul Truck Loading, each (2 total)	PM	1.00E-04	lb/ton	0%	0.07
	PM_{10}	1.00E-04	lb/ton	0%	0.07
	$PM_{2.5}$	1.00E-04	lb/ton	0%	0.07
Crusher Loading	PM	1.00E-04	lb/ton	0%	0.07
	PM_{10}	1.00E-04	lb/ton	0%	0.07
	$PM_{2.5}$	1.00E-04	lb/ton	0%	0.07
Screening Conveyors, each (60 total)	PM	1.40E-04	lb/ton	0%	0.10
	PM_{10}	4.60E-05	lb/ton	0%	0.03
	$PM_{2.5}$	1.30E-05	lb/ton	0%	0.01
Screening, each (6 total)	PM	2.20E-03	lb/ton	0%	1.54
	PM_{10}	7.40E-04	lb/ton	0%	0.52
	$PM_{2.5}$	5.00E-05	lb/ton	0%	0.04
Crushers, each (4 total)	PM	1.20E-03	lb/ton	0%	0.84
	PM_{10}	5.40E-04	lb/ton	0%	0.38
	$PM_{2.5}$	1.00E-04	lb/ton	0%	0.07
Front End Loader – Commercial Truck Loading, each (2 total)	PM	1.00E-04	lb/ton	0%	0.15
	PM_{10}	1.00E-04	lb/ton	0%	0.15
	$PM_{2.5}$	1.00E-04	lb/ton	0%	0.15

Conveying & Screening

There are several conveying and screening operations at the limestone plants. Particulate emissions from these sources are based on a limestone throughput of 700 tons per hour per plant. The Conveyor Transfer Point (controlled) emission factor and the Screening (controlled) emission factor were taken from AP-42 (reference (2), Chapter 11.19, Table 11.19.2-2 "Emission Factors for Crushed Stone Processing Operations," 8/04). These emission factors are for conveying and screening controlled with wet suppression to moisture content at least 0.55-2.88%. No additional control factor was included. There are a total of 8 screening operations and 67 conveyor transfer points included for the limestone plants.

Front End Loader Operation

Front-end loaders are used to load riprap, limestone haul trucks, and commercial trucks. The front-end loading rate is 160 ton per hr of riprap for each of three loaders, 700 ton per hr for loading haul trucks with limestone at each plant, and 1,500 ton per hr for loading commercial trucks with final product at each plant. The Truck Loading - Crushed Stone emission factor was taken from AP-42 (reference (2) Chapter 11.19, Table 11.19.2-2 "Emission Factors for Crushed Stone Processing Operations," 8/04). Because there is no data available for PM, the PM_{10} emission factors are scaled up by 100% to conservatively account for PM emissions. There is also no data available for $PM_{2.5}$ and so it was set equal to the PM_{10} emission factor. No control factor was included.

Crushing

A jaw crusher and a vertical shaft impact secondary crusher is used at each of the two limestone plants. The crushing rate is 700 ton/hr at each of the four total crushers. The Tertiary Crushing (controlled) emission factor was taken from AP-42 (reference (2), Chapter 11.19, Table 11.19.2-2 "Emission Factors for Crushed Stone Processing Operations," 8/04). This emission factor is for conveying and screening controlled with wet suppression to moisture content at least 0.55-2.88%. No additional control factor was included.

Each of the jaw crushers are loaded by haul trucks at a rate of 700 ton/hr. To estimate these emissions, the Truck Loading - Crushed Stone emission factor is used from AP-42 (reference (2), Chapter 11.19, Table 11.19.2-2 "Emission Factors for Crushed Stone Processing Operations," 8/04).

2.2.2.7 Sand and Gravel Mining

The primary sources of particulate emissions at the sand and gravel mining operation are the truck traffic emissions, which were included above. Emissions from the long-term gravel stockpile and the sand and gravel plant generator were also included above. Sand and gravel mining specific calculated emissions described below are shown in Table 16.

Table 16 Gravel Mining Operations Emissions Summary

Source	Pollutant	Emission Factor	Units	Control Efficiency	Emission Rate (lb/hr)
Primary Crusher	PM	0.0012	lb/ton gravel	0%	0.60
	PM_{10}	0.0005	lb/ton gravel	0%	0.27
	$PM_{2.5}$	0.0001	lb/ton gravel	0%	0.05
Primary Screen	PM	0.0022	lb/ton gravel	0%	1.10
	PM_{10}	0.0007	lb/ton gravel	0%	0.37
	$PM_{2.5}$	0.00005	lb/ton gravel	0%	0.03
Secondary Crusher	PM	0.0012	lb/ton gravel	0%	0.60
	PM_{10}	0.0005	lb/ton gravel	0%	0.27
	$PM_{2.5}$	0.0001	lb/ton gravel	0%	0.05
Conveyor Transfer Point, each (10 total)	PM	0.00014	lb/ton gravel	0%	0.07
	PM_{10}	0.00005	lb/ton gravel	0%	0.02
	$PM_{2.5}$	0.00001	lb/ton gravel	0%	0.01
Front End Loader 1	PM	0.0001	lb/ton gravel	0%	0.05
	PM_{10}	0.0001	lb/ton gravel	0%	0.05
	$PM_{2.5}$	0.0001	lb/ton gravel	0%	0.05
Front End Loader 2	PM	0.0001	lb/ton gravel	0%	0.05
	PM_{10}	0.0001	lb/ton gravel	0%	0.05
	$PM_{2.5}$	0.0001	lb/ton gravel	0%	0.05
Final Product Loadout	PM	0.0001	lb/ton gravel	0%	0.05
	PM_{10}	0.0001	lb/ton gravel	0%	0.05
	$PM_{2.5}$	0.0001	lb/ton gravel	0%	0.05

Crushing, Screening, and Conveying

The sand and gravel mining operations include two stages of crushing and a primary screen. Additionally, there are 10 conveyor transfer points to move the gravel. Particulate emissions from these sources are based on a throughput of 500 tons per hour. The Tertiary Crushing (controlled) emission factor, the Conveyor Transfer Point (controlled) emission factor, and the Screening (controlled) emission factor were taken from AP-42 (reference (2), Chapter 11.19, Table 11.19.2-2 "Emission Factors for Crushed Stone Processing Operations," 8/04). These emission factors are for conveying and screening controlled with wet suppression to moisture content at least 0.55-2.88%. No additional control factor was included.

Front End Loader Operation

Front-end loaders are used at the sand and gravel mine at a rate of 1,000 tons per hour. A front-end loader is also used to fill commercial trucks with the final product, at a rate of 465 ton/hr. The Truck Loading - Crushed Stone emission factor was taken from AP-42 (reference (2) Chapter 11.19, Table 11.19.2-2 "Emission Factors for Crushed Stone Processing Operations," 8/04). Because there is no data available for PM, the PM_{10} emission factors are scaled up by 100% to conservatively account for PM emissions. There is also no data available for $PM_{2.5}$ and so it was set equal to the PM_{10} emission factor. No control factor was included.

2.2.2.8 Mulch and Soils Operations

The primary sources of emissions at the mulch and soils operation are the truck traffic emissions, which were included above. Stockpiles for the compost, unscreened soil, and mulch product were also included above. Emissions for other operations associated with mulch and soils operations are shown in Table 17. Calculation details are described in the following sections.

Table 17 Mulch and Soils Operations Emissions Summary

Source	Pollutant	Emission Factor	Units	Control Efficiency	Emission Rate (lb/hr)
Screener	PM	2.20E-03	lb/ton	0%	0.22
	PM_{10}	7.40E-04	lb/ton	0%	0.07
	$PM_{2.5}$	5.00E-05	lb/ton	0%	0.01
Backhoe Drop	PM	3.86E-04	lb/ton	0%	0.04
	PM_{10}	1.83E-04	lb/ton	0%	0.02
	$PM_{2.5}$	2.77E-05	lb/ton	0%	2.77E-03
Loader Drop	PM	3.86E-04	lb/ton	0%	0.04
	PM_{10}	1.83E-04	lb/ton	0%	0.02
	$PM_{2.5}$	2.77E-05	lb/ton	0%	2.77E-03
Bulldozer	PM	5.23	lb/hr	0%	5.23
	PM_{10}	1.24	lb/hr	0%	1.24
	$PM_{2.5}$	0.55	lb/hr	0%	0.55

Screening

The mulching materials pass through a screener at a maximum rate of 100 tons per hour. Emissions were estimated using the Screening (controlled) emission factor from AP-42 (reference (2), Chapter 11.19, Table 11.19.2-2 "Emission Factors for Crushed Stone Processing Operations," 8/04). This emission factor is for conveying and screening controlled with wet suppression to moisture content at least 0.55-2.88%. No additional control factor was included.

Bulldozers

A small bulldozer is used for stacking soils, pushing soils close to the loadout area, and reclamation. The bulldozing emission factor is calculated according to AP-42 (reference (2), Chapter 11.9, Table 11.9-1 "Emission Factors For Uncontrolled Open Dust Sources at Western Surface Coal Mines,” 7/98).

$$E_{PM} = 5.7 * S^{1.2} / M^{1.3}, \quad E_{PM10} = 0.75 * 1 * S^{1.5} / M^{1.4}, \quad E_{PM2.5} = 0.105 * 5.7 * S^{1.2} / M^{1.3}$$

E_{PM} = PM emissions (lb/hr), E_{PM10} = PM_{10} emissions (lb/hr), $E_{PM2.5}$ = $PM_{2.5}$ emissions (lb/hr)

S = Material Silt Content = 17.5%

M = Material Moisture Content = 15%

The minimum moisture content for the screened soil is 15% and the silt content of the mulch and soil is 15-20%, as provided by MN Mulch & Soil, an operator of mulching at the Site.

Material Handling

A backhoe and a loader are used, resulting in particulate emissions from material drops. Particulate emissions are estimated according to AP-42 (reference (2), Chapter 13.2.4, "Aggregate Handling and Storage Piles," 11/06).

$$E = k*0.0032*(U/5)^{1.3}/(M/2)^{1.4}$$

E = Emissions (lb/ton of material transferred)
M = Material Moisture Content
U = mean wind speed (mph)
k = particle size multiplier; PM = 0.74, PM_{10} = 0.35, $PM_{2.5}$ = 0.053

The minimum moisture content for the unscreened soil handled is 12% as provided by MN Mulch & Soil. The mean wind speed for the area is estimated to be 8.53 mph per actual information from Flying Cloud Airport in Eden Prairie, Minnesota. The backhoe and the loader are each estimated to transfer up to 100 tons of screened soil per hour.

2.2.3 Total Facility Summary

Annual emissions for the entire facility are summarized in Table 18. Particulate emissions vary among the alternatives depending on if the alternative has one sand plant or two, and also because of changes in haul road distances due to plant locations. Potential particulate emissions are also different while the Renaissance Festival lease is in effect, since there will not be any limestone mining or processing on the MS property while the Renaissance Festival continues to operate on-site. Table 18 shows the range of potential emissions covered by all alternatives.

Table 18 Annual Emissions Summary

Pollutant	Total Facility Potential Emissions – During Renaissance Festival (tpy) [1]	Total Facility Potential Emissions - Post Renaissance Festival (tpy) [1]	Title V Major Source Thresholds (tpy)	PSD Major Source Thresholds (tpy)
PM	94.4 (4/6) – 168.7 (2)	99.4 (4/6) – 173.7 (2)	100	250
PM_{10}	39.1 (4/6) – 56.9 (2)	40.0 (4/6) – 57.8 (2)	100	250
$PM_{2.5}$	20.3 (4/6) – 27.8 (2)	20.5 (4/6) – 27.9 (2)	100	250
SO_2	0.24	0.24	100	250
NO_X	63.0	63.0	100	250
CO	99.2	99.2	100	250
VOC	2.41	2.41	100	250
CO_2e [2]	42,191	42,191	100,000	100,000
Total HAPs	0.69	0.69	25	--
Individual HAPs (Hexane)[3]	0.62	0.62	10	--

[1] Particulate emissions vary depending on the alternative used. Emissions are presented as a range from the alternative with the lowest emissions to the alternative with the highest emissions. The alternatives are identified in parentheses.

[2] CO_2e = carbon dioxide equivalent, which is the amount of greenhouse gas emissions (i.e. methane) with the same global warming potential as one ton CO_2.

[3] The highest individual HAP, hexane, is emitted from the Dryers.

During the air permitting process, if the selected alternative to build is an alternative that exceeds the Title V major thresholds, MJS will refine the plant layout and/or emissions estimates as needed to ensure the potential to emit is below Title V major source thresholds, otherwise a Title V permit will be accepted in exchange for more flexibility in operations. In any case, potential emissions will not exceed PSD major source thresholds.

3.0 Air Modeling Methodology

The purpose of the MJS Modeling Analysis is to demonstrate compliance of the multiple design layouts with the PM_{10} and $PM_{2.5}$ NAAQS and further considers land use agreements that will affect the ability for MJS to control access to the public (ambient air receptors). The SEAW identified particulate emissions as being the focus of control measures and monitoring plans so the modeling analysis was focused on these pollutants. The modeling also addresses fugitive dust emissions, which is typically the primary source of air emissions from non-metallic mineral mining operations which has the greatest potential to impact air quality. To most efficiently accommodate these variations, the modeled analysis starts with scenarios that are more restrictive based on design layouts and their proximity to land use agreement specific receptors. This section describes the specific inputs selected for the NAAQS modeling analysis.

3.1 Model Selection and Options

The air dispersion model used for this analysis is the EPA regulatory model AERMOD (v15181). The adjusted U* option was selected for the PM_{10} and $PM_{2.5}$ NAAQS modeling. MPCA's 2009-2013 processed AERMET dataset (v14134) with surface data from Flying Cloud Airport in Eden Prairie, Minnesota and upper air data from the National Weather Service in Chanhassen, Minnesota was chosen as the representative meteorological dataset. The $PM_{2.5}$ modeling analysis included only direct $PM_{2.5}$ emissions and excluded secondary formation of $PM_{2.5}$ from NO_X and SO_2 combustion sources. This exclusion followed current EPA guidance of sources emitting less than 40 TPY of NO_X or SO_2 modeling only direct $PM_{2.5}$ emissions. The modeling results provided for the proposed sand plant operating concurrently with the Renaissance Festival are very conservative, as no credit has been taken for plume depletion. Plume depletion is represented in AERMOD by Method 1, which represents particulate settling and was used for the Alternative 5 operational scenario when the Renaissance Festival lease is terminated and is no longer running concurrently with the sand plant.

3.2 Emission Source Characterizations

As described in Section 3.0 of this report, the Project emission sources consist of multiple plant stacks, material handling, conveying, hauling, and wind erosion. The proposed sand plant is the only source with stacks that are modeled as point sources in AERMOD. Stack locations and parameters like height, temperature, flow rate, and diameter were provided by MJS. The specific model inputs are included in the accompanying emission rate spreadsheet AQDM-02.xls in tab "Point Source Parameters".

The surface-based fugitive dust mining and material handling sources are represented as two open pit sources and individual volume sources in the dispersion modeling analysis. An open pit source sums all of the individual emission sources occurring in it and divides the total emission rate over the surface area for an emission rate per square meter. There are two open pit sources: one located on BRP's property and the other is on the MS property. The BRP open pit source includes fugitive emissions from the riprap, limestone, and sand plant in Alternatives 1, 2, 3, and 6. In the emission rate spreadsheet AQDM-02.xls, the sources summed into the BRP open pit source are identified by the ID "BRPPIT" in the "Emission Summary" tab. The MS open pit includes fugitive emissions from sand hauling for all alternatives and the sand plant Alternatives 2 and 5 and is identified by the ID "MKRENPIT" when the Renaissance Festival lease is in effect and “MKSPIT” when the Renaissance Festival lease is terminated in the “Emission Summary” tab.

A third open pit source is located on the northern side of MS’s property and represents emissions from the sand and gravel mining operations (SG). During the first few years of the proposed project, the SG operations are expected on the east side of the rail corridor. Over time, the SG operations will move to the western side of the rail corridor. SG operations will not be occurring at full scale at both locations, so full scale is modeled at the eastern side of the corridor for most scenarios as it has the most physically constricted footprint. However, Alternative 4 has the sand plant operations located near the western SG operations so for Alternative 4 the western SG operations were evaluated as well as the eastern SG operations to account for any possible overlapping of modeled source impacts. The SG emissions are included in the open pit source identified by the ID “GRAVEL” in the “Emission Summary” tab of the AQDM-02.xls inputs spreadsheet. The modeling parameter inputs for open pits are included in the AQDM-02.xls inputs spreadsheet in tab “Area Source Parameters”.

Specific surface-based fugitive sources not occurring in the BRP and MS open pit sources are represented by volume sources and include overburden material handling on the MS and BRP properties, unpaved haul road traffic, stockpile wind erosion, and the mulching operations occurring on the MS property north of the Renaissance Festival booth site and campground. The modeling parameter inputs for these sources are included in the AQDM-02.xls inputs spreadsheet in tab “Volume Source Parameters”. Figure 7 shows the material hauling road routes used to calculate unpaved road emissions. The mulch and winter waste sand pile roads are modeled explicitly with volume sources and the unpaved roads within the open pit sources are summed into the open pit total emission rate.

3.2.1 Modeling Operational Restrictions

The NAAQS modeling analysis includes multiple operations occurring at the same time with relatively little source-receptor distance from the ambient air boundary. Preliminary modeling demonstrated that the highest modeled concentrations were occurring at the fence line during the overnight hours when the meteorological boundary layer is stable with low wind speeds and mixing heights. This is a well-known occurrence with the EPA’s regulatory AERMOD model; surface-based fugitive sources typically show highest modeled concentrations during nighttime, low-wind, stable conditions. To address these modeled impacts, specific operating limits were implemented on material handling and truck traffic to reduce these impacts when the Renaissance Festival lease is in effect. These operating limits are as follows:

- Overburden material handling operations limited to 6am-10pm (no operations 10pm to 6am)
- Gravel pit truck loadout operations limited to 6am-2am (no loadout 2am-6am)
- Mulching operations limited to 6am-10pm in April-October (no operations 10pm-6am)
- Limestone plant hauling (within the quarry) limited to 6am-2am year-round (no hauling 2am-6am) and 7am-7pm during winter months (Dec-Feb) (no hauling 7pm-7am winter months)

- Limestone delivery traffic limited to 6am-2am year-round (no hauling 2am-6am year-round) and 6am-10pm during winter months (Dec-Feb) (no hauling 10pm-6am winter months)

- While the Renaissance Festival lease agreement is in effect one of the two limestone plants can process limestone (loaders, jaw crushers, and screens) at a rate of 700 tph in the Bryan Rock pit. When the Renaissance Festival lease is terminated, and sandstone mining and processing operations are running, full limestone operations can be conducted at both facilities at 700 ton/hr per plant and a combined total rate of 2 million tpy with the exception of Alternative 2 which is further discussed in Section 4.2.

3.2.2 Variable Emission Scalars

Wind erosion source emissions were refined using the AERMOD emission factor option that sets up wind speed categories and calculates the minimum wind speed where wind erosion would occur, which is referred to as a threshold wind speed. This minimum wind speed was calculated using 2009-2013 fastest mile wind speed data, from Flying Cloud Airport, and the particle size information for wet and dry sand from the "Control of Open Fugitive Dust Sources". The spreadsheet "Wind Erosion_FlyingCloudAP.xlsx" included with this report contains the methodology for the emission rate scalars per wind speed category. The categories are the MPCA manual default of 0-4 m/s, 4-6 m/s, 6-8 m/s, 8-10 m/s, 10-12 m/s, >12 m/s.

3.3 Receptors

Development of the EIS receptor grid was complicated by the co-location of the Minnesota Renaissance Festival within the proposed project area. On the Malkerson (west) side of the project area, the property boundary extends north from 145th St W to Highway 41. For modeling purposes, the property boundary can be identical to the ambient air boundary which defines the "portion of the atmosphere, external to buildings, to which the general public has access" if the property boundary has a complete physical barrier preventing public access. Because the modeling analysis was conducted assuming the Minnesota Renaissance Festival was operating, the ambient air boundary does not match the property boundary due to the public's access to Malkerson property south of Hwy 41.

The receptor grids used for the evaluations considered the current lease agreements when developing them. Currently, Malkerson Sales has a lease agreement with MRF for use of the fairgrounds, associated parking and road easements for site access. The primary modeling performed by MJS placed receptors in the areas where MS has granted land use to MRF so as to represent ambient air. In addition, receptors were placed on property that MJS will control but is near the property that MRF is granted access, to help MJS understand how much of their property they would need to control.

The MJS receptor grid follows the current MPCA modeling manual recommendations for receptor spacing and extent. Ten-meter spaced receptors follow the fence line/property boundary and also cover the Renaissance Festival grounds and stable area during the period when the Renaissance Festival lease is in effect, even though both areas will be mined in the future as part of the Project. (The Renaissance Festival booth site and campground will be mined for limestone and sandstone. The stable area is located north of sandstone and limestone mining limits, but will be mined for sand and gravel.) For the Renaissance Festival terminated lease scenario, the 10-meter spaced receptors on the leased property are removed for the expansion of the Malkerson Sales pit. For both scenarios, 50 meter spaced receptors extend from the fence line/property boundary out to 1 kilometer. From 1 km to 2 km, receptors are spaced every 100 meters. From 2 to 5 km, receptors are spaced every 250 meters. From 5 to 10 km, receptors are spaced every 500 meters. From 10 km to 15 km, receptors are spaced 1 km. Figure 9 shows the proposed receptor grid for the primary modeling analysis and represent the area that MJS will control per the definitions of ambient air (fences or physical barriers).

A preliminary Significant Impact Area (SIA) modeling run was completed for a Cartesian 50 km receptor grid to determine the maximum grid extent for the PM_{10} and $PM_{2.5}$ NAAQS modeling. This is determined by the maximum extent of modeled concentrations that are above the appropriate Significant Impact Level (SIL). The modeling analysis for the SIA did not incorporate refined Method 1 modeling options for PM_{10}.

3.4 Meteorological Data

The representative 5-year (2009-2013) AERMET meteorology dataset selected was surface data from Flying Cloud Airport in Eden Prairie, Minnesota and upper air data from the NWS in Chanhassen, Minnesota. Flying Cloud Airport is located approximately 9 miles NE of the Site and has similar land use characteristics (hay/pasture, cultivated crops, open water, and medium intensity development). The average wind speed is 7.5 knots with a higher percentage of northwesterly and southerly winds. The data was processed by MPCA using AERMET (v14134) and using the Adjusted U* option. Adjusted U* corrects AERMOD's over prediction of surface based mechanically generated fugitive sources during stable, low-wind nighttime conditions. The MJS Project is an open pit mining and processing operation with PM_{10} and $PM_{2.5}$ emissions generated from surface based fugitive sources. Therefore, this option will better represent maximum-modeled air concentrations for PM_{10} and $PM_{2.5}$.

3.5 Background Values and Nearby Sources

Background values used for the 24-hour and annual $PM_{2.5}$ NAAQS analysis are from the nearest monitor in Shakopee, Minnesota (505) and are shown in Table 19. The 3-year average (2014-2016) of the 98th percentile, 24-hour concentration (17.3 $\mu g/m^3$) and of the maximum annual concentration (7.03 $\mu g/m^3$) will be added to the modeled $PM_{2.5}$ results for comparison to the NAAQS. The background values used for the 24-hour PM_{10} NAAQS and annual PM_{10} MAAQS are from the Minneapolis, Minnesota (966) monitor. Availability of PM_{10} monitors in the west metro was limited, so a monitor representing the south metro was chosen as the most likely representative of conditions in the southwest metro. The 3-year maximum (2014-2016) high 2nd high 24-hour concentration (56 $\mu g/m^3$) and the maximum annual concentration (14.6 $\mu g/m^3$) will be added to the modeled PM_{10} results for comparison to the NAAQS and MAAQS. All monitoring data was retrieved from EPA's AirData website (reference (3)).

Table 19 Particulate Background Values

Background Values - Monitor 505 ($PM_{2.5}$) and Monitor 966 (PM_{10})	2014-2016 PM_{10} (µg/m^3)	2014-2016 $PM_{2.5}$ (µg/m^3)
24-hour	56	17.3
Annual	14.6	7.03

MPCA's Square Root Mean Distance (SQRMD) GIS tool was run to determine the nearby sources to include in the PM_{10} and $PM_{2.5}$ NAAQS analysis. Along with this tool, discretion was used based on the AERMET wind rose, available nearby background monitors, and location of nearby sources to screen out nearby sources to explicitly model. The impacts from fugitive dust from a mine are going to be more localized within 5 km of the Project and not extending out 50 km. For PM_{10}, SQMD was run for the MPCA inventory years 2011-2013 that include dozens of sources, including all permitted local sources (examples include the site itself – Bryan Rock and Bituminous Roadways Inc.) and resulted with a list of six sources: Anchor Glass Container Corporation – Shakopee, CertainTeed Corporation, Flint Hills Resources Pine Bend, Gopher Resources, Rahr Malting Co – Shakopee, and Xcel Energy – Black Dog. All of these facilities are located greater than 5 km away and east/northeast of the Project as shown in Figure 10. The wind rose for the Flying Cloud Airport AERMET dataset shows that the lowest percentage of wind speeds are blowing from this direction. This indicated that these sources would minimally impact the MJS receptors. Likewise, the significant distance of these sources from MJS would result in little to no impact from the Project at these facilities. Therefore, for PM_{10} NAAQS modeling, the Blaine, Minnesota (6010) monitor represents any impacts from nearby sources on the Project receptors.

Figure 11 shows the SQMD run $PM_{2.5}$ nearby sources to include and the location of the $PM_{2.5}$ background monitor used for this NAAQS modeling. These sources include Anchor Glass Container Corporation – Shakopee, CertainTeed Corporation, Flint Hills Resources Pine Bend, and Rahr Malting Co – Shakopee. The $PM_{2.5}$ monitor is 1 mile south of these sources and would include impacts from these sources. Therefore, to avoid double counting these sources with the background concentrations, they were not explicitly modeled.

4.0 Results and Discussion

EIS Alternatives 1 through 6 were modeled for the Renaissance Festival temporary lease receptor grid and associated operational restrictions to conservatively evaluate the alternatives for comparison with the 24-hour and Annual PM_{10} and $PM_{2.5}$ NAAQS/MAAQS. Table 20 shows the modeled results with the background concentrations included. These reflect the operation of the Renaissance Festival and the previously discussed restrictions. The EIS alternatives with sand plants located in the southern portion of the property resulted in the higher modeled results.

Table 20 Alternative-Specific Model Results

EIS Alternative Layout	24-hour PM_{10} (μg/m^3)	Annual PM_{10}[(a)] (μg/m^3)	24-hour $PM_{2.5}$ (μg/m^3)	Annual $PM_{2.5}$ (μg/m^3)
1	128	32	30.1	10.9
2	129	37	31.2	11.7
3	125	30	31.6	11.1
4	119	30	28.2	10.0
4 (Gravel Pit West)	119	30	28.1	9.9
5	131	35	32.1	11.1
6	125	30	31.6	11.1
	150	**50**	**35**	**12**

After the Renaissance Festival lease is terminated, the AAB can return to the property boundary and restrictions necessary to attain the NAAQS with the lease agreement can be removed. These results are discussed in Section 4.2.

The property boundary, which will serve as the AAB unless otherwise noted, is shown on Figure 9. However, in the figures associated with the analyses shown below, receptors are placed within the AAB on the north end of the property when the sand and gravel mine is operated on the east side of the railroad tracks. This is not intended to show the AAB as being relaxed, rather it shows that control methods necessary to establish an AAB are not required in this area when the sand and gravel pit is operating on the east side of the tracks. The sand and gravel pit will be operating either on the east or west side of the tracks and operations on the east side resulted in the higher modeled concentrations so modeling results are shown with this configuration. An additional run of Alternative 4 was performed with the sand and gravel on the west side of the railroad tracks to demonstrate that this most conservative configuration for sand and gravel mining on the west side of the tracks coupled with the northern most sand plant location models compliance with the AAB boundary.

The following sections describe the modeling results for each alternative, where the maximum concentrations were located, and the culpable sources for those maximums.

4.1 Renaissance Festival Results

4.1.1 Alternative 1 Model Results

Alternative 1 has one 1.2 MTPY sand plant at the MS-N plant site (northern portion of the MS property) and one 1.2 MTPY plant site on the BRP property. Alternative 1 model results for 24-hour and annual PM_{10} and $PM_{2.5}$ are below the NAAQS/MAAQS guidelines, therefore Alternative 1 is not expected to have a significant adverse environmental effect on ambient air quality. Figure 12 through Figure 15 show the 24-hour and Annual PM_{10} and $PM_{2.5}$ NAAQS results on the ambient air receptors. The maximum 24-hour PM_{10} NAAQS concentrations are located at receptors on the Renaissance Festival grounds and are due primarily to the mulching material handling operations. The maximum annual PM_{10} and 24-hour and annual $PM_{2.5}$ NAAQS concentrations are located along the railroad boundary receptors. The main contributor to the maximum annual results is the BRP sand plant stacks.

4.1.2 Alternative 2 Model Results

Alternative 2 has one 1.2 MTPY sand plant at the MS-S plant site (southern portion of the MS property) and one 1.2 MTPY plant site on the BRP property. Alternative 2 model results for 24-hour and annual PM_{10} and $PM_{2.5}$ are below the NAAQS/MAAQS guidelines, therefore Alternative 2 is not expected to have a significant adverse environmental effect on ambient air quality. Figure 16 through Figure 19 show the 24-hour and Annual PM_{10} and $PM_{2.5}$ NAAQS results on the ambient air receptors. The maximum 24-hour and annual PM_{10} NAAQS concentrations are located at receptors on the Renaissance Festival grounds and are due to the combined impacts of the MS-S sand plant and the mulching material handling operations. The maximum 24-hour and annual $PM_{2.5}$ NAAQS concentrations are located along the railroad boundary receptors. The main contributor to the maximum annual results is the MS-S sand plant stacks and the open pit fugitive sources.

4.1.3 Alternative 3 and 6 Model Results

Alternatives 3 and 6 have one 2.4 MTPY plant located on the BRP property. Alternatives 3 and 6 model results for 24-hour and annual PM_{10} and $PM_{2.5}$ are below the NAAQS/MAAQS guidelines, therefore Alternative 3 and 6 are not expected to have a significant adverse environmental effect on ambient air quality. Figure 20 through Figure 23 show the 24-hour and Annual PM_{10} and $PM_{2.5}$ NAAQS results on the ambient air receptors. The maximum 24-hour PM_{10} NAAQS concentrations are located at receptors on the Renaissance Festival grounds and the primary contributor to the 24-hour maximum impacts is the mulching material handling operations. The maximum annual PM_{10} and 24-hour and annual $PM_{2.5}$ NAAQS concentrations are located along the railroad boundary receptors. The main contributors to the maximum annual results are the open pit fugitive sources, specifically the BRP open pit source, which contains emission from the 2.4 MTPY sand plant alternative.

4.1.4 Alternative 4 Model Results

Alternative 4 has one 2.4 MTPY plant at the MS-N plant site. Alternative 4 model results for 24-hour and annual PM_{10} and $PM_{2.5}$ are below the NAAQS/MAAQS guidelines, therefore Alternative 4 is not expected to have a significant adverse environmental effect on ambient air quality. Figure 24 through Figure 27 show the 24-hour and Annual PM_{10} and $PM_{2.5}$ NAAQS results on the ambient air receptors. The maximum

24-hour PM_{10} NAAQS concentrations are located at receptors on the Renaissance Festival grounds and along the north boundary surrounding the gravel operations. The primary contributors to the 24-hour PM_{10} maximum impacts are the mulching material handling and gravel mining operations. The maximum annual PM_{10} and 24-hour and annual $PM_{2.5}$ NAAQS concentrations are located along the railroad boundary receptors with additional areas of higher concentrations on the fence line near the MS north sand plant and near the gravel pit for $PM_{2.5}$. The main contributors to the maximum annual results are the open pit fugitive sources, mulching operations, and the 2.4 MTPY MS north sand plant.

An additional Alternative 4 modeling analysis was conducted for SG mining on the west property just north of the 2.4 MTPY plant where the horse stables currently reside. Figure 28 through Figure 31 show the 24-hour and Annual PM_{10} and $PM_{2.5}$ NAAQS results on the ambient air receptors. Alternative 4 model results for 24-hour and annual PM_{10} and $PM_{2.5}$ are below the NAAQS/MAAQS guidelines, therefore Alternative 4 is not expected to have a significant adverse environmental effect on ambient air quality. The maximum impact areas are similar for both Alternatives with the only difference being the location of maximums near the gravel pit moving to the west with the alternative gravel pit location.

4.1.5 Alternative 5 Model Results

Alternative 5 has one 2.4 MTPY plant located at the MS-S plant site. Alternative 5 model results for 24-hour and annual PM_{10} and $PM_{2.5}$ are below the NAAQS/MAAQS guidelines, therefore Alternative 5 is not expected to have a significant adverse environmental effect on ambient air quality. Figure 32 through Figure 35 show the 24-hour and Annual PM_{10} and $PM_{2.5}$ NAAQS results on the ambient air receptors. The maximum 24-hour PM_{10} NAAQS concentrations are located at receptors on the Renaissance Festival grounds and the primary contributors to the 24-hour maximum impacts is the mulching material handling operations. The maximum annual PM_{10} and 24-hour and annual $PM_{2.5}$ NAAQS concentrations are located along the railroad boundary receptors near the MS south sand plant. The main contributors to the maximum annual results are the MS 2.4 MTPY plant alternative and the MS open pit fugitive sources.

4.2 Results with no Renaissance Festival

After completing the modeling analysis of the Alternatives at receptors associated with the Renaissance Festival operating, MJS then evaluated the limiting scenario - passed NAAQS with smallest percentage (Alternatives 2 and 5) assuming the Renaissance Festival lease is terminated along with additional emissions from the limestone production at both MS and BRP. These runs included Method 1 plume depletion for the PM_{10} NAAQS modeling to account for settling of particulates from the air.

Alternative 2 air impacts were modeled at 101% of the annual $PM_{2.5}$ NAAQS at receptors along the railroad right of way boundary. For Alternative 2, Figure 36 through Figure 39 show the 24-hour and Annual PM_{10} and $PM_{2.5}$ NAAQS results on the receptor grid representing the facility ambient air boundary without the Renaissance Festival operating. These results are summarized in Table 21. The main sources influencing these air concentrations are the BRP and MS sand plants and the in-pit MS limestone haul traffic. While an issue, in practical terms, the public cannot occupy the railroad tracks for an extended period of time, especially for an entire year, making these impacts unrepresentative of actual exposure and less concerning. If this alternative is chosen for the Project and associated air permitting, the results are near enough the standards that design changes could be implemented to eliminate the modeled exceedances along the railroad receptors.

Results are summarized in Table 21 and demonstrate that the Alternative 5 model results for 24-hour and annual PM_{10}/$PM_{2.5}$ are below the NAAQS/MAAQS guidelines. For Alternative 5, Figure 40 through Figure 43 show the 24-hour and Annual PM_{10} and $PM_{2.5}$ NAAQS results on the receptor grid representing the facility ambient air boundary without the Renaissance Festival operating.

Therefore the no Renaissance Festival Alternative 5 impacts are not expected to have a significant adverse environmental effect on ambient air quality. This passing alternative configuration shows the ability of the MJS facility to comply with the NAAQS both with and without the Renaissance Festival based on the associated production restrictions. Alternatives 2 and 5 were the model limiting alternatives. Remodeling with the no Renaissance Festival assumptions show that while Alternative 2 barely fails (and could be made to pass by modifying operations), Alternative 5 does pass. As Alternative 5 Renaissance Festival model results were higher than the remaining scenarios, Alternative 5 having passing results without the Renaissance Festival means the other scenarios will pass too.

Table 21 Model Results - No Renaissance Festival

EIS Alternative Layout	24-hour PM_{10} ($\mu g/m^3$)	Annual PM_{10} ($\mu g/m^3$)	24-hour $PM_{2.5}$ ($\mu g/m^3$)	Annual $PM_{2.5}$ ($\mu g/m^3$)
2	149.5	39	31.9	12.1
5	91	42	32.9	11.9
NAAQS / MAAQS	**150**	**50**	**35**	**12**

5.0 Cumulative Potential Effects

Section 3.5 describes the methodology used to evaluate explicit modeled impacts from other nearby sources. The cumulative potential effects to air quality have been evaluated by applying this methodology using dispersion modeling tools that consider potential emissions from the proposed Project, other specific projects in the area (for criteria pollutants), as well as regional/background sources. For cumulative impacts from criteria pollutants, the dispersion modeling for the proposed Project and other projects in the area demonstrates full compliance with NAAQS and MAAQS.

An analysis of the potential cumulative effects from the proposed Project with additional sources in the area was conducted as part of this EIS. There were three nearby sources that did not screen into the modeling evaluation described above but were evaluated for this analysis due to their proximity to the Project: Fairmount's Shakopee Sands facility (Shakopee Sands), Jordan Aggregates, and FML Sand, LLC's proposed sand facility (FAM). Shakopee Sands (Air Permit 13900120-3) is located 1 mile south of Merriam Junction Sands along Highway 169 and is currently shuttered due to the downturn of the industrial sand market. It could begin operations again as it is a permitted facility, so it was evaluated in this cumulative potential effects analysis. Jordan Aggregates was a proposed aggregate mining operation south of the Merriam Junction Sands property along Highway 169. The project completed an EIS in 2014 and had applied for an Interim Use Permit Application, which the County denied in 2016, but it is included in the cumulative analysis since the outcome of the permitting process was unknown at the time the analysis was conducted. FAM had proposed a sandstone mining and processing facility that completed a Scoping EAW in July 2015, but is not currently being pursued and has not provided enough detail regarding the project to include it as a probable source to adequately analyze cumulative effects. Therefore, this cumulative potential effects analysis includes the MJS, Shakopee Sands, and Jordan Aggregates projects.

The MJS Project, Jordan Aggregates and Shakopee Sands are located within Scott County and their primary source of emissions is fugitive dust generated from mining activities (stockpiling, loading/unloading, and unpaved road vehicle traffic). Air impacts from mine Site fugitive dust emissions are proven to be localized and driven by wind speed and wind direction. Figure 44 shows the wind rose for the 5 year AERMET dataset from Flying Cloud Airport in Eden Prairie, MN. The predominant wind directions in the modeling analysis are northwesterly and southerly with wind speed averages of 7.5 knots. For purposes of combined impacts from the three projects, their overlap would occur north of the Merriam Junction Sands property or south of the Jordan Aggregates property. The results show 24-hour PM_{10} maximum impacts southeast of Shakopee Sands between 7-10 ug/m^3 and less than 5 ug/m^3 southeast of Jordan Aggregates. Both the 24-hour and annual $PM_{2.5}$ impacts southeast of Shakopee Sands are less than their SIL of 1.2 ug/m^3 and 0.3 ug/m^3. Jordan Aggregates is another 3 miles south of Shakopee Sands, so the $PM_{2.5}$ impacts are even further below the SIL southeast of Jordan Aggregate. Therefore, there is no significant risk for an increase in overall cumulative effects from the three projects due to meteorological conditions, the distance between sources, and the source types (fugitive dust) at each facility, which are localized and less likely to overlap with distance.

The modeling results affirm that the potential cumulative emissions discussed in this section will be below NAAQS. The background concentration applied to the MJS modeled concentrations accounts for nearby existing sources in Shakopee, MN. The additional mining facilities evaluated in this section are unlikely to overlap impacts with any significance to the proposed MJS Project due to the meteorological wind patterns, distances between facilities, and the localized impacts of each project due to the primary source of emissions being fugitive dust. MJS is proposing operational fence line monitoring to verify that particulate levels do not exceed NAAQS standards.

6.0 Draft Ambient Air Monitoring Plan

This draft ambient air monitoring plan identifies proposed parameters of testing, equipment, schedule and frequency for the Project. The final plan will be dependent on the alternative that is ultimately developed and the conditions of the MPCA air permit. Upon completion of construction of the sand plant, MJS will conduct ambient air monitoring for PM_4 Silica. There is no State or Federal ambient air quality standard for silica. However, the Minnesota Department of Health has established a chronic Heath Based Value (HBVchronic) of 3 $\mu g/m^3$ which will be used to assess the monitoring results.

The proposed sand processing facility will be in the Minnesota River Valley (Figure 44) and will be located on the eastern side of valley. The terrain is fairly flat, with a slight rise in terrain as you move east from the river. The climate of this region varies greatly by season. The average wind speed is 8.6 miles per hour with a higher percentage of northwesterly and southerly winds.

6.1 Methods

The overall strategy for measuring particulate emissions at MJS is to monitor ambient air upwind (background) and downwind (impact) from the facility. Monitoring stations will be placed at two locations near the facility property line. Placing monitors near the facility property line will best represent contributions that are related to the facility and will minimize the potential for attributing contributions from other sources. One monitoring location will serve primarily as the upwind location, collecting background ambient air concentrations. The second monitoring location will be downwind of the alternative specific culpable sources modeled in the previous sections. An on-site weather station will also be installed to gather wind speed, wind direction, temperature, and precipitation data.

6.1.1 Monitor Location

Wind data and modeling results from Section 3.0 will be used to select ambient air monitor locations. Considering that winds predominantly come from the northwest, the upwind ambient air monitor should be near the northern side of the facility on the western side of the MS parcel, far enough south to eliminate the influence of TH41. The downwind Site will be on an eastern or southern boundary and will be dependent on the alternative chosen.

The monitor will be sited to reduce impacts from objects that might influence the data collection. Monitors will Sited following EPA guidance for ambient particulate monitoring outlined in Table 22. The PM_4 monitor will be placed so as the air intake is 2 meters above ground level.

Table 22 Siting Guidelines

Parameter	Guidance
Height of Air Intake	Approximately 2-15 meters above the ground
Sampler location	Greater than 20 meters away from the dripline and more than 10 meters away from the dripline when trees act as the obstruction
Sample intake	Have unrestricted airflow in a 270^0 arc around the sampler.
Distance from the sampler to obstacles	Be at least twice the height the obstacle protrudes above the sample intake

6.1.2 Data Collection

Table 23 provides information on the instrument currently proposed to conduct PM_4 monitoring at both monitoring locations. The Partisol 2000i, or equivalent, for PM_4 silica will be operated at the monitoring stations. The BGI PQ167 calculates the PM_4 concentration by maintaining a constant airflow and collecting particles smaller than 4 microns in size on a filter. The particle size is limited to 4 microns in diameter by attaching the appropriate Size Selective Jet to the equipment inlet. The filter is then analyzed to determine what percentage of the collected particles are silica. The Partisol 2000i monitor is EPA designated under Reference Method Designation Number RFPS-0498-117 for $PM_{2.5}$ monitoring (reference (4)). Monitors having "equivalent method" or "reference method" numbers signify that they have been designated as proper methods for measuring ambient concentrations for specified air pollutants. PM_4 silica will be analyzed using NIOSH method 7500 Analysis, which is an X-ray diffraction method for measuring silica content on a filter sample. PM_4 silica filter samples will be transferred to a lab certified to conduct this analysis that will be determined before Project start up.

The monitoring equipment specifications for the Partisol, or equivalent, are outlined in Table 23. The sampler contains internal temperature, pressure, and humidity sensors to help control a constant airflow through the device.

Table 23 Sample Collection Instrumentation Details

Equipment Details	Specification
Partisol 2000i	collection period -1/12 days 24 hours
Flow Rate	16.7 Liter/minute (standard); may be adjusted from 1-25 liters/minute
Flow Rate Accuracy	5%
Media Type -	47 mm PVC filter
Reference or Equivalent Method Number	RFPS-0498-117

6.2 Implementation

6.2.1 Monitor location

Wind data and modeling results from Section 3.0 will be used to select ambient air monitor locations. Considering that winds predominantly come from the northwest, the upwind ambient air monitor should be near the northern side of the facility on the western side of the MS parcel. The downwind Site will be on an eastern or southern boundary and will be dependent on the alternative chosen. Siting will also take into consideration any potential impacts from existing or potential new facilities that may emit similarly sized silica particles. Ambient monitor locations, directly to the east of the BRP parcel, have not been excluded from consideration but, if pursued, would need to consider impacts from Highway 169 traffic, so as to ensure they are representative of facility impacts and not of Hwy 169. The on-Site weather station will also be installed near one of the monitors and will collect continuous wind speed and direction measurements. The preliminary monitoring locations are shown on Figure 44.

6.2.2 Data Collection

Data collection of PM_4 data has been recently required for new industrial sand facilities in Minnesota. Proposed methods are addressed below. A site specific fence-line monitoring plan will be prepared and submitted to the MPCA as part of the application for a permit.

The fence-line monitoring plan includes:

- Two monitoring locations along the facility property boundary chosen in accordance with Quality Assurance Handbook for Air Pollution Measurement Systems, volume II, part 1, Ambient Air Quality Monitoring Program Quality System Development, EPA-454/R-98-004, United States Environmental Protection Agency (reference (5)). The choice is also informed by either five years of National Weather Service meteorological data for the region or by one year of on-site meteorological data.
- Sampling method
- Weather station details including location. It will be installed and operated to:
    - collect and record hourly average meteorological data, including wind speed, wind direction, barometric pressure, and temperature; and
    - will be calibrated in accordance with procedures for meteorological measurements in Quality Assurance Handbook for Air Pollution Measurement Systems, Meteorological Measurements, EPA-454/B-08-002(reference (6))
- Plans to collect samples over a period of at least 24 hours at least once every twelve days

MJS will operate the fence-line monitoring system for two years after start up. MJS will provide information to the MPCA after 2 years justifying the end of monitoring.

7.0 Fugitive Dust Control Plan

As part of EIS support efforts, MJS has developed a draft Fugitive Dust Control Plan (FDCP). The FDCP will be further developed with source and Site specifics during air permitting when a specific alternative and associated design will be selected. The elements contained in this FDCP reflect best practices adopted by the industry.

7.1 Applicability

Mining in general, including Industrial Sand facilities, includes a number of emission sources that will generate fugitive emissions. The details on specific sources and emission rates associated with the Project alternatives were described earlier in Section 2.0.

This preliminary FDCP covers emissions from sources such as drilling and blasting, mobile equipment operations, material handling, outdoor product storage, crushing and conveying, truck loading, truck hauling and employee vehicle traffic at the proposed mine and processing facility.

Once the facility is operational, the FDCP will be implemented by MJS to control particulate emissions. Routine recordkeeping of fugitive dust conditions and associated mitigation measures will be conducted and kept. These records will serve to document MJS efforts to implement the FDCP and to control fugitive emissions.

7.2 Implementation

Control measures for fugitive particulate emissions are addressed below. Methods are source dependent and will be listed accordingly.

7.2.1 Open Storage Piles

The natural moisture content of the sand is typically high enough to minimize dust generation potential. Wet processing further increases the moisture content. Because of this, negligible emissions are expected from many of the storage piles. The sand's moisture content in longer term stockpiles may drop or be reduced, but is typically 3 to 5 percent as it reaches the dryer. In these instances where leveraging the natural moisture content of the stockpiled material is deemed insufficient to control emissions, MJS will use at least one of the following control measures if the water content gets too low for each source of fugitive dust emissions:

- Recessing stockpiles below surrounding topography:
- using wind barriers;
- using existing or constructed landscape grades or features for wind protection:
- using vegetative covers planted directly on storage piles.
- installing and operating a water spray or water fogging system;

- locating the source inside a partial enclosure; or
- applying chemical dust suppression agents on the source;
  - the product used must be marketed specifically for dust suppression
  - the product must be used as directed
  - the owner or operator must post on Site a valid material safety data sheet that provides a complete list of ingredients and provides the product safety data
  - the owner or operator must include a copy of the product's material safety data sheets in the plan
  - the owner or operator must describe in the plan the site-specific impacts associated with using the product

The final plan will explain how the measures selected will be implemented based on final design and Site-specific conditions, including addressing high-wind events.

7.2.2 Vehicle-related activities

Dust generation can be minimized by paving roads. Naturally occurring precipitation also will minimize dust generation potential. In instances where natural precipitation is not sufficient to create “wet” conditions (moisture content >2%) minimizing fugitive emissions, MJS will use the following control measures for fugitive dust emissions:

- apply water to unpaved roads on a routine basis; when visible dust emissions from roads are observed, water the source of the visible emissions until the moisture content is wet;
- if the ambient air temperature at the facility is less than 35 degrees Fahrenheit, or other safety hazards arise from watering roads, MJS will suspend road watering until conditions allow; and
- water application is not required on days when there is no truck hauling.

For paved roads that are between the entrance of the facility and the silica sand transfer and loading system, MJS will, on days when the facility receives silica sand truck hauling traffic:

- vacuum sweep paved facility road surfaces on a routine basis; may not vacuum/sweep if sufficient rainfall occurred within past 24 hours;
- vacuum sweep paved roads near the facility entrance to recover silica sand spills or deposits that become a source of visible dust emissions; and
- do not need to vacuum/sweep if weather conditions prevent them from being vacuum swept due to documented inclement weather.

Sand haul vehicles operating at the facility will have working bed covers. Covers will be deployed on sand loads before leaving the facility to minimize dust generation.

7.2.3 Reporting and record keeping

MJS will maintain written records containing production records, load records, maintenance records, and associated procedures. In addition, MJS will maintain facility inspection records specific to the FDCP including:

- the date and time of periodic facility visual observations;
- a listing of any sources with visible emissions and associated corrective actions taken;
- the monthly amount of dust suppressant or water used to control fugitive dust;
- a copy of the FDCP including any variance from the approved plan or alternative control measures used at the facility;
- a daily record of actions taken on the paved and unpaved roads at the facility including:
    - the roads watered
    - the amount of water applied
    - the time watered
    - the method of application
    - rainfall records to justify when water not applied
    - times when each segment of paved roads was vacuum swept
- visible emissions observation results—if visible emissions were observed, then the record must identify:
    - the source of the emissions and
    - the contingency efforts undertaken

8.0 Summary and Conclusions

The EIS modeling analysis was completed following current MPCA modeling guidance for evaluating PM_{10} and $PM_{2.5}$ NAAQS ambient air concentrations. Section 4.0 demonstrated that all 6 EIS alternatives model compliance with the 24-hour and annual PM_{10} and $PM_{2.5}$ NAAQS while the Renaissance Festival is operating along with current operations at BRP and MS. Results show maximum impacts along the property line with immediate decline of concentrations within 1 km of the property boundary. Using operating assumptions consistent with when the Renaissance Festival lease is terminated, all alternatives will pass except for EIS Alternative 2. While this alternative is not modeled as passing, the $PM_{2.5}$ annual NAAQS it is only modeled to be slightly out of compliance (101% of the standard), operations could be modified to bring this alternative into compliance.

Potential mitigation measures to reduce PM and respirable silica emissions to ambient air receptors include:

For all Alternatives:

- Implementation of the operating restrictions outlined in Section;
- Implementation of a Fugitive Dust Control Plan; and

Implementation of an Ambient Air Monitoring Plan for Alternative 2

- Design modifications to plant locations for Alternative 2;
- Modification of MS mining operations

9.0 References

1. **Scott Louisville Township.** Merriam Junction Sands Scoping Environmental Assessment Worksheet. June 3, 2014.

2. **U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards.** Compilation of Air Pollutant Emission Factors, AP-42. [Online] September 27, 2016. https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emission-factors.

3. **U.S. Environmental Protection Agency.** Air Data: Air Quality Data Collected at Outddor Monitors Across the US. [Online] December 23, 2016. http://aqsdr1.epa.gov/aqsweb/aqstmp/airdata/download_files.html.

4. —. List of Designated Reference and Equivalent Methods. December 17, 2016.

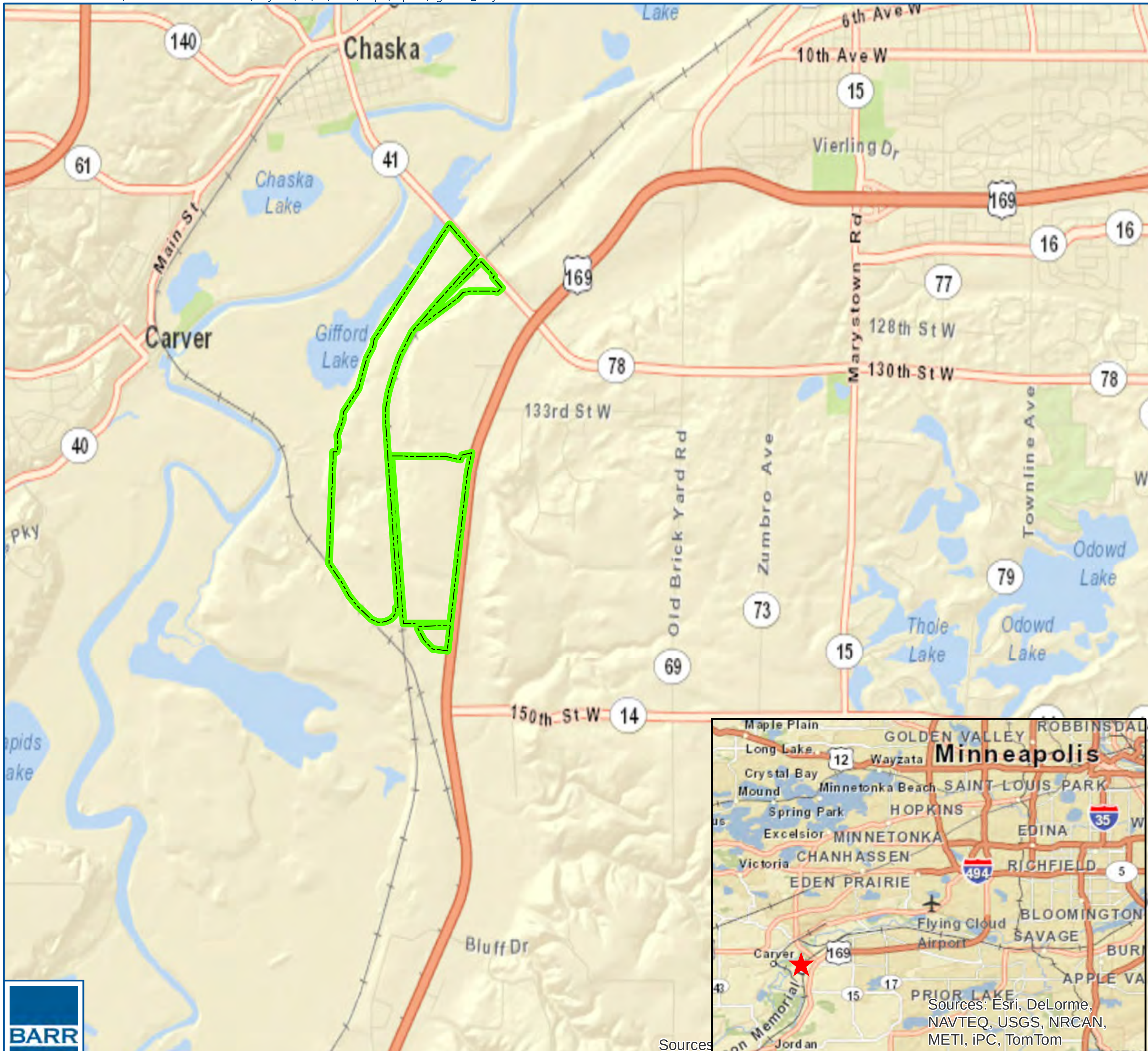
5. —. Ambient Air Quality Monitoring Program Quality System Development (EPA-454/R-98-004). August 1998.

6. —. Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV: Meteorological Measurements Version 2.0. March 2008. EPA-454/B-08-002.

7. **Richards, John and Brozell, Todd.** Assessment of Community Exposure to Ambient Respirable Crystalline Silica near Frac Sand Processing Facilities. *Atmosphere.* 2015, 6, pp. 960-982.

Figures

Barr Footer: ArcGIS 10.4, 2017-06-01 14:20 File: I:\Projects\23\70\1044\Maps\Report\Figure01_ProjectLocation.mxd User: JJM

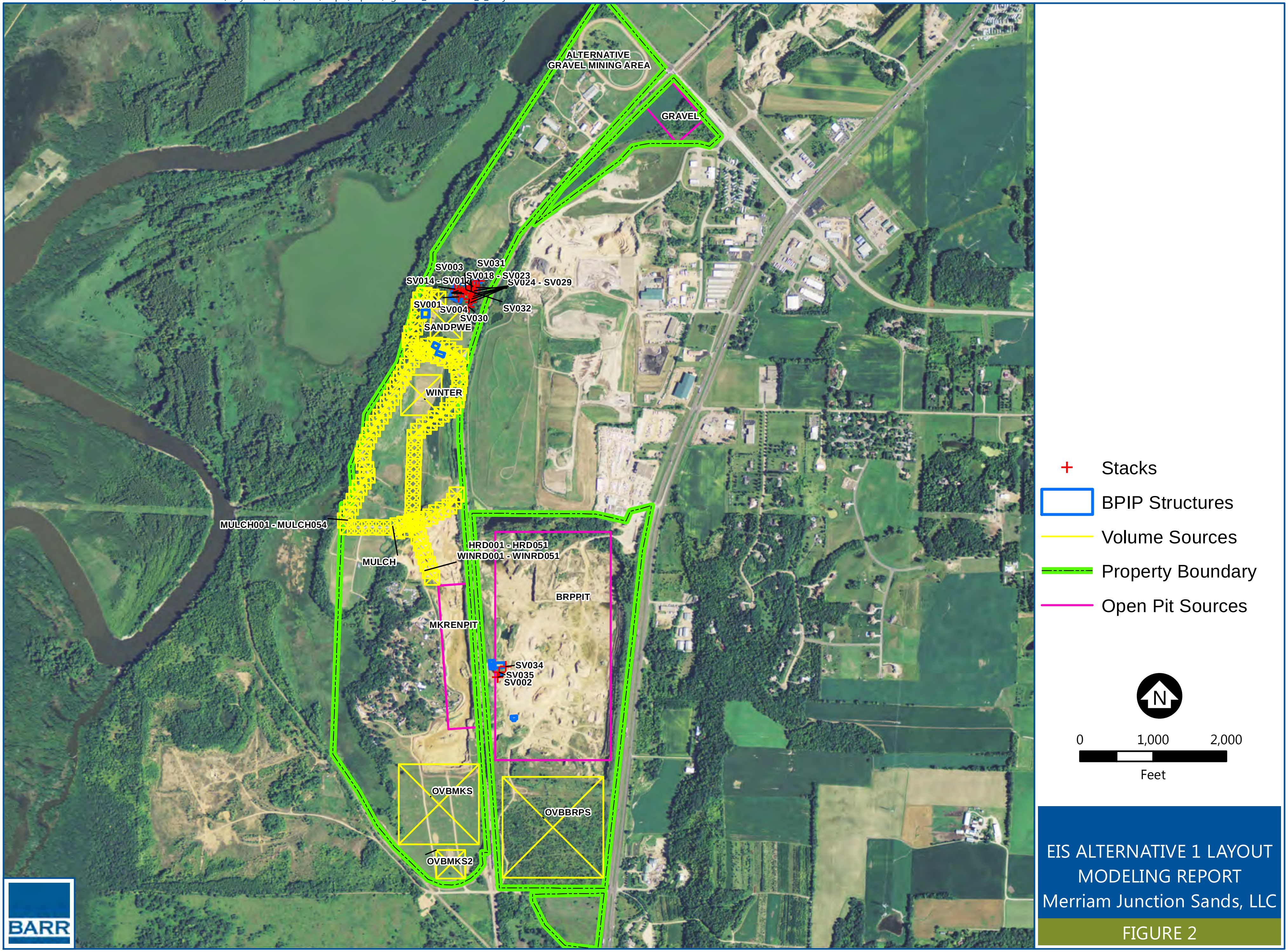


BARR

PROJECT LOCATION
EIS ALTERNATIVE OPTIONS
MODELING REPORT
Merriam Junction Sands, LLC

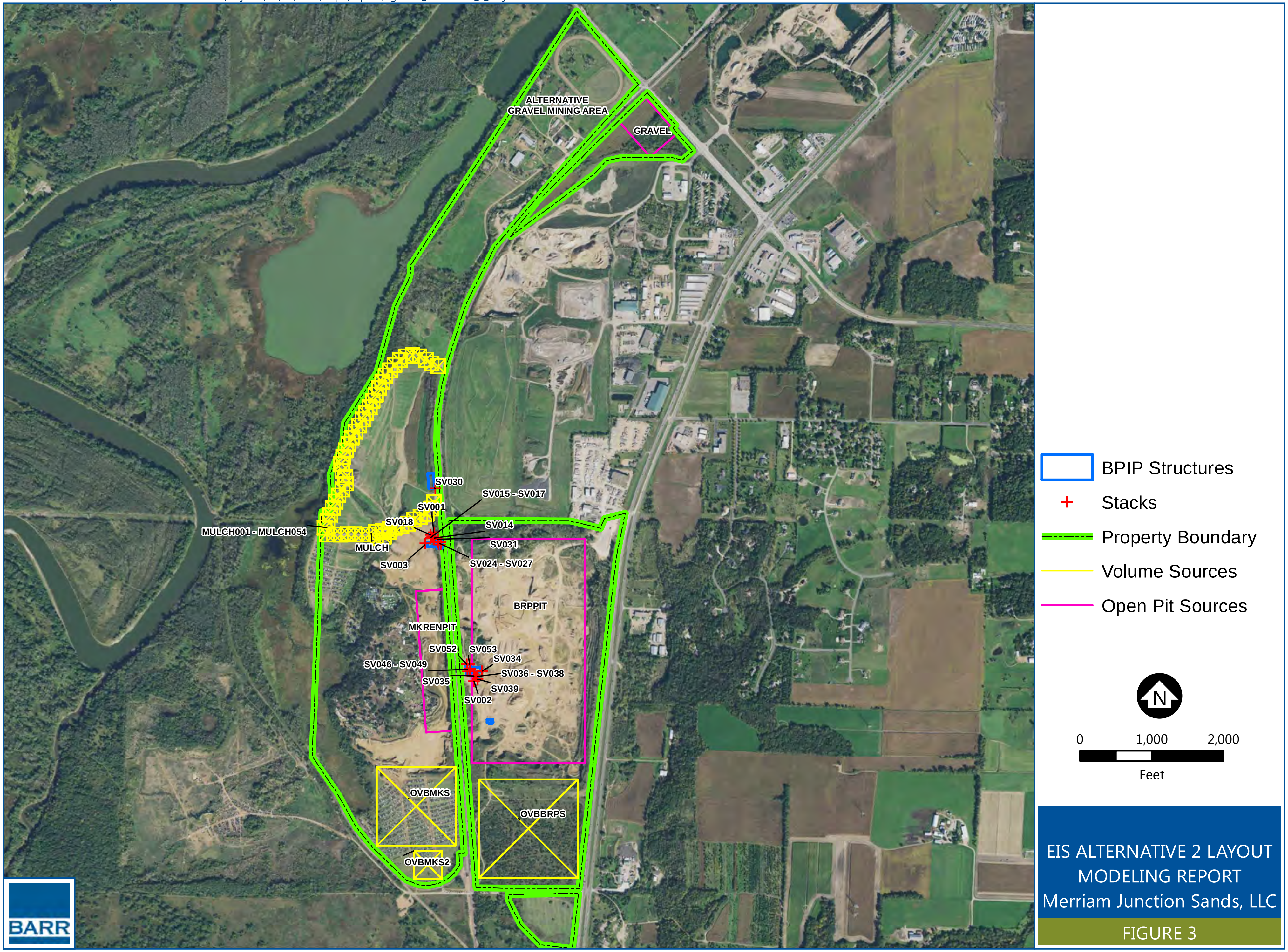
FIGURE 1

Barr Footer: ArcGIS 10.4, 2017-06-01 15:12 File: I:\Projects\23\70\1044\Maps\Report\Figure02_Alternative_1_ProjectScenario.mxd User: JJM



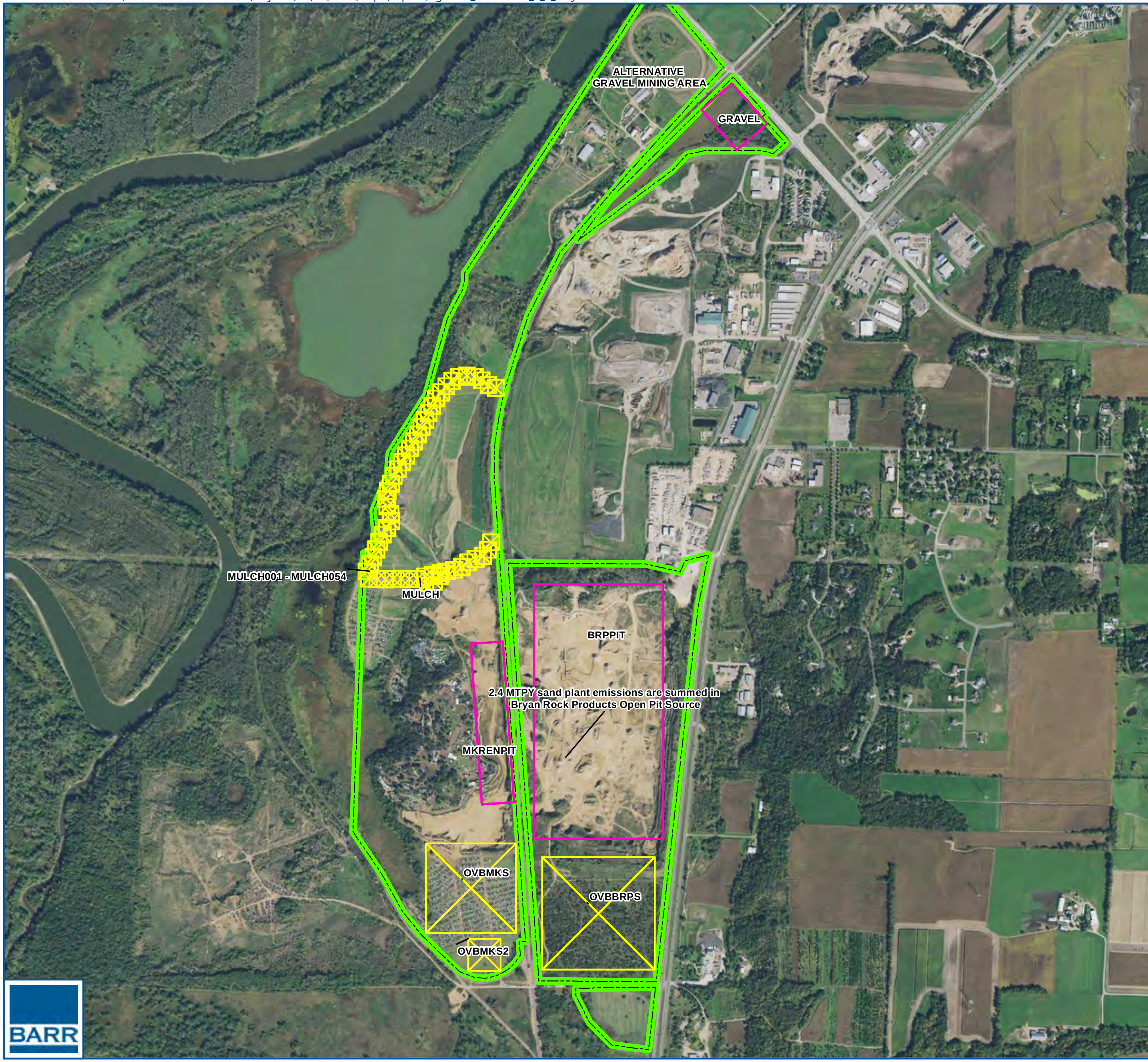
EIS ALTERNATIVE 1 LAYOUT
MODELING REPORT
Merriam Junction Sands, LLC

FIGURE 2



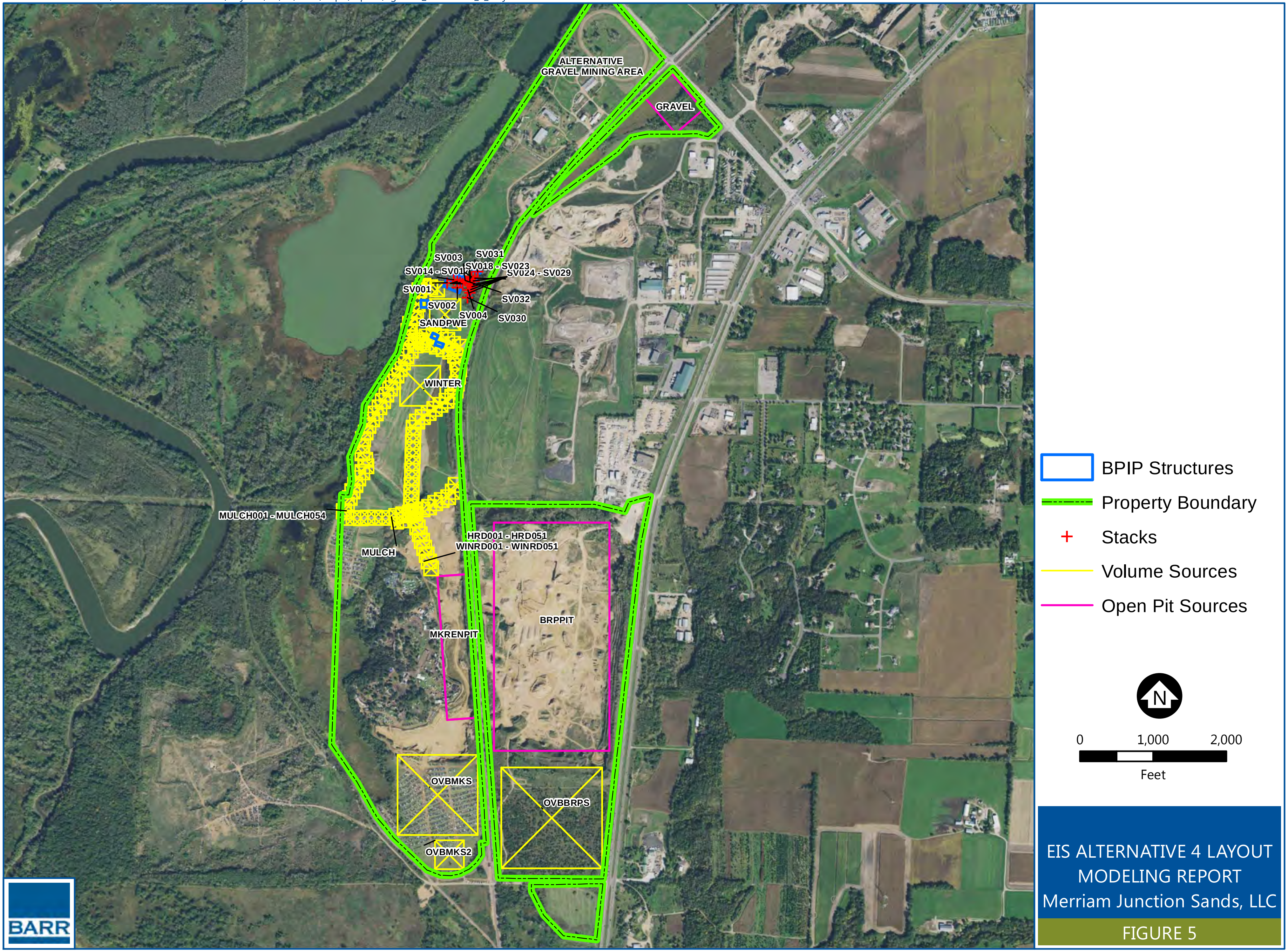
EIS ALTERNATIVE 2 LAYOUT
MODELING REPORT
Merriam Junction Sands, LLC

FIGURE 3



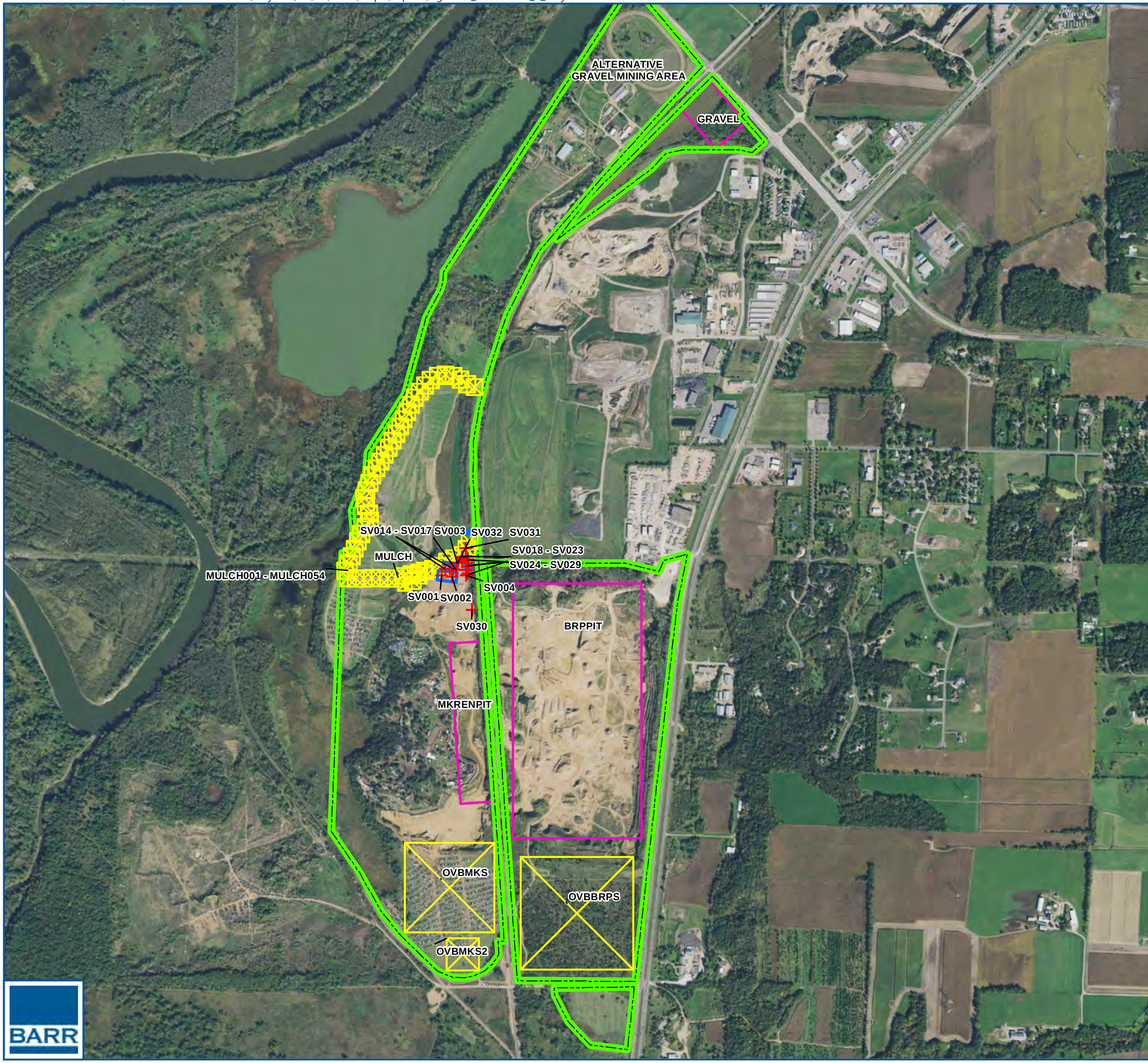
EIS ALTERNATIVE 3 AND 6
LAYOUTS
MODELING REPORT
Merriam Junction Sands, LLC

FIGURE 4



EIS ALTERNATIVE 4 LAYOUT
MODELING REPORT
Merriam Junction Sands, LLC

FIGURE 5



BPIP Structures
Stacks
Volume Sources
Property Boundary
Open Pit Sources

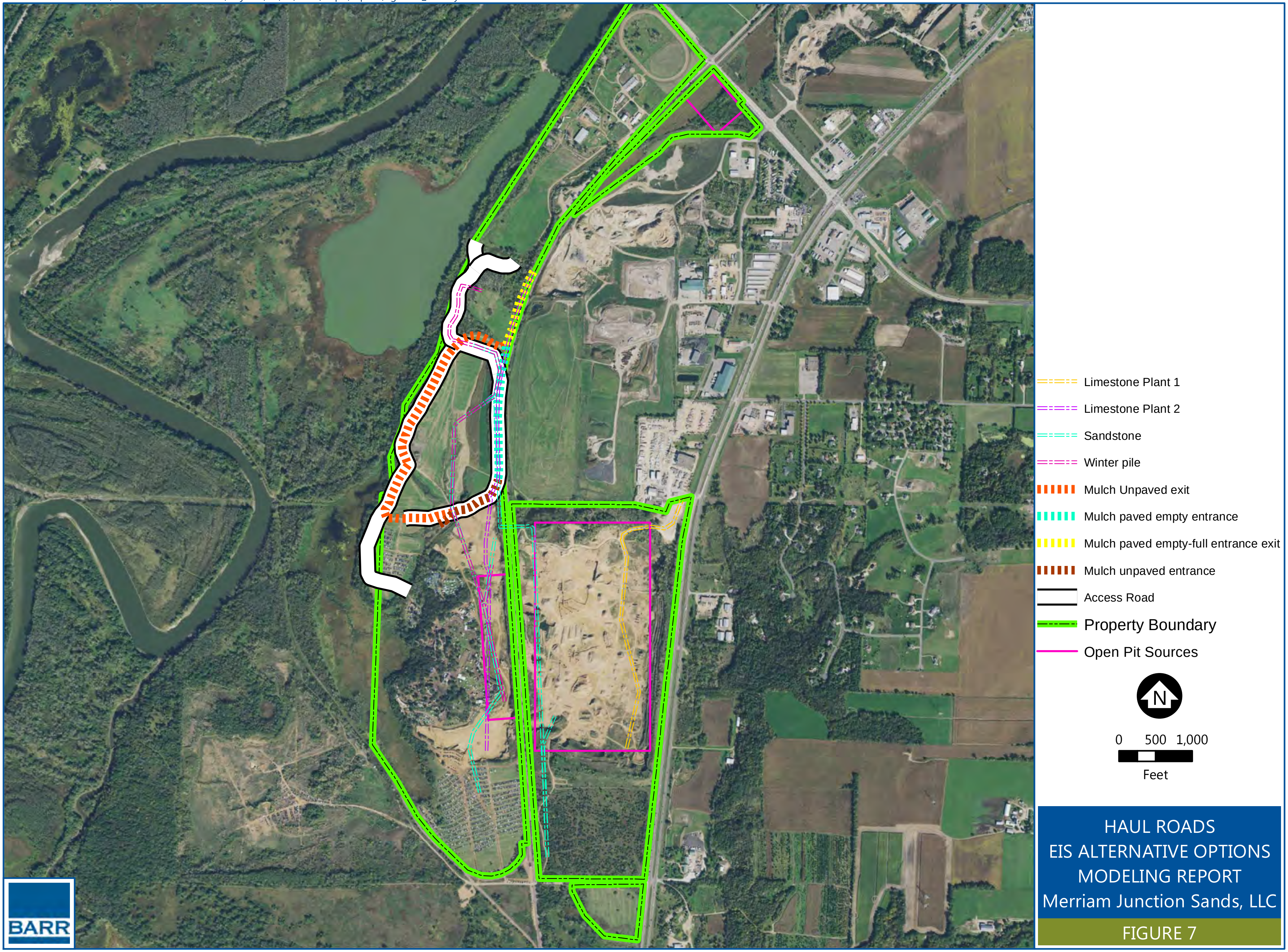
N

0 1,000 2,000
Feet

EIS ALTERNATIVE 5 LAYOUT
MODELING REPORT
Merriam Junction Sands, LLC

FIGURE 6

BARR



HAUL ROADS
EIS ALTERNATIVE OPTIONS
MODELING REPORT
Merriam Junction Sands, LLC

FIGURE 7

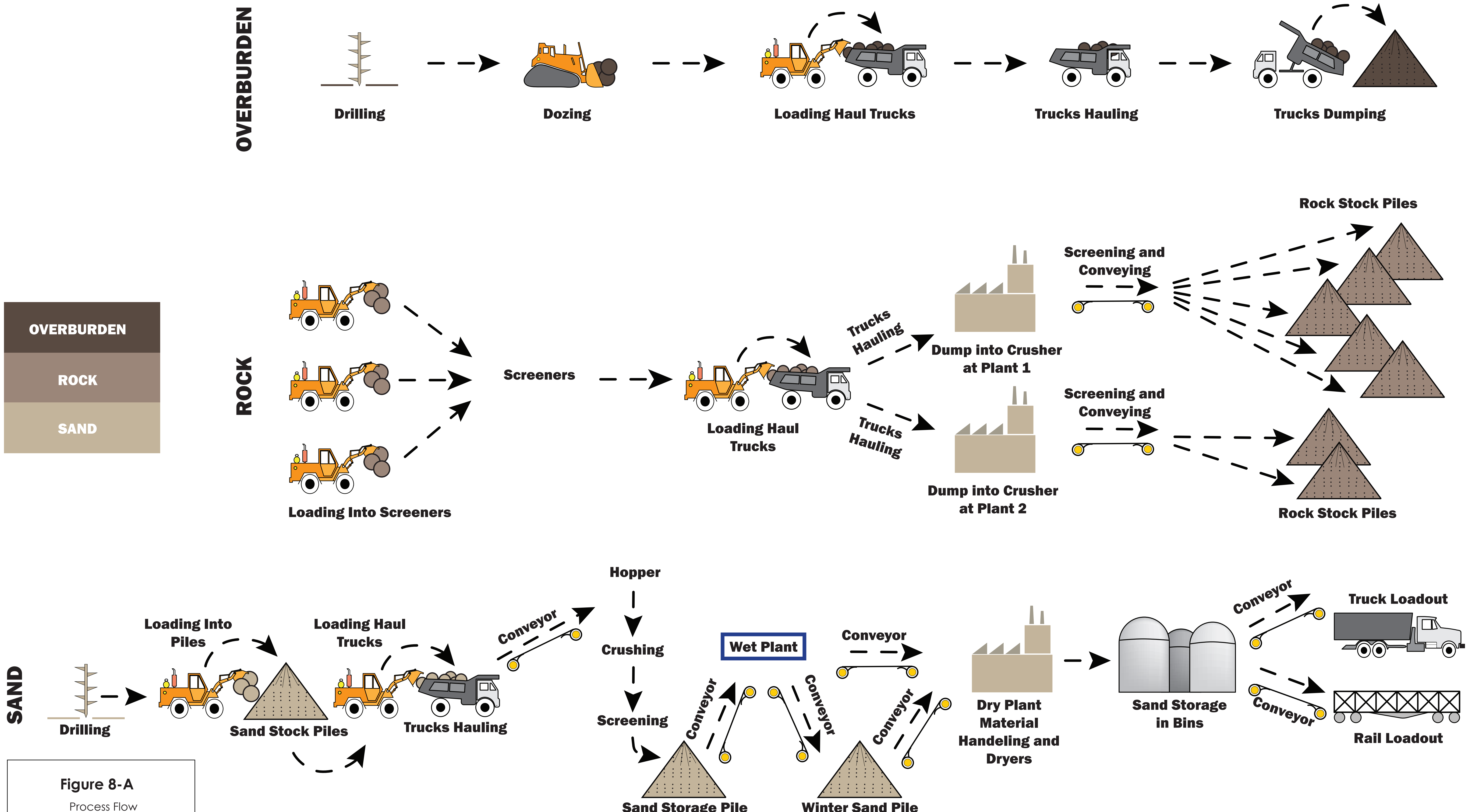


Figure 8-A

Process Flow
EIS Alternative Options
Modeling Report
Merriam Junction Sands, LLC

BARR

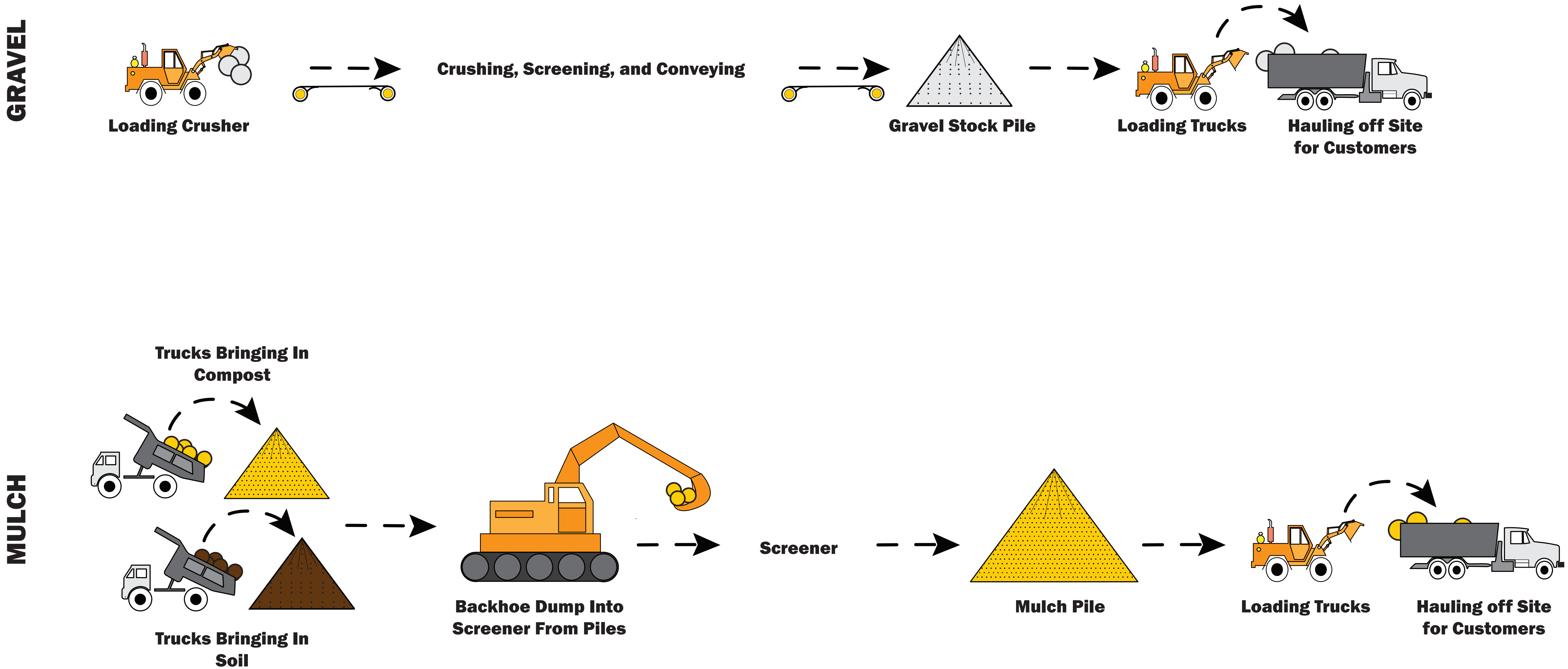


Figure 8-B

Process Flow
EIS Alternative Options
Modeling Report
Merriam Junction Sands, LLC

BARR

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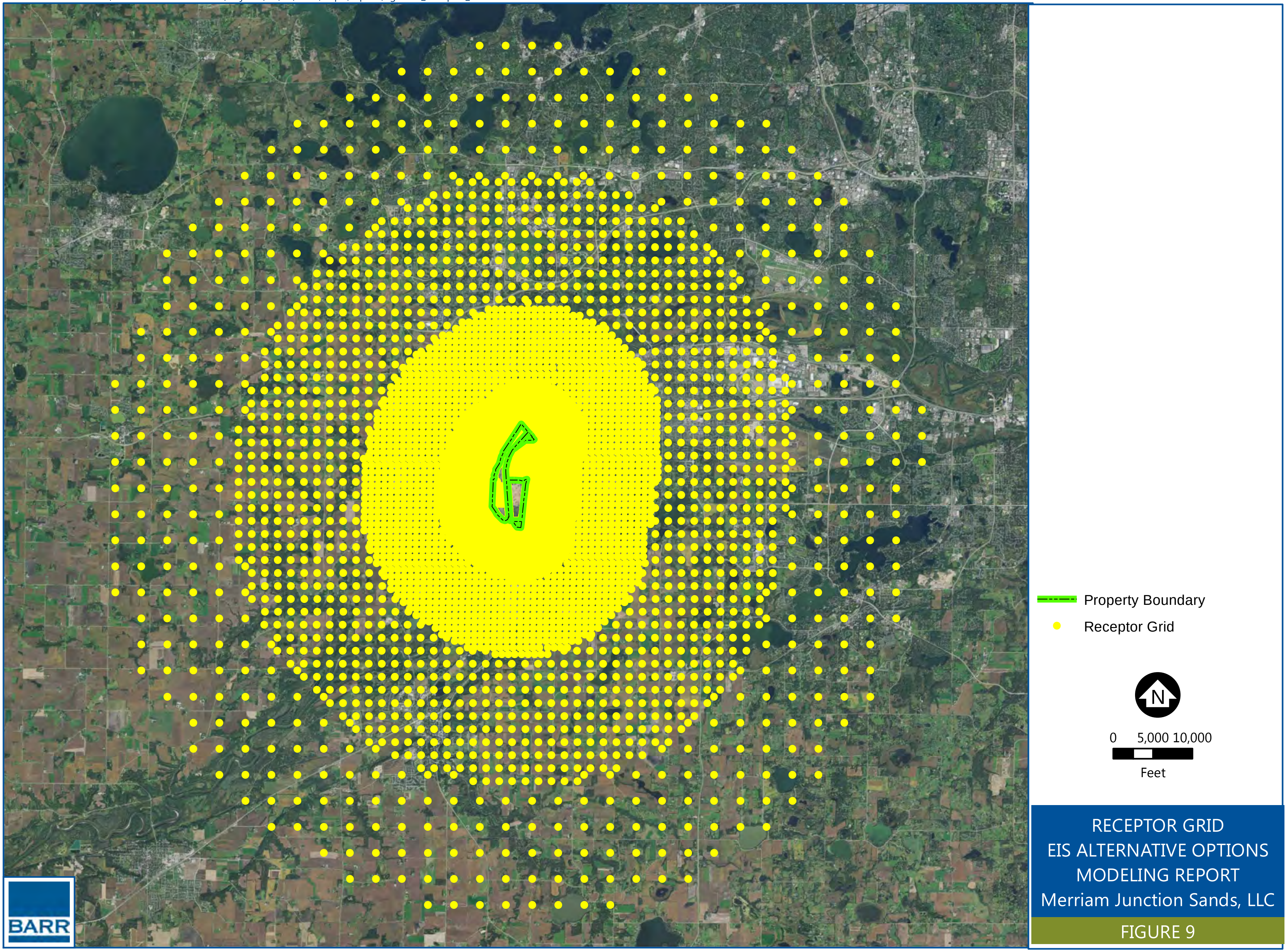
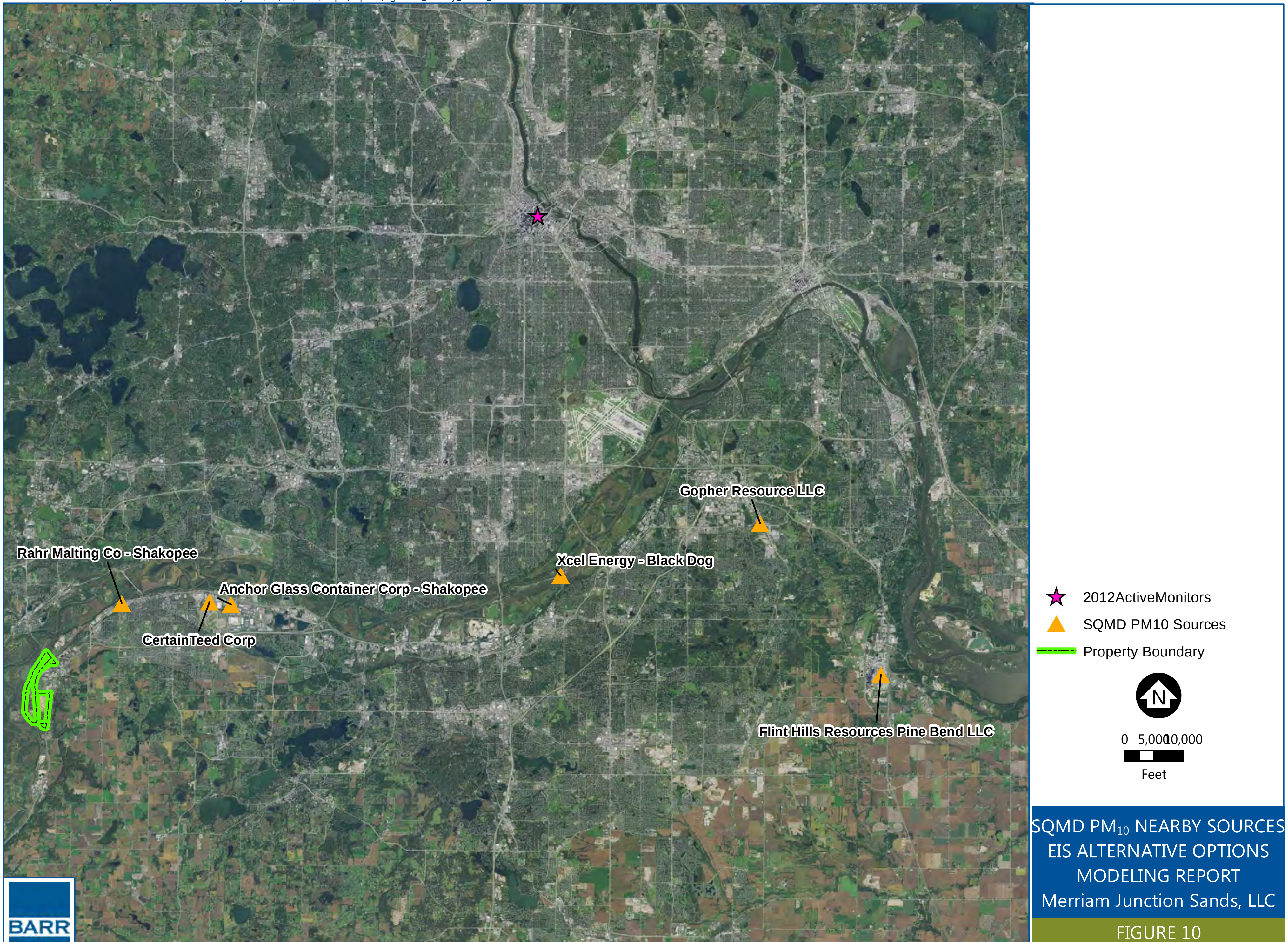


RECEPTOR GRID
EIS ALTERNATIVE OPTIONS
MODELING REPORT
Merriam Junction Sands, LLC

FIGURE 9

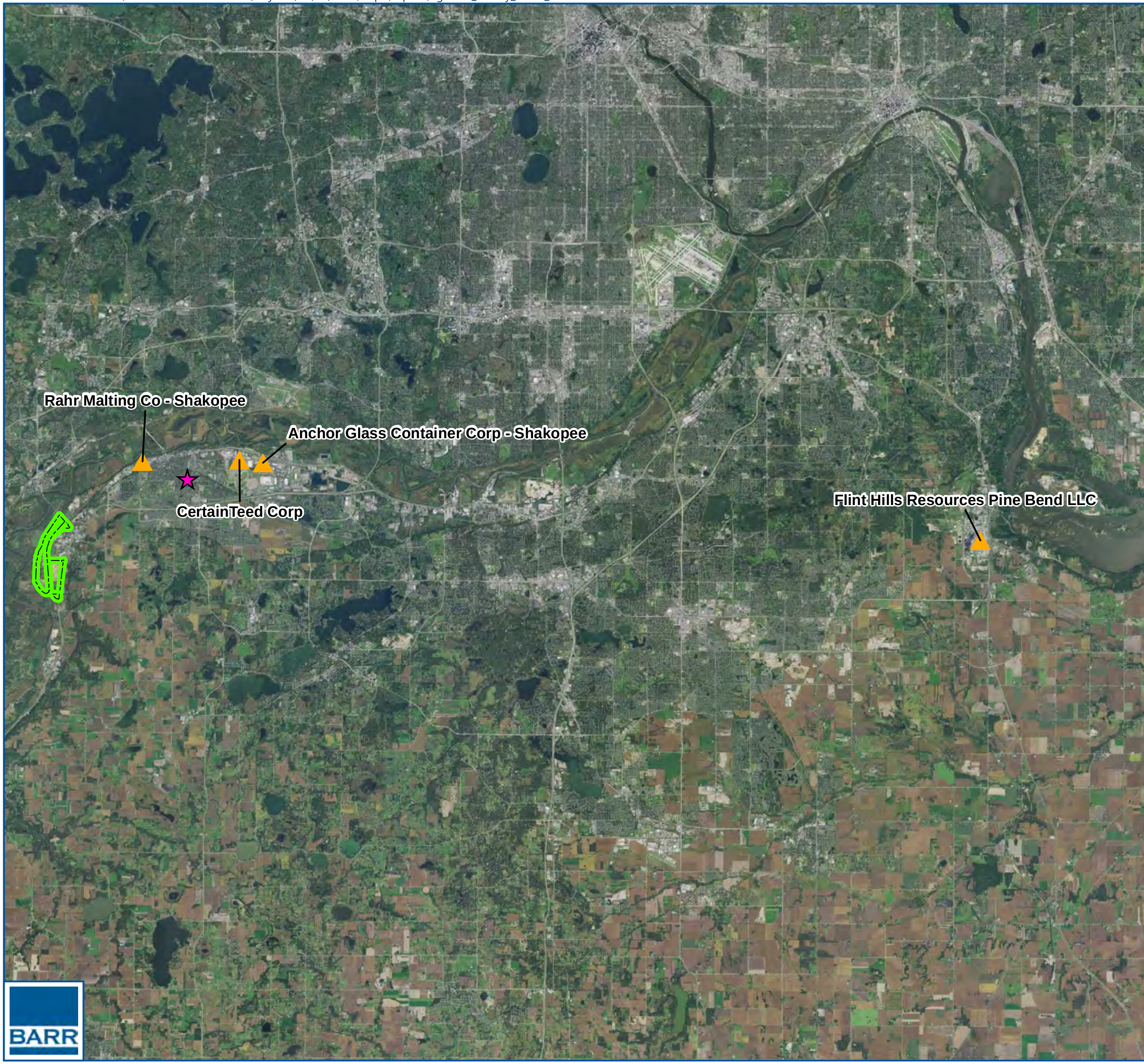
BARR



SQMD PM_{10} NEARBY SOURCES
EIS ALTERNATIVE OPTIONS
MODELING REPORT
Merriam Junction Sands, LLC

FIGURE 10

Barr Footer: ArcGIS 10.4, 2017-06-02 13:13 File: I:\Projects\23\70\1044\Maps\Report\Figure11_nearby_PM25_sources.mxd User: JJM



2012ActiveMonitors
SQMD PM2.5 Sources
Property Boundary

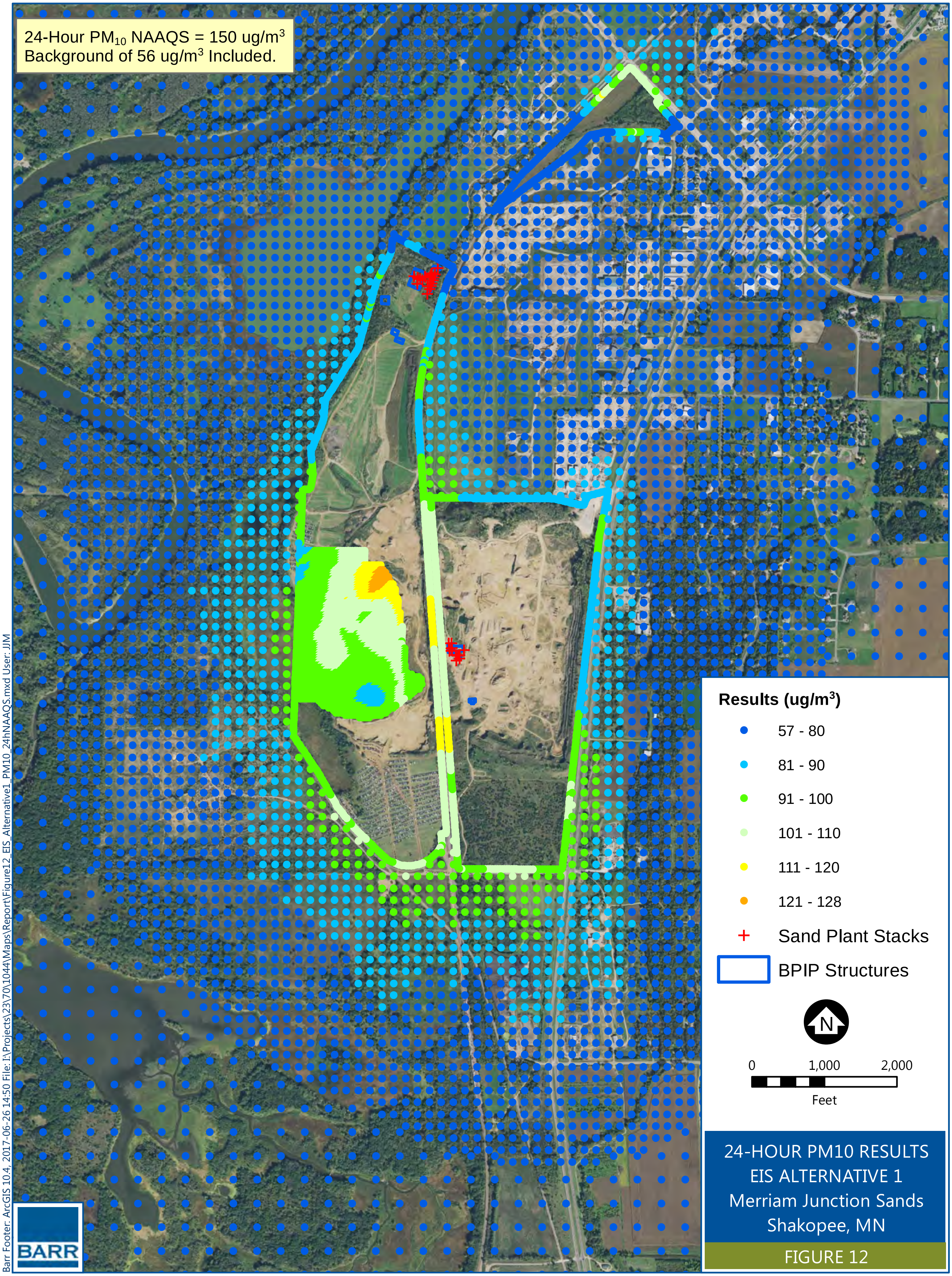
N

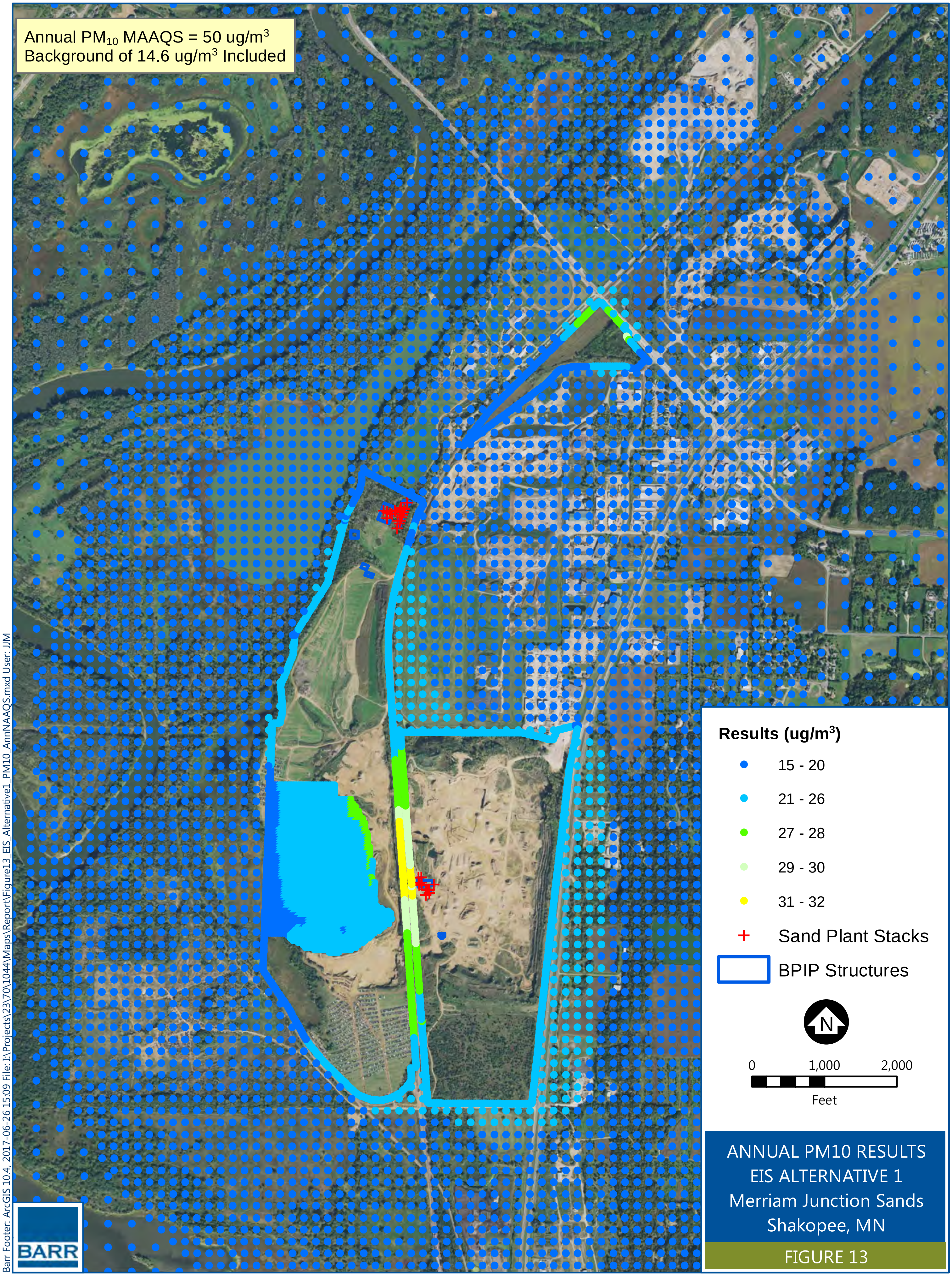
0 5,000 10,000
Feet

SQMD $PM_{2.5}$ NEARBY SOURCES
EIS ALTERNATIVE OPTIONS
MODELING REPORT
Merriam Junction Sands, LLC

FIGURE 11

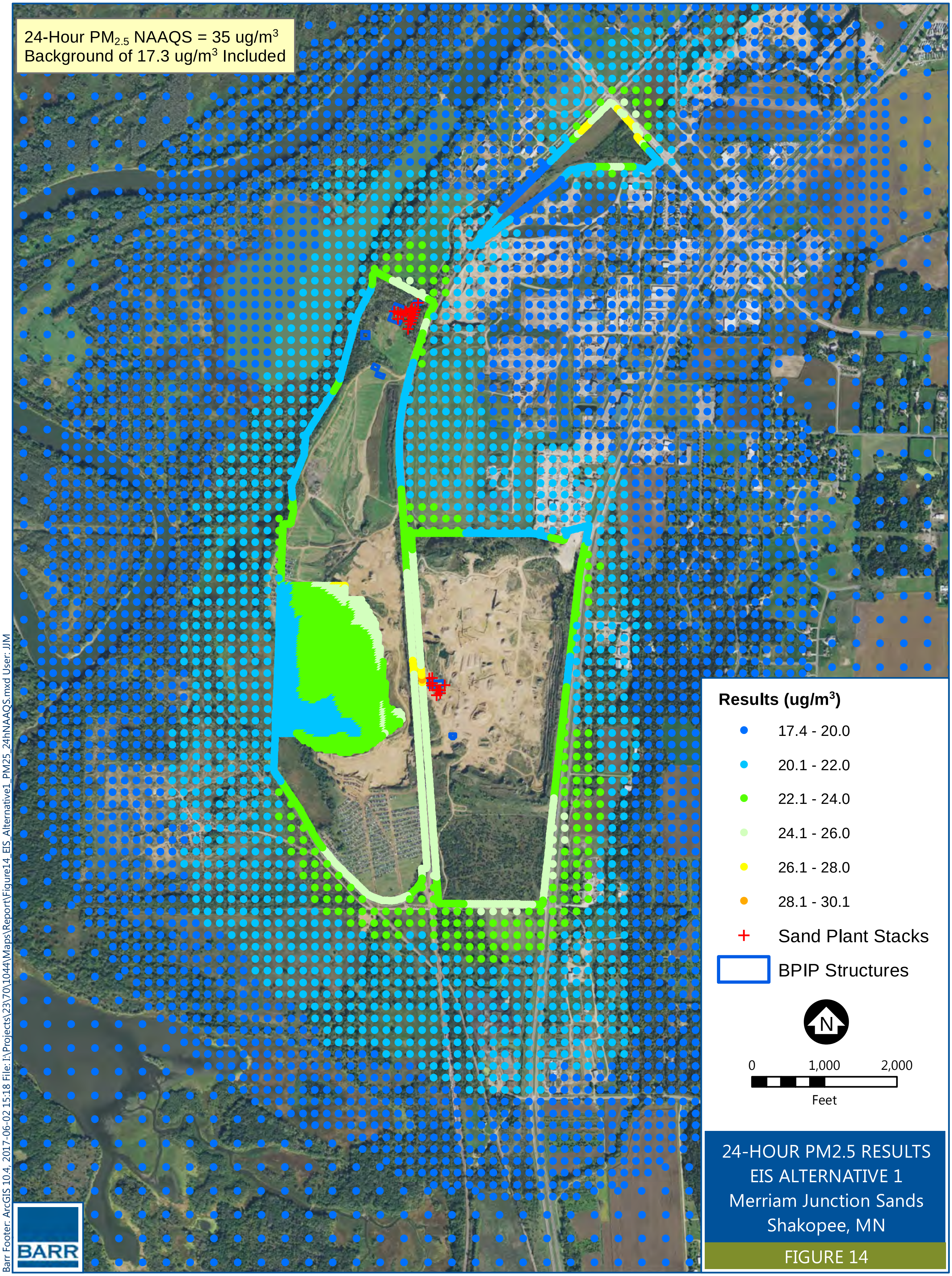
BARR


24-Hour PM10 NAAQS = 150 ug/m3
Background of 56 ug/m3 Included.
Results (ug/m3)
57 - 80
81 - 90
91 - 100
101 - 110
111 - 120
121 - 128
Sand Plant Stacks
BPIP Structures
N
0
1,000
2,000
Feet
24-HOUR PM10 RESULTS
EIS ALTERNATIVE 1
Merriam Junction Sands
Shakopee, MN
FIGURE 12
BARR



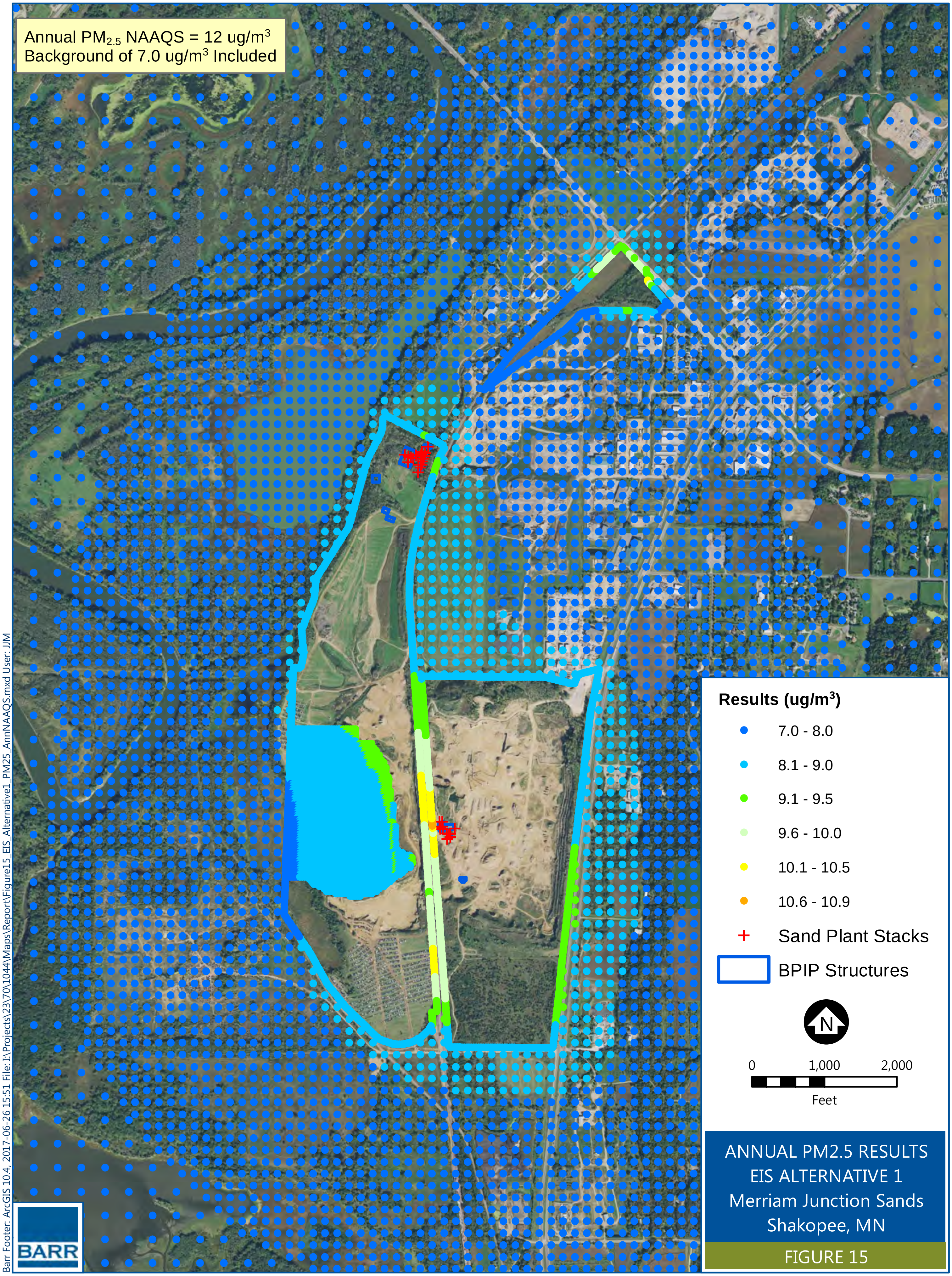
ANNUAL PM10 RESULTS
EIS ALTERNATIVE 1
Merriam Junction Sands
Shakopee, MN

FIGURE 13



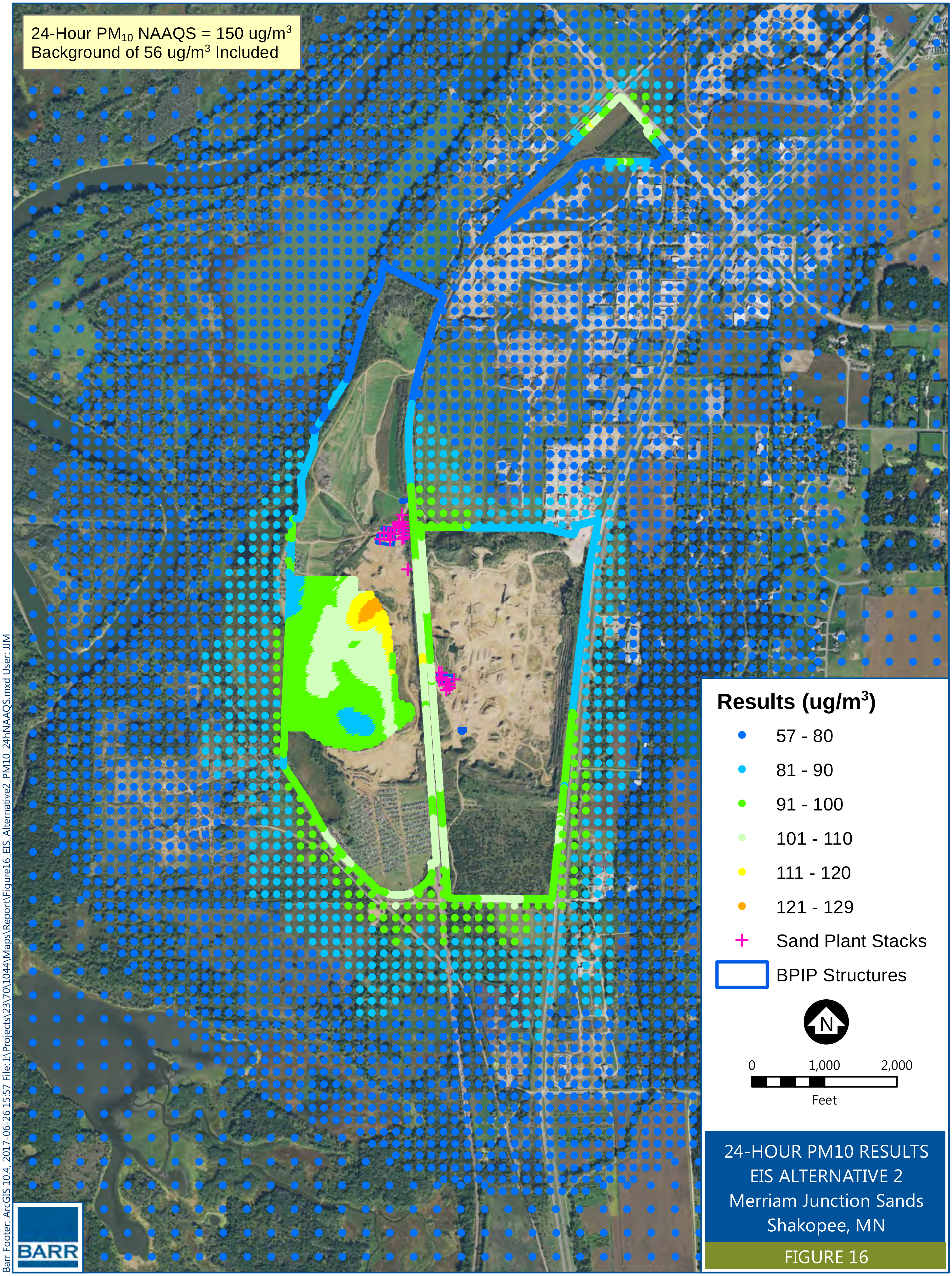
24-HOUR PM2.5 RESULTS
EIS ALTERNATIVE 1
Merriam Junction Sands
Shakopee, MN

FIGURE 14



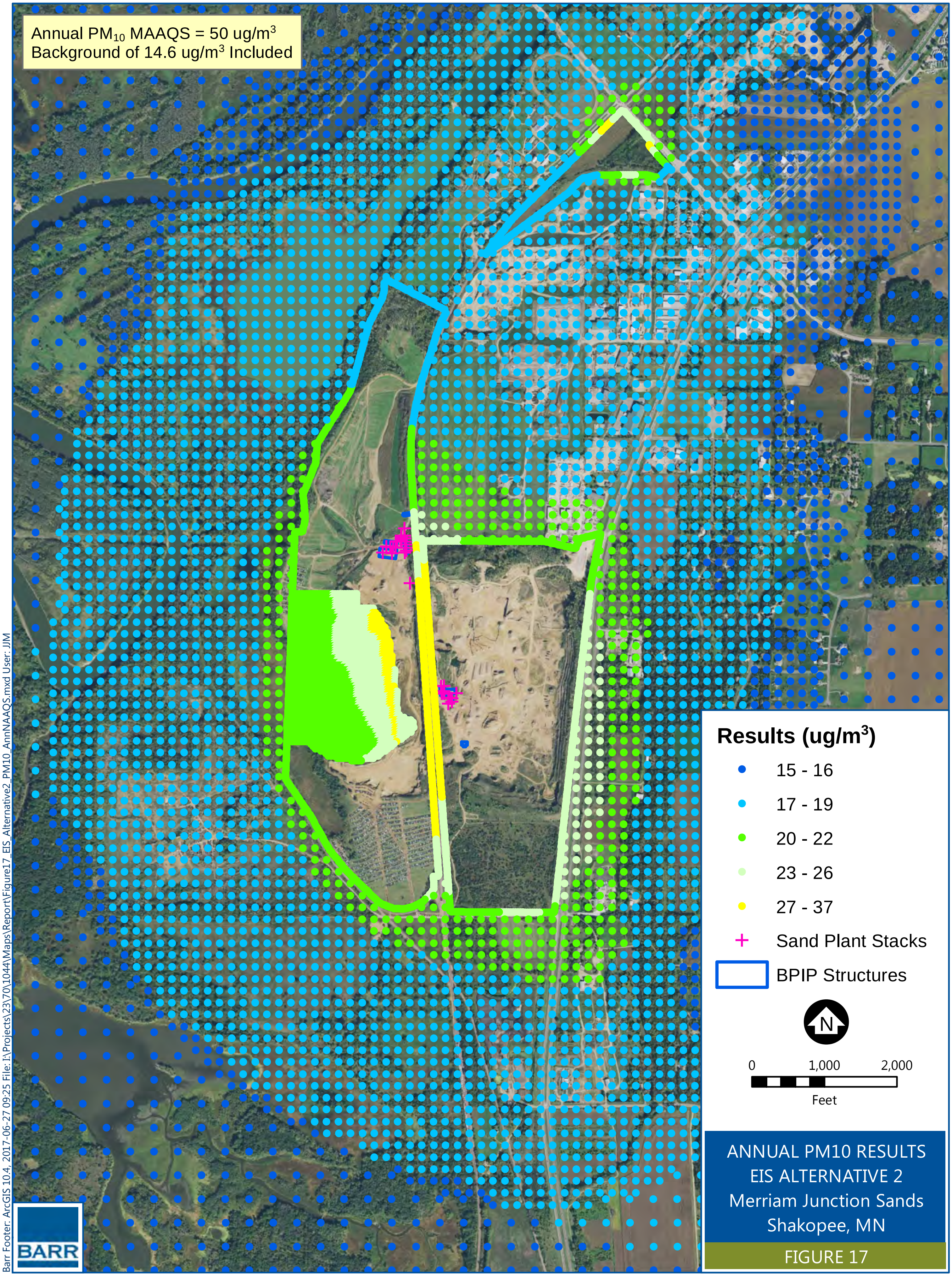
ANNUAL PM2.5 RESULTS
EIS ALTERNATIVE 1
Merriam Junction Sands
Shakopee, MN

FIGURE 15



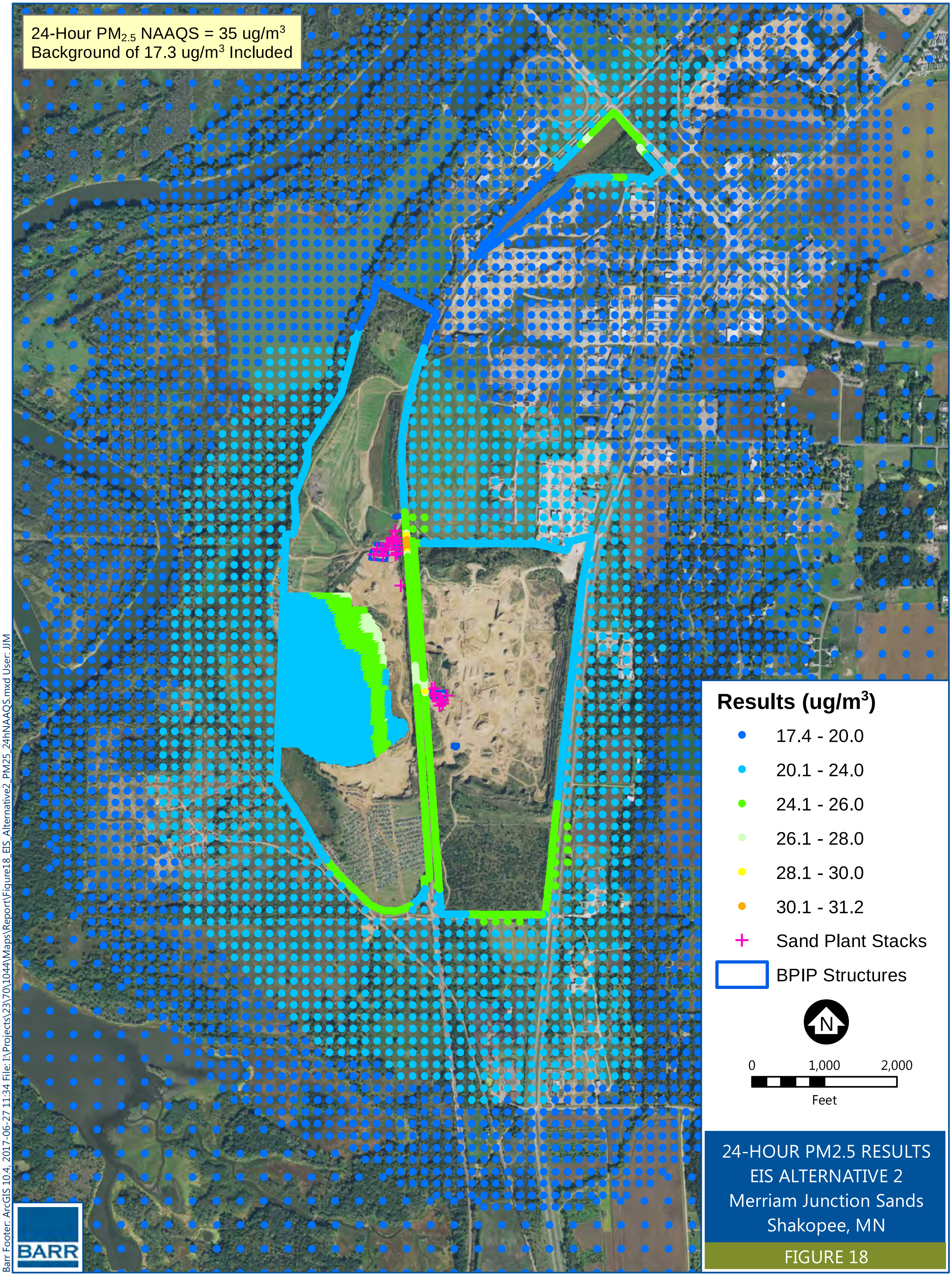
24-HOUR PM10 RESULTS
EIS ALTERNATIVE 2
Merriam Junction Sands
Shakopee, MN

FIGURE 16



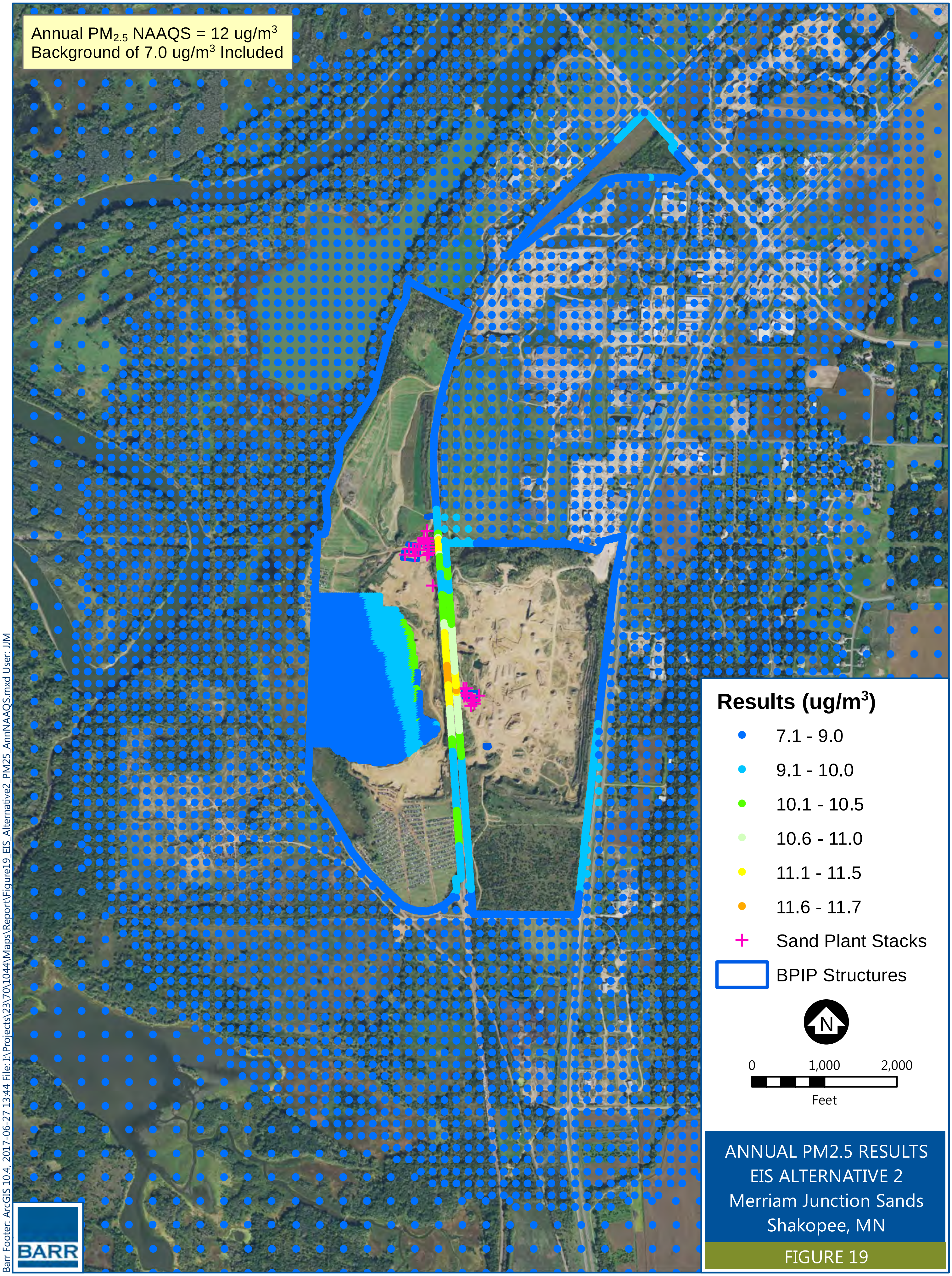
ANNUAL PM10 RESULTS
EIS ALTERNATIVE 2
Merriam Junction Sands
Shakopee, MN

FIGURE 17



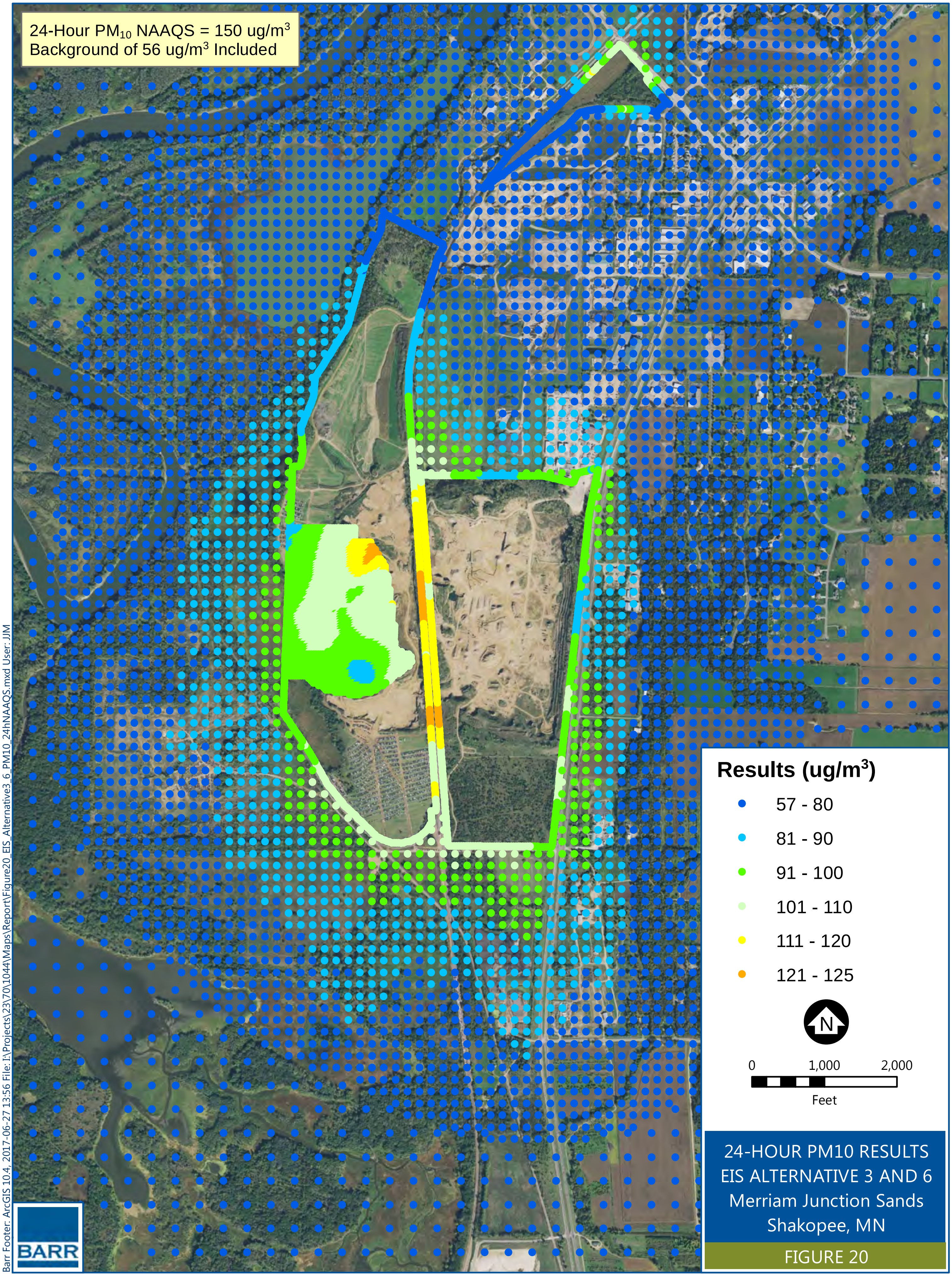
24-HOUR PM2.5 RESULTS
EIS ALTERNATIVE 2
Merriam Junction Sands
Shakopee, MN
FIGURE 18

BARR



ANNUAL PM2.5 RESULTS
EIS ALTERNATIVE 2
Merriam Junction Sands
Shakopee, MN

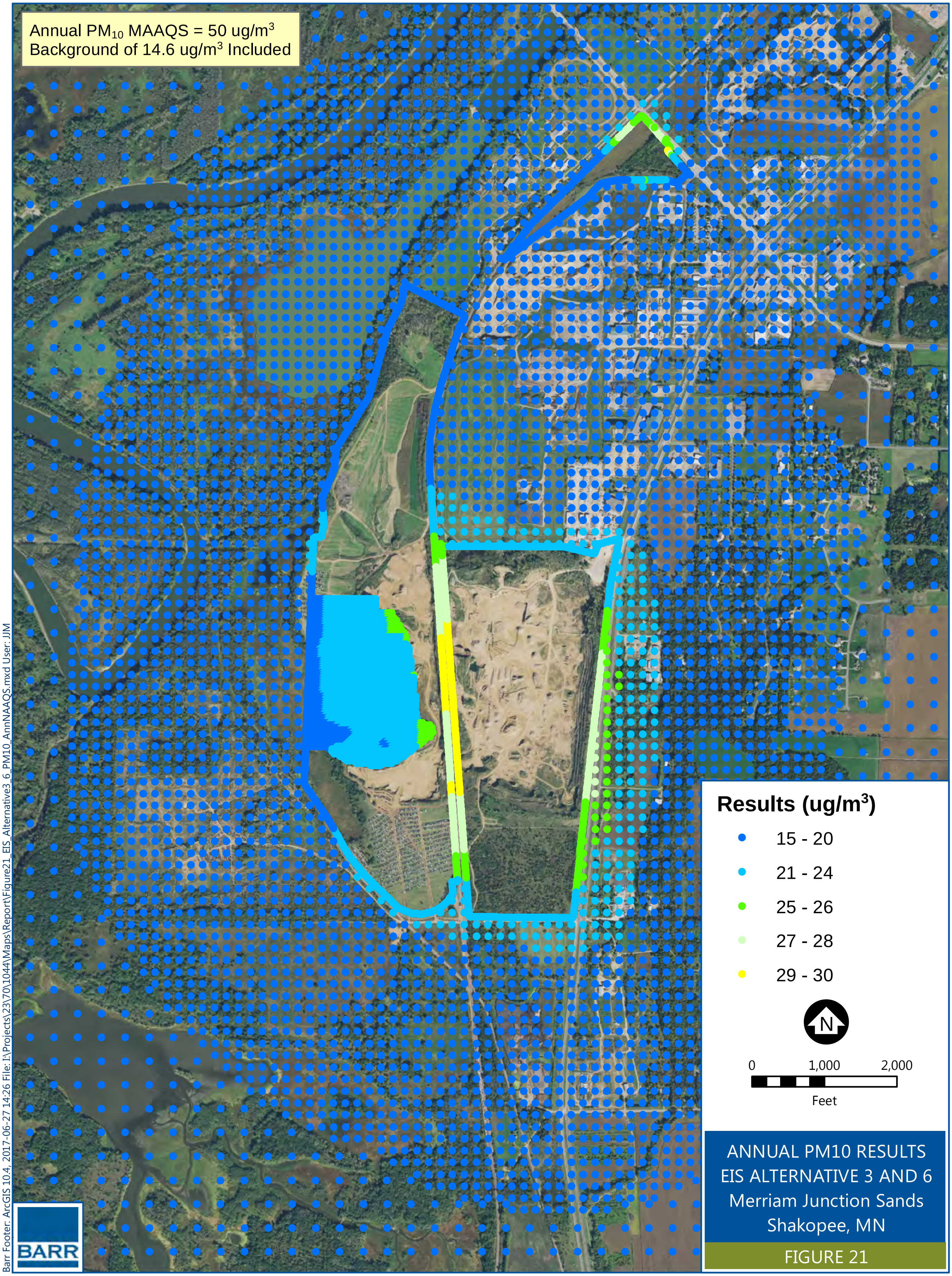
FIGURE 19

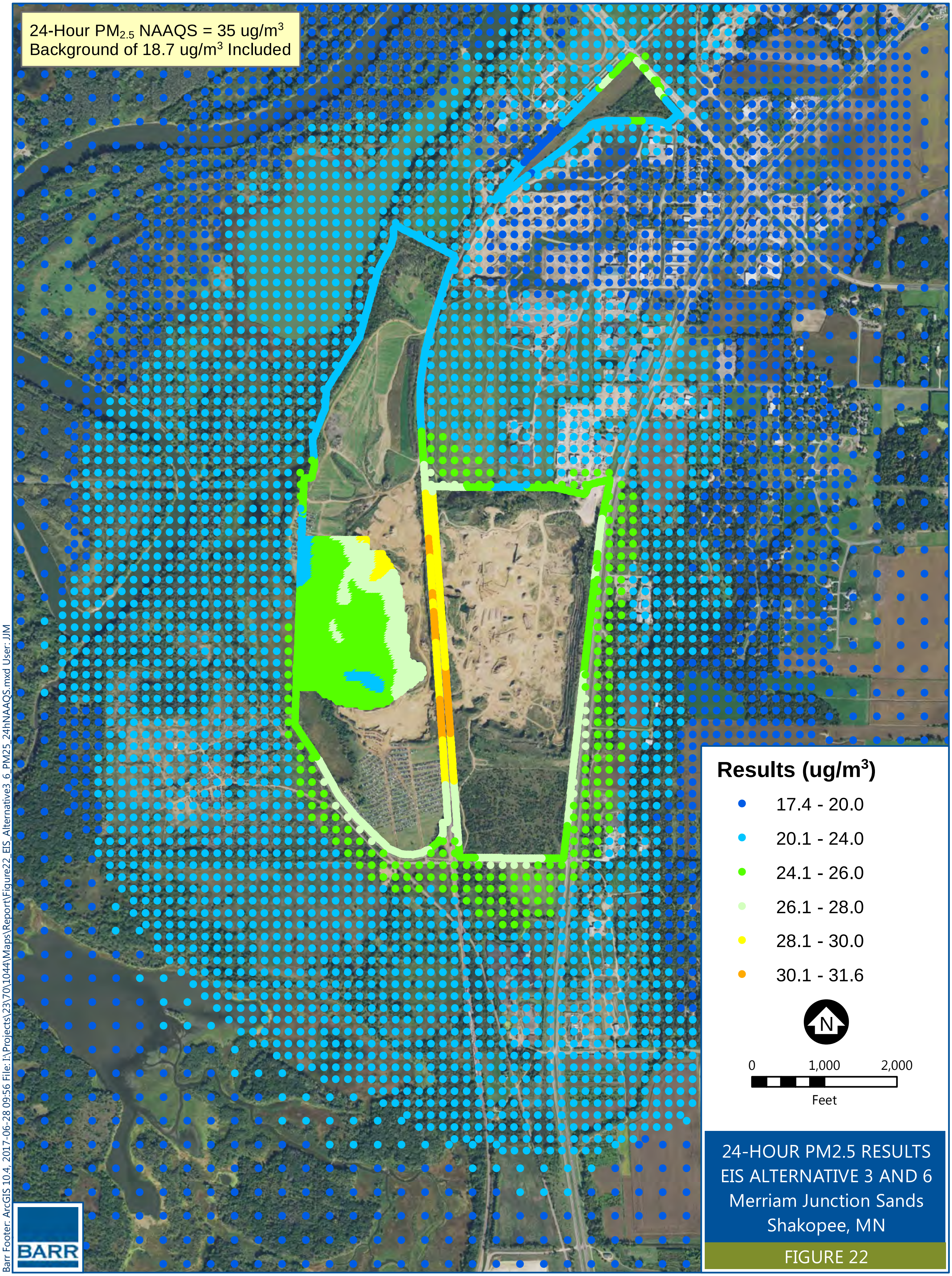


24-HOUR PM10 RESULTS
EIS ALTERNATIVE 3 AND 6
Merriam Junction Sands
Shakopee, MN

FIGURE 20

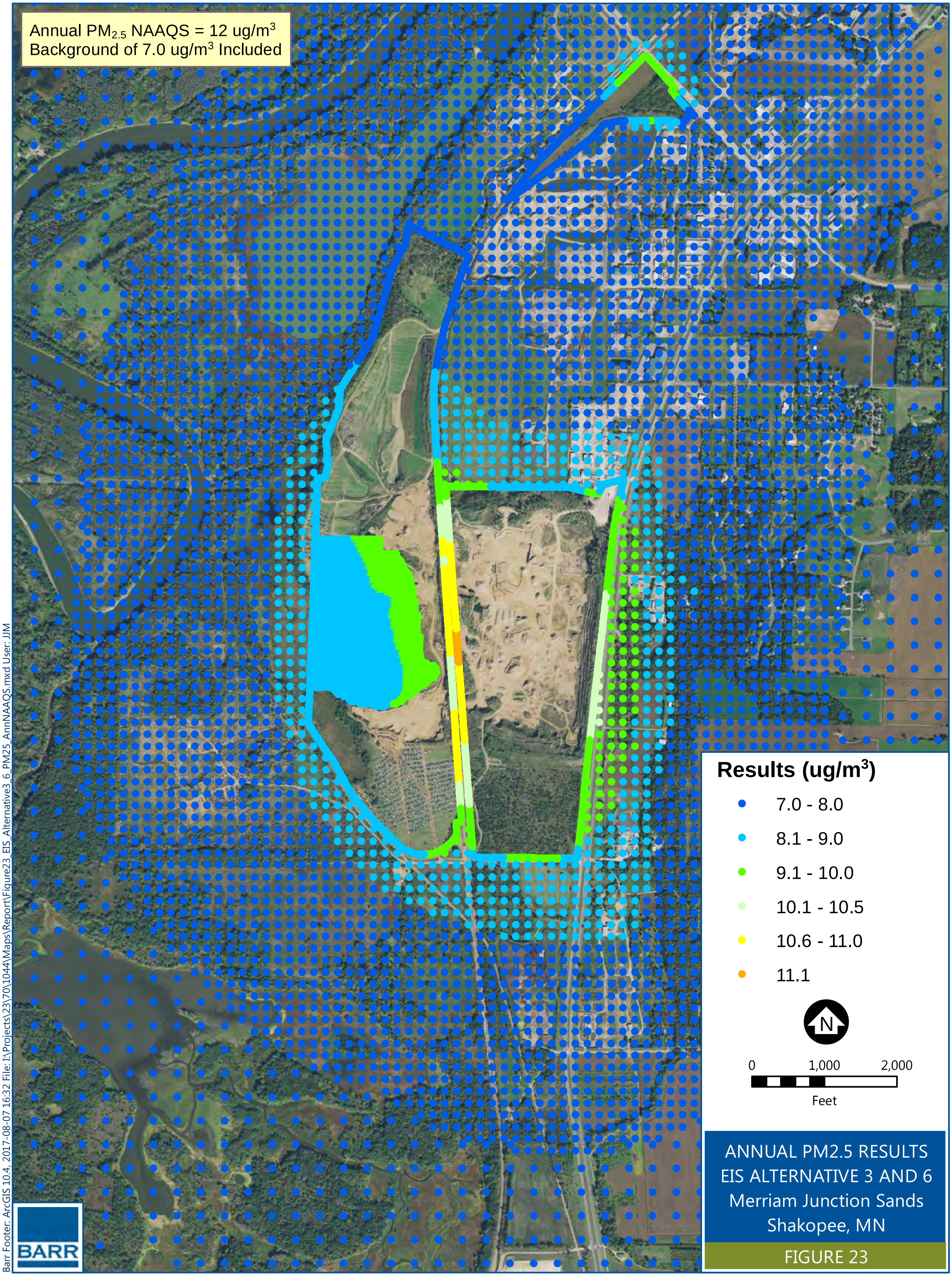
BARR


Annual PM_{10} MAAQS = 50 ug/m^3
Background of 14.6 ug/m^3 Included
Results (ug/m^3)
15 - 20
21 - 24
25 - 26
27 - 28
29 - 30
N
0
1,000
2,000
Feet
ANNUAL PM10 RESULTS
EIS ALTERNATIVE 3 AND 6
Merriam Junction Sands
Shakopee, MN
FIGURE 21
BARR

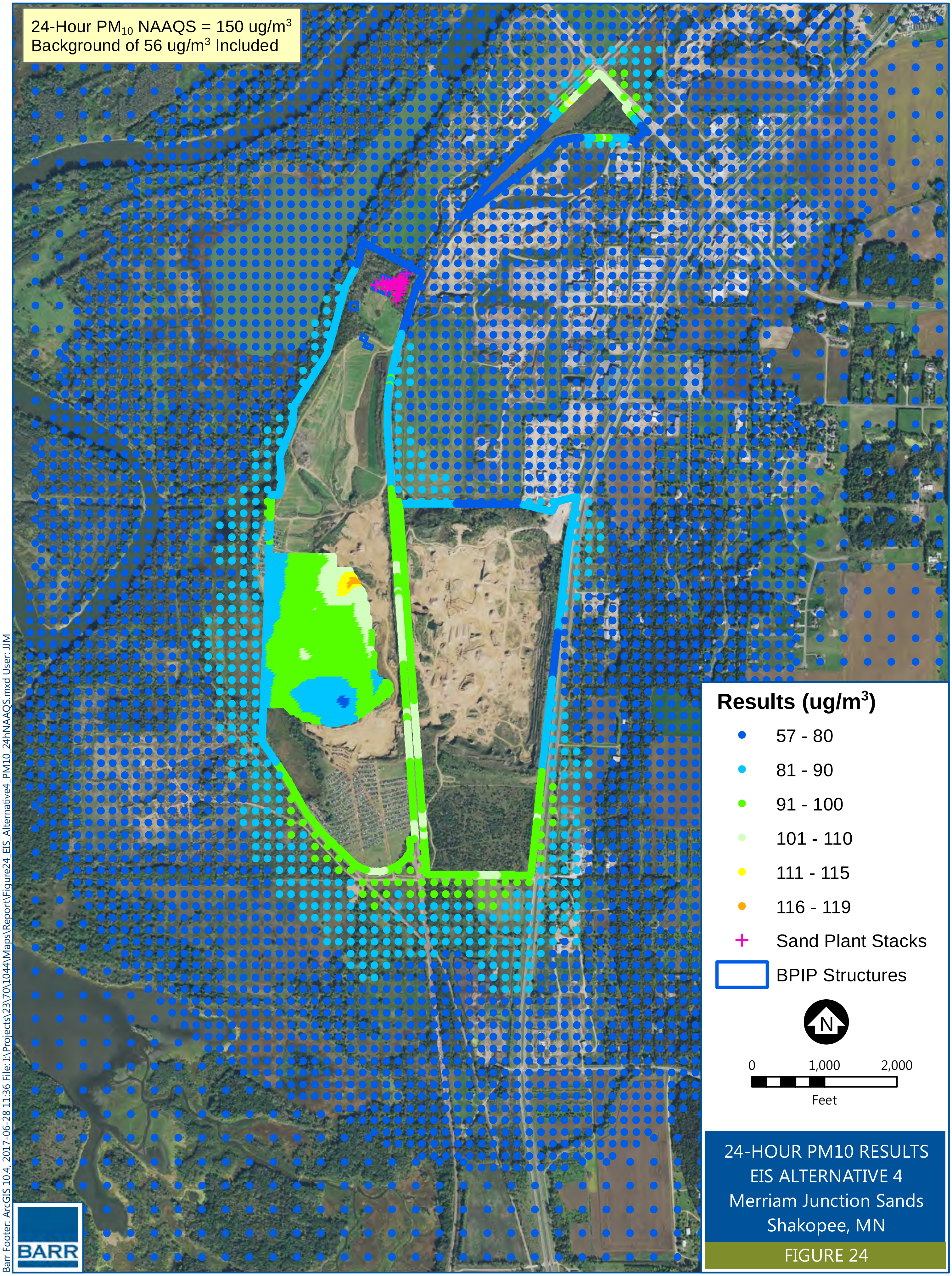


24-HOUR PM2.5 RESULTS
EIS ALTERNATIVE 3 AND 6
Merriam Junction Sands
Shakopee, MN

FIGURE 22

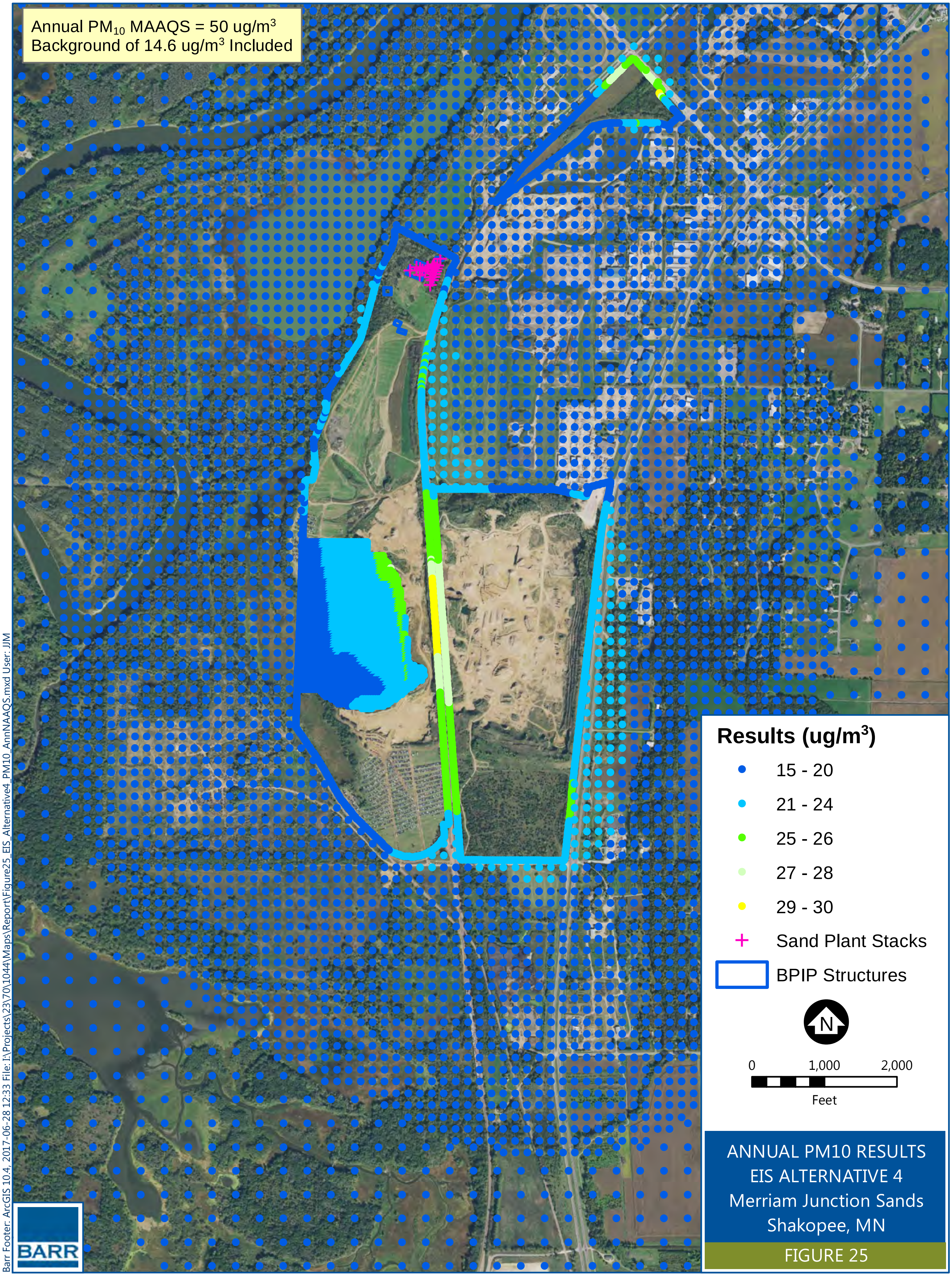


Annual PM2.5 NAAQS = 12 ug/m3
Background of 7.0 ug/m3 Included
Results (ug/m3)
7.0 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 10.5
10.6 - 11.0
11.1
N
0
1,000
2,000
Feet
ANNUAL PM2.5 RESULTS
EIS ALTERNATIVE 3 AND 6
Merriam Junction Sands
Shakopee, MN
FIGURE 23
BARR

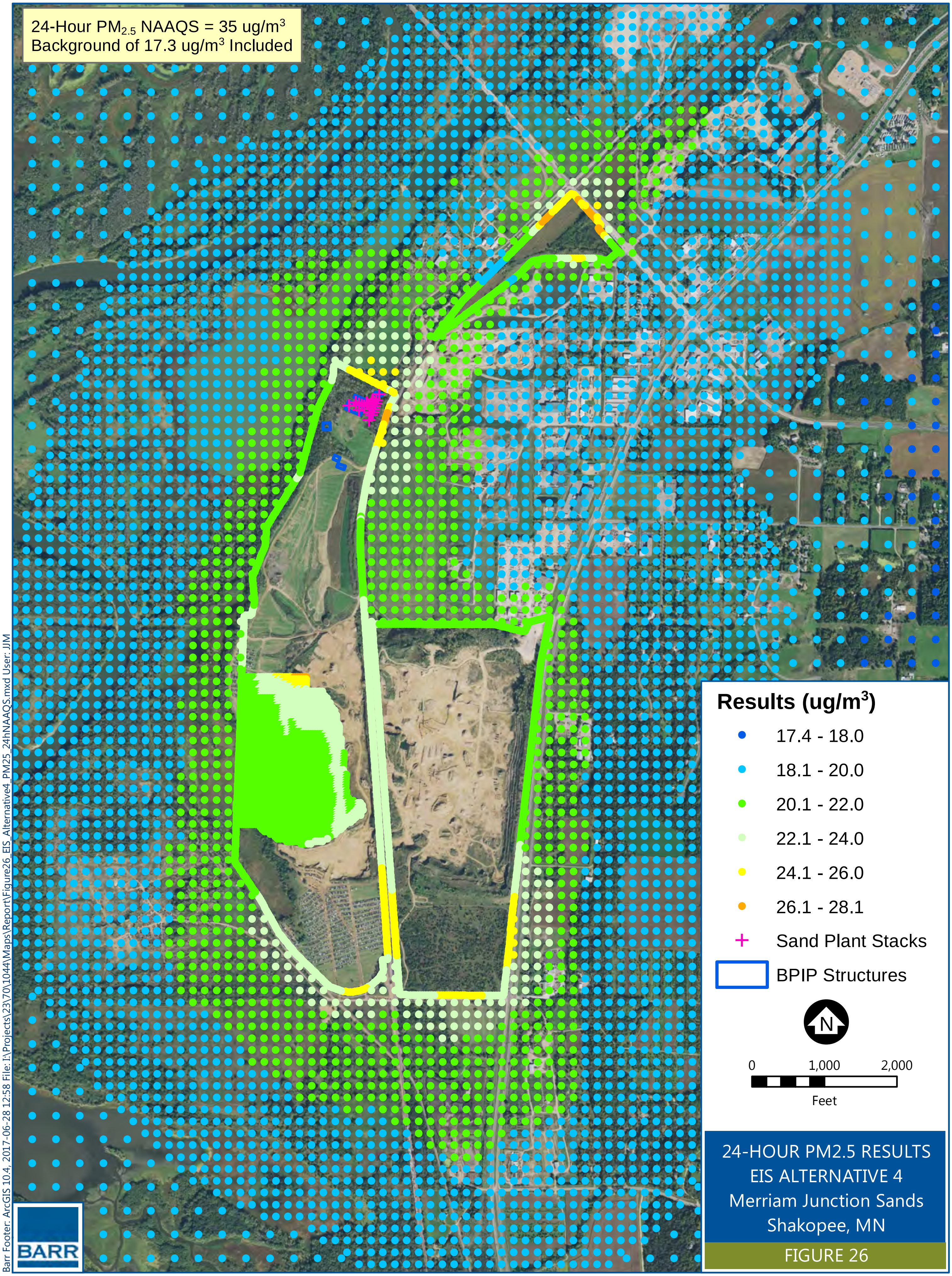


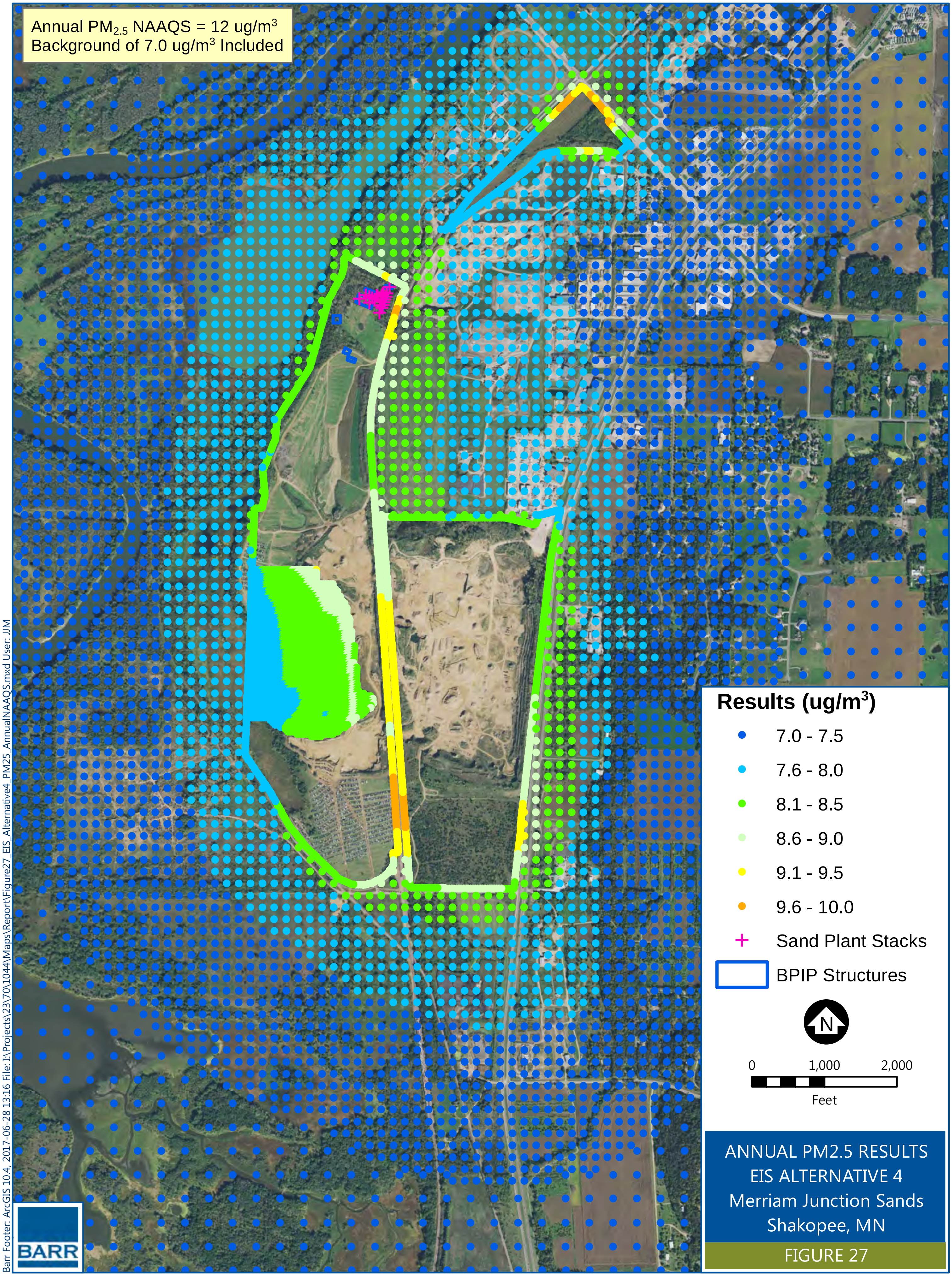
24-HOUR PM10 RESULTS
EIS ALTERNATIVE 4
Merriam Junction Sands
Shakopee, MN

FIGURE 24



Annual PM10 MAAQS = 50 ug/m3
Background of 14.6 ug/m3 Included
Results (ug/m3)
15 - 20
21 - 24
25 - 26
27 - 28
29 - 30
Sand Plant Stacks
BPIP Structures
N
0
1,000
2,000
Feet
ANNUAL PM10 RESULTS
EIS ALTERNATIVE 4
Merriam Junction Sands
Shakopee, MN
FIGURE 25
BARR


24-Hour $PM_{2.5}$ NAAQS = 35 ug/m^3
Background of 17.3 ug/m^3 Included
Results (ug/m^3)
17.4 - 18.0
18.1 - 20.0
20.1 - 22.0
22.1 - 24.0
24.1 - 26.0
26.1 - 28.1
Sand Plant Stacks
BPIP Structures
N
0
1,000
2,000
Feet
24-HOUR PM2.5 RESULTS
EIS ALTERNATIVE 4
Merriam Junction Sands
Shakopee, MN
FIGURE 26
BARR



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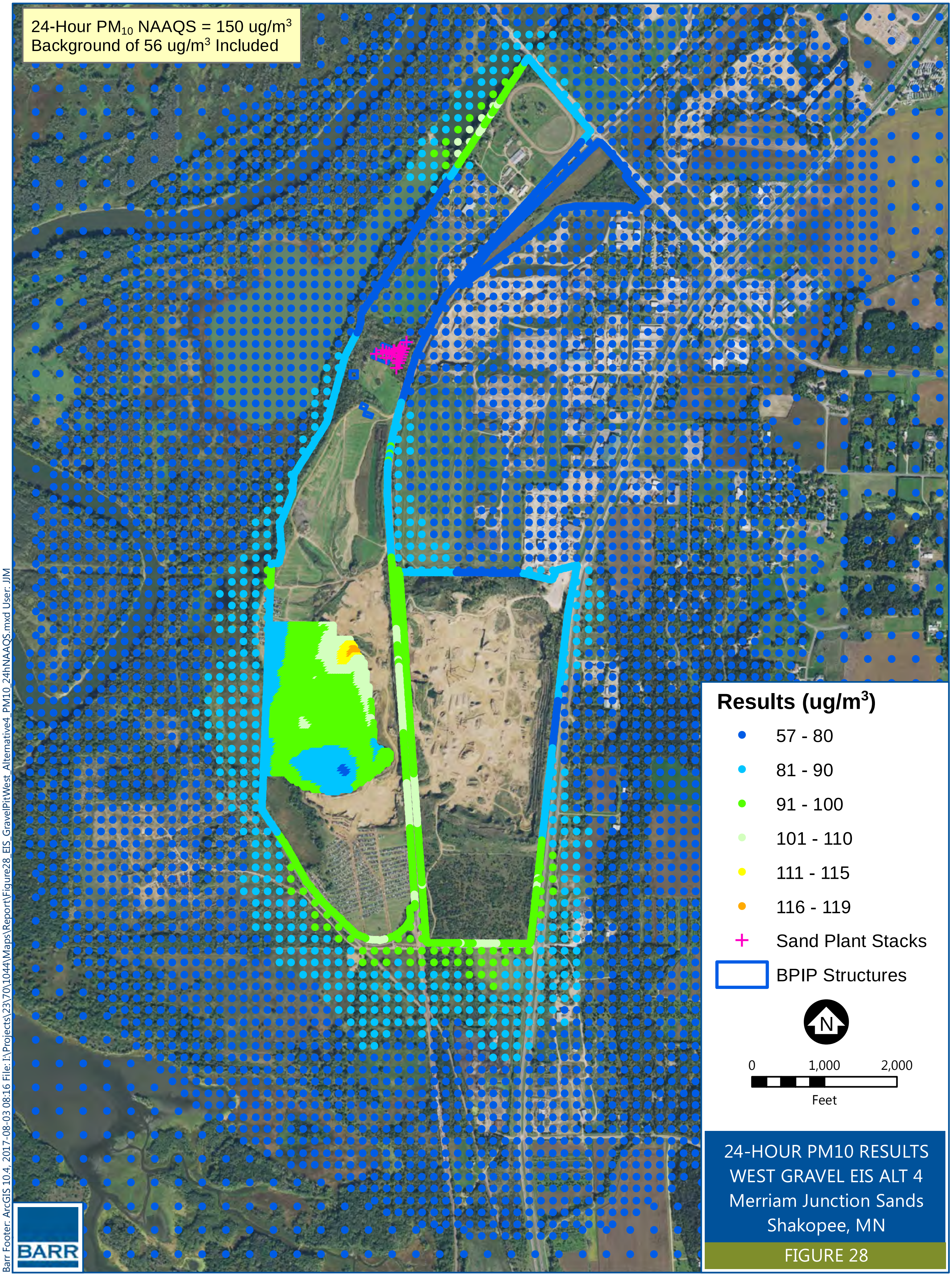
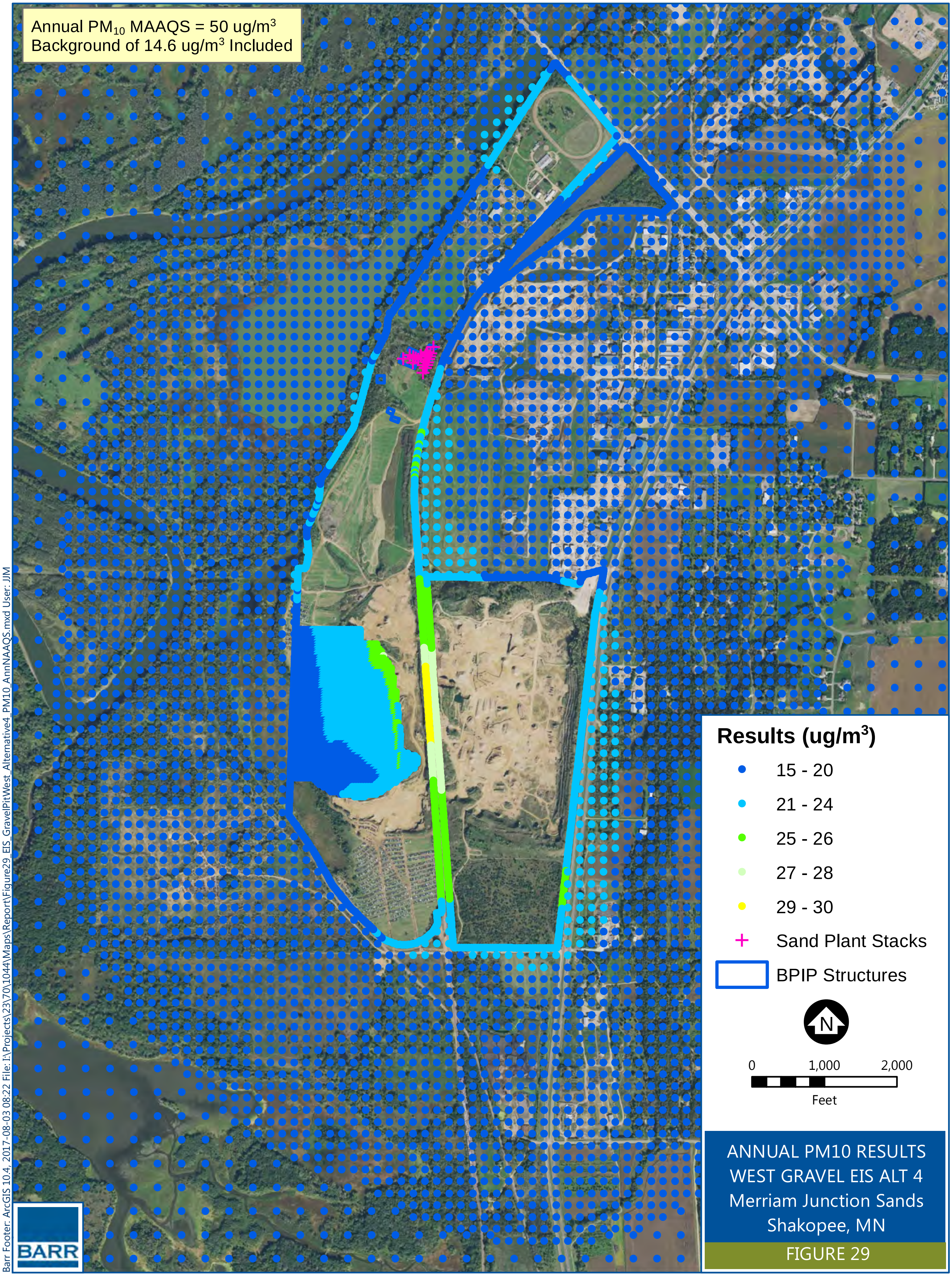
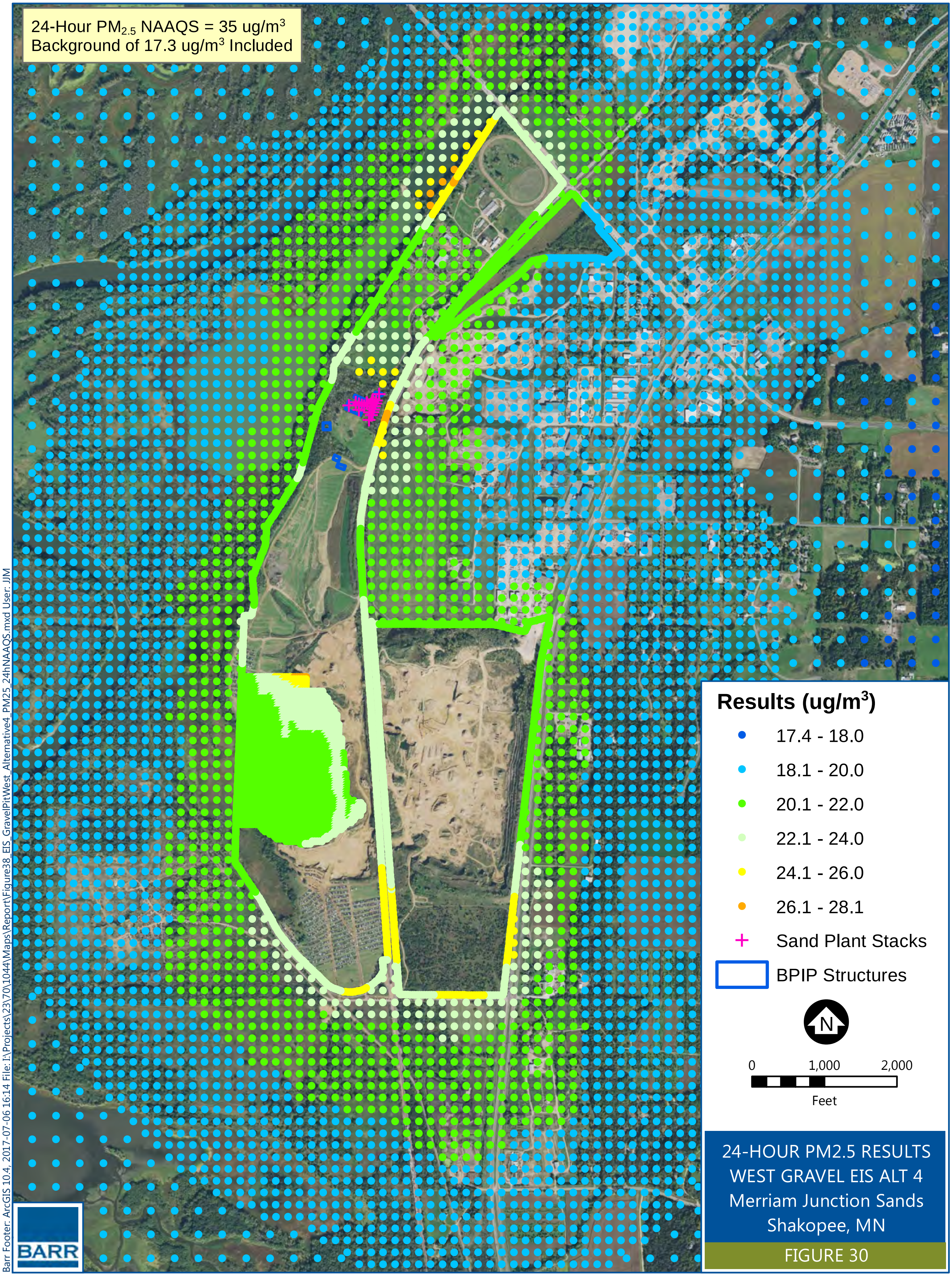

24-Hour PM10 NAAQS = 150 ug/m3
Background of 56 ug/m3 Included
Results (ug/m3)
57 - 80
81 - 90
91 - 100
101 - 110
111 - 115
116 - 119
Sand Plant Stacks
BPIP Structures
N
0
1,000
2,000
Feet
24-HOUR PM10 RESULTS
WEST GRAVEL EIS ALT 4
Merriam Junction Sands
Shakopee, MN
FIGURE 28
BARR



ANNUAL PM10 RESULTS
WEST GRAVEL EIS ALT 4
Merriam Junction Sands
Shakopee, MN

FIGURE 29

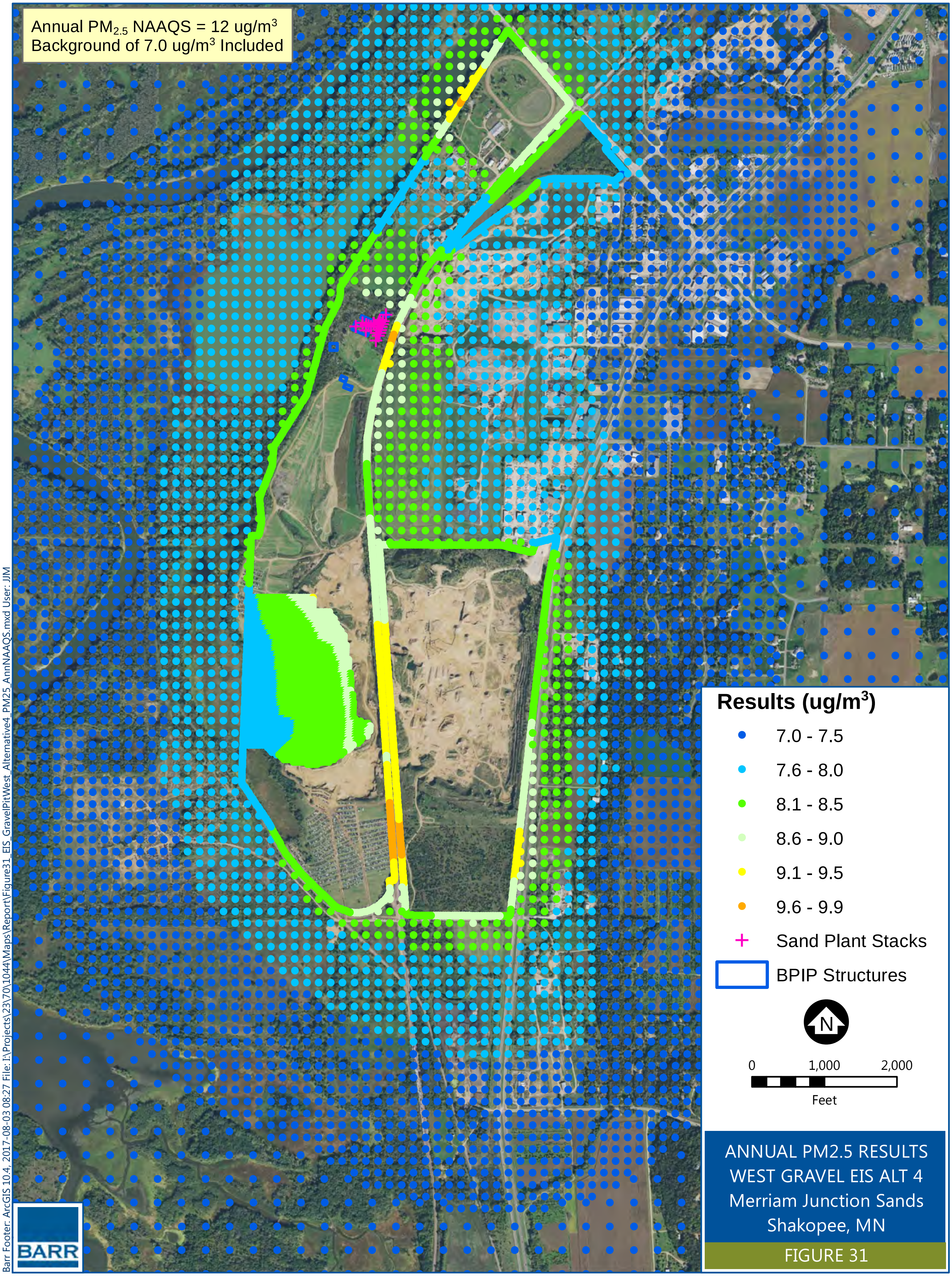
BARR

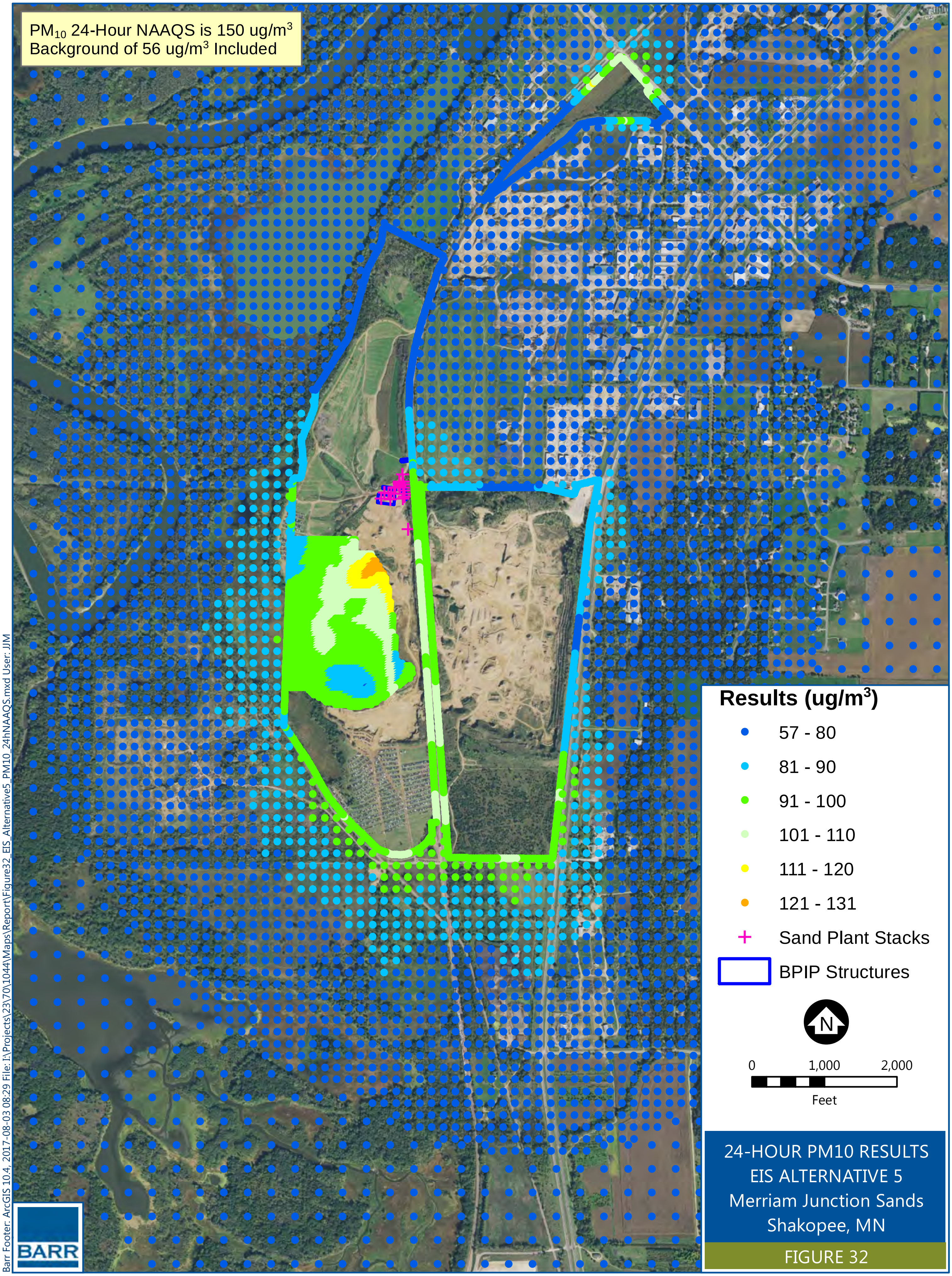


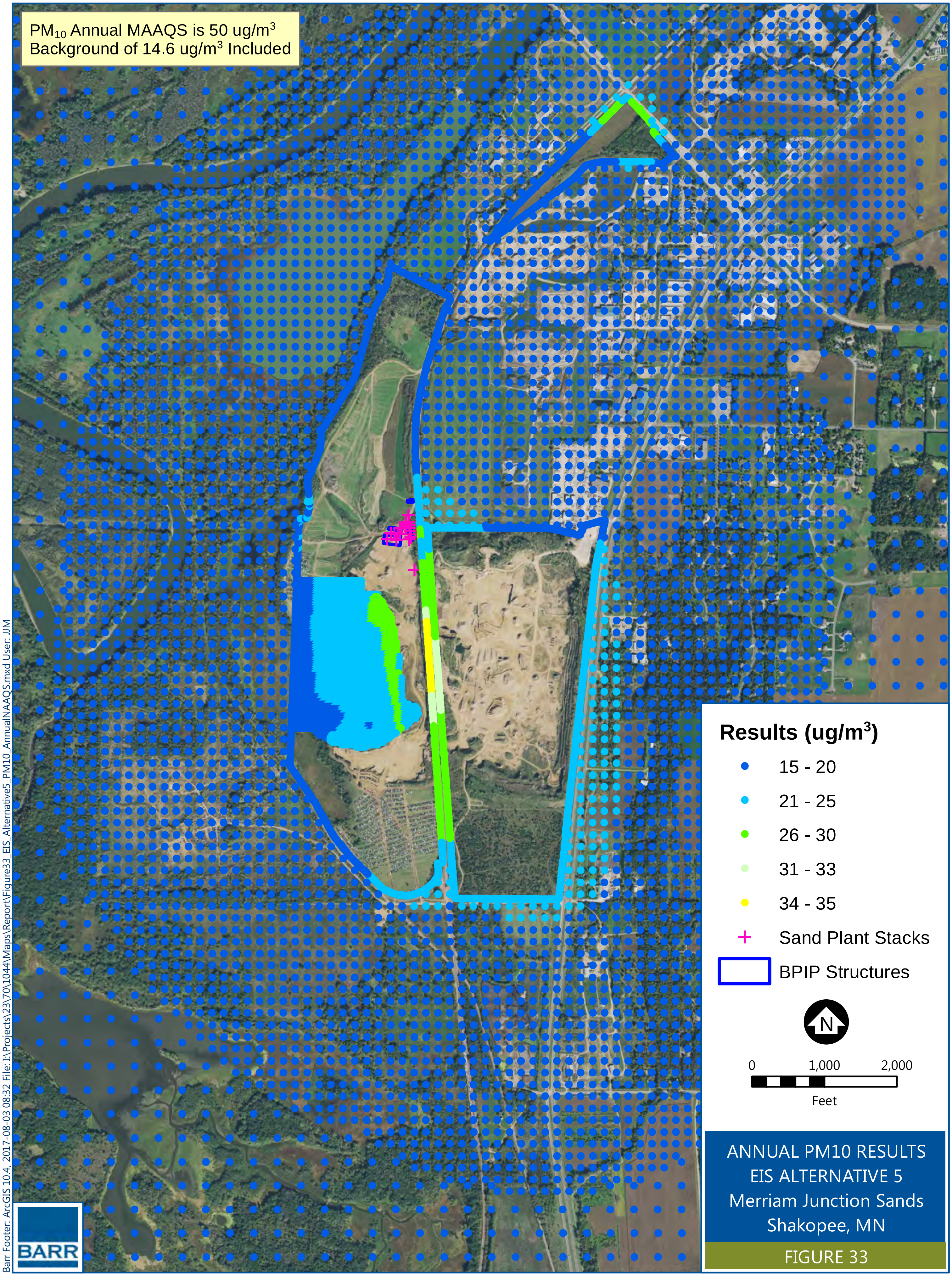
24-HOUR PM2.5 RESULTS
WEST GRAVEL EIS ALT 4
Merriam Junction Sands
Shakopee, MN

FIGURE 30

BARR

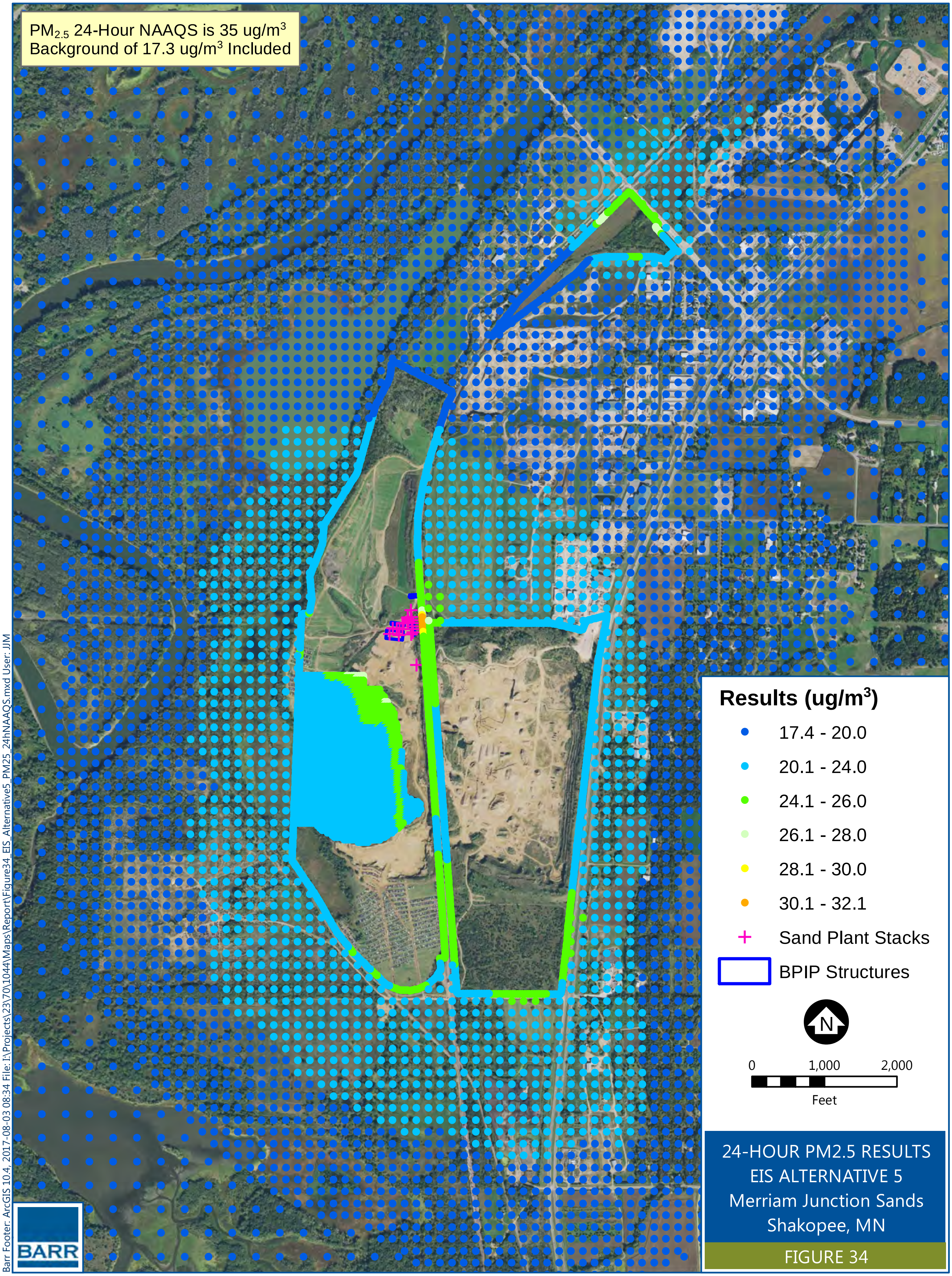

Annual PM2.5 NAAQS = 12 ug/m3
Background of 7.0 ug/m3 Included
Results (ug/m3)
7.0 - 7.5
7.6 - 8.0
8.1 - 8.5
8.6 - 9.0
9.1 - 9.5
9.6 - 9.9
Sand Plant Stacks
BPIP Structures
N
0
1,000
2,000
Feet
ANNUAL PM2.5 RESULTS
WEST GRAVEL EIS ALT 4
Merriam Junction Sands
Shakopee, MN
FIGURE 31
BARR


PM10 24-Hour NAAQS is 150 ug/m3
Background of 56 ug/m3 Included
Results (ug/m3)
57 - 80
81 - 90
91 - 100
101 - 110
111 - 120
121 - 131
Sand Plant Stacks
BPIP Structures
N
0
1,000
2,000
Feet
BARR
24-HOUR PM10 RESULTS
EIS ALTERNATIVE 5
Merriam Junction Sands
Shakopee, MN
FIGURE 32



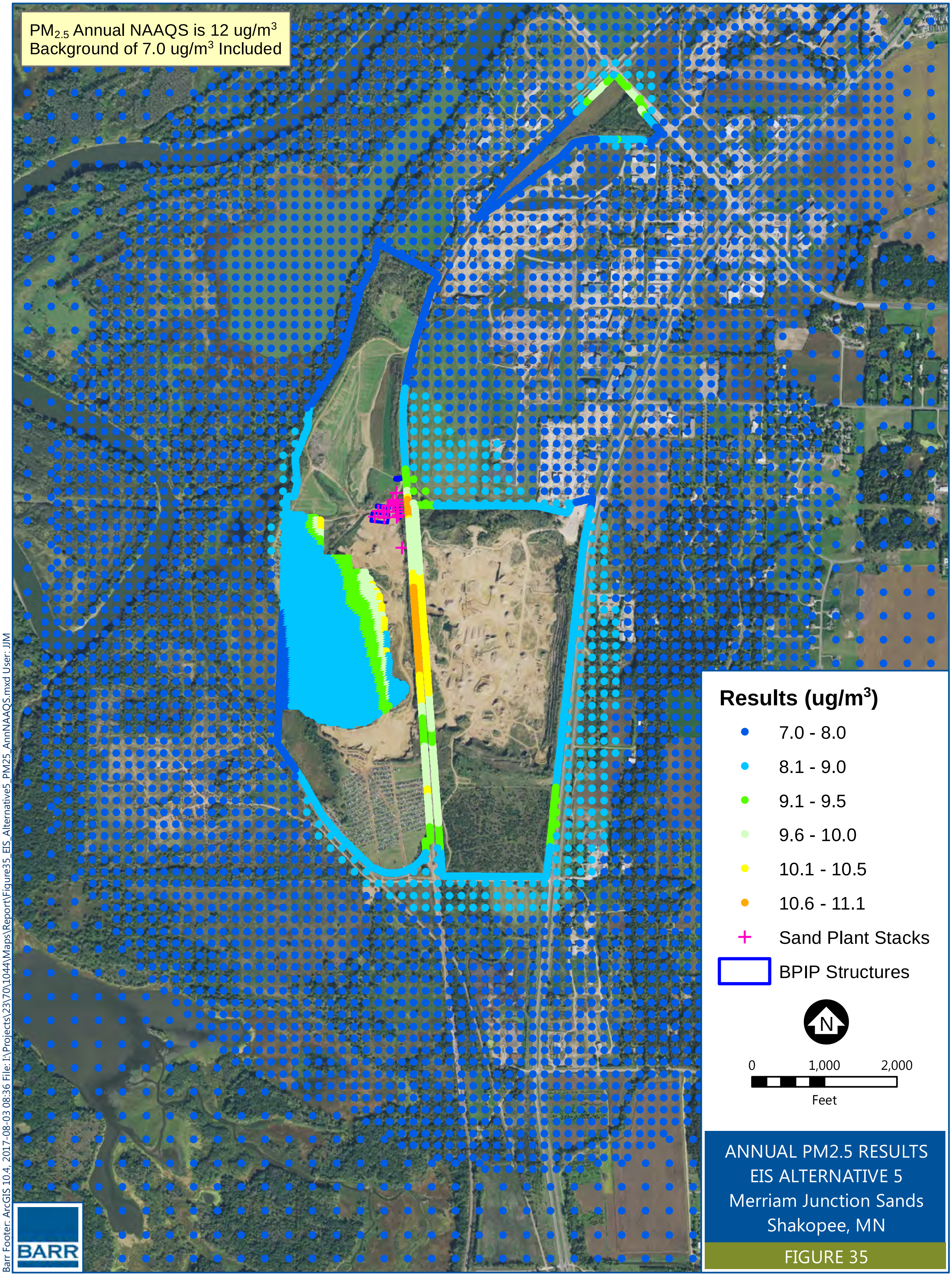
ANNUAL PM10 RESULTS
EIS ALTERNATIVE 5
Merriam Junction Sands
Shakopee, MN

FIGURE 33



24-HOUR PM2.5 RESULTS
EIS ALTERNATIVE 5
Merriam Junction Sands
Shakopee, MN

FIGURE 34



PM$_{2.5}$ Annual NAAQS is 12 ug/m^3
Background of 7.0 ug/m^3 Included
Results (ug/m^3)
7.0 - 8.0
8.1 - 9.0
9.1 - 9.5
9.6 - 10.0
10.1 - 10.5
10.6 - 11.1
Sand Plant Stacks
BPIP Structures
N
0
1,000
2,000
Feet
BARR
ANNUAL PM2.5 RESULTS
EIS ALTERNATIVE 5
Merriam Junction Sands
Shakopee, MN
FIGURE 35

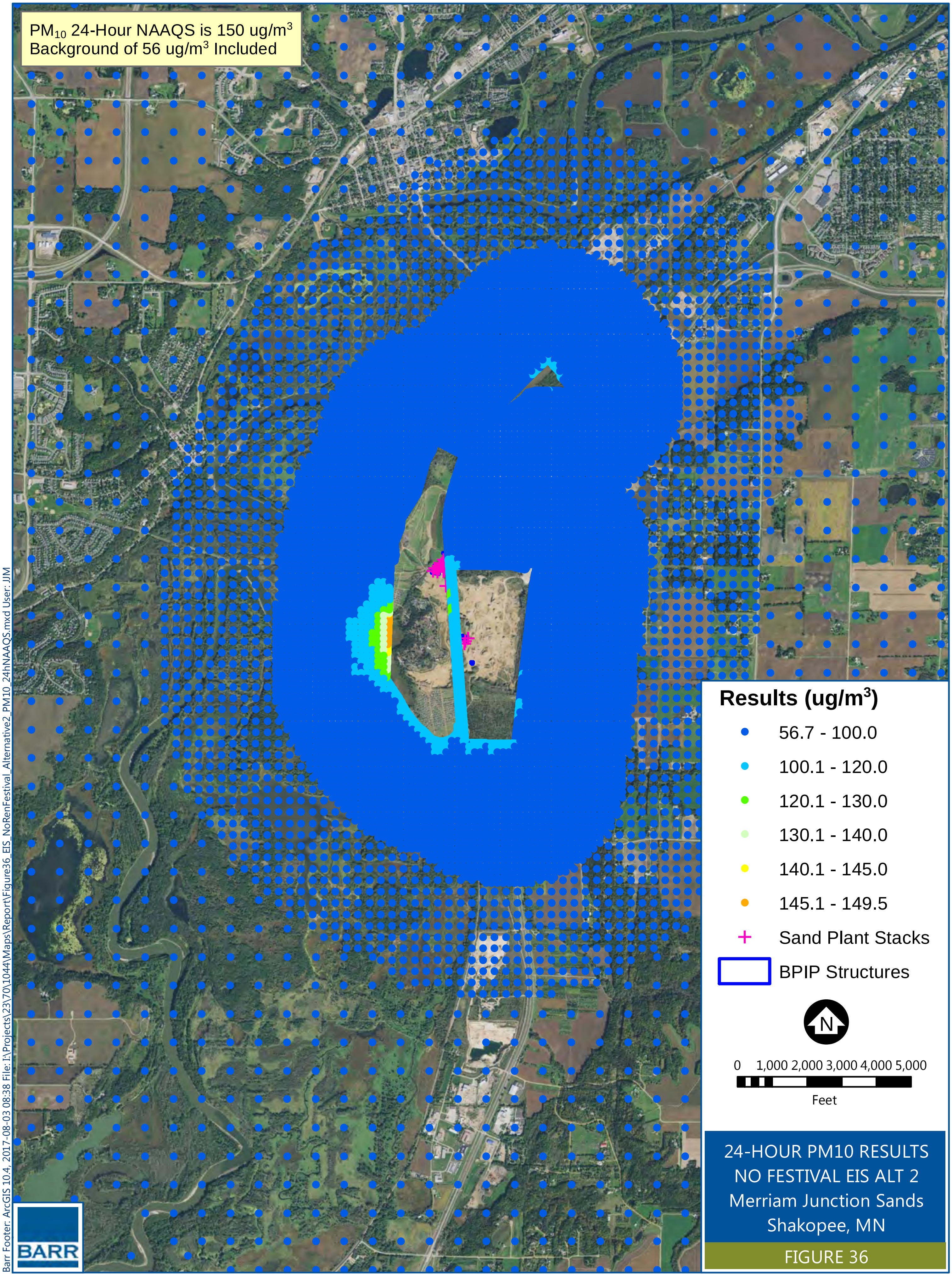
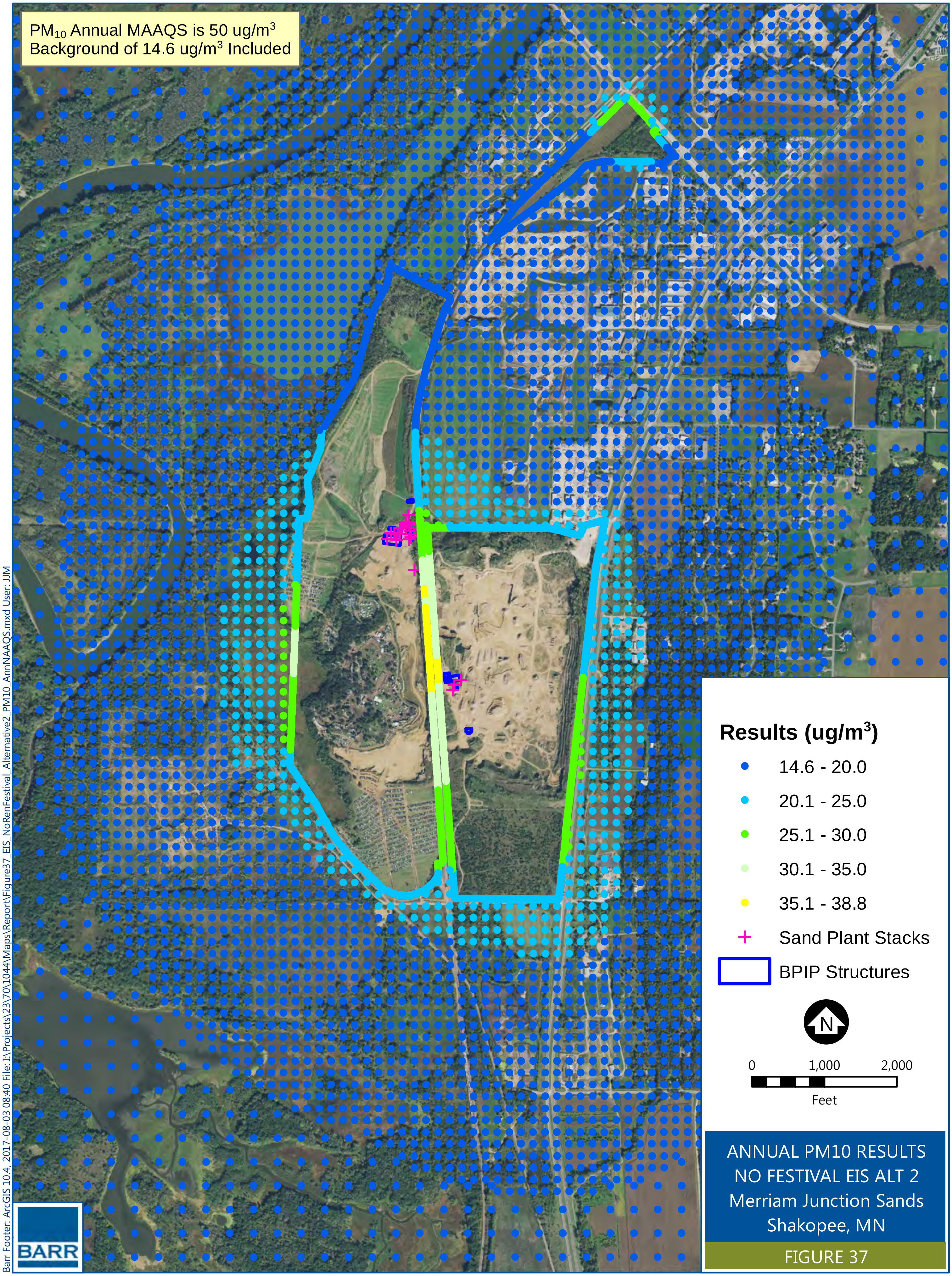
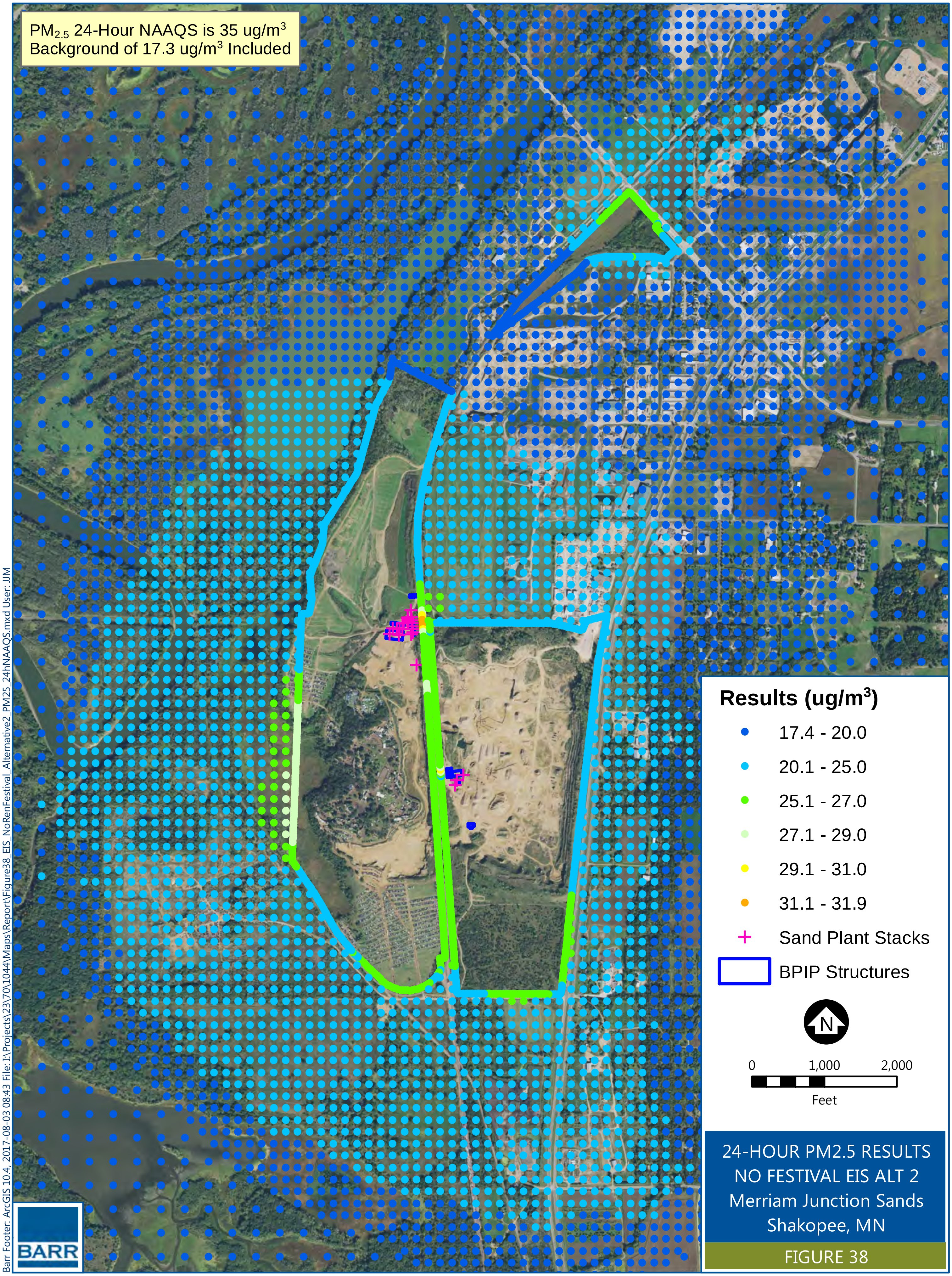

PM10 24-Hour NAAQS is 150 ug/m3
Background of 56 ug/m3 Included
Results (ug/m3)
56.7 - 100.0
100.1 - 120.0
120.1 - 130.0
130.1 - 140.0
140.1 - 145.0
145.1 - 149.5
Sand Plant Stacks
BPIP Structures
N
0 1,000 2,000 3,000 4,000 5,000
Feet
24-HOUR PM10 RESULTS
NO FESTIVAL EIS ALT 2
Merriam Junction Sands
Shakopee, MN
BARR

FIGURE 36



ANNUAL PM10 RESULTS
NO FESTIVAL EIS ALT 2
Merriam Junction Sands
Shakopee, MN

FIGURE 37



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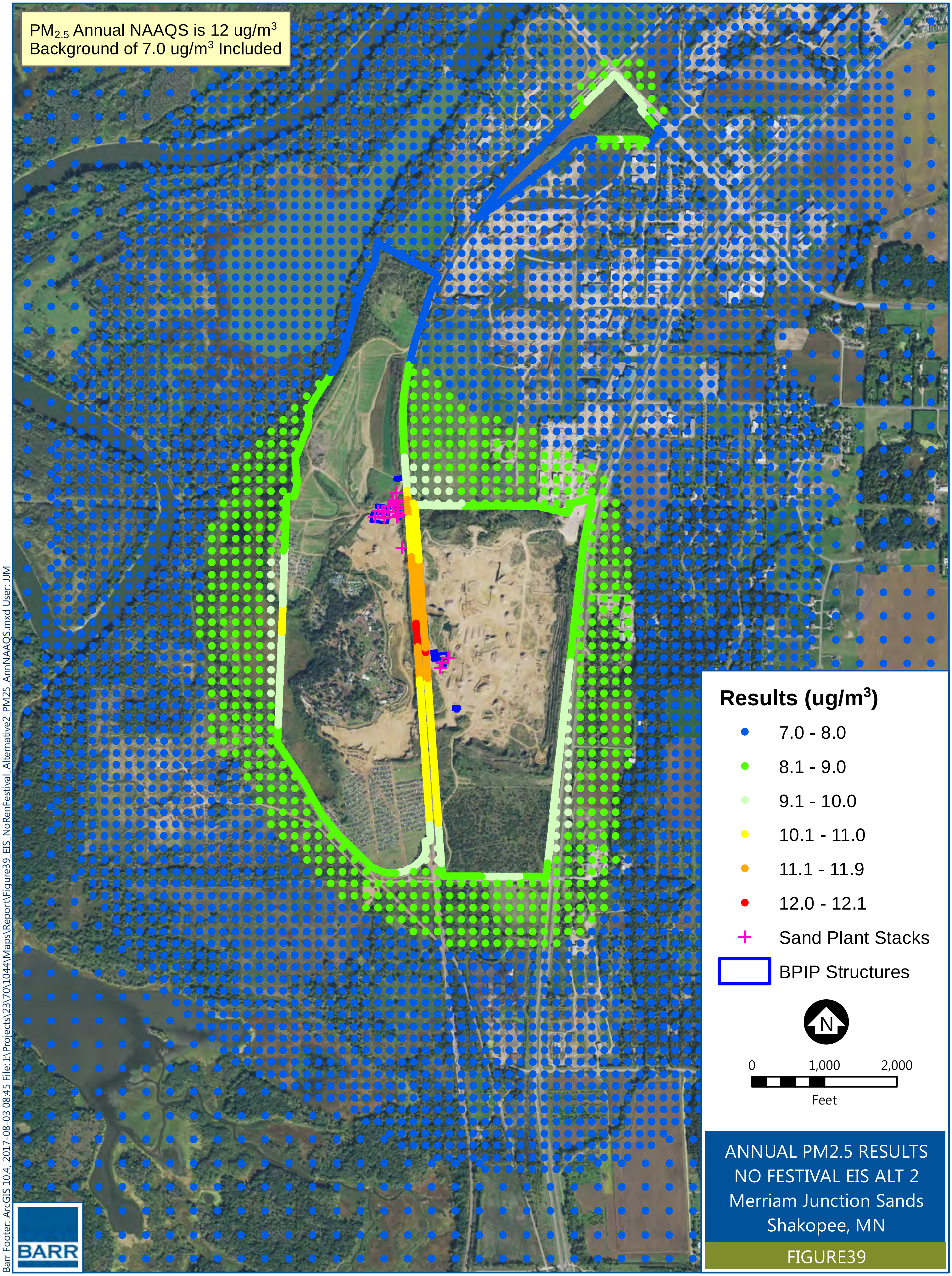
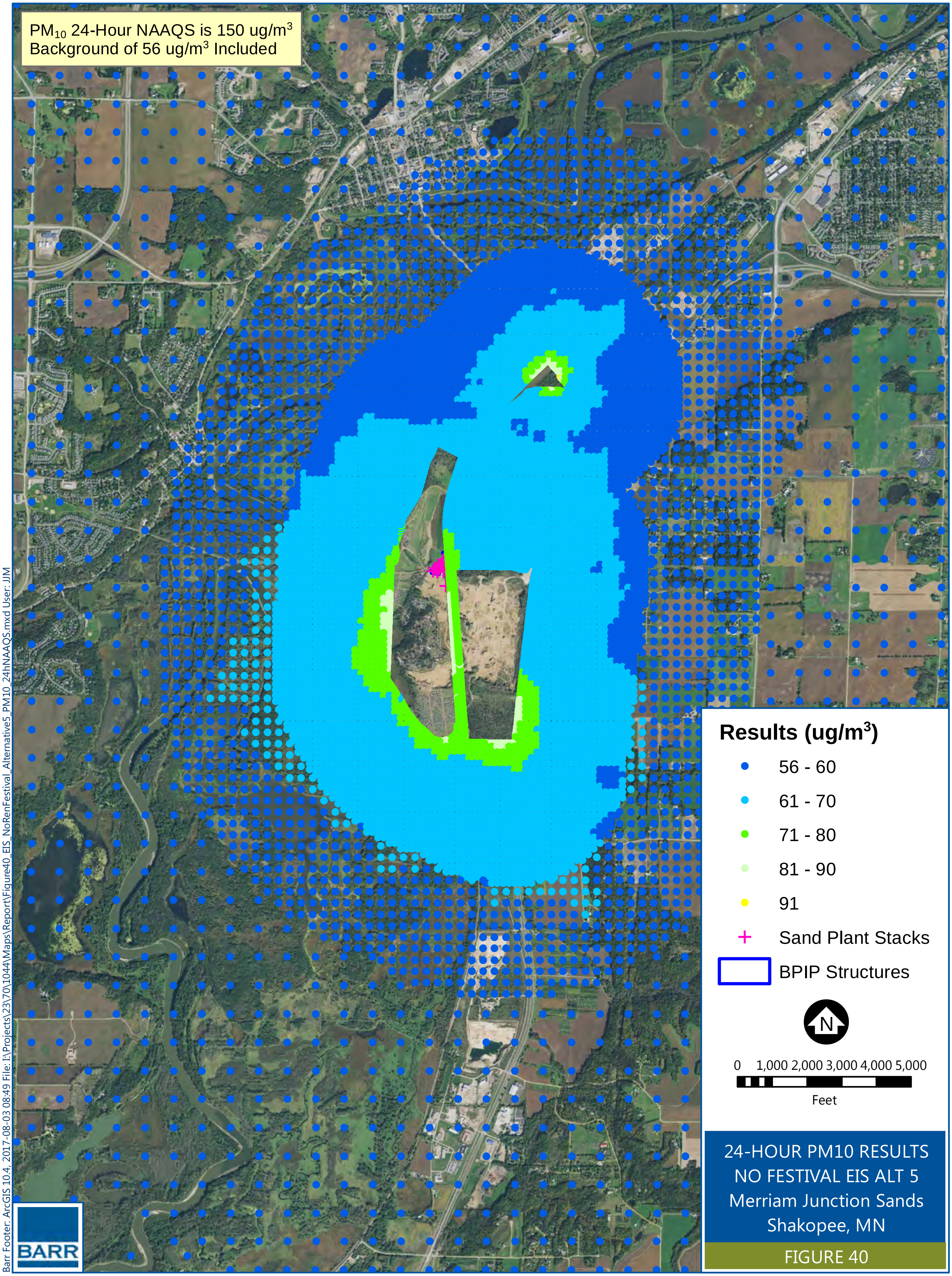


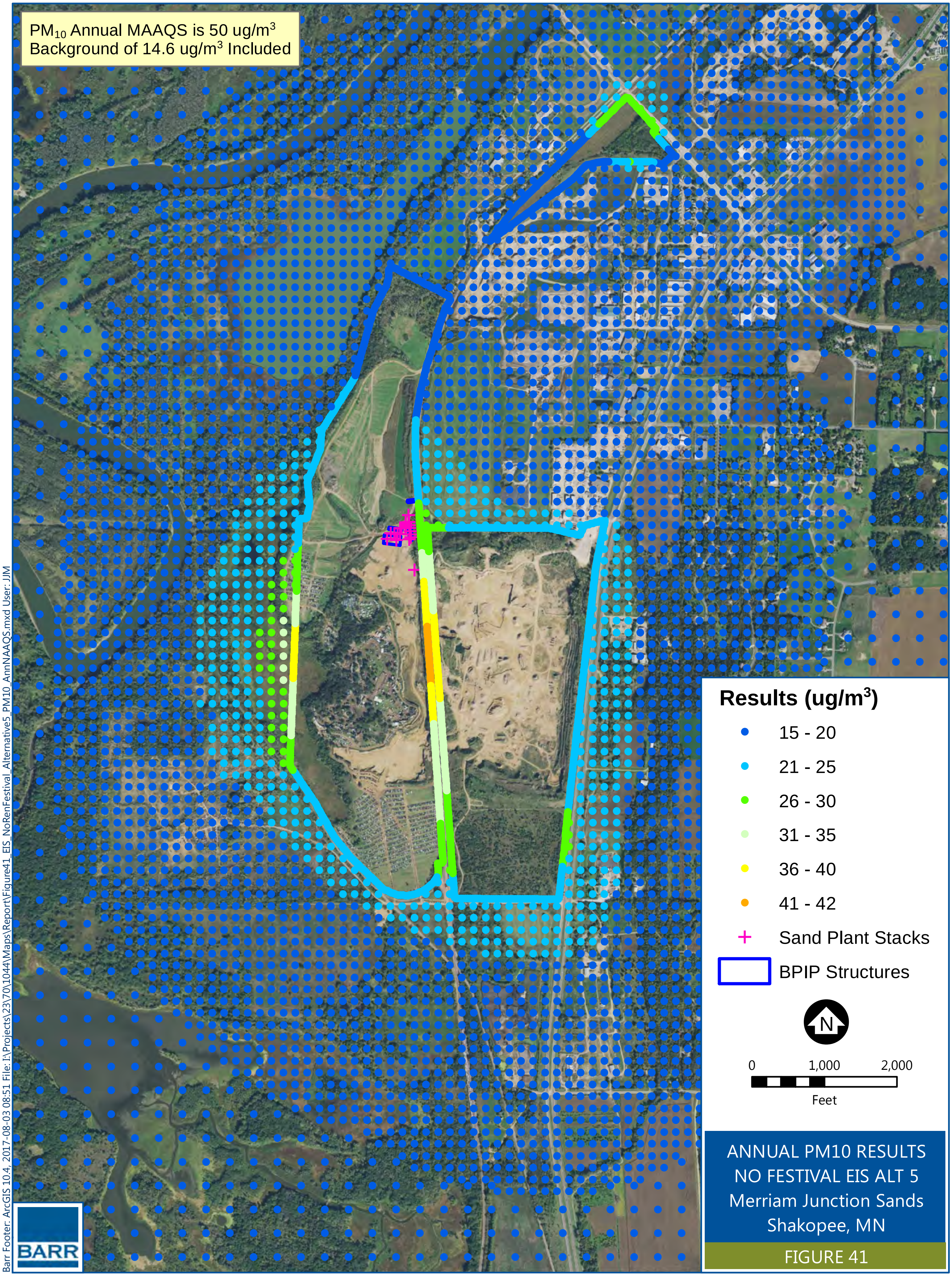
ANNUAL PM2.5 RESULTS
NO FESTIVAL EIS ALT 2
Merriam Junction Sands
Shakopee, MN

FIGURE39

Barr Footer: ArcGIS 10.4, 2017-08-03 08:45 File: I:\Projects\23\70\1044\Maps\Report\Figure39_EIS_NoRenFestival_Alternative2_PM25_AnnNAAQS.mxd User: JJM

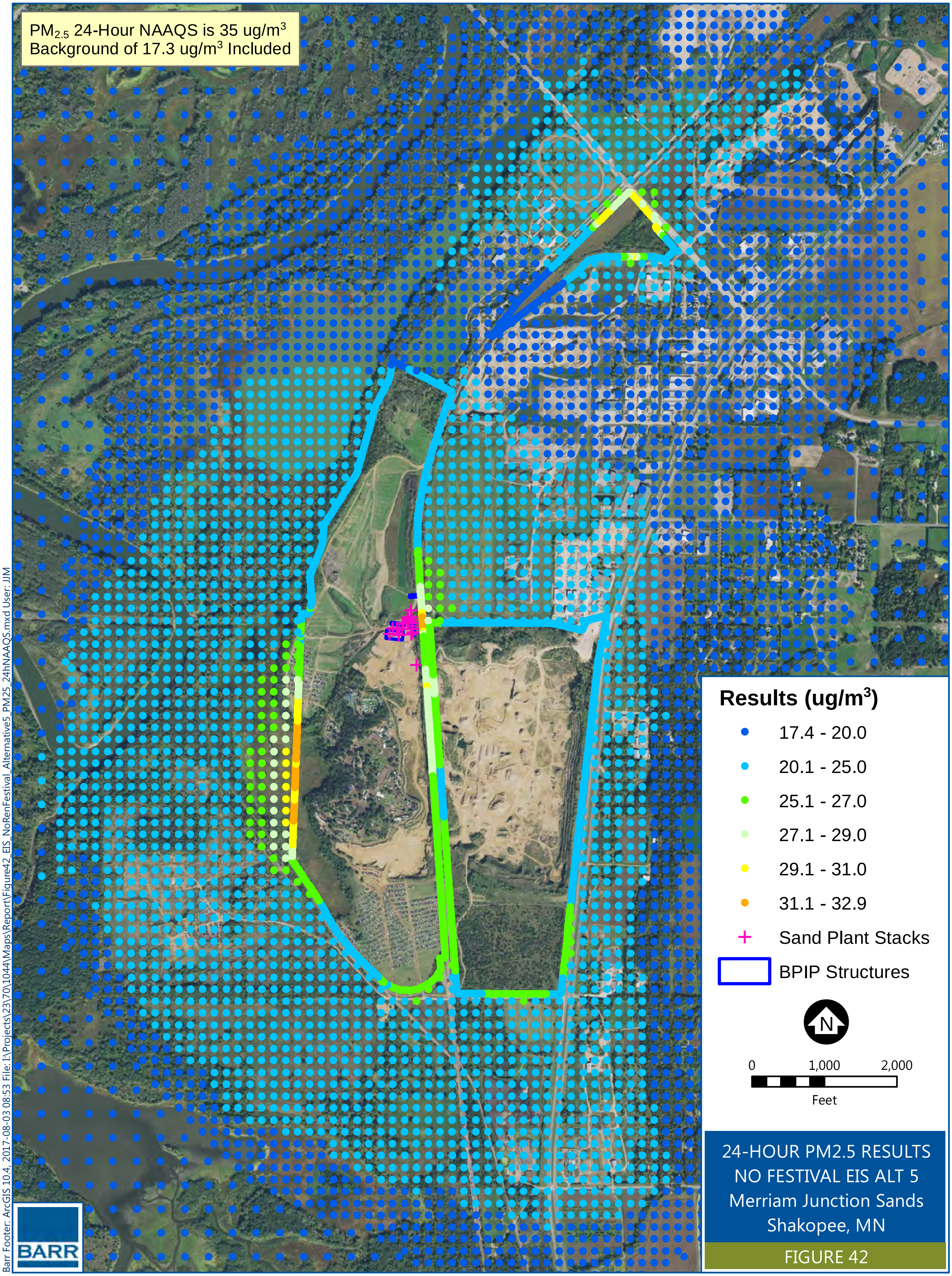


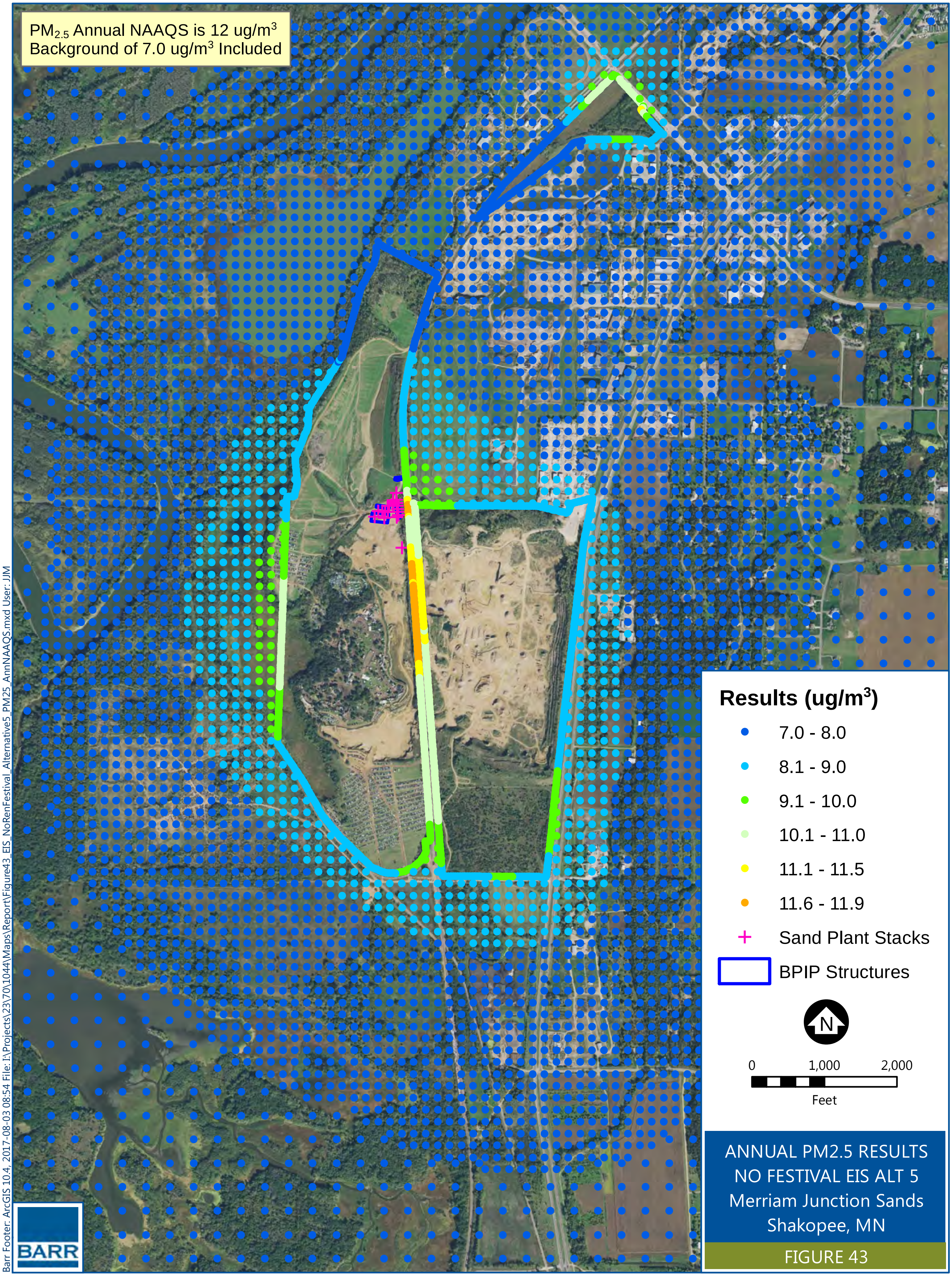
PM10 24-Hour NAAQS is 150 ug/m3
Background of 56 ug/m3 Included
Results (ug/m3)
56 - 60
61 - 70
71 - 80
81 - 90
91
Sand Plant Stacks
BPIP Structures
N
0 1,000 2,000 3,000 4,000 5,000
Feet
BARR
24-HOUR PM10 RESULTS
NO FESTIVAL EIS ALT 5
Merriam Junction Sands
Shakopee, MN
FIGURE 40

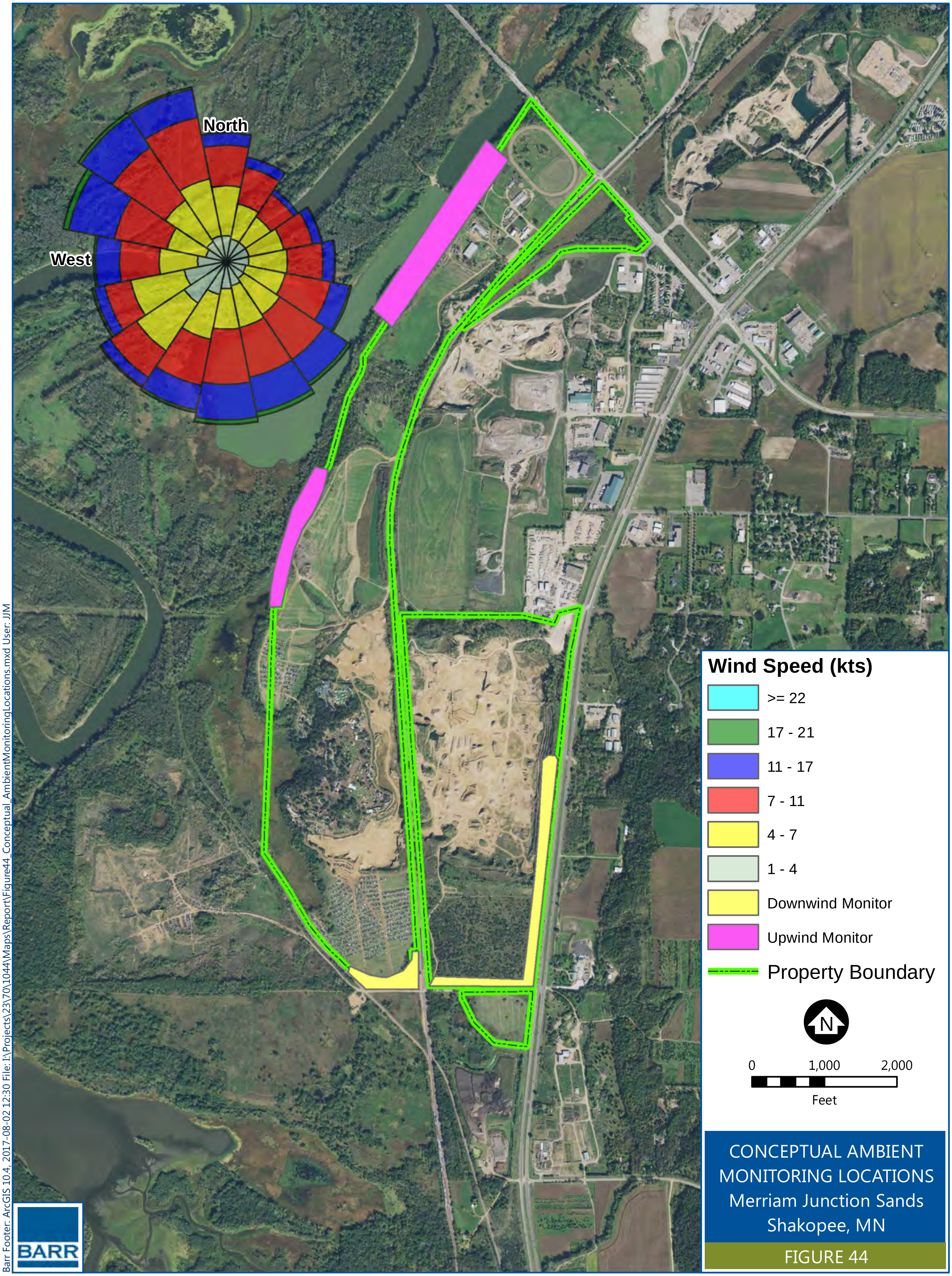


ANNUAL PM10 RESULTS
NO FESTIVAL EIS ALT 5
Merriam Junction Sands
Shakopee, MN

FIGURE 41


PM2.5 24-Hour NAAQS is 35 ug/m3
Background of 17.3 ug/m3 Included
Results (ug/m3)
17.4 - 20.0
20.1 - 25.0
25.1 - 27.0
27.1 - 29.0
29.1 - 31.0
31.1 - 32.9
Sand Plant Stacks
BPIP Structures
N
0
1,000
2,000
Feet
24-HOUR PM2.5 RESULTS
NO FESTIVAL EIS ALT 5
Merriam Junction Sands
Shakopee, MN
FIGURE 42
BARR


PM2.5 Annual NAAQS is 12 ug/m3
Background of 7.0 ug/m3 Included
Results (ug/m3)
7.0 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
11.1 - 11.5
11.6 - 11.9
Sand Plant Stacks
BPIP Structures
N
0
1,000
2,000
Feet
ANNUAL PM2.5 RESULTS
NO FESTIVAL EIS ALT 5
Merriam Junction Sands
Shakopee, MN
FIGURE 43
BARR


North
West
Wind Speed (kts)
>= 22
17 - 21
11 - 17
7 - 11
4 - 7
1 - 4
Downwind Monitor
Upwind Monitor
Property Boundary
N
0
1,000
2,000
Feet
CONCEPTUAL AMBIENT MONITORING LOCATIONS
Merriam Junction Sands
Shakopee, MN
FIGURE 44
BARR