ALPHA GEOSCIENCE

Geology
Hydrology
Remediation
Water Supply

March 18, 2020

Mr. Tom Biamonte
Shelby Crushed Stone
10830 Blair Rd
Medina, New York 14103

Re: NOIA Responses – Comment #7
Shelby Crushed Stone - Medina Mine Expansion

Dear Tom:

This letter addresses hydrogeologic-related comment #7 by Mr. Robert Call (NYSDEC) in the February 14, 2020 Notice of Incomplete Application (NOIA) for the referenced site (Mine ID #80346). The comment is provided below, along with our response.

NYSDEC Comment #7: *The Department is currently considering the information provided regarding how the project meets the Freshwater Wetlands standards and is also assessing the significance of potential impacts to the resource. As the proposed expansion area is centrally located in the middle of the 502-acre wetland, concerns include the potential ecological impact of bisecting the larger wetland resource. While it is hypothesized that there will be "no significant hydrogeologic impacts to the remaining wetland", the larger question is if the activity will result in no more than an insubstantial degradation to any part of the wetland. Please discuss in greater detail the potential ecological impacts to MD-9, and detail any measures proposed to assure that the larger wetland will not continue to be bisected.*

Alpha Geoscience's (Alpha's) response to this comment focuses on the potential changes in the physical environment of Wetland MD-9 (MD-9). Although the impact to aquatic and terrestrial species within the wetland ecosystem are beyond Alpha's expertise, it is a reasonable assumption that minimal physical impacts will yield minimal aquatic and terrestrial species impacts. Our response seeks to put the impact of the proposed mine expansion in context with the greater drainage basin that feeds the wetland. A water budget analysis was used to evaluate recharge to the wetland under existing conditions and future conditions after removal of the 8.7-acre wetlands (post-mine expansion).

The approximate extent of MD-9, the current life-of-mine (LOM) and the proposed expansion area are shown on Figure 1. The expansion area contains 8.7 acres of delineated wetland that is part of Wetland MD-9 (MD-9). The expansion area is located on the northern edge of the wetland and is not "centrally located in the middle of the 502-acre wetland" as stated in the NYSDEC Comment #7. Also, the expansion area will not be "bisecting the larger wetland resource," as stated in Comment #7. This is not just a semantic issue. The suggestion that the expansion area is in the middle of the wetland, and that it splits (bisects) the wetland into two parts, misrepresents the facts and is an important clarification that needs to be emphasized, especially given public concern for wetlands in general.

Wetland Soil and Water Availability

The removal of 8.7 acres of the 502-acre wetland will not change the soil type in the remaining acreage of MD-9; consequently, the availability of water in the wetland is the only physical condition of interest. The placement of a berm along the boundary between the remaining portions of MD-9 and the mine will preclude drainage of surface water from the wetland to the mine and will not interfere with the normal hydraulic processes that occur within the remaining wetland area.

Alpha has been able to show through the ongoing investigations that the hydrology of MD-9 is sustained by direct precipitation to the wetland surface and runoff from the surface water drainage basin that drains into the wetland, which also includes water in the primary ditch (Figure 1) that backs up seasonally due to beaver dams further downstream. Our January 20, 2020 letter to you included an analysis of the hydrology that showed that the wetland recharges the underlying bedrock aquifer, which is the year-round water table aquifer. In other words, the bedrock aquifer does not discharge to or sustain the wetland hydrology. The wetland discharge to the underlying bedrock aquifer is very slow due to the fine grained, low permeability nature of the wetland substrate. It is because of these conditions that the primary impact on the wetland hydrology can be assessed by considering how the removal of 8.7 acres of MD-9, at the edge of the wetland, will affect the quantity of direct precipitation to the wetland, the surface water runoff to the wetland, and the rate of surface water drainage from the wetland. Since there is no change to the surface water drainage system from the wetland by the removal of 8.7 acres from the northern edge, then the direct precipitation and runoff quantities are the most important physical parameters of interest. These are best evaluated by a water budget analysis.

Water Budget Analysis

A water budget analysis considers many factors such as monthly precipitation, surface water runoff rates, evapotranspiration (evaporation from the land surface and transpiration by plants) and percolation to the underlying water table. Wetland MD-9 receives recharge from two sources: 1) runoff from the surrounding drainage basin, and 2) direct precipitation. Alpha considered these factors in determining the volume of surface water draining from the surrounding basin and the volume of water accumulation in the wetland from direct precipitation.

The applicable area of MD-9 that is receiving water from the above two water sources is 491.7 acres. This area was determined from the mapped extent of contiguous Palms Muck soil (501.9 acres); minus an area on the western edge (2.3 acres) that is classified as Palms Muck, but is outside of the drainage basin; minus an area of farmland (2.0 acres) on the eastern edge that is classified as Palms Muck; and minus 5.9 acres of Palms Muck that is within the expansion area, but is outside the delineated wetland. The border of the wetland within the expansion area reflects the edge of the actual wetland as it was delineated by Earth Dimensions in 2019. For purposes of this study, the total area of MD-9, as described above, is approximately 491.7 acres. This area is consistent with the general area of MD-9 as shown on the New York State Regulatory Freshwater Wetlands map for Orleans County and the National Wetlands Inventory map (with minor discrepancies around the edge of MD-9 due to the accuracy of those maps).

The drainage basin for MD-9 was delineated from topographic contours based on New York State Digital Elevation Models (DEMs; Figure 2). The total area of the MD-9 drainage basin is approximately 1448.2 acres (excluding MD-9). Figure 3 presents the soils map for the MD-9 drainage basin. The large area of Palms Muck on Figure 3 is generally consistent with the boundary of Wetland MD-9.

Runoff from MD-9 Drainage Basin

To estimate the amount of runoff that enters MD-9 from the drainage basin outside the wetland, runoff coefficients had to be applied to the soil areas. Runoff is estimated based on the soil type, topographic slope and vegetation cover (i.e, wooded, open field, or mixed). Soil types and slopes are provided in the Soil Survey of Orleans County, New York (Bradford et al., 1973). Vegetation cover for the MD-9 drainage basin were delineated based on field observation and the 2015 orthoimagery of the area and are shown on Figure 4. Alpha considered three cover types: 1) Wooded, 2) Farmland/Open field/pasture, and 3) Mixed (areas with mixed farms, woodlands and lawns).

GIS was used to overlay Figure 3 and Figure 4 in order to extract the acreage of land cover types within each soil type in the drainage basin (excluding MD-9). The results of that process are

presented in Table 1. Runoff coefficients were then assigned to each cover type within each soil type based on typical runoff coefficients provided in Landphair and Motloch (1985). The runoff coefficients were than multiplied by the annual precipitation to provide an annualized runoff rate in cubic feet per year that was converted to gallons per minute (gpm). The precipitation data from the National Oceanographic and Atmospheric Administration weather station at Albion, NY (NOAA Station ID 300055) are presented in Table 2. The Albion station is located approximately 12 miles east-northeast of the site.

The annualized runoff (gpm) for each cover type, within each soil type, are provided in Table 1. The sum of the all the runoff rates represents the total runoff from the drainage basin. The total annualized runoff from the MD-9 drainage basin, under existing conditions, is approximately 708.1 gpm. This represents the total annualized water contribution to Wetland MD-9 from the surrounding drainage basin.

Direct precipitation to MD-9

The second source of water to MD-9 is direct precipitation to the wetland area itself. The wetland receives 35.74 inches of direct precipitation per year. The Palms Muck that underlies the wetland is a level, organic soil with very slow runoff (Bradford et al., 1973). A runoff coefficient of 0.10 was assigned to the Palms Muck (Table 1). A full water budget analysis was conducted for the Palms Muck to approximate the evapotranspiration and percolation (Attachment 1) in MD-9.

The results indicate that most (67%) of the precipitation to the wetland is removed through evapotranspiration, with 23% recharging the underlying bedrock aquifer and 10% lost to runoff (Attachment 1). The annualized runoff rate from MD-9 under existing conditions is approximately 90.8 gpm (Table 3). The runoff from MD-9 ultimately leaves the wetland via the primary ditch that leads to Oak Orchard Creek, approximately 4000 ft beyond MD-9 (Figure 1). The evapotranspiration from MD-9 is approximately 609.5 gpm (Table 3). This is a high ET rate and is consistent with the nature of water tolerant plant species that dominate the wetland. The existing annualized percolation rate within the wetland is approximately 207.6 gpm (Table 3). Percolation is equivalent to ground water recharge and represents water that has passed through the soil and not been taken up by evapotranspiration.

Hydrologic Impact to Wetland MD-9 after Proposed Mine Expansion

Table 3 summarizes the existing and future hydrologic conditions after the mine expansion. The existing water contribution to wetland MD-9 from the drainage basin outside the wetland is approximately 708.1 gpm. Mining in the proposed expansion area will result in the removal of 6.3 acres of drainage basin that contributes surface water to MD-9. The removal of this area will

decrease the amount of runoff to the wetland by 1.3 gpm. This is due to the direct removal of 5.9 acres of Palms Muck and 0.4 acres of HcB soil within the expansion area. This represents a 0.18% decrease in the amount of runoff contribution to the wetland.

The existing direct precipitation, evapotranspiration, and percolation in the wetland will obviously decrease because an 8.7-acre portion of wetland will be removed. The net changes in these quantities are shown on Table 3, each of which decreases by 1.8% due to direct removal of the expansion area.

The NYSDEC's comment #7 asks if the "the activity will result in no more than an insubstantial degradation to any part of the wetland." Regarding the hydrological impact to the ecology of the remaining wetland, after mine expansion, it is Alpha's professional opinion that the impact of a negative 0.18% change in runoff contribution to MD-9 is certainly "no more than an insubstantial degradation" to the wetland. The physical changes to the wetland will be more than offset by the proposed creation, restoration, or preservation of greater than 26 acres of wetland at the proposed Pask Road Site, located 5 miles east of MD-9.

Let me know if you have any questions regarding this evaluation.
Sincerely,

Steven M. Trader, PG, CPG
Alpha Geoscience

Reference:

Bradford, A.H., Puglia, P.S. and Yoakum, TD., 1973, Soil Survey of Orleans County, New York, USDA, Soil Conservation Service, 138 p.

Landphair, H.C. and Motloch, J.L., 1985, Site Reconnaissance and Engineering, Elsevier Scince Publishing Co., Inc., New York, 248 p.

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TABLES

TABLE 1
Shelby Crushed Stone
Surface Water Contribution Summary Table

Soil Type	Cover Type	Area (acres)	Runoff Coefficient	Annualized Runoff[1] (gpm)
AnA	Farm	44.8	0.27	22.3
	Mixed	23.5	0.2	8.7
	Wooded	12.3	0.25	5.7
ArB	Farm	0.0	0.26	0.0
	Mixed	3.3	0.22	1.3
	Wooded	3.0	0.25	1.4
BoB	Farm	123.3	0.26	59.2
	Mixed	41.4	0.22	16.8
	Wooded	63.5	0.25	29.3
Ca	Farm	0.2	0.1	0.0
	Mixed	0.3	0.1	0.1
	Wooded	6.8	0.1	1.3
Cb	Farm	1.5	0.1	0.3
CmB	Farm	5.5	0.37	3.8
	Wooded	1.4	0.35	0.9
CoC	Wooded	3.7	0.35	2.4
ElB	Wooded	8.1	0.25	3.7
GaB	Farm	11.9	0.26	5.7
	Wooded	14.5	0.25	6.7
GP	Farm	1.1	0	0.0
	Mixed	0.7	0	0.0
	Wooded	3.0	0	0.0
HbB	Farm	116.5	0.32	68.8
	Mixed	12.5	0.27	6.2
	Wooded	16.0	0.3	8.8
HcA	Farm	105.3	0.23	44.7
	Wooded	19.6	0.21	7.6
HcB	Farm	17.9	0.32	10.6
	Mixed	25.8	0.27	12.9
	Wooded	5.2	0.3	2.9
HoB	Mixed	3.5	0.22	1.4
	Wooded	4.8	0.25	2.2
HpC	Farm	12.3	0.37	8.4
	Mixed	8.8	0.31	5.1
	Wooded	70.4	0.35	45.5
KaA	Farm	31.4	0.27	15.6
	Mixed	11.6	0.2	4.3
	Wooded	52.9	0.25	24.4
Ln	Farm	0.7	0.1	0.1
	Wooded	13.9	0.1	2.6
Lz	Farm	3.4	0.1	0.6
	Wooded	4.0	0.1	0.7
MdB	Farm	33.2	0.26	15.9
	Wooded	15.8	0.25	7.3
MdC	Farm	37.4	0.37	25.5
	Mixed	4.9	0.31	2.8
	Wooded	11.4	0.35	7.4
Mn	Farm	15.4	0.18	5.1
	Mixed	8.8	0.15	2.4
	Wooded	6.0	0.16	1.8
Ne	Farm	40.5	0.27	20.2
	Mixed	7.0	0.2	2.6
	Wooded	38.6	0.25	17.8
NgA	Farm	20.2	0.27	10.1
	Mixed	0.5	0.2	0.2
	Wooded	19.7	0.25	9.1
OnB	Farm	21.0	0.32	12.4
OnC	Farm	9.2	0.42	7.2
	Wooded	0.3	0.4	0.2
OtB	Farm	50.3	0.32	29.7
	Mixed	2.7	0.27	1.3
	Wooded	21.5	0.3	11.9
OvA	Farm	6.3	0.27	3.1
Pm	Farm	4.4	0.1	0.8
	Wooded	8.3	0.1	1.5
Su	Farm	6.8	0.1	1.3
	Mixed	10.1	0.1	1.9
	Wooded	18.9	0.1	3.5
W	Mixed	3.8	0	0.0
	Wooded	0.1	0	0.0
WsA	Farm	32.5	0.27	16.2
	Mixed	7.3	0.2	2.7
	Wooded	31.3	0.25	14.4
WsB	Farm	13.9	0.37	9.5
	Wooded	29.6	0.35	19.1
Grand Total		1448.2	0	708.1

Notes:

1 - Annualized Runoff = Annual Precipitation x Runoff Coeffient; Annual Precipitation = 35.74" per year

TABLE 2
Shelby Crushed Stone
Temperature and Precipitation Normals 1981-2010
Albion - NOAA Station ID 300055

Lat/Long 43.2722°, -78.1664° Elevation = 440.0 ft

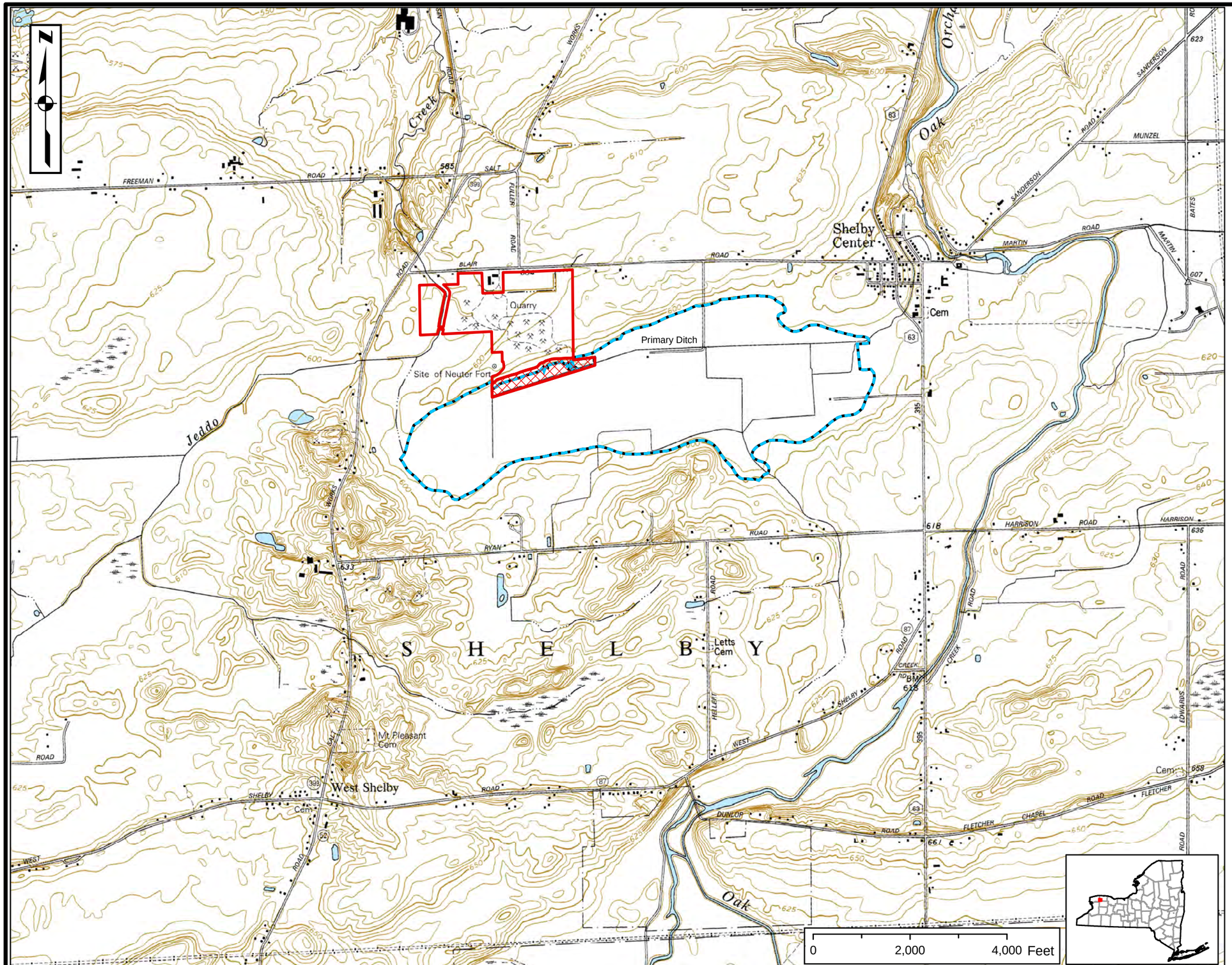
Month	Temperature (°F)	Precipitation (inches)
January	25.2	2.92
February	26.8	2.06
March	34.9	2.72
April	47.1	2.95
May	57.8	3.03
June	67.5	3.02
July	71.9	3.06
August	70.3	3.06
September	63.3	3.56
October	51.8	3.10
November	41.2	3.29
December	30.4	2.97
Average	**49.0**	**35.74**

TABLE 3
Shelby Crushed Stone
Summary Table of Hydrologic Changes

	Pre-Expansion		Post-Expansion			
	Area (acres)	Annualized Runoff Contribution (gpm)	Area (acres)	Annualized Runoff Contribution (gpm)	Change (gpm)	Change (%)
Surface Water Contribution from MD-9 Drainage Basin	1448.2	708.1	1441.9	706.8	-1.3	-0.18%
	Area (acres)	Annualized Flow (gpm)	Area (acres)	Annualized Flow (gpm)	Change (gpm)	Change (%)
Wetland MD-9						
Direct Precipitation	491.7	907.8	483.0	891.8	-16.1	-1.8%
Runoff	491.7	90.8	483.0	89.2	-1.6	-1.8%
AET	491.7	609.5	483.0	598.7	-10.8	-1.8%
Perc	491.7	207.6	483.0	203.9	-3.7	-1.8%

Total precipitation of 35.74 inches/yr = 1.85 gpm/ac

FIGURES



LEGEND

- Life of Mine Boundary
- Proposed Expansion Area
- Approximate Wetland MD-9 Boundary

Source:
- NYS Department of Transportation Raster Quadrangle (1:24,000 scale - UTM Zone 18, NAD 83)

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FIGURE 1
Site Location Map

Shelby Crushed Stone
Medina Mine
Town of Shelby
Orleans County, New York

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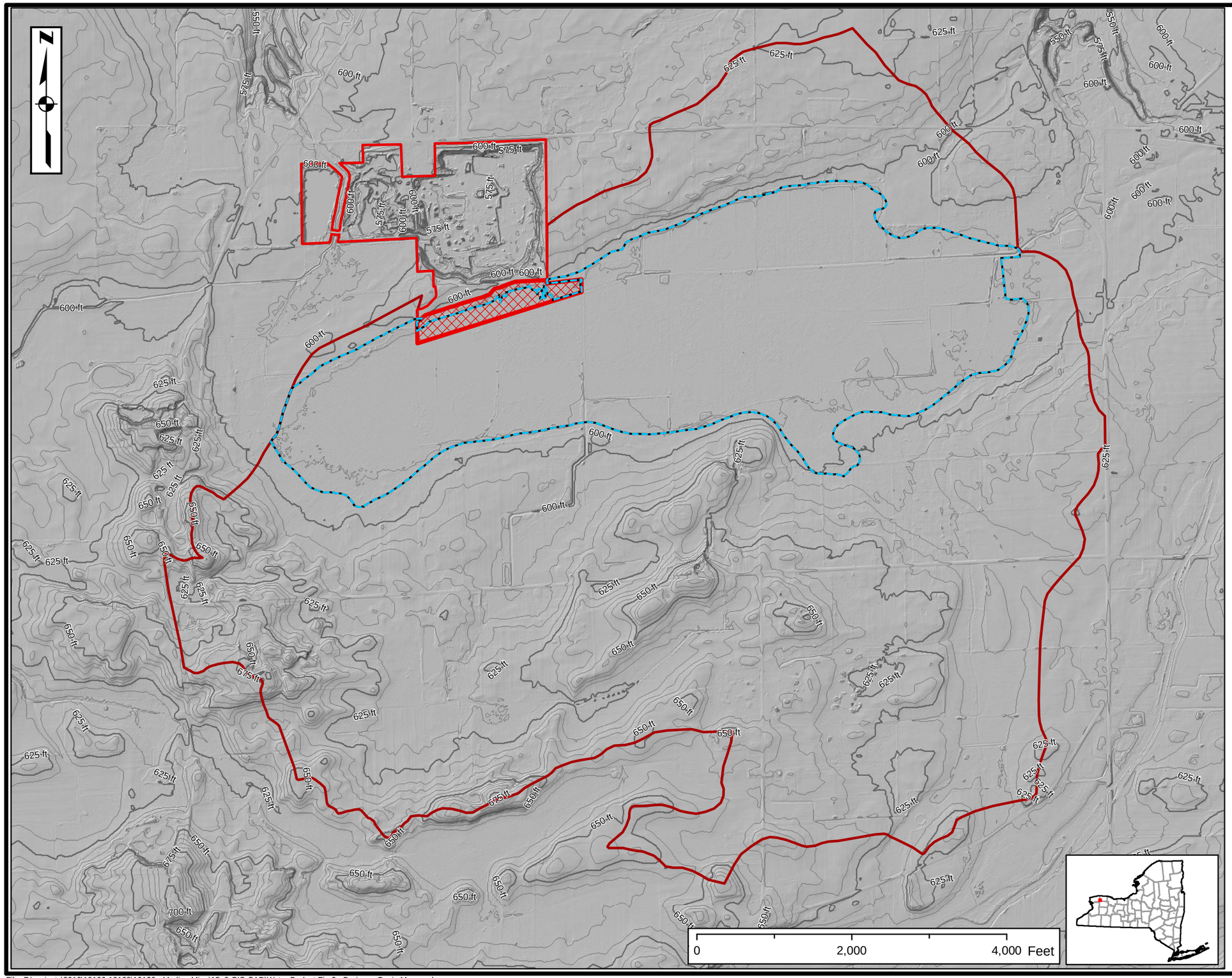

LEGEND

- Approximate Wetland MD-9 Boundary
- Life of Mine Boundary
- Proposed Expansion Area
- Surface Water Drainage Basin Boundary
- Topographic Contour Line (5 ft interval)
- Topographic Contour Line (25 ft interval)

Source:
- Topographic contours based on New York State Digital Elevation Models (DEM).

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FIGURE 2
Drainage Basin Map

Shelby Crushed Stone
Medina Mine
Town of Shelby
Orleans County, New York

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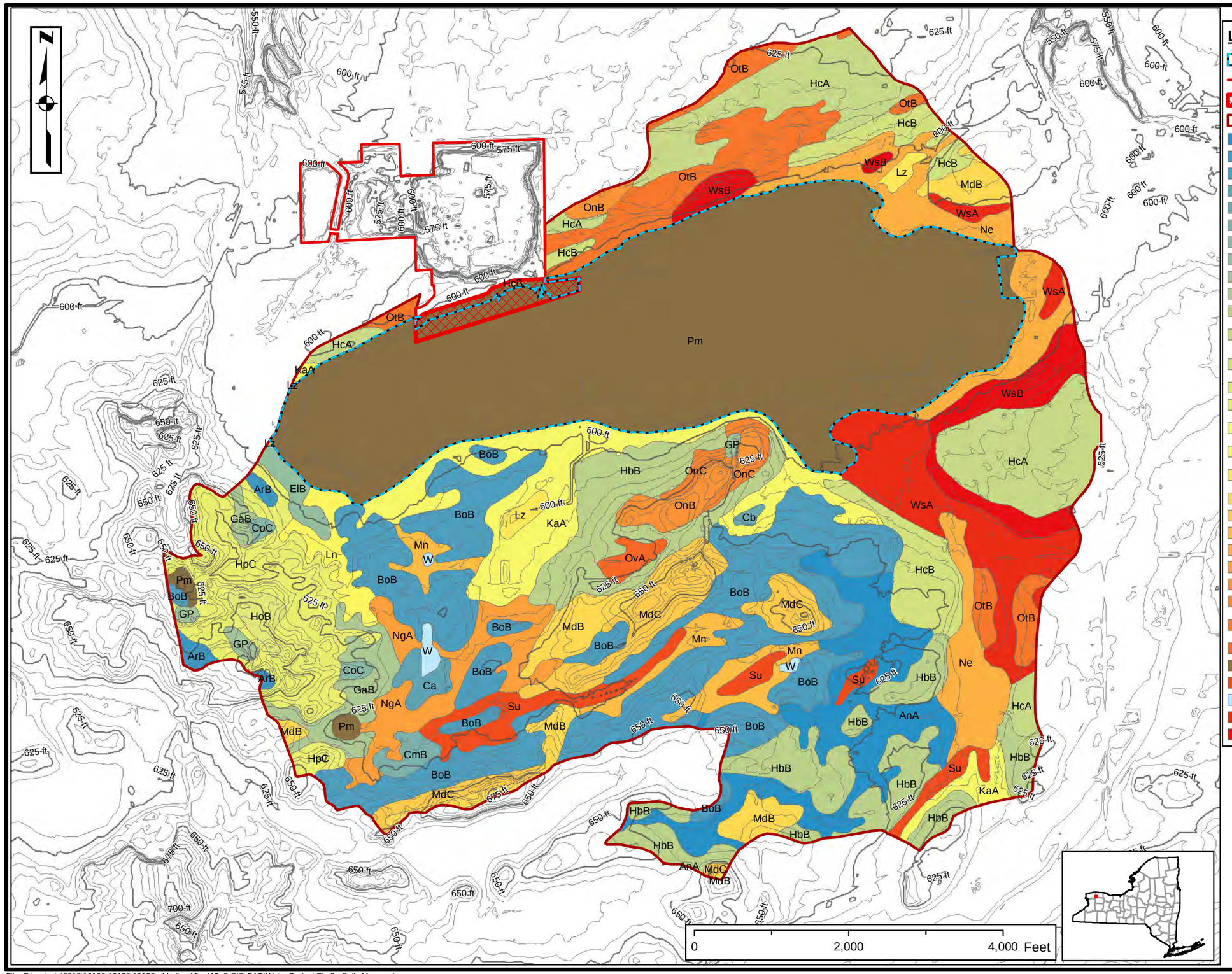

LEGEND

- Approximate Wetland MD-9 Boundary
- Life of Mine Boundary
- Proposed Expansion Area
- Surface Water Drainage Basin Boundary
- AnA;Appleton silt loam, 0 to 3 percent slopes
- ArB;Arkport very fine sandy loam, 0 to 6 percent slopes
- BoB;Bombay fine sandy loam, 3 to 8 percent slopes
- Ca;Canandaigua soils
- Cb;Carlisle muck
- CmB;Collamer silt loam, 2 to 6 percent slopes
- CoC;Colonie loamy fine sand, 6 to 12 percent slopes
- ElB;Elnora loamy fine sand, 0 to 6 percent slopes
- GP;Gravel pits
- GaB;Galen very fine sandy loam, 2 to 6 percent slopes
- HbB;Hilton loam, 3 to 8 percent slopes
- HcA;Hilton loam, 0 to 3 percent slopes, bedrock substratum
- HcB;Hilton loam, 3 to 8 percent slopes, bedrock substratum
- HoB;Howard gravelly loam, 3 to 8 percent slopes
- HpC;Howard soils, 8 to 25 percent slopes
- KaA;Kendaia and Appleton soils, 0 to 3 percent slopes, bedrock substratum
- Ln;Lamson soils
- Lz;Lyons soils, 0 to 3 percent slopes, bedrock substratum
- MdB;Madrid fine sandy loam, 3 to 8 percent slopes
- MdC;Madrid fine sandy loam, 8 to 15 percent slopes
- Mn;Massena fine sandy loam
- Ne;Newstead silt loam
- NgA;Niagara silt loam, 0 to 2 percent slopes
- OnB;Ontario loam, 3 to 8 percent slopes
- OnC;Ontario loam, 8 to 15 percent slopes
- OtB;Ontario loam, 0 to 8 percent slopes, bedrock substratum
- OvA;Ovid silt loam, 0 to 3 percent slopes
- Pm;Palms muck
- Su;Sun silt loam
- W;Water
- WsA;Wassaic silt loam, 0 to 3 percent slopes
- WsB;Wassaic silt loam, 3 to 8 percent slopes

Source:
- Topographic contours based on New York State Digital Elevation Models (DEM).
- Soil Survey Geographic (SSURGO) database, U.S. Department of Agriculture, Natural Resources Conservation Service.

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FIGURE 3
Soils Map

Shelby Crushed Stone
Medina Mine
Town of Shelby
Orleans County, New York

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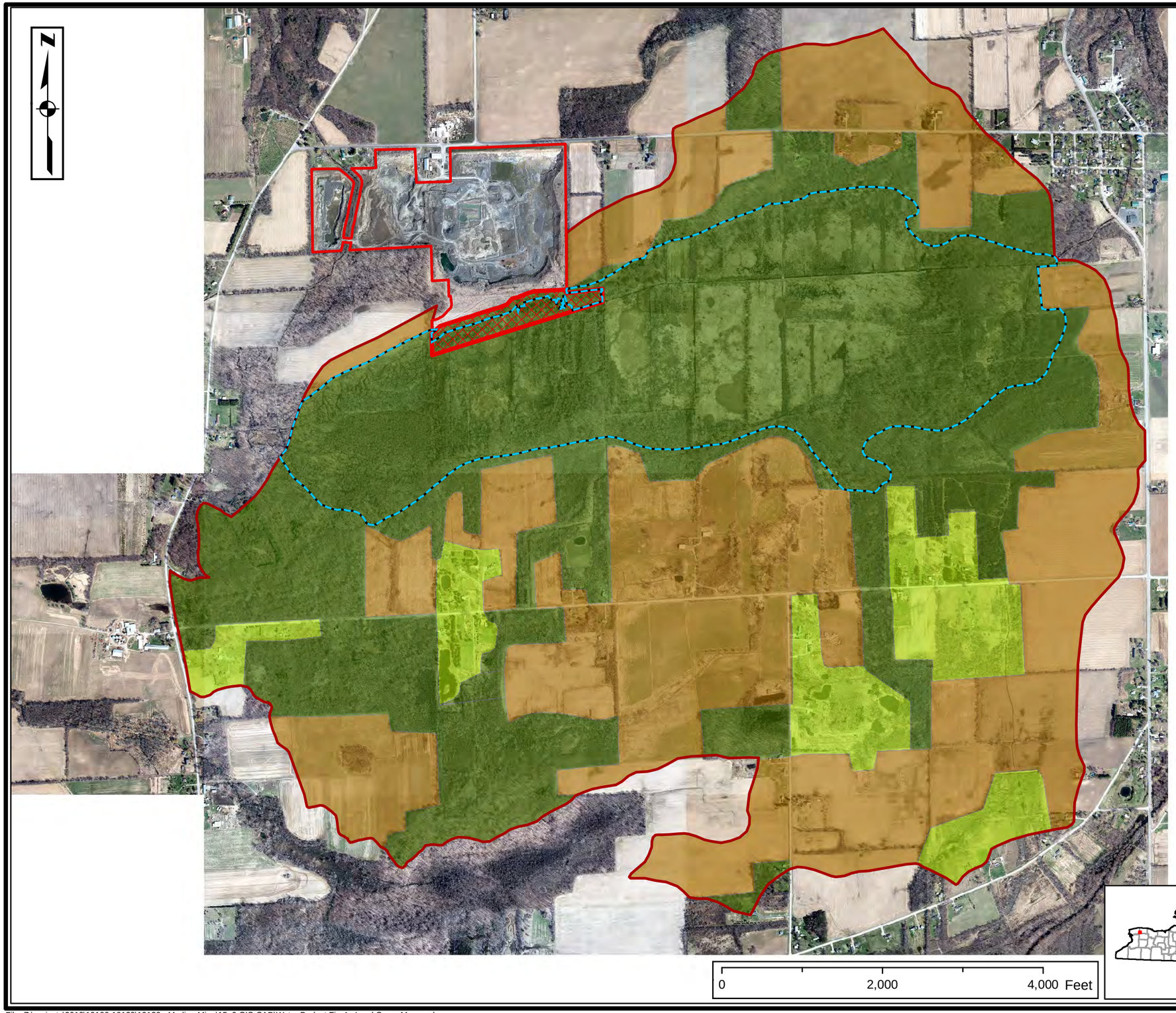

LEGEND

- Approximate Wetland MD-9 Boundary
- Life of Mine Boundary
- Proposed Expansion Area
- Surface Water Drainage Basin Boundary

Land Cover Type

- Farmland, Open Field, Pasture
- Mixed (Farmland, Wooded, Lawns)
- Wooded

Source:
- Orleans County 12-inch Resolution Color Infrared Orthoimagery (2015).
- Land Cover determination by Alpha.

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FIGURE 4
Land Cover Map

Shelby Crushed Stone
Medina Mine
Town of Shelby
Orleans County, New York

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ATTACHMENT 1
Palms Muck
Water Budget Summary

ATTACHMENT 1

Shelby Crushed Stone — Water Budget Analysis: Palms Muck — Pm

Month	Temp °C	Precip. P (mm)	C_r	Runoff (mm)	Infiltration (mm)	Monthly Heat Index	Annual Heat Index I	a	Unadjusted Monthly PE (mm)	Unadjusted Daily PE (mm)	Mean Possible Monthly Duration of Sunlight (12-hr units)	Adjusted Monthly PE (mm)	Infilt-PET (mm)	Σ Neg. Infilt. (mm)
Jan	-3.78	74.17	0.10	7.42	66.75	0.00	44.70	1.20	0.00	0.00	24.3	0.00	66.75	0.00
Feb	-2.89	52.32	0.10	5.23	47.09	0.00	44.70	1.20	0.00	0.00	24.6	0.00	47.09	0.00
Mar	1.61	69.09	0.10	6.91	62.18	0.18	44.70	1.20	4.76	0.15	30.6	4.70	57.48	0.00
Apr	8.39	74.93	0.10	7.49	67.44	2.19	44.70	1.20	34.47	1.15	33.6	38.61	28.83	0.00
May	14.33	76.96	0.10	7.70	69.27	4.93	44.70	1.20	65.55	2.11	37.8	79.93	-10.66	-10.66
Jun	19.72	76.71	0.10	7.67	69.04	7.99	44.70	1.20	96.13	3.20	38.4	123.05	-54.01	-64.67
Jul	22.17	77.72	0.10	7.77	69.95	9.53	44.70	1.20	110.60	3.57	38.7	138.07	-68.11	-132.79
Aug	21.28	77.72	0.10	7.77	69.95	8.96	44.70	1.20	105.30	3.40	36	122.28	-52.33	-185.11
Sep	17.39	90.42	0.10	9.04	81.38	6.60	44.70	1.20	82.65	2.76	31.2	85.96	-4.58	-189.69
Oct	11.00	78.74	0.10	7.87	70.87	3.30	44.70	1.20	47.72	1.54	28.5	43.87	27.00	0.00
Nov	5.11	83.57	0.10	8.36	75.21	1.03	44.70	1.20	19.02	0.63	24.3	15.41	59.80	0.00
Dec	-0.89	75.44	0.10	7.54	67.89	0.00	44.70	1.20	0.00	0.00	23.1	0.00	67.89	0.00
	9.45	907.80		90.78	817.02	44.70			566.20			651.87		
		35.74	Inches	3.57	Inches									

Soil Moisture Storage (ST) in millimeters 345.44

Lat/Long 43.2722°, -78.1664°

Month	Soil Moisture Storage (mm)	Δ Soil Moisture Storage (mm)	AET (mm)	Water Defecit (mm) (PET-AET)	Perc (mm)	Perc (in)
Jan	345.44	0.00	0.00	0.00	66.75	2.63
Feb	345.44	0.00	0.00	0.00	47.09	1.85
Mar	345.44	0.00	4.70	0.00	57.48	2.26
Apr	345.44	0.00	38.61	0.00	28.83	1.13
May	334.82	-10.62	79.89	0.04	0.00	0.00
Jun	285.82	-49.00	118.03	5.01	0.00	0.00
Jul	234.12	-51.70	121.66	16.41	0.00	0.00
Aug	200.84	-33.27	103.23	19.05	0.00	0.00
Sep	198.17	-2.67	84.06	1.90	0.00	0.00
Oct	225.17	27.00	43.87	0.00	0.00	0.00
Nov	284.97	59.80	15.41	0.00	0.00	0.00
Dec	345.44	60.47	0.00	0.00	7.42	0.29
			609.45	42.42	207.57	
			23.99	Inches	8.17	Inches

Total Runoff	3.57	inches
Total AET	23.99	inches
Total Perc.	8.17	inches
	35.74	inches