Stormwater Management Report

for

THE ESTATES AT HURSTMONT

VOLUME I

BLOCK 27 LOT 2

Harding Township

Morris County, New Jersey

PREPARED BY:

GLADSTONE DESIGN, INC.

Consulting Engineers | Land Surveyors | Landscape Architects | Land Planners

265 Main Street, P.O. Box 400
Gladstone, New Jersey 07934

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Ronald A. Kennedy, P.E.
NJ PROFESSIONAL ENGINEER
LICENSE No. GE33453

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INTRODUCTION

The project "The Estates at Hurstmont" is a proposed age-restricted residential community with associated site improvements located at the property known as Block 27 Lot 2 in the Township of Harding, Morris County, New Jersey. The site (see **Figure 1**) consists of a total tract area of 19.73 acres, located along Mount Kemble Avenue, formerly known as New Jersey State Highway Route 202. The property is bordered to the southeast by Mount Kemble Avenue, with New Jersey Interstate Highway Route 287 beyond, to the east and west by residential lots and to the southwest and north by public land. The site was previously developed and contains the remains of two (2) residential structures, a green house, a tennis court, and gardens. The site is characterized by upland forest areas and maintained landscaped areas.

The proposed multi-family residential development and independent and assisted living facility is comprised of fifteen (15) residential buildings (The Carriages and The Cottages), the Senior Living Facility, and an accessory wastewater treatment building. The Carriages are comprised of twenty-eight (28) three- to four-bedroom age-restricted units and The Cottages are comprised of twelve (12) two-bedroom age-restricted units. The Senior Living Facility is comprised of 210 units that will include a mix of independent living units, assisted living units, and memory care units. Of the 210 units in the Senior Living Facility, 40 units are affordable units. The affordable units are intended to meet a portion of Harding Township's affordable housing obligation. In addition to The Carriages, The Cottages, and the Senior Living Facility, associated improvements such as access drives, parking areas, walkways, trails, trash collection and stormwater management systems are proposed. The stormwater will be managed through seven (7) Small-Scale Bioretention basins, two (2) Large-Scale Bioretention basins, and two (2) Underground Detention basins. The bioretention basins will be constructed in accordance with the New Jersey Department Environmental Protection (NJDEP) standards for Small-Scale and Large-Scale Bioretention basins with underdrains.

EXISTING SITE DATA

TOPOGRAPHY:

The site topography ranges from gently sloping to very steeply sloping. The topographic elevations on the site range from around 375 feet above mean sea level (msl) in the southwest corner of the site near Mount Kemble Avenue, to around 545 feet above msl at the northern property boundary (See **Figure 2**). Overland flow is generally directed from the norther property boundary of the site to the southeastern property boundary, except for a small portion of the property which drains southwest along Mount Kemble Avenue.

SOILS:

The existing soil stratum is comprised predominantly of six (6) soil groupings; Califon loam (CakB), Cokesbury gravelly loam (CobA), Parker gravelly sandy loam (PaoC), Parker-Gladstone complex (PauCc and PauDc), and Parker-Rock outcrop complex (PawE).

Califon loam is a 3 to 8 percent sloping series consisting till derived from gneiss and/or colluvium derived from gneiss, classified with a Hydrologic Soil Group 'C'. The depth to the water table is about 6 to 30 inches, and the capacity of the most limiting layer to transmit water is moderately low to moderately high.

Cokesbury gravelly loam is a 0 to 3 percent sloping series consisting till derived from gneiss and/or colluvium derived from gneiss, classified with a Hydrologic Soil Group 'D'. The depth to

the water table is about 0 to 12 inches, and the capacity of the most limiting layer to transmit water is moderately low to moderately high.

Parker gravelly sandy loam is a 3 to 15 percent sloping series consisting of residuum weathered from granite and gneiss, classified with a Hydrologic Soil Group 'B'. The depth to the water table is about more than 80 inches, and the capacity of the most limiting layer to transmit water is high.

Parker-Gladstone complex is a 0 to 15 (PauCc) and 15 to 25 (PauDc) percent sloping series consisting of loamy colluvium derived from granite and gneiss and/or loamy residuum weathered from granite and gneiss, classified with a Hydrologic Soil Group 'B'. The depth of the water table is more than 80 inches, and the capacity of the most limiting layer to transmit water is moderately high to high (PauCc) and moderately high to high (PauDc).

Parker-Rock outcrop complex is a 25 to 45 percent sloping series consisting of residuum weather from granite and gneiss, classified with a Hydrologic Soil Group 'B'. The depth to the water table is more than 80 inches, and the capacity of the most limiting layer to transmit water is high.

REGULATED AREAS:
There are no New Jersey Department of Environmental Protection (NJDEP) regulated areas located on the site that impact the development potential of the site.

STORMWATER MANAGEMENT REGULATION COMPLIANCE

The proposed stormwater management system has been designed to be in compliance with the requirements of the New Jersey Department of Environmental Protection's Stormwater Management Rules (N.J.A.C. 7:8, adopted March 2, 2021), Residential Site Improvements standards, and Harding Township's Stormwater Management Ordinance. The proposed project is defined as a major stormwater development project based upon NJDEP's definition as it proposes to disturb more than 1-acre of land (16.57 Ac. /721,864 S.F.), more than ¼-acres of new motor vehicle surface (2.80 Ac. /121,923 S.F.), and more than ¼ acres of new impervious coverage (8.20 Ac. /357,065 S.F.).

NJDEP identifies four (4) primary requirements for proposed stormwater management measures: utilization of non-structural stormwater strategies; provide peak rate of runoff reduction for erosion and flood control; provide water quality treatment for regulated vehicular surfaces; and provide groundwater recharge facilities. A summary of the compliance and methodology for each of the (4) areas are outlined below.

NON-STRUCTURAL STORMWATER STRATEGIES:

The project utilizes non-structural stormwater strategies, also known as Low Impact Development techniques, that reduce and/or prevent adverse runoff impacts through careful site planning and both nonstructural and structural techniques that preserve the site's natural hydrologic response to precipitation. Low impact development techniques interact with the hydrologic response by controlling stormwater runoff and pollutants closer to the source and providing site design measures that significantly reduce the overall impact of land development on stormwater runoff. The low impact development techniques promote the concept of designing stormwater with nature. The project has been designed to address to the maximum extent practicable the nine nonstructural strategies outlined in the NJDEP Best Management Practices Manual.

RUNOFF QUANTITY STANDARDS:

In accordance with N.J.A.C. 7:8-5.6, the project is required to meet the minimum design and performance standards to control erosion, maintain groundwater recharge, and control stormwater runoff quantity impacts to the development. In order to satisfy the requirements for stormwater runoff quantity impacts, N.J.A.C. 7:8-5.6(b) outlines four criteria to demonstrate compliance. The project also utilizes criteria #3 for Points of Analysis "A", "B", "C", and "D", which requires the stormwater management measures be designed so that the post-construction peak runoff rates for the 2, 10, and 100-year storm events are 50, 75, and 80 percent of the pre-construction peak runoff rates. In order to satisfy the requirements for stormwater runoff quantity impacts in Harding Township which require the stormwater management measures be designed so that the post-construction peak runoff rates for the 2, 10, and 100-year storm events are 50, 70, and 75 percent of the pre-construction peak runoff rates. The percentages apply only to the post construction stormwater runoff that is attributable to the portion of the site which the proposed development is to be constructed. The allowable flow calculations are based upon disturbance areas for POA "A", POA "B", POA "C", and POA "D". The allowable flow rate calculations will be for POA "A", POA "B", POA "C", and POA "D" where a total of 15.11 acres of disturbance is utilized in the calculations. This number only includes the disturbance going to each of the points of analysis. The total proposed disturbance for the site is 16.57 acres.

WATER QUALITY STANDARDS:

The stormwater management measures are to be designed to reduce the post-construction load of total suspended solids (TSS) in the stormwater runoff generated by the water quality design storm by 80 percent of the anticipated load from the developed site in accordance with N.J.A.C. 7:8-5.5. In accordance with Harding Township ordinance, the proposed small-scale bioretention basins have been designed with a 90% TSS removal rate. As the project proposes an increase of motor vehicle surface of 2.80 Ac. /121.923 S.F., the development is required to meet water quality regulations.

GROUNDWATER RECHARGE STANDARDS:

In order to control stormwater runoff quantity impacts, groundwater recharge is required in accordance with N.J.A.C. 7:8-5.4(b)3. The proposed stormwater management system is designed such that 100% of the average annual pre-construction groundwater recharge volume for the site is infiltrated post-construction. The pre-construction average annual groundwater recharge volume was determined utilizing the New Jersey Groundwater Recharge Spreadsheet (Version 2.0, Nov. 2003) GSR-32. On-site soil log investigation was performed to identify areas on the site conducive for infiltration. Results of the infiltration testing can be found in the Geotechnical Engineering Report prepared by Geo-Technology Associates, Inc., dated October 2022, last revised May 2023.

METHODOLOGY:

Run-off has been generated under both pre- and post-development conditions in accordance with "Part 630 Hydrology, National Engineering Handbook, Chapter 10".

Runoff Curve Numbers

Runoff curve numbers (CN's) have been established by use of the hydrologic soil groups associated with the soils found in the U.S.D.A Natural Resource Conservation Service Web Soil Survey as well as Chapter 9 of the National Engineering Handbook. A composite soil survey map

(See Figure 3) is provided for review of the general soil characteristics. Run-off curve numbers can be found in **Appendix "A"**.

Time of Concentration

The time of concentration under the existing and proposed conditions has been established by review of the topography shown on the plans. For both existing and proposed drainage areas along with proposed impervious surfaces, time of concentration has been calculated based on the McCuen-Spiess criteria. The included weighted curve number calculation sheets and time of concentration sheets have been updated accordingly. Times of concentration can be found in **Appendix "A"** of this report.

Hydrographs

Hydrographs were generated using "Pond Pack" by Haestad Methods. This program is based upon the Soil Conservation Service methodology for tabular hydrographs using the NOAA Type C storm event as detailed in "National Engineering Handbook Part 630 Hydrology." The 24-hour rainfall for the four (4) respective storms studied is as follows:

Storm Event	24 Hour Rainfall
1-yr	1.25"-2 Hr. Storm*
2-yr	3.49"
10-yr	5.22"
100-yr	8.49"

*The 1-year storm event used is based on the New Jersey Department of Environmental Protection 1.25-inch/2-hour Stormwater Quality Design Storm.

The NJDEP Watershed and Land Management Stormwater Rules have been revised to include a Future Precipitation Change Factor for the 2-, 10-, and 100-year storm event, based on the county where the proposed development is located on. The Future Precipitation Change Factors for Morris County for the four (4) respective storms studied is as follows:

Storm Event	Factors	24 Hour Rainfall
1-yr	-	1.25"-2 Hr. Storm*
2-yr	1.23	4.29"
10-yr	1.28	6.68"
100-yr	1.46	12.40"

HYDROLOGIC ANALYSIS

Existing Flow Conditions:

An analysis of the existing site conditions was performed based upon field observation and calculated utilizing weighted curve number calculations and runoff hydrographs. An existing conditions land cover analysis (**DA-1**) has been prepared to visualize the existing land cover calculated in the weighted curve number calculation sheets. The existing conditions weighted curve number calculation summary sheet can be found in **Appendix "A-1"** and the hydrographs can be found in **Appendix "B-1"** of this report. The information is summarized in the table on the next page.

EXISTING CONDITIONS (C.F.S.)								
STORM EVENT	POINT "A"	POINT "A" ALLOWABLE FLOW *	POINT "B"	POINT "B" ALLOWABLE FLOW *	POINT "C"	POINT "C" ALLOWABLE FLOW *	POINT "D"	POINT "D" ALLOWABLE FLOW *
2	2.21	1.53	3.06	1.92	6.41	4.38	1.93	1.71
10	7.60	6.19	8.38	6.51	15.56	12.60	7.10	6.61
100	24.25	20.51	25.46	20.72	48.04	40.42	23.66	22.29

*The calculations for the allowable flows have been included as part of **Appendix "B-2"** of this report. A summary describing the characteristics of each existing drainage area is outlined below. The drainage areas are depicted on the Existing Drainage Area Map (DA-1) located in **Appendix "I"** of this report. As mentioned before, reduction factors have been applied to Points of Analysis "A", "B", "C" and "D", as these points utilize criteria #3 of the N.J.A.C. 7:8-5.6(b). The reduction factors utilized satisfies the criteria #3 of the N.J.A.C. 7:8-5.6(b) and the requirements for stormwater runoff quantity impacts in Harding Township.

Existing Drainage Area #1 (4.77 Ac.)

Existing drainage area #1 is located in the northwestern portion of the site and a portion of the adjacent property to the north. Stormwater runoff flows overland from the adjacent property to the north of the site along the west side of the stie before exiting the property along the northwest property boundary. The runoff generated by this drainage area is analyzed where the on-site water leaves the site along the western property boundary and is analyzed as Point of Analysis 'A'. This drainage area consists of portions of the existing development, including walls and stairs; upland forested areas in the northern portion of the drainage area; and maintained landscaped areas around the existing development.

Existing Drainage Area #2 (5.02 Ac.)

Existing drainage area #2 is located mainly in the southwestern portion of the site and a portion of the adjacent property to the north. Stormwater runoff flows overland from the adjacent property to the north of the site through the center of the cite before exiting the property along the southwest property boundary. The runoff generated by this drainage area is analyzed where the on-site water leaves the site at the southwest property corner as Point of Analysis 'B'. This drainage area consists of a portion of the existing development, maintained landscaped areas around the existing development, upland forested areas in the northern portion of the drainage area, with the remainder of the drainage area being comprised of maintained landscaped areas.

Existing Drainage Area #3 (11.40 Ac.)

Existing drainage area #3 is located in the center portion of the site and a portion of the adjacent property to the north. Stormwater runoff flows overland from the adjacent property to the north of the site through the center of the site before exiting the property along the southern property boundary into Mount Kemble Avenue. The runoff generated by this drainage area is analyzed where the on-site Water leaves the site at the southern property boundary and is collected in the existing stormwater system and is analyzed as Point of Analysis 'C'. This drainage area consists of the remainder of the existing development on the property, maintained landscaped areas adjacent to the existing development; upland forested areas in the northern portion of the drainage

area, and forested areas at the southern property boundary; with the remainder of the drainage area being comprised of maintained landscaped areas.

Existing Drainage Area #4 (5.16 Ac.)

Existing drainage area #4 is comprised of the remainder of the project site and portions of the adjacent property to the north. Stormwater runoff flows overland from the adjacent property to the north along the eastern property boundary of the subject site. The runoff generated by this drainage area is analyzed where the on-site water leaves the site at the southeastern property corner and is analyzed as Point of Analysis 'C'. This drainage area consists of forested areas.

Proposed Flow Conditions:

An analysis of the proposed site conditions was performed based upon the proposed development depicted on the Site Plans and calculated utilizing weighted curve number and runoff hydrographs. The proposed conditions land cover analysis (**DA-2**) has been prepared to visualize the proposed land cover calculated on the weighted curve number calculation sheets. The weighted curve number calculation summary sheet can be found in **Appendix "A-2"** and the hydrographs can be found in **Appendix "B-3"** of this report. The information is summarized in the table below.

PROPOSED CONDITIONS (C.F.S.)								
STORM EVENT	POINT "A"	POINT "A" ALLOWABLE FLOW *	POINT "B"	POINT "B" ALLOWABLE FLOW *	POINT "C"	POINT "C" ALLOWABLE FLOW *	POINT "D"	POINT "D' ALLOWABLE FLOW
2	1.15	1.53	1.84	1.92	4.33	4.38	1.70	1.71
10	4.06	6.19	5.35	6.51	8.14	12.60	6.28	6.61
100	13.07	20.51	20.48	20.72	39.66	40.42	20.79	22.29

*The calculations for the allowable flows have been included as part of **Appendix "B-2"** of this report. A summary describing the characteristics of each proposed drainage area is outlined below. The drainage areas are depicted on the Proposed Drainage Area Map (DA-2) located in **Appendix "I"** of this report. Reduction factors have been applied to Point of Analysis "A", "B", "C", and "D", as these points utilize criteria #3 of the N.J.A.C. 7:8-5.6(b). The reduction factors utilized satisfies the criteria #3 of the N.J.A.C. 7:8-5.6(b) and the requirements for stormwater runoff quantity impacts in Harding Township.

Proposed Drainage Area #1 (2.04 Ac.)

Proposed Drainage Area #1 is the undetained portion of existing drainage area #1. Stormwater runoff flows overland, from a portion of the adjacent property to the north, away from the proposed development, towards point of analysis "A". The drainage area consists of upland forested areas in the northern portion of the drainage area, and portions of open space area. There are no proposed stormwater BMPs located in proposed drainage area #1 and all runoff is undetained and flows overland.

Proposed Drainage Area #2 (1.31 Ac.)

Proposed Drainage Area #2 is the southern undetained portion of existing drainage area #2. Stormwater runoff flows overland from beneath the developed portion of the site to the southwestern property boundary, towards point of analysis "B". The drainage area is comprised

of maintained landscaped areas with woods along the property boundary. There are no proposed stormwater BMPs located in proposed drainage area #2.

Proposed Drainage Area #2Z (0.29 Ac.)

Proposed Drainage Area #2Z is the northern undetained portion of existing drainage area #2. Stormwater runoff flows overland, from a portion of the adjacent property to the north, where it is then directed towards point of analysis “A”. The drainage area is comprised of upland forested areas. There are no proposed stormwater BMPs located in proposed drainage area #2Z.

Proposed Drainage Area #3 (1.55 Ac.)

Proposed Drainage Area #3 is the southern undetained portion of existing drainage area #3. Stormwater runoff flows overland from beneath the developed portion of the site to the southern property boundary along Mount Kemble Avenue towards point of analysis “C”. This drainage area consists of impervious associated with Mount Kemble Avenue, forested areas along Mount Kemble Avenue, and the remainder of the drainage area being maintained landscaped areas along the developed portions. There are no proposed stormwater BMPs located in proposed drainage area #3.

Proposed Drainage Area #3Z (3.17 Ac.)

Proposed Drainage Area #3Z is the northern undetained portion of existing drainage area #3. Stormwater runoff flows overland, from a portion of the adjacent property to the north, where it is then conveyed via a storm conveyance system towards large-scale bioretention basin #12. Discharge from this basin is ultimately analyzed at point of analysis “B”. The drainage area is comprised of upland forested areas.

Proposed Drainage Area #4 (4.28 Ac.)

Proposed Drainage Area #4 is the undetained portion of existing drainage area #4. Stormwater runoff flows overland, from a portion of the adjacent property to the north, away from the proposed development, towards point of analysis “D”. The drainage area consists of upland forested areas in the northern portion of the drainage area, and portions of open space area. There are no proposed stormwater BMPs located in proposed drainage area #4 and all runoff is undetained and flows overland.

Proposed Drainage Area #5 (2.47 Ac.)

Proposed Drainage Area #5 consists of roof runoff from four (4) townhouse buildings, maintained landscaped areas, and portions of impervious associated with Road A and Road D. Runoff flows overland from a high point between and along a portion of the northern wall and is collected via a storm conveyance system and directed towards small-scale bioretention basin #5, where it will be treated for water quality and collected via an underdrain. Discharge from this basin is conveyed via a storm conveyance system towards large-scale bioretention basin #11 and is ultimately analyzed at point of analysis “C”.

Proposed Drainage Area #6 (0.94 Ac.)

Proposed Drainage Area #6 consists of maintained landscaped areas, and portions of impervious associated with Road A. Runoff flows from a high point along a portion of the northern wall and is collected via a storm conveyance system and directed towards small-scale bioretention basin #6,

where it will be treated for water quality and collected via an underdrain. Discharge from this basin is conveyed via a storm conveyance system towards large-scale bioretention basin #12 and is ultimately analyzed at point of analysis “B”.

Proposed Drainage Area #7 (0.44 Ac.)

Proposed Drainage Area #7 consists of maintained landscaped areas, and portions of impervious associated with the entrance circle to the independent and assisted living facility and associated walkways and parking areas. Runoff flows overland from a high point along the building and is collected via a storm conveyance system and directed towards small-scale bioretention basin #7, where it will be treated for water quality and collected via an underdrain. Discharge from this basin is conveyed via a storm conveyance system towards small-scale bioretention basin and is ultimately analyzed at point of analysis “B”.

Proposed Drainage Area #8 (0.90 Ac.)

Proposed Drainage Area #8 consists of the western portion of the roof runoff associated with the independent and assisted living facility. Roof runoff flows via a storm conveyance system to underground detention basin #8. Discharge from this basin is directed towards large-scale bioretention basin #11 and is ultimately analyzed at point of analysis “C”.

Proposed Drainage Area #9 (0.95 Ac.)

Proposed Drainage Area #9 consists of the eastern portion of the roof runoff associated with the independent and assisted living facility. Roof runoff flows via a storm conveyance system to underground detention basin #8. Discharge from this basin is directed towards large-scale bioretention basin #11 and is ultimately analyzed at point of analysis “C”.

Proposed Drainage Area #10 (2.33 Ac.)

Proposed Drainage Area #10 consists of roof runoff from two (2) townhouse buildings, maintained landscaped areas, and portions of impervious associated with Road A, Road B, and the service drive associated with the independent and assisted living facility. Runoff flows overland from a high point between a portion of the northern walls and is collected via a storm conveyance system and directed towards small-scale bioretention basin #10, where it will be treated for water quality and collected via an underdrain. Discharge from this basin is conveyed via a storm conveyance system towards large-scale bioretention basin #11 and is ultimately analyzed at point of analysis “C”.

Proposed Drainage Area #11 (0.72 Ac.)

Proposed Drainage Area #11 consists of maintained landscaped areas around large-scale bioretention basin #11. Runoff flows overland from highpoints around large-scale bioretention basin #11 into the basin. Additionally, flows from small-scale bioretention basin #5, underground detention basin #8, underground detention basin #9, and small-scale bioretention basin #10 are discharged into large-scale bioretention basin #11. Discharge from this basin is analyzed at point of analysis “C”.

Proposed Drainage Area #11A (1.72 Ac.)

Proposed Drainage Area #11A consists of roof runoff from three (3) townhouse buildings, maintained landscaped areas, and portions of impervious associated with Road B and Road C.

Runoff flows overland from a high point behind the northern townhouse building along road C and is collected via a storm conveyance system and directed towards small-scale bioretention basin #11A, where it will be treated for water quality and collected via an underdrain. Discharge from this basin is conveyed via a storm conveyance system towards large-scale bioretention basin #11 and is ultimately analyzed at point of analysis “C”.

Proposed Drainage Area #12A (2.44 Ac.)

Proposed Drainage Area #12A consists of roof runoff from five (5) townhouse buildings, maintained landscaped areas, and portions of impervious associated with Road C, and Road D. Runoff flows overland from a high point along road D and is collected via a storm conveyance system and directed towards small-scale bioretention basin #12A, where it will be treated for water quality and collected via an underdrain. Discharge from this basin is conveyed via a storm conveyance system towards large-scale bioretention basin #12 and is ultimately analyzed at point of analysis “B”.

Proposed Drainage Area #12 (0.35 Ac.)

Proposed Drainage Area #12 consists of maintained landscaped areas around large-scale bioretention basin #12. Runoff flows overland from highpoints around large-scale bioretention basin #12 into the basin. Additionally, flows from small-scale bioretention basin #6, small-scale bioretention basin #7, and small-scale bioretention basin #12A are discharged into large-scale bioretention basin #12. Discharge from this basin is analyzed at point of analysis “B”.

Proposed Drainage Area #13 (0.45 Ac.)

Proposed Drainage Area #13 consists of maintained landscaped areas, roof runoff from the sewer treatment building, and impervious associated with the access road for the sewer treatment building. Runoff flows overland from a point behind the sewer treatment building, down the access road, and is collected via a storm conveyance system and directed towards small-scale bioretention basin #13, where it will be treated for water quality and collected via an underdrain. Discharge from this basin is analyzed at point of analysis “C”.

The tables below outline the proposed site disturbance and increase in vehicular impervious coverage and non-vehicular impervious coverage for the total tract and each of the proposed BMPs:

SITE DISTURBANCE*			
TOTAL SITE DISTURBANCE (ACRES)	TOTAL NON-VEHICULAR IMPERVIOUS AREA (ACRES)	TOTAL VEHICULAR IMPERVIOUS AREA (ACRES)	TOTAL IMPERVIOUS AREA (ACRES)
15.11**	4.72	3.31	8.03

*****Total impervious areas shown in “Site Disturbance” chart above is the total impervious calculated for the proposed drainage analysis. This includes the existing impervious within the drainage boundaries that will remain once proposed development is constructed. The total vehicular impervious area within the property line boundaries is 2.80 acres and the total proposed non-vehicular impervious area for the project is 5.40 acres.

** Total site disturbance in the chart above is to Points of Analysis “A”, “B”, “C”, & “D” which utilize reduction factors. The overall site disturbance for the project is 16.57 acres.

TOTAL AREA TO PROPOSED BMP***					
BMP #	TOTAL DRAINAGE AREA (ACRES)	TOTAL NON-VEHICULAR IMPERVIOUS AREA (ACRES)	TOTAL VEHICULAR IMPERVIOUS AREA (ACRES)	TOTAL IMPERVIOUS AREA (ACRES)	TSS REMOVAL RATE PROVIDED
5	2.47	0.61	0.60	1.21	90%
6	0.94	0.07	0.21	0.28	90%
7	0.44	0.06	0.15	0.21	90%
8	1.85	1.85	0.00	1.85	90%
10	2.33	0.30	1.00	1.30	90%
11	0.72	0.37	0.00	0.37	N/A
11A	1.72	0.50	0.36	0.86	90%
12	0.35	0.00	0.00	0.00	N/A
12A	2.44	0.87	0.45	1.32	90%
13	0.45	0.08	0.11	0.19	90%

***Total impervious areas shown in “Total area to proposed BMP” chart above are total impervious areas directed towards an on-site stormwater BMP and excludes any undetained impervious areas. The undetained imperious area amounts to 0.44 acres associated with the proposed entrance road and existing impervious that will remain once proposed development is constructed.

Proposed Stormwater Management BMPs:

The project is designed utilizing a variety of Best Management Practices as outlined in the NJDEP regulations. Small scale bioretention basins, underground infiltration basins, and a large-scale bioretention basin have been designed for the project. A description of each basin type is outlined below, as well as a summary of the runoff rates, water surface elevations, and outlet structure information for each BMP.

SMALL-SCALE BIORETENTION BASIN: Small-scale bioretention systems are facilities used to address the stormwater quality and quantity impacts for the proposed project, these basins are designed to treat an inflow drainage area less than 2.5-acres. The systems are used to remove a wide range of pollutants from regulated vehicular surfaces. The system is designed with a 1.5-foot-thick soil planting bed with vegetation ranging from trees to herbaceous species which provides 80% TSS removal. The stormwater runoff enters the system and is filtered through the soil media before discharging from the basin. The basins are a mixture of infiltration basins and basins with underdrains that discharge the runoff to the downstream stormwater systems depending on the basin design.

UNDERGROUND INFILTRATION BASIN: The underground infiltration basin is a facility constructed to promote groundwater recharge and address the quantity impacts of the land development. The infiltration basin is installed in an area with passing soil permeability rates for groundwater recharge. The underground infiltration basins are ACO StormBrixx Underground Infiltration System.

LARGE-SCALE BIORETENTION BASIN: Bioretention systems are facilities used to address the stormwater quality and quantity impacts for the proposed project. The system is designed with a 1.5-foot-thick soil planting bed with vegetation ranging from trees to herbaceous species. The stormwater runoff enters the system and is filtered through the soil media before discharging from the basin through an underdrain system. The large-scale bioretention basins are designed to be

used to reduce peak runoff rates and do not have a limit on the contributory inflow drainage area. Although the large-scale bioretention basins will contain soil media that will treat runoff from water quality storm event, its purpose will be for quantity control.

GROUNDWATER RECHARGE

In order to achieve groundwater recharge requirements and provide quantity control, groundwater recharge is required in accordance with N.J.A.C. 7:8-5.4(b)3. The proposed stormwater management system is designed such that 100% of the average annual pre-construction groundwater recharge volume for the site is infiltrated post-construction. The pre-construction average annual groundwater recharge volume was determined utilizing the New Jersey Groundwater Recharge Spreadsheet (Version 2.0, Nov. 2003) GSR-32. The NJGRS sheets can be found in **Appendix "C-3".** Soil investigation and permeability testing was performed in accordance with Chapter 13 of the New Jersey Stormwater Best Management Practices Manual. The soil logs and the permeability test results can be found in the Geotechnical Engineering Report, prepared by Geo-Technology Associates, Inc., dated October 2022, last revised May 2023.

The infiltration rates utilized for each of the infiltration basins can be found in the Hydrogeologic Evaluation for Stormwater Recharge. A summary of the results are as follows:

- Bioretention Basin #6 utilizes a design permeability rate of 1.0 in/hr. The double-ring test performed on soil data samples produced a permeability rate of 2.0 in/hr, which was the lowest rate of the 2 performed within the basin footprint. The rate of 1.0 in/hr. was determined by taking half of the in-field permeability test result as per the BMP manual.

- Underground Infiltration Basin #8 utilizes a permeability rate of 0.5 in/hr. The double-ring test performed on soil data samples produced a permeability rate of 1.0 in/hr, which was the lowest rate of the 2 performed within the basin footprint. The rate of 0.5 in/hr. was determined by taking half of the in-field permeability test result as per the BMP manual.

- Bioretention Basin #10 utilizes a design permeability rate of 0.63 in/hr. The double-ring test performed on soil data samples produced a permeability rate of 1.25 in/hr, which was the lowest rate of the 2 performed within the basin footprint. The rate of 0.63 in/hr. was determined by taking half of the in-field permeability test result as per the BMP manual.

STORMWATER COLLECTION SYSTEM

The stormwater collection system consists of a series of stormwater inlets and flared end sections connected by reinforced concrete pipe and high-density polyethylene pipe. The collected run-off is directed to the stormwater management facilities previously described. The stormwater collection system is designed in accordance with the residential site improvements standards and accepted engineering practices. The Rainfall Intensity Curve was used to generate stormwater intensities based upon the Time of Concentration generated by the "Nomograph for Calculations of Time of Concentration" and a weighted run-off coefficient ("C") was calculated for each drainage area. Manning's Equation was used to ensure adequacy of the pipes and The Rational Method was used to generate stormwater flows. According to the Residential Site Improvement Standards (RSIS), the stormwater collection system is only required to be sized for the 25-year storm. At the suggestion of the Township Engineer, the stormwater collection system has been upsized to accommodate the 100-year storm. Basin discharge pipes have been designed to accommodate the 100-year storm. The specified inlet casings are compliant with the New Jersey Department of Environmental Protection Stormwater Regulations, details of which can be found on the Construction Detail Sheets.

Pipe calculations and hydraulic grade line calculations are provided in **Appendix "D"**. Nomograph Runoff Coefficients and Rainfall Intensity Curves can be found in **Appendix "H"**.

SOIL EROSION AND SEDIMENT CONTROL

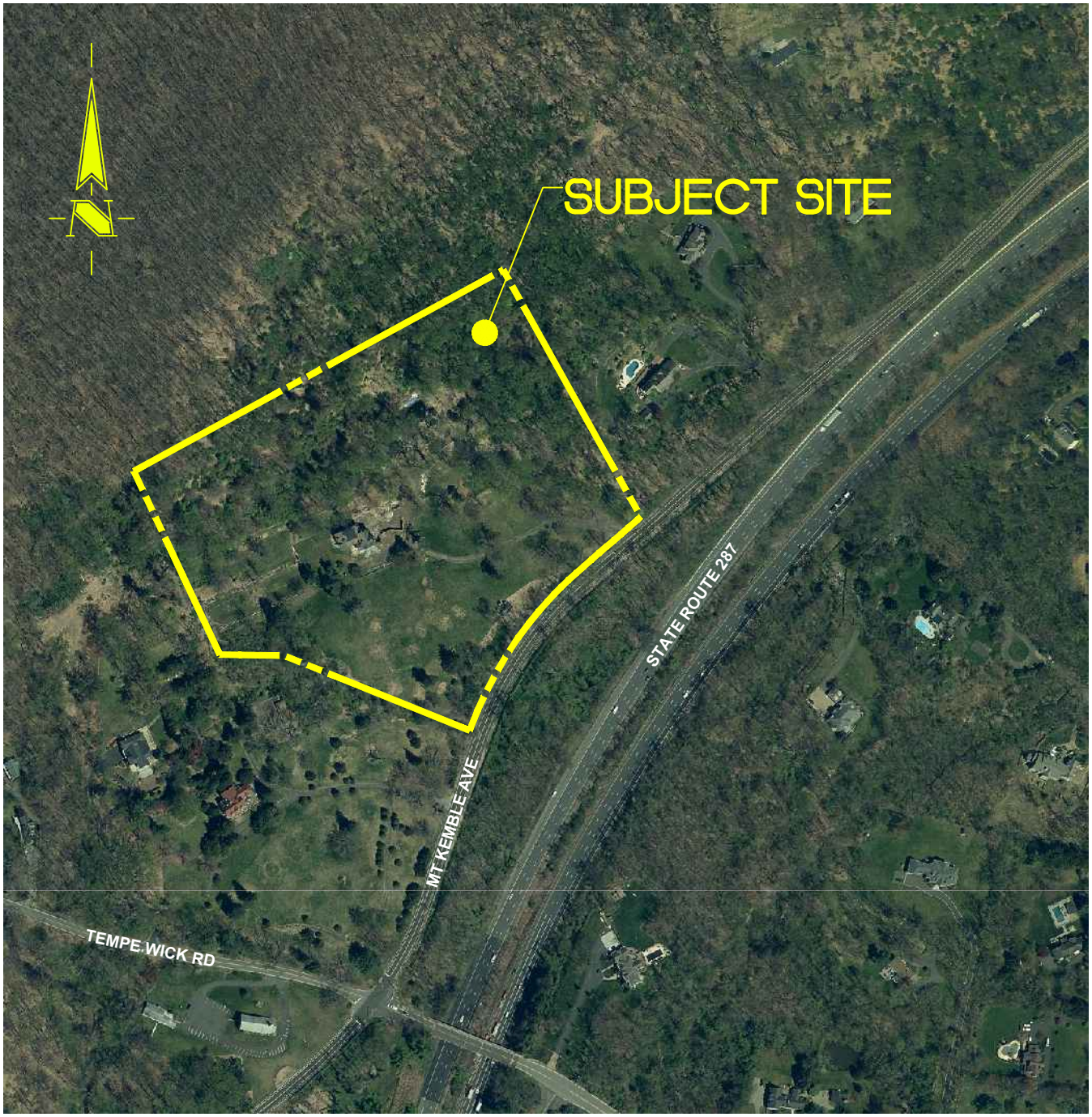
The Soil Erosion and Sediment Control Measures for this project include designed riprap conduit outlet protection apron, perimeter silt fencing, temporary and permanent seeding and mulching, and the installation of temporary stone tracking pads. All provisions are to be in accordance with the "Standards for Soil Erosion and Sediment Control in New Jersey". The specifics of these soil erosion and sediment control measures are shown on the project site plans. The computations for sizing the conduit outlet protection aprons are provided in **Appendix "E"**. The conduit outlet protection for the discharge into and out of the basin has been designed for the 100-year storm event. The conduit outlet protection is designed in accordance with Section 4.12 of the above noted manual published by the New Jersey State Soil Conservation Committee.

EMERGENCY SPILLWAY

The bioretention basins have an emergency spillway designed using the 100-year + 50% storm event and placing the outlet structure in a closed condition. This has been done to demonstrate that the spillway can handle the storm flow in case of the outlet structure being incapacitated. For the basins where a spillway was not feasible, the Outlet Control Structure and the outlet pipe have been upsized to control the 100-year + 50% storm event. The routing and velocity calculations can be found in **Appendix "F"**.

CONCLUSION

A review of the methodology and analysis used for this stormwater management study reveals that the measures that have been taken to provide water quality treatment with the use of *Best Management Practices* (BMP's) and the proposed on-site detention facility will maintain the post-construction peak rates of runoff below allowable rates for the storm events studied and meet water quality. A narrative on the compliance of the project to the low impact development techniques per NJDEP BMP manual has been provided in **Appendix "G"** of this report. Based upon the information provided in this report, it is determined that the basins and other stormwater management facilities can be constructed as proposed without negative impact due to stormwater runoff to areas downstream of the project and construction can take place while adhering to the rules and regulations of State and Local agencies.



NOTES:
1. OUTLINE OF PROPERTY IN QUESTION APPROXIMATE FROM HARDING TOWNSHIP TAX MAP.

GLADSTONE DESIGN, Inc.

Consulting Engineers
Land Surveyors
Landscape Architects
Land Planners

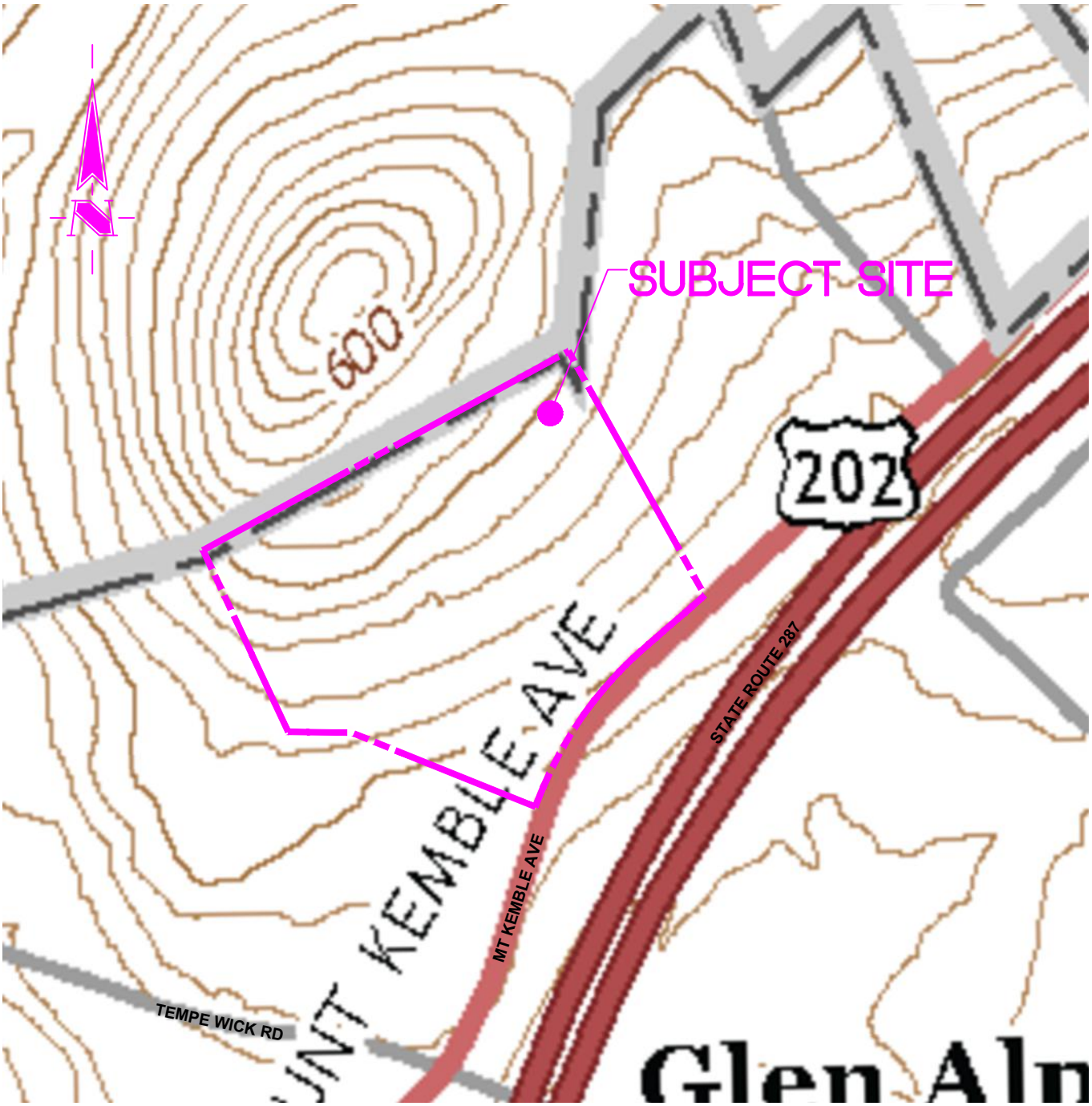
265 Main Street P.O. Box 400
Gladstone, New Jersey 07934
Telephone (908) 234-0309
Facsimile (908) 719-3320

NJ Certificate of Authorization
No. 24GA28034400

HURSTMONT ESTATE

LOT 2 BLOCK 27
HARDING TOWNSHIP
MORRIS COUNTY, N.J.

SHEET TITLE:	KEY MAP
REFERENCE:	GOOGLE MAPS
DWN.	GKP
CHKD.	BLR
SCALE	1"=400'
DATE	05-26-23
FIG. NO.	1
JOB NO.	1047-01



NOTES:
1. QUAD MAP FROM UNITED STATES GEOLOGICAL SURVEY, BERNARDSVILE AND MENDHAM QUADRANGLE 7.5 MINUTE SERIES TOPOGRAPHIC MAP.
2. OUTLINE OF PROPERTY IN QUESTION APPROXIMATE FROM HARDING TOWNSHIP TAX MAP.

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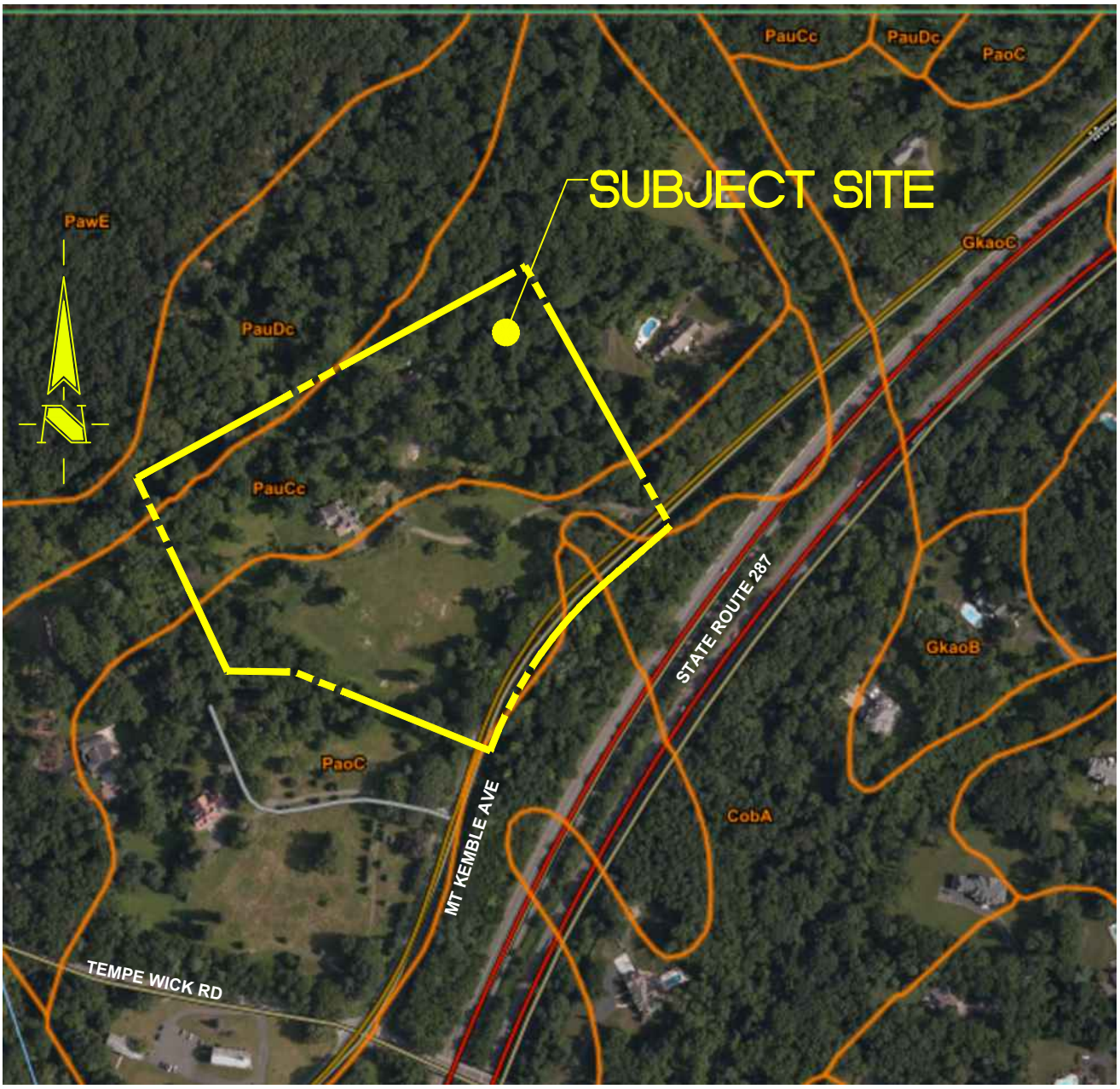
HURSTMONT ESTATE

LOT 2 BLOCK 27
HARDING TOWNSHIP
MORRIS COUNTY, N.J.

SHEET TITLE:	U.S.G.S. QUAD MAP
REFERENCE:	BERNARDSVILLE AND MENDHAM QUADRANGLE
DWN.	GKP
CHKD.	BLR
SCALE	1"=400'
DATE	05-26-23
FIG. NO.	2
JOB NO.	1047-01



NOTES:
1. OUTLINE OF PROPERTY IN QUESTION APPROXIMATE FROM HARDING TOWNSHIP TAX MAP.

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HURSTMONT ESTATE

LOT 2 BLOCK 27
HARDING TOWNSHIP
MORRIS COUNTY, N.J.

SHEET TITLE: SOILS MAP

REFERENCE: U.S.D.A. N.R.C.S. WEB SOIL SURVEY

DWN.	GKP
CHKD.	BLR
SCALE	1"=400'
DATE	05-26-23
FIG. NO.	3
JOB NO.	1047-01