Addendum 1 to Maryland's Air Monitoring Network Plan 2017
Monitoring to meet $SO_2$ Data Requirements Rule

## 1. Introduction

On August 10, 2015, the U.S. Environmental Protection Agency finalized requirements to monitor or model ambient sulfur dioxide ($SO_2$) levels in areas with large sources of $SO_2$ emissions to help implement the 1-hour $SO_2$ National Air Ambient Quality Standard (NAAQS). This rule is known as the Data Requirements Rule or the $SO_2$ DRR. The final rule establishes that states, local, and tribal agencies must characterize air quality around sources that emit 2,000 tons per year (tpy) or more of $SO_2$. Sources may avoid the requirement for air quality characterization near a source by adopting enforceable emission limits that ensure that the source will not emit more than 2,000 tpy of $SO_2$. The final rule gives agencies and sources the flexibility to characterize air quality using either modeling of actual source emissions or using appropriately sited ambient air quality monitors. Modeling and monitoring are both appropriate ways to assess local $SO_2$ concentrations, and this flexibility allows agencies to work with the sources to select a cost-effective approach that adequately characterizes each required area. The rule also establishes a timeline for implementation of both the monitoring and modeling approaches. By January 15, 2016, each air agency is required to submit to the relevant EPA Regional Administrator a final list identifying the sources in the state around which $SO_2$ air quality is to be characterized. The list must include sources with emissions above 2,000 tpy of $SO_2$. On January 5, 2016 Maryland Department of the Environment (MDE) submitted to EPA Region III a letter listing all applicable facilities within the State of Maryland. By July 1, 2016, each air agency is required to identify, for each source area on the list, the approach (ambient monitoring or air quality modeling) it will use to characterize air quality. In lieu of characterizing areas around listed 2,000 tpy or larger sources, air agencies may indicate by July 1, 2016 that they will adopt enforceable emissions limitations that will limit those sources' emissions to below 2,000 tpy. For source areas that are to be evaluated through ambient monitoring, the air agency must submit relevant information concerning monitoring sites to the EPA Regional Administrator by July 1, 2016. This addendum to the MDE Annual Air Monitoring Network Plan for 2017 includes the air monitoring plan for Verso Luke Mill, the one facility in Maryland that is choosing to do air monitoring, in accordance with the EPA's monitoring requirements specified in 40 CFR Part 58.

**Table 1. Maryland Facility that has proposed monitoring to demonstrate compliance with the $SO_2$ DRR.**

| Facility Name | CAMD $SO_2$ (tons) | MDE Data System (TEMPO) $SO_2$ (tons) |
|---|---|---|
| Verso Luke Mill | N/A | 16,999.39 |

## 2. Primary Quality Assurance Organization and Data Quality Review

To implement the $SO_2$ DRR and to ensure that the data collected, reviewed, validated, and certified are consistent with the requirements of 40 CFR Part 58 Appendix A, MDE and Verso Luke Mill, the facility collecting the data, will have to properly define and structure the relationship between MDE's Ambient Air Monitoring Program, the facility's management and environmental infrastructure, the monitoring data collection personnel, and the data quality certifying procedures employed by the facility. These proposed monitoring sites will be part of the Maryland Air Monitoring Network Plan for a minimum of three years beyond the required January 1, 2017 start date. All monitoring, storing, evaluating, reporting, validating, and certifying procedures associated with these sites must meet the same regulatory regimen as all other sites in the Maryland Air Monitoring Network and must be described in and consistent with the MDE $SO_2$ Air Monitoring Quality Assurance Project Plan (QAPP). These monitoring sites will essentially be operated as State or Local air Monitoring Station (SLAMS) monitors and to this end MDE defines the functional requirements of the Quality System for these monitors as follows:

*Primary Quality Assurance Organization* –MDE will be the Primary Quality Assurance Organization (PQAO) for these monitoring sites. 40 CFR Part 58 Appendix A Section 1.2 states that the PQAO is "responsible for a set of stations that monitors the same pollutant and for which data quality assessments will be pooled. Each criteria pollutant sampler/monitor must be associated with only one PQAO." Each site installed to meet the monitoring requirements of the $SO_2$ DRR will be included in the Maryland $SO_2$ QAPP and Air Monitoring Network Plan. MDE will provide oversight in the form of Annual Performance Evaluations and will work with EPA to perform the necessary Technical Systems Audits and ensure that each site is included in the EPA TTP audit program. MDE will also include the data generated from these sites in the data certification submitted to EPA annually.

*Monitoring Organization* – Verso Luke Mill will be the monitoring organization and will be responsible for operating the monitoring sites. Verso Luke Mill will collect, review, report, validate, and certify their data and submit to MDE verification that the data were properly certified. Verso Luke Mill will also be required to perform, record, store, and report to MDE all quality assurance activities performed. The QA activities will be outlined in an independent QAPP document that will be submitted by the Verso Luke Mill and incorporated into the MDE $SO_2$ QAPP. Verso Luke Mill will be expected to operate the monitoring site, perform all maintenance, perform routine QA procedures, and perform calibrations.

## 3. Monitoring Proposals and Siting

The following sections contain the detailed proposal and justification for the monitor siting decisions.

# Results of Preliminary Modeling Analysis to Support the Locations of Candidate Ambient $SO_2$ Monitor Locations for the Verso Luke Mill

This appendix provides a general description of the methodology used and the results obtained for the preliminary dispersion modeling analysis that was used to support the identification of the candidate ambient $SO_2$ monitor locations in the vicinity of the Verso Luke Mill. The Mill is located approximately 30 kilometers southwest of Cumberland, MD along the Potomac River and spans three counties and two states (Allegany and Garrett counties in Maryland and Mineral County, West Virginia). The Mill's primary sources of $SO_2$ emissions are located on the Maryland side of the Potomac River.

The methodology that was followed to conduct this modeling analysis is summarized below and includes the following steps:

- Based upon initial modeling, the AERMOD model was run using a reduced receptor grid that covered the areas in the vicinity of the mill that were determined to include the areas with the highest SO2 impacts.
- The model output was analyzed following the steps outlined in Appendix A of the USEPA monitoring TAD[1]. These steps focus upon first identifying the "top 200 receptors" based upon peak daily 1-hour maximum predicted concentrations. Then these candidate receptors are subsequently each given a score based upon the magnitude and frequency of their predicted peak daily 1-hour maximum concentrations.
- The analyses provided below include an evaluation of modeled design value (DV[2]) spatial distributions in combination with the frequency of 1-hour daily maxima predicted by AERMOD using the MAXDAILY output option.

In accordance with Appendix A of the EPA Monitoring TAD, the sections below describe the steps that were followed to obtain a prioritized list of receptor locations for consideration as candidate monitor location sites using modeled receptor DVs and frequency of receptors having the 1-hour daily maximum concentration among the top 200 DV receptors. This analysis also takes into account whether the potential monitor locations are logistically feasible based on local topography, availability of electric power and land ownership. Final justification for preferred monitoring locations will require ground reconnaissance review of candidate sites.

The modeling procedures that were employed generally follow the guidance provided in the USEPA Modeling TAD[3]. AERMOD was applied using default options and an emissions profile for the Mill that is representative of combination of current and future allowable emission rates.

The approach that was used to select the emission rates used for the preliminary dispersion modeling will ensure the monitors are placed in the correct location (according to the model) in order capture maximum $SO_2$ exposure starting in January 2017. The modeling was performed using the historical meteorological multi-tower database used for the Luke Mill AERMOD Evaluations. This data, however, was reprocessed using up-to-date model versions and executables.

1 http://www3.epa.gov/airquality/sulfurdioxide/pdfs/SO2MonitoringTAD.pdf

2 The design value is the 99$^{th}$ percentile peak daily 1-hour maximum concentration averaged over the years modeled, computed at each model receptor.

3 https://www3.epa.gov/airquality/sulfurdioxide/pdfs/SO2ModelingTAD.pdf

The methodology that was used to identify the candidate monitor locations is described in the following steps.

**Step 1: Determining and Ranking Maximum Design Value Locations**

The AERMOD model (Version 15181) was run with default options for all receptors shown in Figure 1 and 2. The "ambient air boundary" that was used with this preliminary modeling evaluation is shown on Figures 1 and 2 as a purple line. This boundary corresponds to the Mill's property boundary around the main operating areas of the Mill and support facilities on the Maryland side of the Potomac River. It also corresponds to the property boundary where access is controlled on the West Virginia side of the river in areas to the southwest and southeast of the Mill. The ambient air boundary south of the mill was drawn within mill property to be conservative. The basis for modeled emission rates are noted above and have been normalized in accordance with the monitoring TAD.

The first step in the monitor siting process was to account for the location of receptors with the highest magnitude of impacts. The receptors with the maximum design values (DVs, the 99th percentile peak daily 1-hour maximum concentrations averaged over the years modeled) over the entire modeling domain were ranked. Table 1 shows the top 20 DV receptors ranked from highest (highest DV = rank 1) to lowest (lowest DV = rank 20). To prioritize the receptors to be evaluated for potentially establishing the location of an ambient $SO_2$ monitor, the top 200 DV receptors identified from this step and shown in Figures 3 and 4 were ranked and analyzed, as recommended by the Monitoring TAD, Appendix A.

**Step 2: Determining Frequency of Occurrence of Concentration Maxima**

The next step in the analysis is designed to account for the frequency in which the top 200 DV receptors identified in Step 1 have daily maximum 1-hour $SO_2$ concentrations. To assess the frequency of occurrence of concentration maxima at the top 200 DV receptors, the MAXDAILY option in AERMOD was used, which outputs the maximum 1-hour concentration for each receptor for each day of the model simulation. This output was used to determine the number of days for which each of the top 200 DV receptors was the overall highest 1-hour concentration for the day for the three modeled years. Table 2 shows the top 20 receptors' frequency of days ranked from highest (highest number of days = rank 1) to lowest (lowest number of days frequency = rank 20).

**Step 3: Scoring of Maximum DVs and Frequency of Occurrence of Concentration Maxima**

The final step in the analysis consisted of creating a prioritized list of receptor locations for consideration of candidate ambient $SO_2$ monitoring sites by using the receptor-by-receptor DVs and frequency of having the 1-hour daily maximum concentration among the top 200 DV receptors.

Table 3 provides the top 20 results of the score ranking used to generate a list of receptor locations, ranked in general order of desirability with regard to potential new ambient $SO_2$ monitor(s). Figures 5 through 9 show the receptors ranked by "Score", reflecting rankings of maximum DV and frequency of having the 1-hour daily maxima amongst the top 200 DV receptors. Lower numerical values of "Score1" indicate higher probabilities of experiencing peak 1-hour $SO_2$ concentrations. Figure 5 shows an overall depiction and Figures 6 through 9 are focused on five potential areas of interest. These areas of interested are highlighted yellow in Figure 5.

Area 1 (as labeled in Figure 5) is located to the east of the Mill's major $SO_2$ sources and includes:

1. 2 of the top 10 and 5 of the top 20 modeled DV values as shown in Figure 4.
2. 9 of the top 20 receptors ranked by DV and frequency as shown in Figure 6. The highest score ranked location is 1.

Area 2 (as labeled in Figure 5) is located to the south-southwest of the Mill and includes:

1. 5 of the top 10 and 10 of the top 20 modeled DV values as shown in Figure 4.
2. 2 of the top 10 and 4 of the top 20 receptors ranked by DV and frequency as shown in Figure 7. The highest score ranked location is 4.

Area 3 (as labeled in Figure 5) is located to the southeast of the Mill and includes:

1. 1 of the top 10 and 1 of the top 20 modeled DV values as shown in Figure 4.
2. 2 of the top 10 and 2 of the top 20 receptors ranked by DV and frequency as shown in Figure 8. The highest score ranked location is 6.

Area 4 (as labeled in Figure 5) is located to the east-southeast of the Mill and includes:

1. 0 of the top 10 and 0 of the top 20 modeled DV values as shown in Figure 4.
2. 1 of the top 10 and 4 of the top 20 receptors ranked by DV and frequency as shown in Figure 8. The highest score ranked location is 3.

Area 5 (as labeled in Figure 5) is located to the north the Mill and includes:

1. 2 of the top 10 and 4 of the top 20 modeled DV values as shown in Figure 4.
2. 0 of the top 10 and 1 of the top 20 receptors ranked by DV and frequency as shown in Figure 6. The highest score ranked location is 19.

**Site Access**

Areas 1, 2, 3, and 5 generally have good site access in terms of locating and servicing a monitor. Area 4, however, is located in a very inaccessible place. The terrain has an extremely sharp gradient, rising over 1000 feet in just over 250 meters.

**Analysis Conclusions**

This preliminary analysis was used to identify the candidate monitor locations that are most likely to be most impacted by $SO_2$ emissions discharged from Luke Mill sources. The dispersion modeling has been conducted using AERMOD, consistent with guidance provided in EPA's $SO_2$ monitoring TAD. The modeling involved the use of the Mill's future allowable emission profile in order to ensure proper placement on the monitors based on how the Mill will be operating in the future.

The procedures recommended by the monitoring TAD involved the identification of the top 200 receptors according to the predicted design values. These receptors were then ranked according to the magnitudes and the frequencies of the predicted concentrations.

The modeling identified five potential areas of consideration for candidate monitor locations as shown in Figure 5. One monitor would be placed in the vicinity of the receptor marked with a score rank of 2 (see Figure 6) within Area 1. This location is preferred over the over receptors in this same general area with score ranks of 1, 7, 8, 9 and 10 because the model does not know there is a large physical terrain feature directly between the source and these receptor locations. In reality, this terrain feature makes it unreasonable to expect that the plume from the Mill's $SO_2$ emission units will be directly transported to these receptor locations in the fashion predicted by the model.

A second monitor would be placed in Area 2 in the vicinity of the receptor marked with a score rank of 4 (see Figure 7), and a third monitor would be placed in Area 5 in the vicinity of receptor marked with a score rank 19 (see Figure 6). Area 5 is lower on the score rank compared to other areas, but it is closer to populated areas than other candidate locations, and moreover 4 of the top 20 ranked modeled DV values are within this area.

No monitors are proposed to be placed in either Areas 3 or 4. In order to characterize air quality in the region south of the mill, Area 3 is considered to be a less representative candidate monitor location than Area 2 because there are significant terrain features that the plume would have to traverse in order to reach Area 3. Area 4 is an unacceptable location due to limitations related to site access. Also there are multiple significant terrain features intervening with the plume transport that the model has not accounted for to the east and south.

**Table 1: Top 20 Ranked DV Receptors**

| UTM_E[1] | UTM_N[1] | Normalized Concentration | DV_Rank | Area Located? |
|---|---|---|---|---|
| 666300.00 | 4368000.00 | 41.63 | 1 | 2 |
| 669800.00 | 4372000.00 | 40.79 | 2 | 1 |
| 666200.00 | 4368000.00 | 39.41 | 3 | 2 |
| 666300.00 | 4368700.00 | 38.75 | 4 | 2 |
| 669300.00 | 4367000.00 | 38.55 | 5 | 3 |
| 666200.00 | 4368700.00 | 38.43 | 6 | 2 |
| 666300.00 | 4368100.00 | 37.93 | 7 | 2 |
| 669900.00 | 4372300.00 | 37.49 | 8 | 1 |
| 666500.00 | 4372600.00 | 37.40 | 9 | 5 |
| 666500.00 | 4372700.00 | 37.21 | 10 | 5 |
| 666200.00 | 4368100.00 | 37.09 | 11 | 2 |
| 666400.00 | 4368000.00 | 37.00 | 12 | 2 |
| 669800.00 | 4372100.00 | 36.85 | 13 | 1 |
| 666200.00 | 4368600.00 | 36.79 | 14 | 2 |
| 669700.00 | 4372100.00 | 36.59 | 15 | 1 |
| 669800.00 | 4372200.00 | 36.17 | 16 | 1 |
| 666300.00 | 4368200.00 | 36.07 | 17 | 2 |
| 666500.00 | 4372800.00 | 36.01 | 18 | 5 |
| 666300.00 | 4368300.00 | 35.83 | 19 | 2 |
| 666600.00 | 4372500.00 | 35.76 | 20 | 5 |

[1] Zone 17, NAD83

Where:
DV_Rank = the rank with regard to DV (highest DV is rank 1)

**Table 2: Top 20 Receptors, Ranked by Frequency of 1-Hour Daily Maxima**

| UTM_E[1] | UTM_N[1] | nDays | nDays_Rank |
|---|---|---|---|
| 669400.00 | 4371400.00 | 35 | 1 |
| 669500.00 | 4371100.00 | 29 | 2 |
| 671700.00 | 4371500.00 | 25 | 3 |
| 664400.00 | 4370400.00 | 21 | 4 |
| 672061.00 | 4368615.00 | 16 | 5 |
| 669400.00 | 4371300.00 | 14 | 6 |
| 669500.00 | 4371000.00 | 14 | 7 |
| 671882.00 | 4368327.00 | 14 | 8 |
| 672035.00 | 4368574.00 | 14 | 9 |
| 667263.00 | 4370963.00 | 13 | 10 |
| 669400.00 | 4371200.00 | 13 | 11 |
| 668517.00 | 4371231.00 | 12 | 12 |
| 669200.00 | 4371700.00 | 12 | 13 |
| 669500.00 | 4371600.00 | 12 | 14 |
| 671200.00 | 4371600.00 | 12 | 15 |
| 666800.00 | 4371900.00 | 11 | 16 |
| 664300.00 | 4372100.00 | 9 | 17 |
| 669400.00 | 4371800.00 | 9 | 18 |
| 669900.00 | 4372500.00 | 9 | 19 |
| 671700.00 | 4371000.00 | 9 | 20 |

[1] Zone 17, NAD83

Where:
nDays = the number of days that the receptor is the highest concentration for the day
nDays_Rank = the rank of the receptor with regards to nDays (highest nDays is rank 1)

**Table 3: Receptor Ranking by Design Value and Frequency 1-Hour Daily Maxima**

| UTM_E[1] | UTM_N[1] | DV_Rank | nDays | nDays_Rank | Score | Score_Rank | Area Located |
|---|---|---|---|---|---|---|---|
| 669500.00 | 4371100.00 | 29 | 29 | 2 | 31 | 1 | 1 |
| 669800.00 | 4372000.00 | 2 | 7 | 29 | 31 | 2 | 1 |
| 672035.15 | 4368573.74 | 28 | 14 | 9 | 37 | 3 | 4 |
| 666200.00 | 4368700.00 | 6 | 6 | 32 | 38 | 4 | 2 |
| 666400.00 | 4368000.00 | 12 | 7 | 26 | 38 | 5 | 2 |
| 669300.00 | 4367000.00 | 5 | 6 | 36 | 41 | 6 | 3 |
| 669400.00 | 4371400.00 | 46 | 35 | 1 | 47 | 7 | 1 |
| 669400.00 | 4371200.00 | 40 | 13 | 11 | 51 | 8 | 1 |
| 669500.00 | 4371600.00 | 41 | 12 | 14 | 55 | 9 | 1 |
| 669400.00 | 4371300.00 | 51 | 14 | 6 | 57 | 10 | 1 |
| 672060.72 | 4368614.88 | 53 | 16 | 5 | 58 | 11 | 4 |
| 666300.00 | 4368000.00 | 1 | 4 | 59 | 60 | 12 | 2 |
| 671907.30 | 4368368.07 | 36 | 8 | 24 | 60 | 13 | 4 |
| 666300.00 | 4368700.00 | 4 | 4 | 60 | 64 | 14 | 2 |
| 669500.00 | 4371000.00 | 59 | 14 | 7 | 66 | 15 | 1 |
| 669800.00 | 4371900.00 | 44 | 7 | 28 | 72 | 16 | 1 |
| 671932.87 | 4368409.20 | 38 | 6 | 37 | 75 | 17 | 4 |
| 669100.00 | 4366900.00 | 43 | 6 | 35 | 78 | 18 | 3 |
| 666600.00 | 4372500.00 | 20 | 4 | 63 | 83 | 19 | 5 |
| 669900.00 | 4372300.00 | 8 | 4 | 75 | 83 | 20 | 1 |

[1] Zone 17, NAD83

Where:
DV_Rank = the rank with regard to DV (highest DV is rank 1)
nDays =the number of days that the receptor is the highest concentration for that day
nDays_Rank = the rank of the receptor with regards to nDays (highest nDays is rank 1)
Score = is the sum of DV_Rank and nDays + Rank for each receptor
Score_Rank = the rank of the scores [lowest total score (“Score” of 20) is rank 1].

## Figure 1: Far-Field Receptor Grid

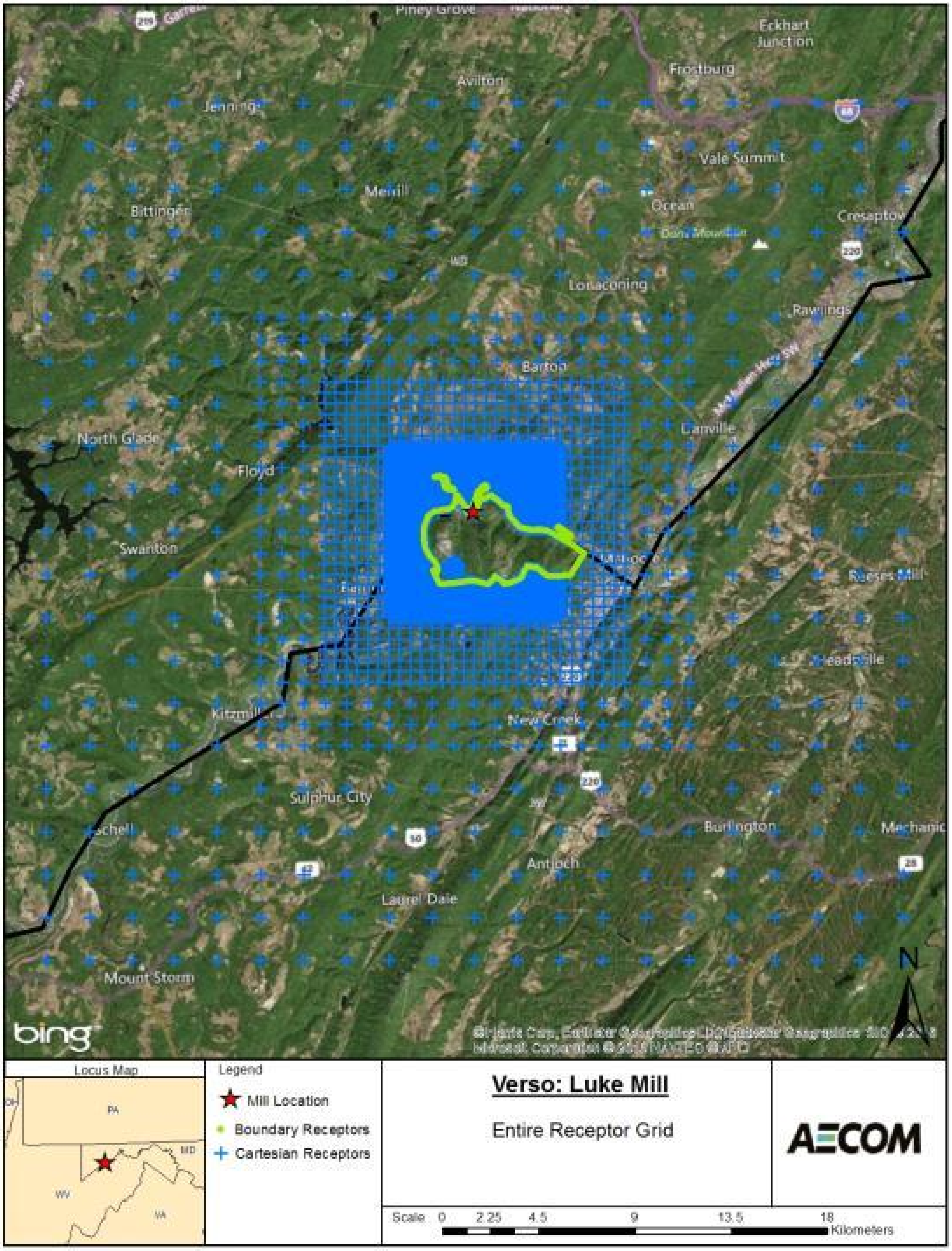


**Figure 2: Near-Field Receptor Grid**

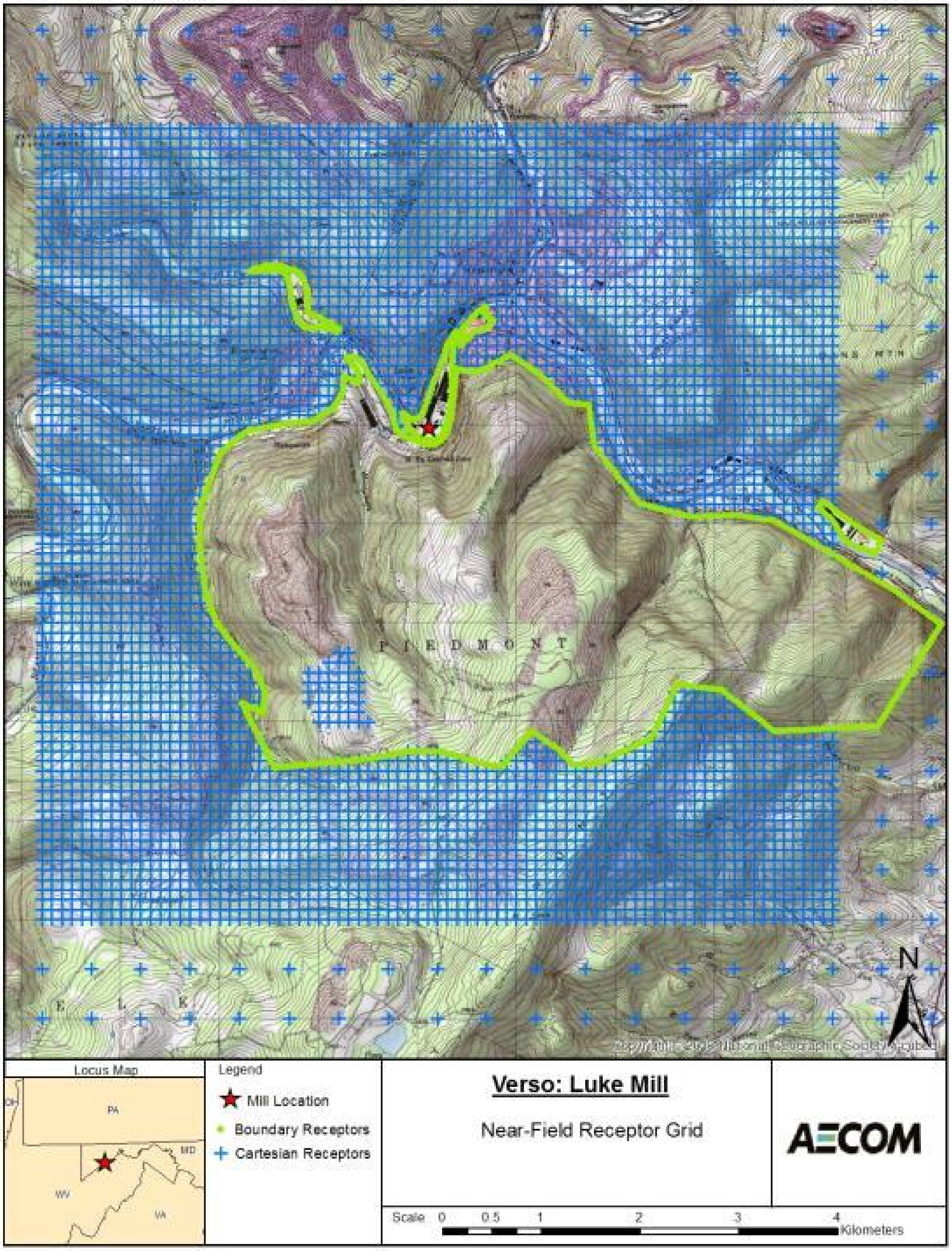


**Figure 3: Locations and Ranking of Maximum 1-Hour $SO_2$ DV Receptors (Top 200)**

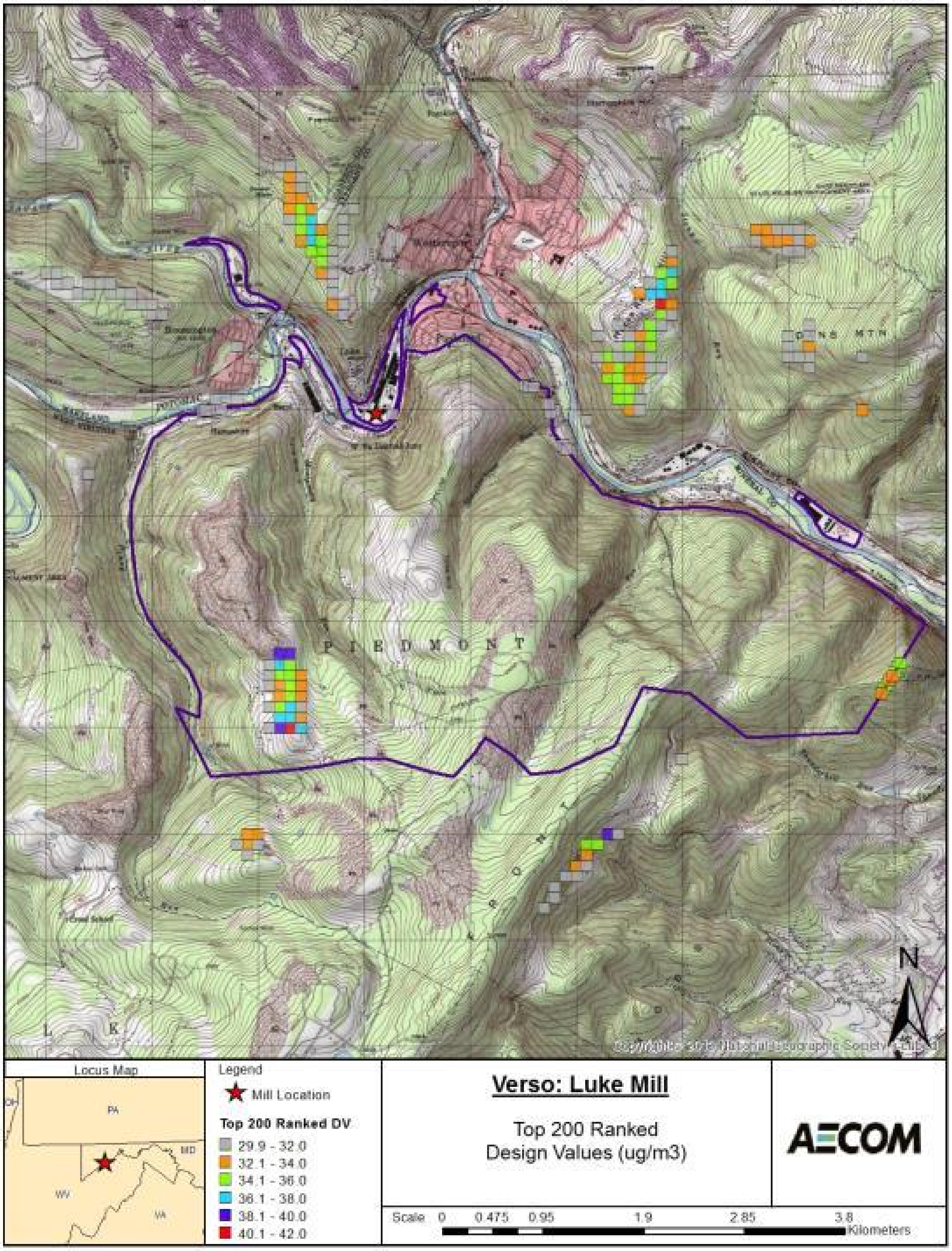


**Figure 4: Locations of the Top 10, 20, and 200 1-Hour $SO_2$ DV Receptors**

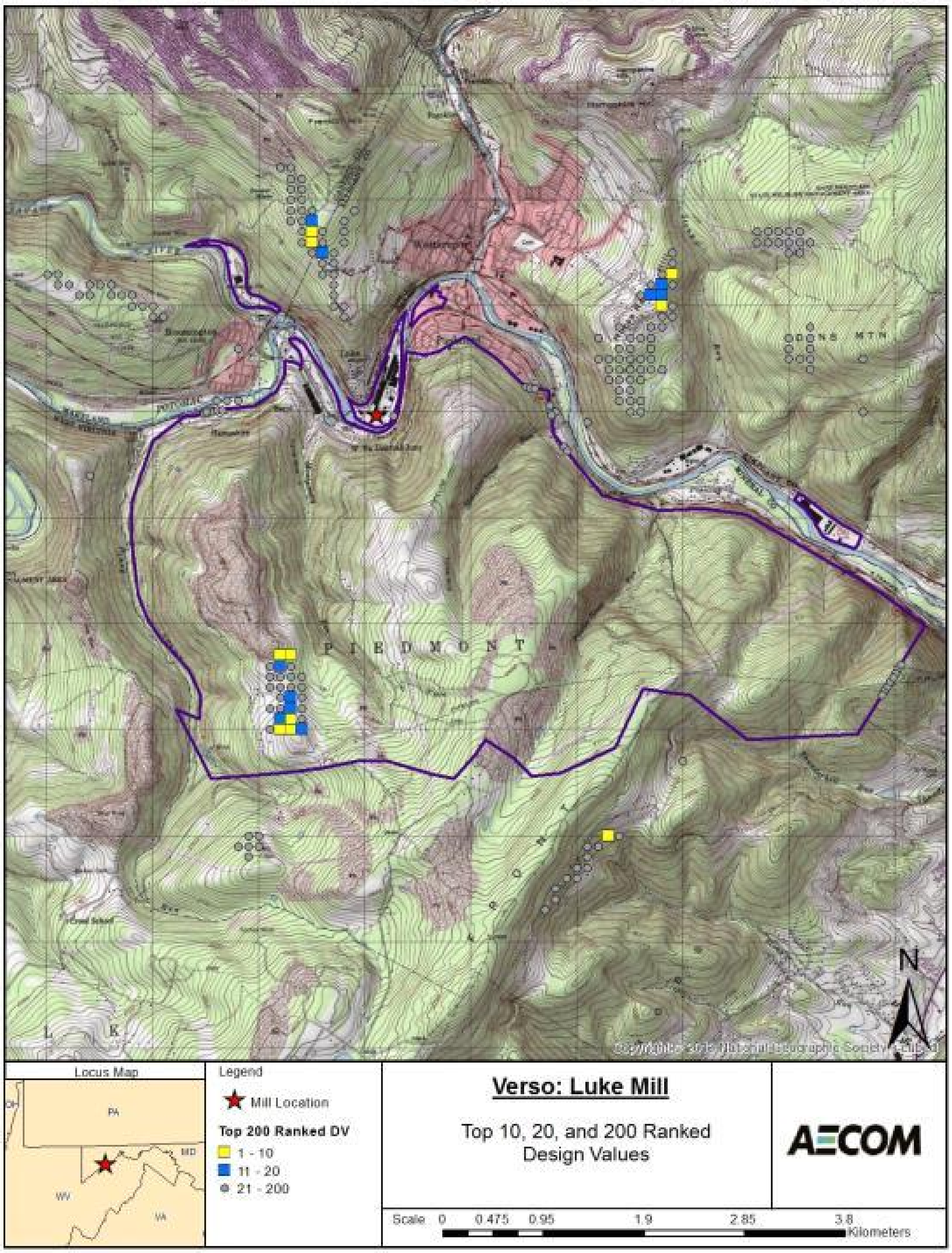


**Figure 5: Receptors by Score Calculated from Ranked DV and Frequency of 1-Hour Daily Maxima**

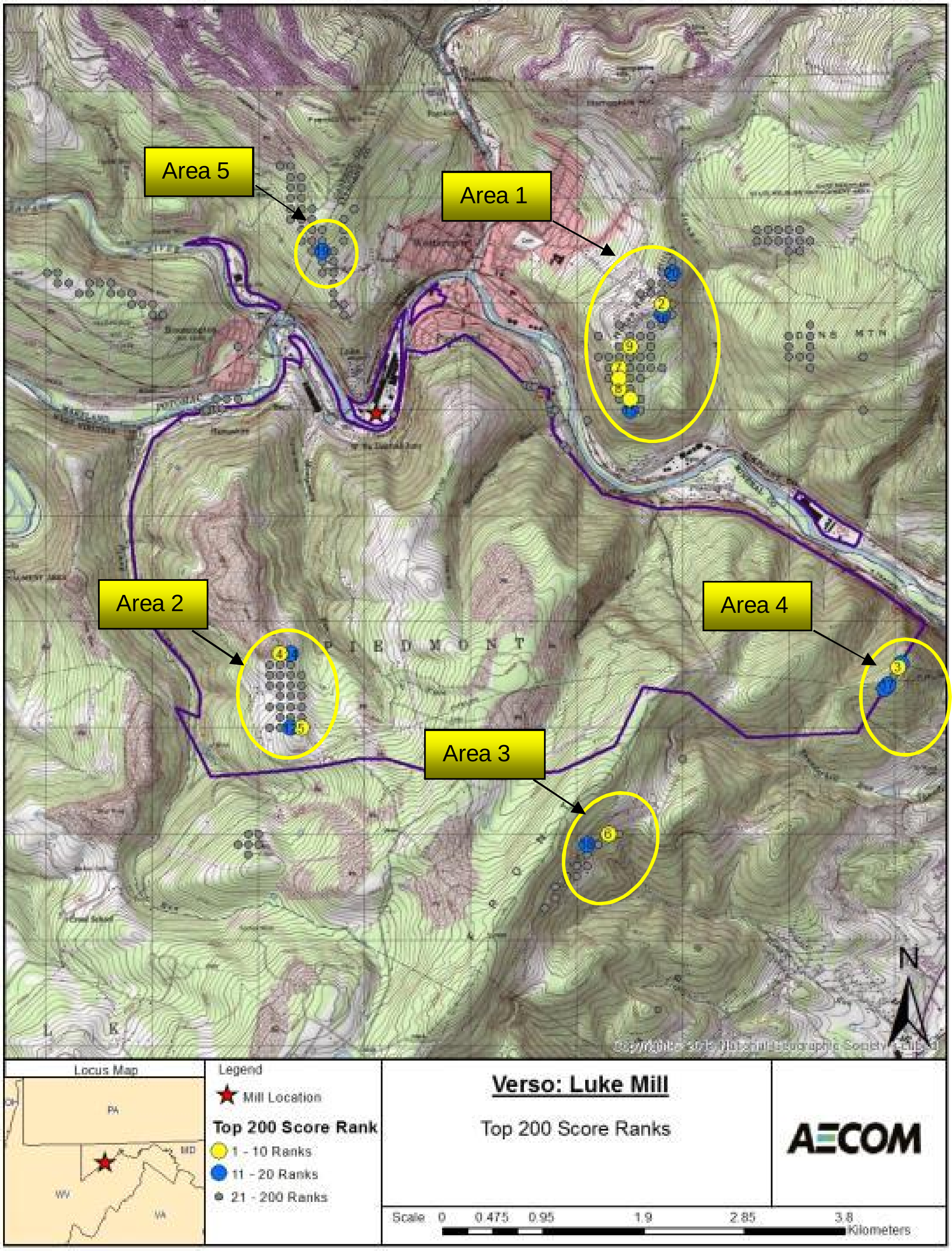


**Figure 6: Receptors by Score Calculated from Ranked DV and Frequency of 1-Hour Daily Maxima (Areas 1 and 5)**

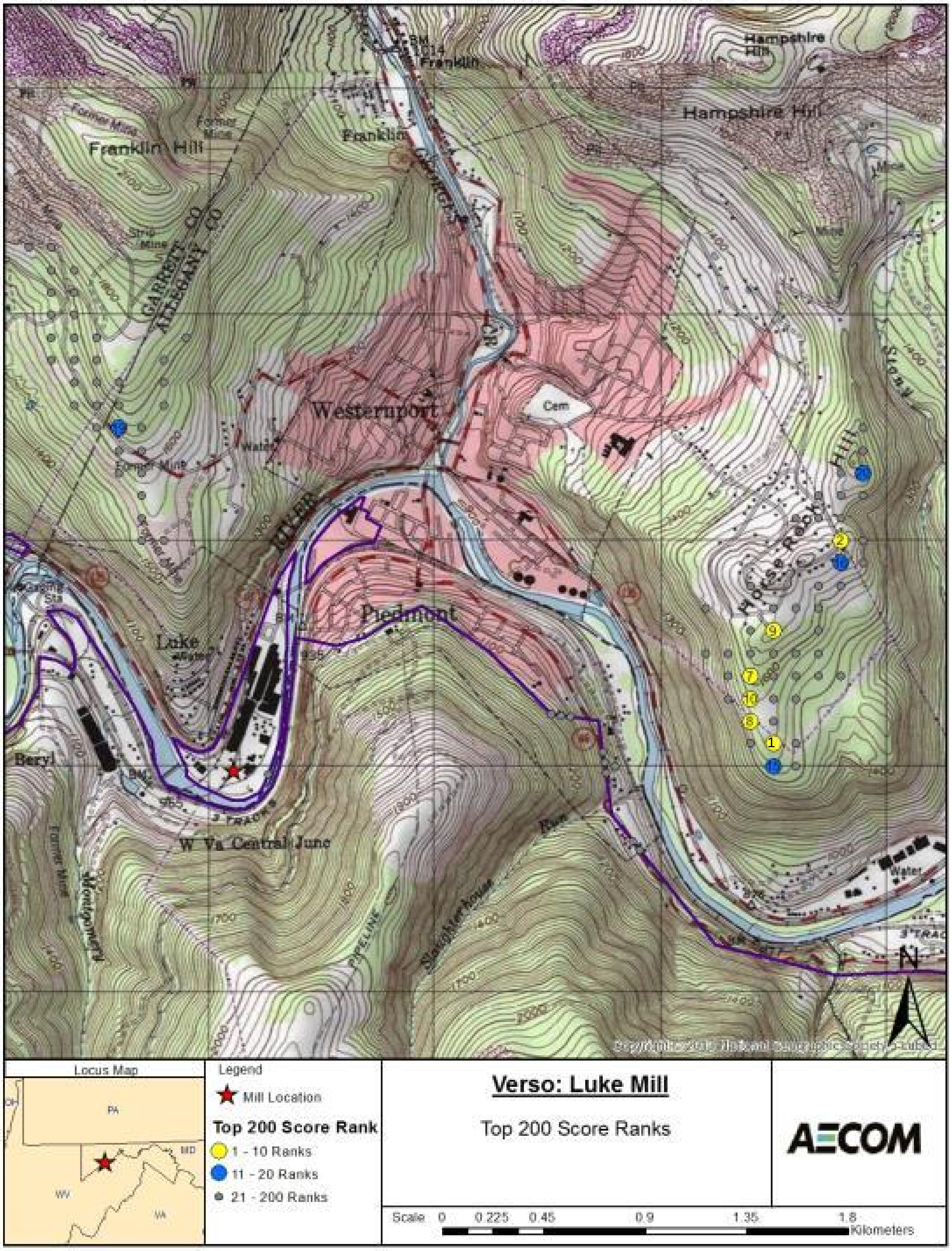


**Figure 7: Receptors by Score Calculated from Ranked DV and Frequency of 1-Hour Daily Maxima (Area 2)**

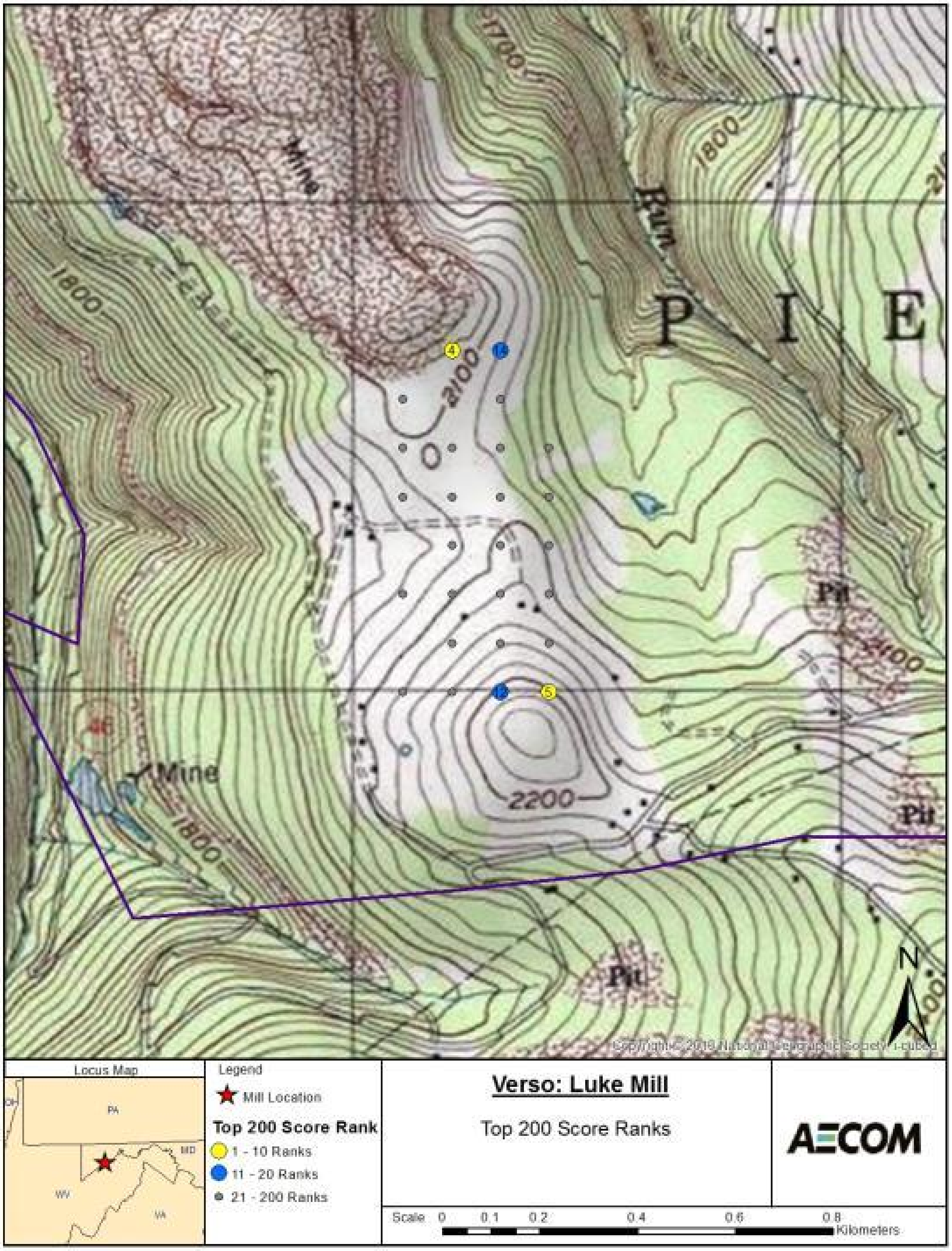


**Figure 8: Receptors by Score Calculated from Ranked DV and Frequency of 1-Hour Daily Maxima (Area 3)**

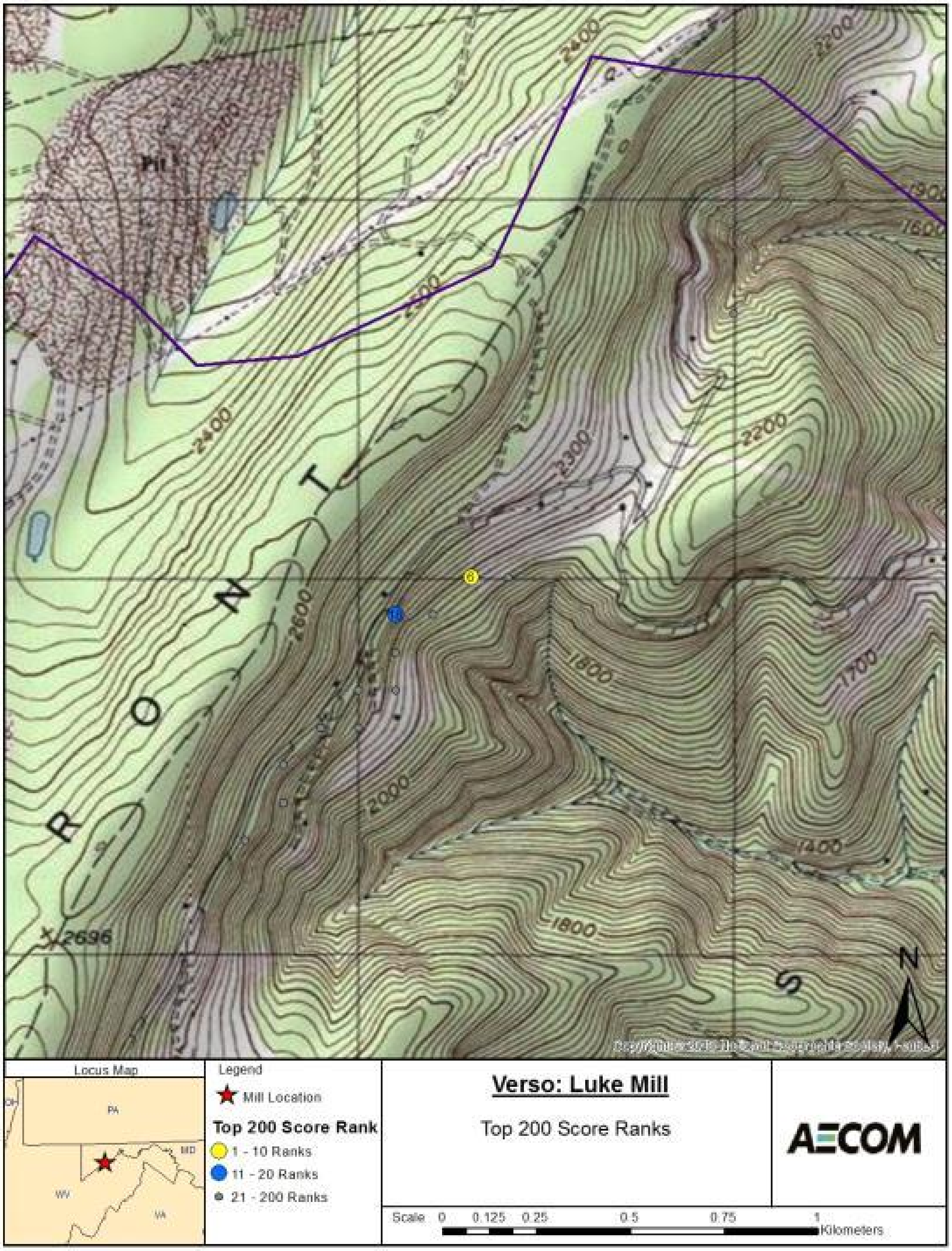
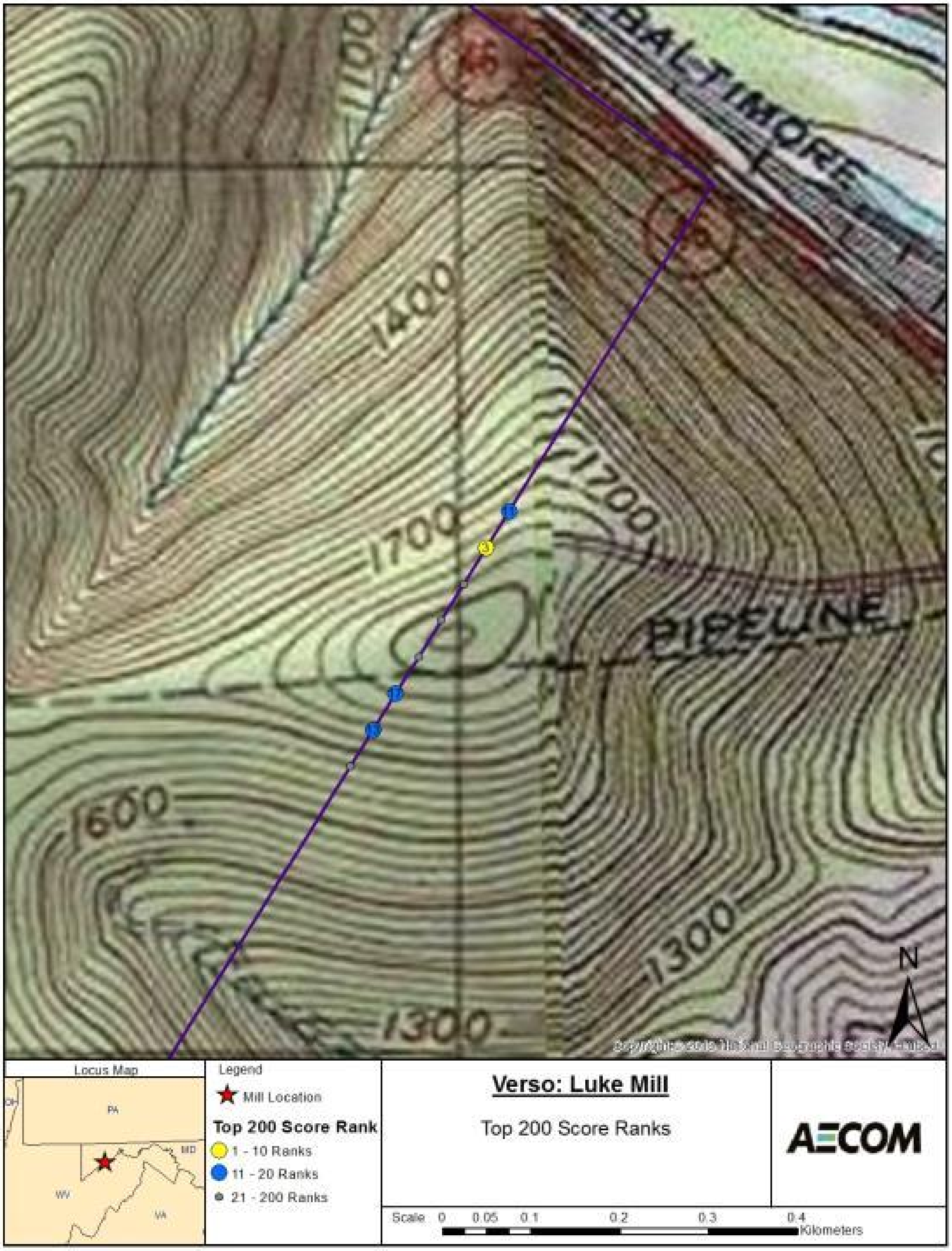


**Figure 9: Receptors by Score Calculated from Ranked DV and Frequency of 1-Hour Daily Maxima (Area 4)**



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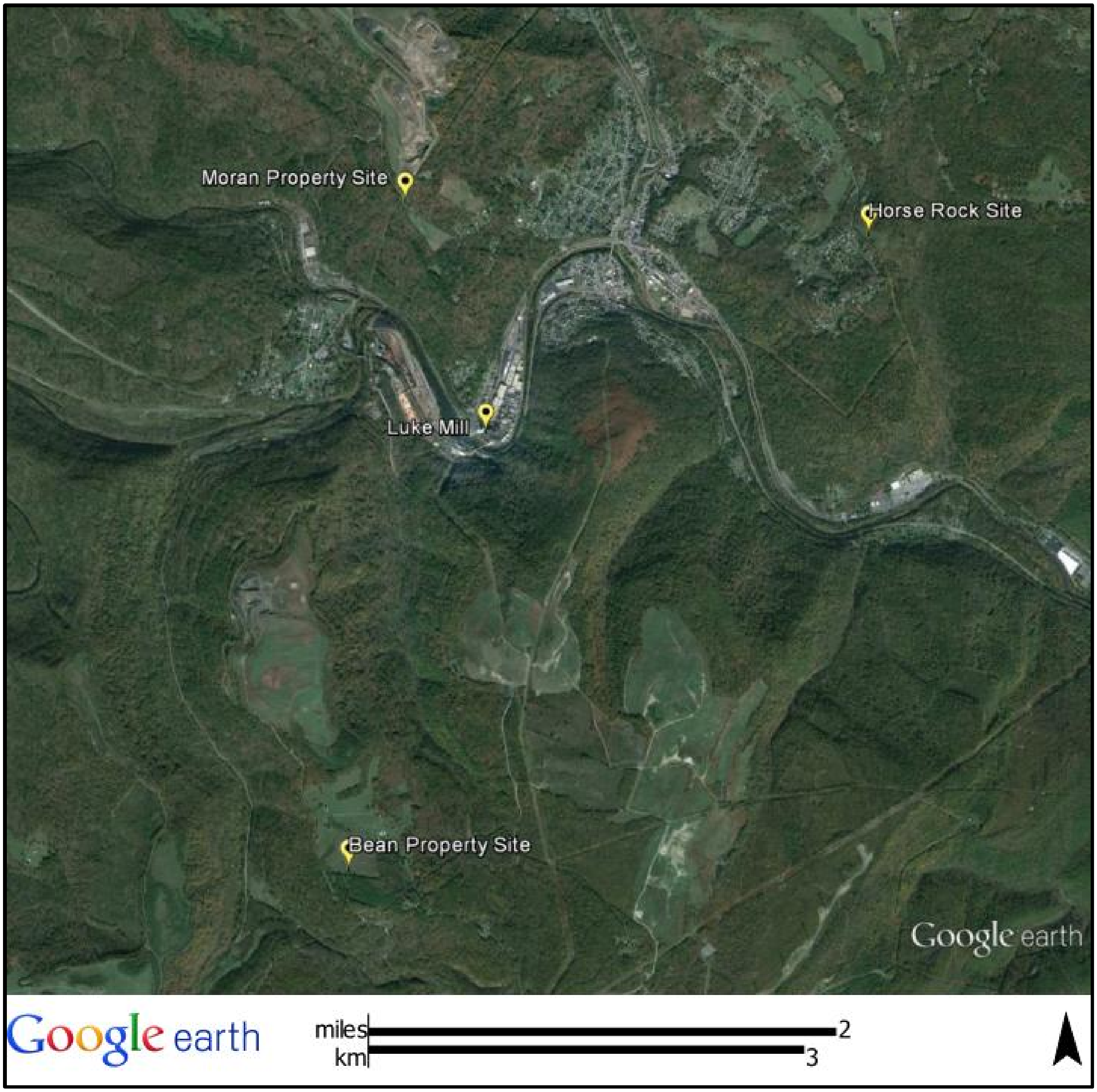
# Verso Luke Mill Stationary Ambient Air Quality Measurements Program

# Candidate Site Locations

To enhance and sustain the world's built, natural and social environments

Thursday, September 01, 2016

**Location of the Candidate $SO_2$ Monitoring Sites – Aerial View**




**GPS Coordinates**

| Candidate Site Name | GPS Coordinates |
|---|---|
| Horse Rock Site | N39 29.017 W079 01.583 |
| Moran Property Site | N39 29.181 W079 03.826 |
| Bean Property Site | N39 26.717 W079 04.148 |

**Horse Rock Site – Cardinal Directions (Area 1)**

| | |
|---|---|
| **Facing North**<br> | **Facing South**<br> |
| **Facing East**<br> | **Facing West**<br> |

**Moran Property Site –Cardinal Directions (Area 5)**

| | |
|---|---|
| **Facing North**<br> | **Facing South**<br> |
| **Facing East**<br> | **Facing West**<br> |

**Bean Property Site – Cardinal Directions (Area 2)**

| | |
|---|---|
| **Facing North**  | **Facing South**  |
| **Facing East**  | **Facing West**  |