

Urban Nutrient Management Plan For George Washington Memorial Parkway

Prepared For:

National Park Service- George Washington Memorial Parkway
Attn: Morgan German

Revision By:

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Site Information:

George Washington Memorial Parkway
Alexandria, Virginia

Watershed- Potomac River-Pimmit Run
VAHU6-PL24

Plan Written- 5/27/2022

Plan Expires- 5/27/2025

Memorial Circle- 3.93 acres

Memorial Ave-1.00 acres

U.S. Marine Corps Memorial- 3.30 acres

Arlington House- 1.11 acres

Total Acres- 9.34

Signature: Matthew W. Austin



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Narrative

Location

The George Washington Memorial Parkway (GWMP) is a 25-mile-long parkway that runs along the Potomac River from Mount Vernon to Langley, Virginia. The Park headquarters is located at 700 George Washington Memorial Parkway in Mclean, Virginia. This plan covers turf located in four adjacent areas all under the control of GWMP: Memorial Circle (38°53'8.68"N/ 77° 3'34.73"W), Memorial Ave (38°53'2.60"N/ 77° 3'53.97"W), Arlington House (38°52'52.30"N/ 77° 4'21.55"W) and the U.S. Marine Corps Memorial (38°53'24.85"N/ 77° 4'12.15"W).

Frost Dates

	Killing Frost Dates	Cool Season Applications	Warm Season Applications
Spring	April 10th	February 27th	April 10th
Fall	October 25th	December 6th	September 25th

Discussion of Use and Past Management Activities

The turf areas are used primarily as medians and open space use is restricted by busy roads or small pedestrian barriers. Due to the proximity to roads, walkways, and urban areas many of the turf areas are severely compacted.

The turf is maintained by the George Washington Memorial Parkway who utilizes third party contractors for mowing, fertilization, and aeration. Fertilization of established turf areas in the past included granular fertilizer application using a tractor mounted single disk spreader with a

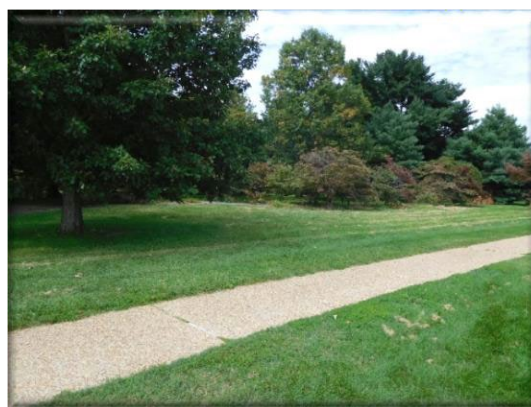


Figure 1: Turf near impervious areas

minimum spread width or 10'. Fertilizer blends of 18-2-18 with 40% of the total nitrogen required to be polymer coated (slowly available) nitrogen was required. The Memorial Avenue site is also aerated annually.

Sensitive Sites

The identified sites are all located within a National Park and near highly visible visitor areas. There are no streams, wetlands, or other sensitive sites located on or adjacent to the nutrient management areas.

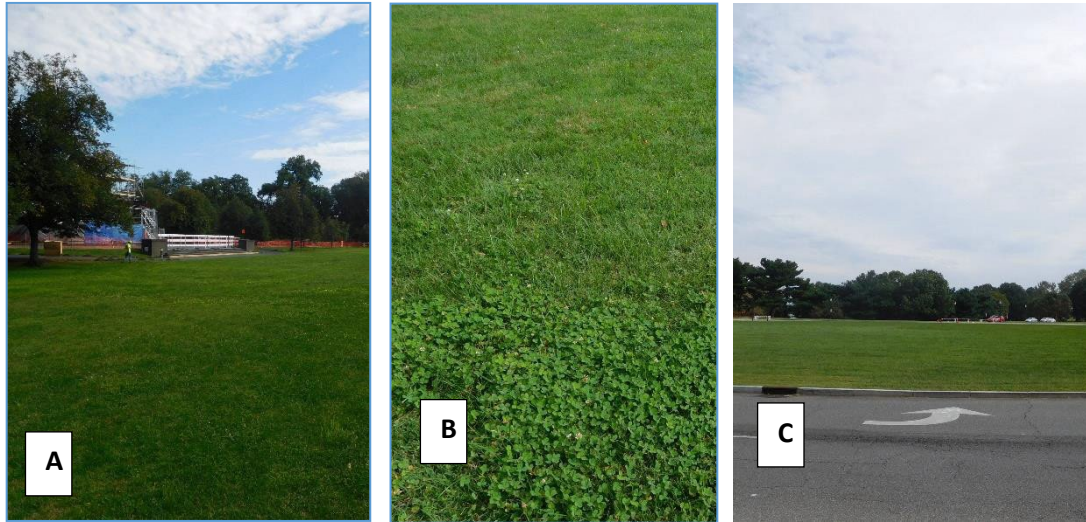


Figure 2: **A-**Iwo Jima Memorial; **B-** Typical Turf Condition; **C-** Memorial Circle

General Budget and Capacity Note

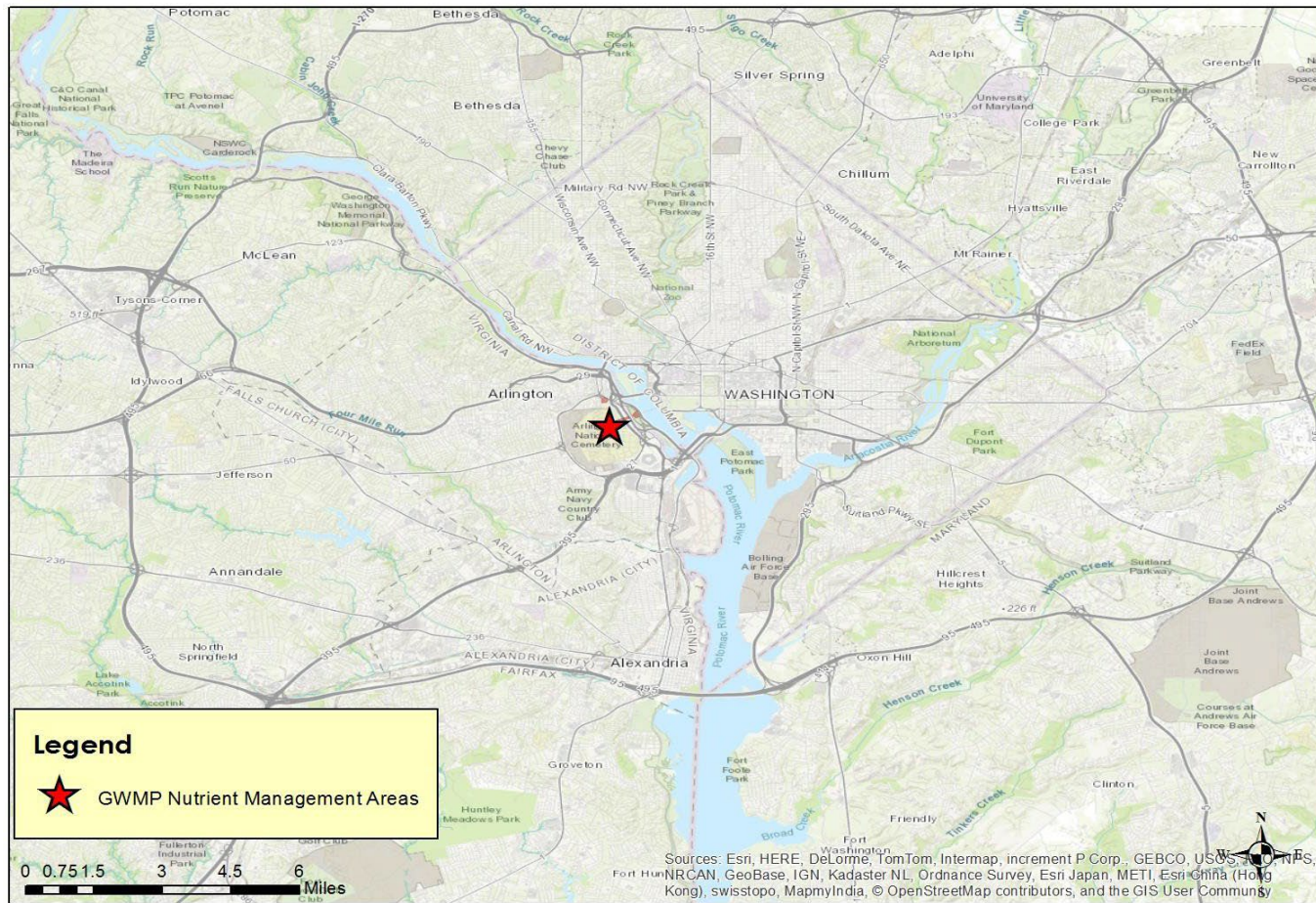
The National Park Service has minimal budget for fertilizer, lime, and reseeding. Therefore, nutrient applications (particularly Spring nitrogen applications) are often slightly reduced to save money – especially if the turf has a good appearance.

Plan Updates

The worksheets in this plan represent maintenance recommendations for the turf grass for the next three years. Nutrient applications will be repeated each year at the same designated times. This plan will need to be revised at the end of the three-year period in order to remain current. Revising a plan takes some time, so the process should begin at least 4 weeks prior to the expiration of the plan.

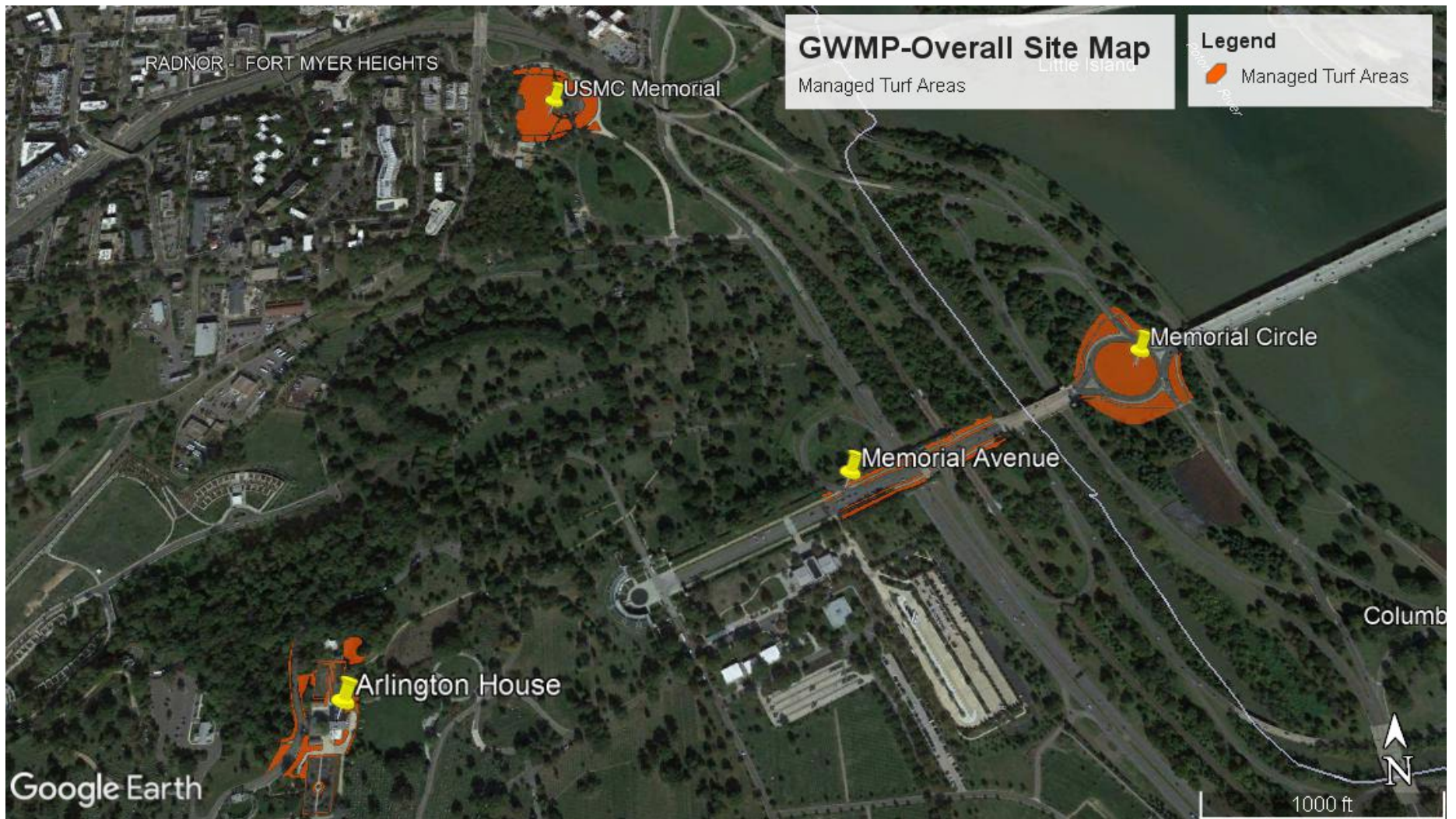
Location Maps

Vicinity Map: GWMP Urban Nutrient Mangement Areas

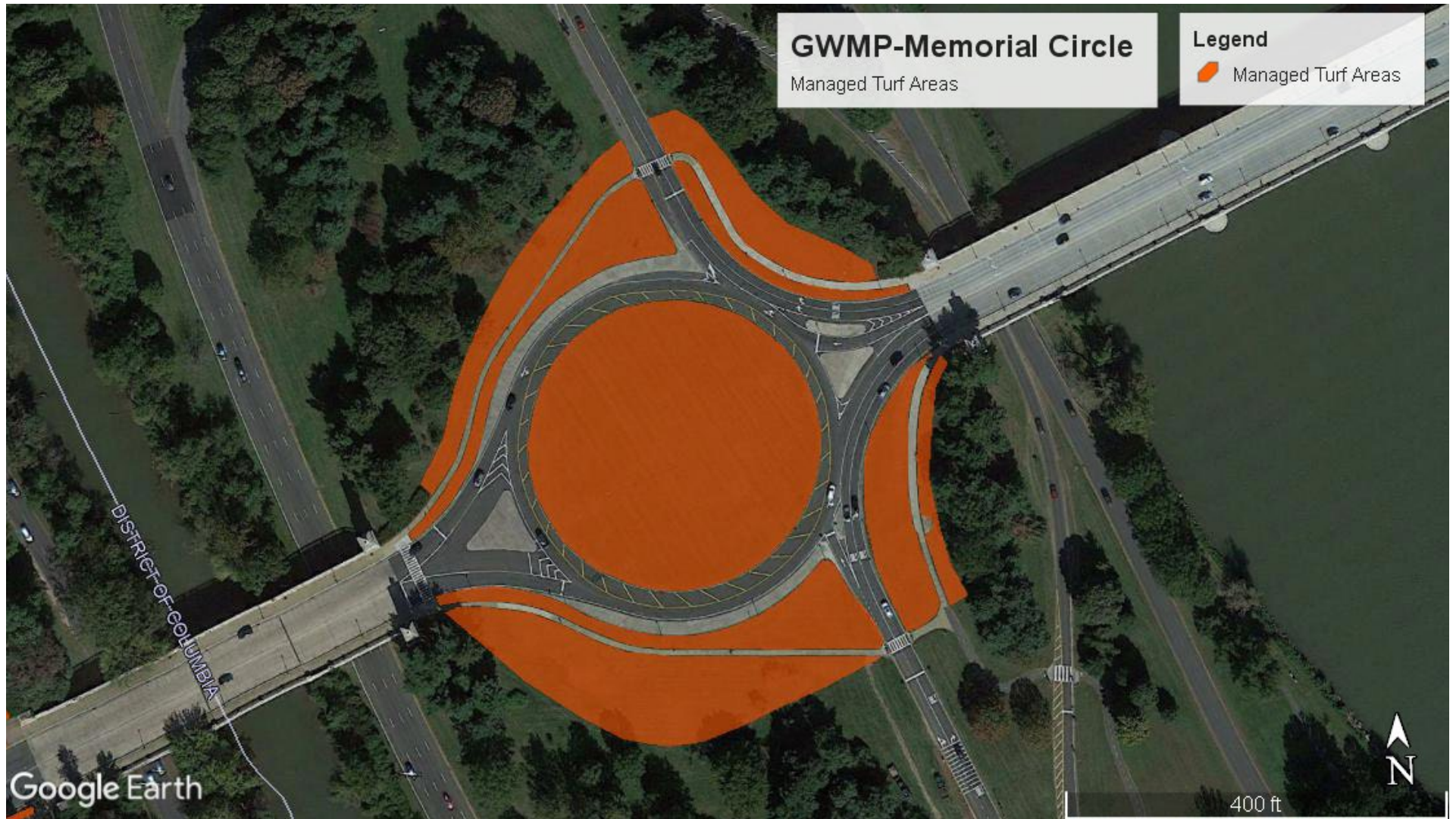


Site Maps

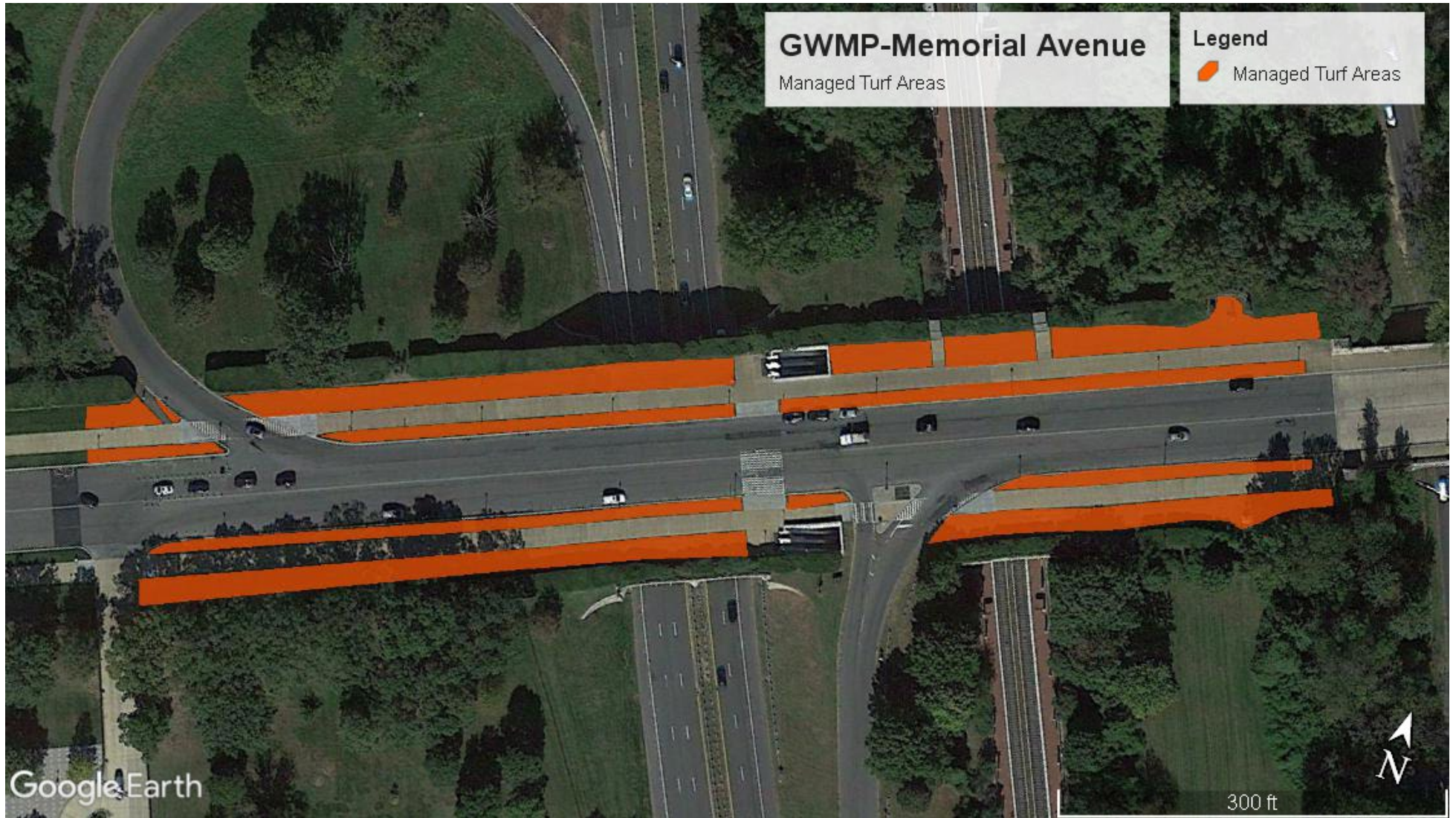
Overall Site Map: GWMP Nutrient Management Locations



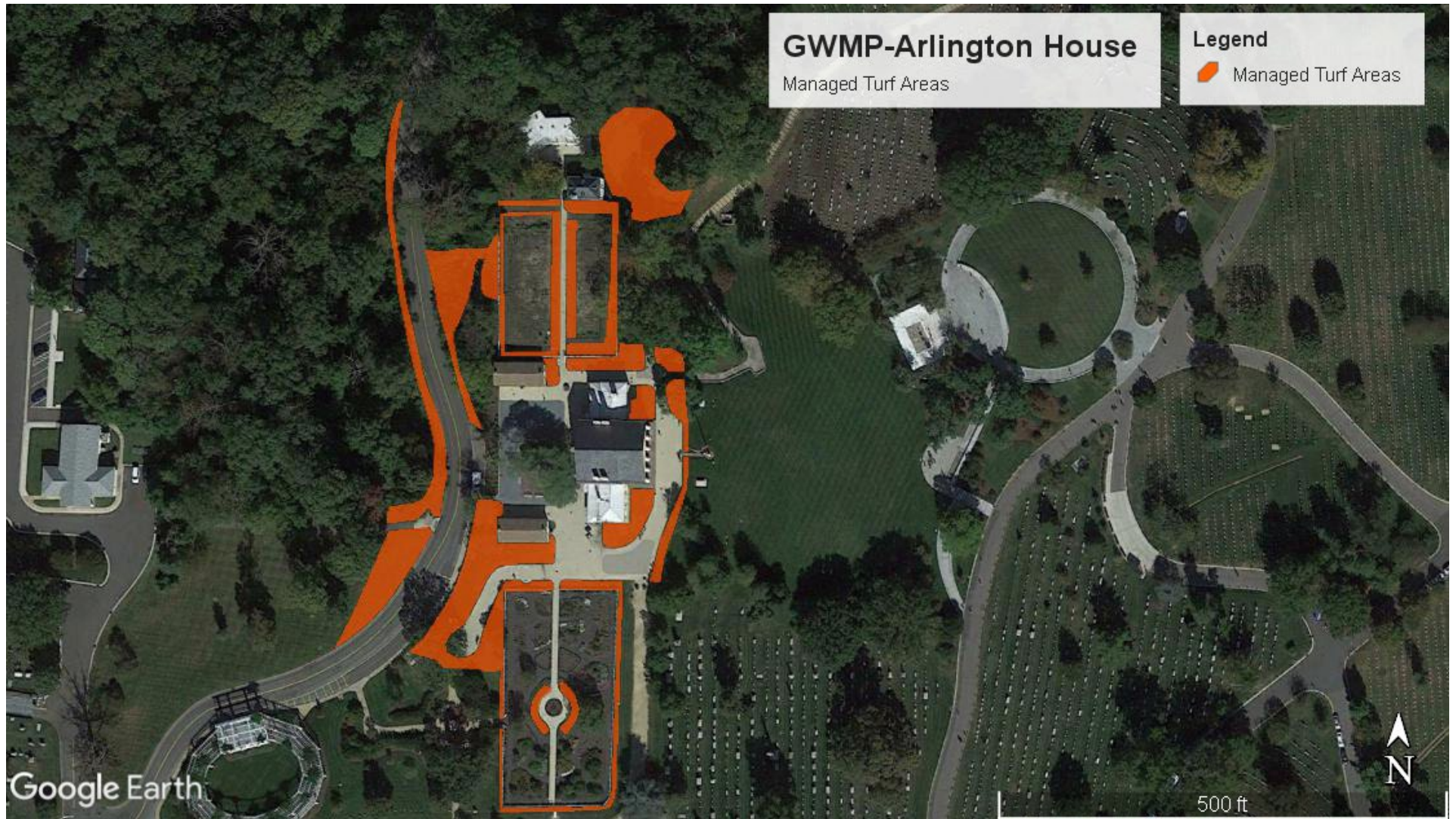
GWMP Turf Management Area: Memorial Circle



GWMP Turf Management Area: Memorial Avenue



GWMP Turf Management Area: Arlington House



GWMP Turf Management Area: United States Marine Corp Memorial



Soil Composition Maps

The National Resources Conservation Service's (NRCS) Web Soil Survey (WSS) provides soil data and information from the National Cooperative Soil Survey. The WSS website can be consulted to determine the soil types at all of the Areas of Interest (AOI) identified within the nutrient management areas. The percentage of each soil type within the AOI can be found directly found below the illustrated map of each site location.

An understanding of the predominant soil types in each managed area will greatly aid in the fertilizer application management of each site by looking at soil characteristics with regards to potential leaching of nutrients, water holding capacity, Cation Exchange Capacity, etc.

Note: The AOI was manually drawn and does not exactly correspond with the exact property boundaries of these identified areas.

Description of Soil Classification

The major soil types found throughout the identified AOI's within this NMP are outlined within this section.

1. **Udorthents-Dumps Complex** is a loamy to clayey soil type. Udorthents-Dumps complex is the primary soil type found within all the identified management areas within this plan. It is described as a heavily modified soil type that primarily consists of overburden and waste rock that have been stockpiled during mining and soil material has been cut and filled during road or building construction. This soil type is very deep, well drained or somewhat excessively drained, nearly level to very steep. These soils are mainly found on side slopes in upland areas. Slopes range from 0-45 percent. Because of the variability of modified soils, a typical profile is not given.

GWMP Site: Memorial Circle



GWMP Site: Memorial Circle (WSS) Soil Types

District of Columbia (DC001)			
District of Columbia (DC001)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
U1	Udorthents	6.3	100.0%
Totals for Area of Interest		6.3	100.0%

GWMP Site: Memorial Avenue



GWMP Site: Memorial Avenue (WSS) Soil Types

Arlington County, Virginia (VA013)			
Arlington County, Virginia (VA013)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
12	Urban land-Udorthents complex, 2 to 15 percent slopes	3.8	100.0%
Totals for Area of Interest		3.8	100.0%

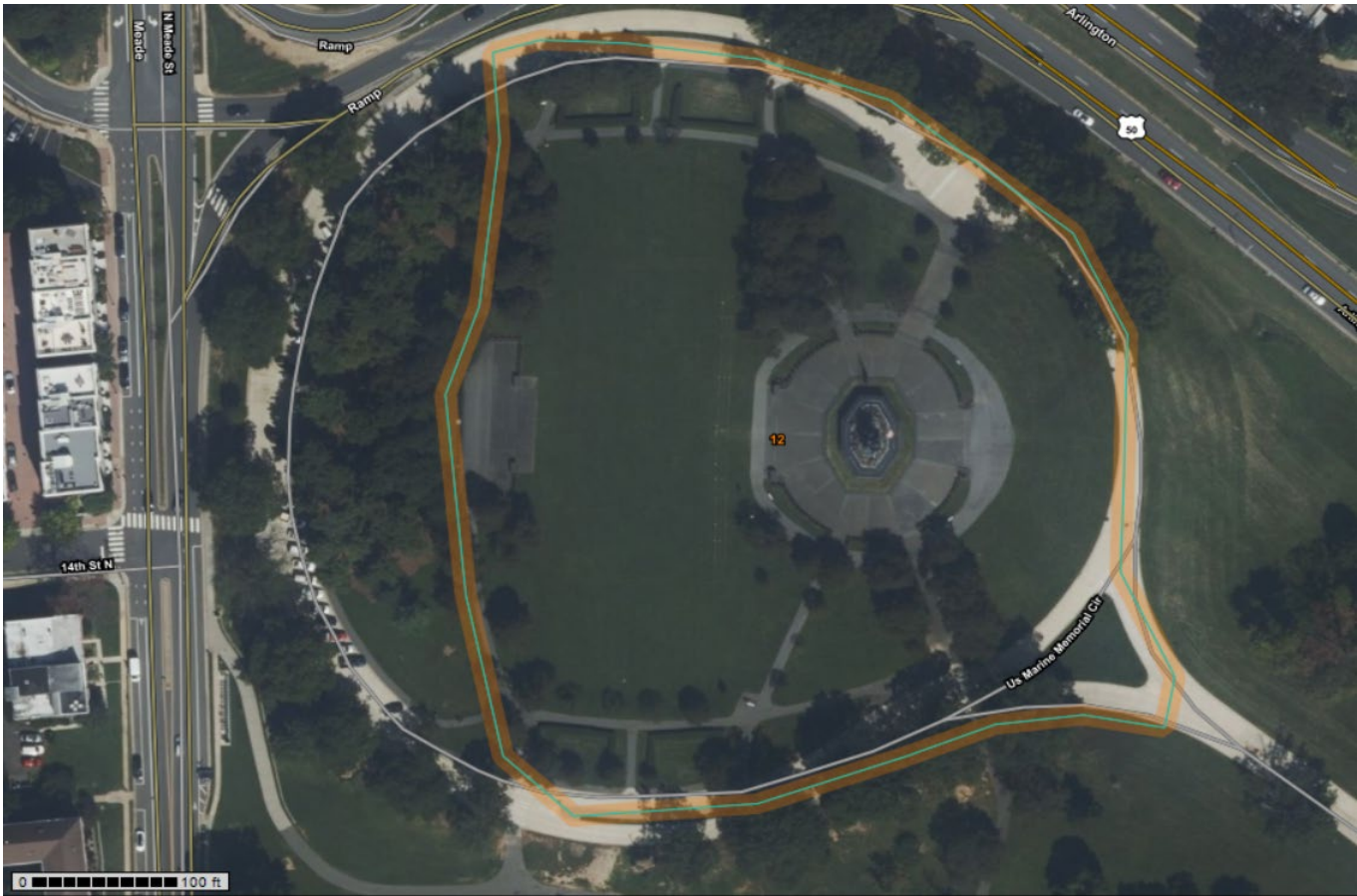
GWMP Site: Arlington House



GWMP Site: Arlington House (WSS) Soil Types

Arlington County, Virginia (VA013)			
Arlington County, Virginia (VA013)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
5	Arlington National Cemetery	1.6	100.0%
Totals for Area of Interest		1.6	100.0%

GWMP Site: United States Marine Corp Memorial



GWMP Site: United States Marine Corp Memorial (WSS) Soil Types

Arlington County, Virginia (VA013)			
Arlington County, Virginia (VA013)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
12	Urban land-Udorthents complex, 2 to 15 percent slopes	5.1	100.0%
Totals for Area of Interest		5.1	100.0%

Soil Test Results



Essential Elements representatives collected samples from the management areas on February 27th, 2022. Samples were taken from the upper 4" of soil, excluding the thatch layer, and in random locations throughout the field area. Soil from each sample was thoroughly mixed, packaged, and sent to Waypoint Analytical in Richmond, VA. This process allows a representative overall average to be obtained to set thresholds for fertilization and lime recommendations.

Waypoint completed analysis of the samples on March 2, 2022. Standard soil test results provide values for pH, cation exchange capacity, phosphorus, calcium, magnesium, potassium, and sodium. Nitrogen is not included in the standard soil sample analysis because nitrogen is extremely mobile and can change dramatically in the soil resulting in inaccurate data. The nitrogen recommendations in this plan are based on Virginia Cooperative Extension research and recommendations for the nitrogen needs of various turf grasses and ornamental plants. The soil samples collected are valid for the life of this plan (three years) or upon a major renovation or redesign of the lawn, whichever occurs sooner.

George Washington Memorial Parkway Soil Test Results								
Managed Area	Soil pH	Buffer pH	Lab* P (ppm)	VT** P (ppm)	VT (H/M/L)	Lab* K (ppm)	VT** K (ppm)	VT (H/M/L)
Memorial Circle	5.8	6.78	40	15.1	M+	156	110.8	H
Memorial Ave	5.9	6.81	39	14.6	M	113	80.2	M+
Arlington House	6.4	6.85	42	16.0	M+	129	91.6	H-
U.S. Marine Corps Memorial	6.4	6.85	41	15.5	M+	107	76.0	M+

*Lab P and K results are from Waypoint sample analyzed on 03/02/2022.

**VT results are Waypoint analysis results (Mehlich III) converted to Virginia Tech analysis results (Mehlich I) using equations found in Virginia Nutrient Management Standards and Criteria, July 2014.

Terms

Soil pH- The soil pH measures active soil acidity or alkalinity. A pH of 7.0 is neutral. Values lower than 7.0 are acid; values higher are alkaline. Usually, the most desirable pH range for mineral soils is 6.0 to 7.0 and for organic soils 5.0 to 5.5.

Buffer pH- An index value used for determining the amount of lime to apply on acid soils to bring the pH to the desired level for the turf to grow. The lower the buffer pH reading, the higher the lime requirement.

WIN- Water Insoluble Nitrogen. WIN is a Nitrogen source which is slowly released for use by Turf over an extended period of time.

VT P- The lab test results for phosphorus from Virginia Tech analysis (Mehlich I).

VT K- The lab test results for potassium from Virginia Tech analysis (Mehlich I).

VT Rating- Virginia Tech soil fertility rating which provides a general guideline for determining the optimum nutrient levels. The fertility rating system uses broad categories of Low, Medium, High, and Very High. It also integrates pluses (+) and minuses (-) to further refine these categories (e.g., Medium +) where plus is on the more fertile end of the scale and minus is on the less fertile end of the scale.

General Nutrient Recommendations

Lime

Lime Recommendations for Turf Areas		
Managed Area	Soil pH	Lime (lbs./1000)
Memorial Circle	5.8	60
Memorial Ave	5.9	50
Arlington House	6.4	30
U.S. Marine Corps Memorial	6.4	30

- **Memorial Circle-** 60 pounds of lime per 1000 ft² is recommended.
- **Memorial Ave-** 50 pounds of lime per 1000 ft² is recommended.
 - *Splitting the Memorial Circle and Memorial Ave lime application into two (2) applications 4-6 months apart is recommended.*
- **Arlington House-** 30 pounds of lime per 1000 ft² is recommended.
- **U.S. Marine Corps Memorial-** 30 pounds of lime per 1000 ft² is recommended.

Phosphorus

Phosphorus Recommendations for Turf Areas		
Managed Area	Soil Test Level	Nutrient Need (lbs./1000 ft ² /yr.)
Memorial Circle	M+	1.0
Memorial Ave	M	1.5
Arlington House	M+	1.0
U.S. Marine Corps Memorial	M+	1.0

- Phosphorus levels for the **Memorial Circle** are in the **Medium** range. Applications of phosphorus are recommended and are not to exceed **1.5 lbs. /1000 ft² annually**.
- Phosphorus levels for the **Memorial Ave** are in the **Medium +** range. Applications of phosphorus are recommended and are not to exceed **1.0lb. /1000 ft² annually**.
- Phosphorus levels for **Arlington House** are in the **Medium +** range. Applications of phosphorus are recommended and are not to exceed **1.0 lb. /1000 ft² annually**.
- Phosphorus levels for the **U.S. Marine Corps Memorial** are in the **Medium +** range. Applications of phosphorus are recommended and are not to exceed **1.0 lbs. /1000 ft² annually**.

Potassium

Potassium Recommendations for Turf Areas		
Managed Area	Soil Test Level	Nutrient Need (lbs./1000 ft ² /yr.)
Memorial Circle	H	0.75
Memorial Ave	M+	1.0
Arlington House	H-	1.0
U.S. Marine Corps Memorial	M+	1.0

- Potassium levels for the **Memorial Circle** are in the **High** range. Applications of potassium are recommended and are not to exceed **0.75 lb. /1000 ft² annually**.
- Potassium levels for the **Memorial Ave** are in the **Medium +** range. Applications of potassium are recommended and are not to exceed **1.0 lb. /1000 ft² annually**.
- Potassium levels for **Arlington House** are in the **High -** range. Applications of potassium are recommended and are not to exceed **1.0 lb. /1000 ft² annually**.
- Potassium levels for the **U.S. Marine Corps Memorial** are in the **Medium +** range. Applications of potassium are recommended and are not to exceed **1.0 lb. /1000 ft² annually**.

Nitrogen

Nitrogen applications for all sites may not exceed **3.5 lbs. /1,000 ft² annually**.

Environmentally Sensitive Sites

Curb and gutter stormwater systems were observed near Memorial Avenue and Memorial Circle. Covers over the openings to the stormwater system are recommended during fertilizer applications. Ensure all granular fertilizer applied near these areas stays in the turf covered area. In locations adjacent to roadways or potential watershed runoff areas it is recommended to use a drop style spreader or a rotary style spreader with a deflector shield to minimize fertilizer onto impermeable surfaces or potential watershed runoff areas. Should particles land on impermeable surfaces, the particles of fertilizer must be collected and removed immediately. No other environmentally sensitive sites were observed within the nutrient management areas.

Detailed Nutrient Recommendations

The tables below provide detailed recommendations for nutrient applications. The worksheet represents the recommended fertilization amount and timing based on the Virginia DCR standards. The amount specified in each month cannot be exceeded but may be reduced. Deviations from the exact date may occur but the interval between applications must be consistent with the worksheet. Changes in fertilizer formulations will require revisions to the tables. **No application of nutrients shall be made to frozen or snow-covered ground per 4VAC50-85-140. A.4.f.**

Roadway and walking path hard surfaces were observed throughout each of the four sites. When applying granular fertilizers near these areas, please remove all fertilizers back onto the turfgrass areas. Do not apply phosphorus to areas testing on or above 55ppm Mehlich I P. If any questions or concerns arise during the implementation of this

plan, contact the plan writer. If you make any changes to the plan, contact the plan writer to update the plans.

National Park Service-George Washington Memorial Parkway

Management Area	Memorial Circle							Area (Acres)	3.93				
Turf Species	Turf type Tall Fescue												
Application Month/Day	Analysis					Application Interval	Fertilizer Type	Fertilizer Description	Rate per 1000ft²	lbs. or oz.	%Slow Release N	Total NPK lbs./1000ft²	Total Product (lbs. per Area)
	N	-	P	-	K							N - P₂O₅ - K₂O	
September 15	18	-	2	-	18	30 Days	WIN		5.00	lbs.	78%	0.90 - 0.10 - 0.90	856
October 15	18	-	2	-	18	30 Days	WIN		5.00	lbs.	78%	0.90 - 0.10 - 0.90	856
November 15*	18	-	2	-	18	30 Days	WIN		5.00	lbs.	78%	0.90 - 0.10 - 0.90	856
	0	-	0	-	0				0.00	lbs.	0%	0.00 - 0.00 - 0.00	
	0	-	0	-	0				0.00	lbs.	0%	0.00 - 0.00 - 0.00	
	0	-	0	-	0				0.00	lbs.	0%	0.00 - 0.00 - 0.00	
April 15*	18	-	2	-	18	30 Days	WIN		4.45	lbs.	78%	0.80 - 0.09 - 0.80	762
	0	-	0	-	0				0.00	lbs.	0%	0.00 - 0.00 - 0.00	
									Total		3.50 - 0.39 - 3.50		

*Optional applications in fall after Veterans Day and Spring if needed.

National Park Service-George Washington Memorial Parkway

Management Area	Memorial Ave							Area (Acres)	1.00				
Turf Species	Turf type Tall Fescue												
Application Month/Day	Analysis					Application Interval	Fertilizer Type	Fertilizer Description	Rate per 1000ft²	lbs. or oz.	%Slow Release N	Total NPK lbs./1000ft²	Total Product (lbs. per Area)
	N	-	P	-	K							N - P₂O₅ - K₂O	
September 15	18	-	2	-	18	30 Days	WIN		5.00	lbs.	78%	0.90 - 0.10 - 0.90	219
October 15	18	-	2	-	18	30 Days	WIN		5.00	lbs.	78%	0.90 - 0.10 - 0.90	219
November 15*	18	-	2	-	18	30 Days	WIN		5.00	lbs.	78%	0.90 - 0.10 - 0.90	219
	0	-	0	-	0				0.00	lbs.	0%	0.00 - 0.00 - 0.00	
	0	-	0	-	0				0.00	lbs.	0%	0.00 - 0.00 - 0.00	
	0	-	0	-	0				0.00	lbs.	0%	0.00 - 0.00 - 0.00	
April 15*	18	-	2	-	18	30 Days	WIN		4.45	lbs.	78%	0.80 - 0.09 - 0.80	194
	0	-	0	-	0		WIN		0.00	lbs.	0%	0.00 - 0.00 - 0.00	
									Total		3.50 - 0.39 - 3.50		

*Optional applications in fall after Veterans Day and Spring if needed.

National Park Service-George Washington Memorial Parkway													
Management Area	U.S. Marine Corps Memorial						Area (Acres)	3.30					
Turf Species	Turf type Tall Fescue												
Application Month/Day	Analysis					Application Interval	Fertilizer Type	Fertilizer Description	Rate per 1000ft²	lbs. or oz.	%Slow Release N	Total NPK lbs./1000ft²	Total Product (lbs. per Area)
	N	-	P	-	K							N	
September 15	18	-	2	-	18	30 Days	WIN		5.00	lbs.	78%	0.90 - 0.10 - 0.90	720
October 15	18	-	2	-	18	30 Days	WIN		5.00	lbs.	78%	0.90 - 0.10 - 0.90	720
November 15*	18	-	2	-	18	30 Days	WIN		5.00	lbs.	78%	0.90 - 0.10 - 0.90	720
	0	-	0	-	0				0.00	lbs.	0%	0.00 - 0.00 - 0.00	
	0	-	0	-	0				0.00	lbs.	0%	0.00 - 0.00 - 0.00	
	0	-	0	-	0				0.00	lbs.	0%	0.00 - 0.00 - 0.00	
April 15*	18	-	2	-	18	30 Days	WIN		4.45	lbs.	78%	0.80 - 0.09 - 0.80	641
	0	-	0	-	0		WIN		0.00	lbs.	0%	0.00 - 0.00 - 0.00	
									Total		3.50 - 0.39 - 3.50		

*Optional applications in fall after Veterans Day and Spring if needed

National Parks Service-George Washington Memorial Parkway

Management Area	Arlington House Turf Area							Area (Acres)	.24				
Turf Species	Turf type Tall Fescue												
Application Month/Day	Analysis					Application Interval	Fertilizer Type	Fertilizer Description	Rate per 1000ft²	lbs. or oz.	%Slow Release N	Total NPK lbs./1000ft²	Total Product (lbs. per Area)
	N	-	P	-	K							N - P ₂ O ₅ - K ₂ O	
September 15	18	-	2	-	18	30 Days	WIN		5.00	lbs.	78%	0.90 - 0.10 - 0.90	54
October 15	18	-	2	-	18	30 Days	WIN		5.00	lbs.	78%	0.90 - 0.10 - 0.90	54
November 15*	18	-	2	-	18	30 Days	WIN		5.00	lbs.	78%	0.90 - 0.10 - 0.90	54
	0	-	0	-	0				0.00	lbs.	0%	0.00 - 0.00 - 0.00	
	0	-	0	-	0				0.00	lbs.	0%	0.00 - 0.00 - 0.00	
	0	-	0	-	0				0.00	lbs.	0%	0.00 - 0.00 - 0.00	
April 15*	18	-	2	-	18	30 Days	WIN		4.45	lbs.	78%	0.80 - 0.09 - 0.80	48
	0	-	0	-	0				0.00	lbs.	0%	0.00 - 0.00 - 0.00	
									Total		3.50 - 0.39 - 3.50		

*Optional applications in fall after Veterans Day and Spring if needed

Fertilizer Application Record

The attached worksheet is provided as a tool to assist with tracking and recording fertilizer applications and should be completed after each application. This worksheet can assist in providing some of the information that may be required by Virginia DCR or DEQ to demonstrate compliance with this plan. Additionally, completed forms can help inform revisions to this plan and/or recommendations in future plans.

References

Department of Conservation and Recreation Revised (2014) Virginia Nutrient Management Standards & Criteria

Google Earth Imagery dated October 2021

National Park Service
<https://www.nps.gov/gwmp/index.htm>

U.S. Department of Agriculture (2015); Natural Resources Conservation Service
<https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>

Virginia Department of Conservation and Recreation. Virginia Hydrologic Unit Explorer.
<https://consapps.dcr.virginia.gov/htdocs/maps/HUExplorer.htm>

Waypoint Analytical Laboratory Richmond, Virginia

Appendix A: General Nutrient Application Worksheets

Product applications outlined in the worksheets below will be made each year (2022-2025). The “General Nutrient Recommendations” provided below represent the **maximum** amount of that nutrient allowed by law annually. The following worksheets represent the recommended fertilization amount and timing based on the Virginia DCR standards. The amount specified in each month cannot be exceeded in a 30-day period.

National Park Service-George Washington Memorial Parkway			
Management Area	Memorial Circle	Area (Sq. Ft.)	171,119
Turf Species	<i>Turf Type Fescue Blend</i>		
Application Timing	lbs/N/1,000 ft ²	lbs/P ₂ O ₅ /1,000 ft ²	lbs/K ₂ O/1,000 ft ²
After August 15	0	0	0
September	0.9	0.375	0.187
October	0.9	0.375	0.187
November	0.9	0.375	0.187
April 15- May 15	0.8	0.375	0.187
June 1- June 15	0	0	0
Total	3.5	1.5	0.75

National Park Service- George Washington Memorial Parkway			
Management Area	Memorial Ave	Area (Sq. Ft.)	43,560
Turf Species	<i>Turf Type Fescue Blend</i>		
Application Timing	lbs/N/1,000 ft ²	lbs/P ₂ O ₅ /1,000 ft ²	lbs/K ₂ O/1,000 ft ²
After August 15	0	0	0
September	0.9	0.375	0.25
October	0.9	0.375	0.25
November	0.9	0.375	0.25
April 15- May 15	0.8	0.375	0.25
June 1- June 15	0	0	0
Total	3.5	1.5	1.0

National Park Service- George Washington Memorial Parkway			
Management Area	Arlington House	Area (Sq. Ft.)	10,454
Turf Species	<i>Turf Type Fescue Blend</i>		
Application Timing	lbs/N/1,000 ft²	lbs/P ₂ O ₅ /1,000 ft²	lbs/K ₂ O/1,000 ft²
After August 15	0	0	0
September	0.9	0.250	0.250
October	0.9	0.250	0.250
November	0.9	0.250	0.250
April 15- May 15	0.8	0.250	0.250
June 1- June 15	0	0	0
Total	3.5	1.0	1.0

National Park Service- George Washington Memorial Parkway			
Management Area	U.S. Marine Corps Memorial	Area (Sq. Ft.)	143,748
Turf Species	<i>Turf Type Fescue Blend</i>		
Application Timing	lbs/N/1,000 ft²	lbs/P ₂ O ₅ /1,000 ft²	lbs/K ₂ O/1,000 ft²
After August 15	0	0	0
September	0.9	0.250	0.250
October	0.9	0.250	0.250
November	0.9	0.250	0.250
April 15- May 15	0.8	0.250	0.250
June 1- June 15	0	0	0
Total	3.5	1.0	1.0

Nutrient Application Notes

Slow-release nitrogen fertilizer **must contain a minimum of 15 % slowly available or controlled release sources of Nitrogen**. This information will be present on the fertilizer label.

Waypoint recommendations- 2 fall applications of 16-4-8 followed by a spring application of 21-3-7, 18-2-18 fertilizer analysis was chosen based on availability of fertilizer to the contractor applying the fertilizer to these 4 sites, and this fertilizer analysis is compliant with all regulations.

Potassium- This plan calls for additional applications of K_2O above the soil test recommendations. Due to the highly visible nature of the four locations, it is advisable to provide additional potassium to facilitate drought tolerance, cold hardiness, disease resistance, and increase plant vigor during times of stress.

Appendix B: GWMP Soil Test Reports

Soil Test Report: GWMP Memorial Circle



7621 Whitepine Road, Richmond, VA 23237
Main 804-743-9401 • Fax 804-271-6446
www.waypointanalytical.com

SOIL ANALYSIS

Client : Essential Elements Matt Austin 172 Old Carriage Way Williamsburg VA 23188	Grower : National Park Service PO:	Report No: 22-060-0790 Cust No: 07469 Date Printed: 03/02/2022 Date Received: 03/01/2022 Date Analysis: 03/02/2022 Page: 1 of 8
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Lab Number : 01296

Field Id :

Sample Id : MEMCIR

Test	Results	SOIL TEST RATINGS					Calculated Cation Exchange Capacity
		Very Low	Low	Medium	Optimum	Very High	
Soil pH	5.8						7.8
Buffer pH	6.78						meq/100g
Phosphorus (P)	40 ppm						Calculated Cation Saturation
Potassium (K)	156 ppm						%K 5.1
Calcium (Ca)	880 ppm						%Ca 56.4
Magnesium (Mg)	178 ppm						%Mg 19.0
Sulfur (S)							%H 19.2
Boron (B)							Hmeq 1.5
Copper (Cu)							
Iron (Fe)							
Manganese (Mn)							
Zinc (Zn)							K : Mg Ratio
Sodium (Na)							0.27
Soluble Salts							Ca : Mg Ratio
Organic Matter	5.1 % ENR 141						2.97
Nitrate Nitrogen							

SOIL FERTILITY GUIDELINES

Crop : Lawn

Rec Units: LB/1000 SF

(lbs)	LIME	(tons)	N	P ₂ O ₅	K ₂ O	Mg	S	B	Cu	Mn	Zn	Fe
60			4.0	0.5	0	0						
Crop :												Rec Units:

Comment :

Soil Test Report: GWMP Memorial Avenue



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SOIL ANALYSIS

Client : Essential Elements Matt Austin 172 Old Carriage Way Williamsburg VA 23188	Grower : National Park Service PO:	Report No: 22-060-0790 Cust No: 07469 Date Printed: 03/02/2022 Date Received : 03/01/2022 Date Analysis : 03/02/2022 Page : 3 of 8
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Lab Number : 01297

Field Id :

Sample Id : MEMAVE

Test	Results	SOIL TEST RATINGS					Calculated Cation Exchange Capacity
		Very Low	Low	Medium	Optimum	Very High	
Soil pH	5.9						7.0
Buffer pH	6.81						meq/100g
Phosphorus (P)	39 ppm						Calculated Cation Saturation
Potassium (K)	113 ppm						%K 4.1
Calcium (Ca)	847 ppm						%Ca 60.5
Magnesium (Mg)	155 ppm						%Mg 18.5
Sulfur (S)							%H 17.1
Boron (B)							Hmeq 1.2
Copper (Cu)							
Iron (Fe)							
Manganese (Mn)							
Zinc (Zn)							K : Mg Ratio
Sodium (Na)							0.23
Soluble Salts							Ca : Mg Ratio
Organic Matter	3.9 % ENR 118						3.27
Nitrate Nitrogen							

SOIL FERTILITY GUIDELINES

Crop : Lawn

Rec Units: LB/1000 SF

(lbs)	LIME	(tons)	N	P ₂ O ₅	K ₂ O	Mg	S	B	Cu	Mn	Zn	Fe
50			4.0	0.5	2.0	0						
Crop :												
Rec Units:												

Comment :

Soil Test Report: GWMP Arlington House



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SOIL ANALYSIS

Client : Essential Elements Matt Austin 172 Old Carriage Way Williamsburg VA 23188	Grower : National Park Service PO:	Report No: 22-060-0790 Cust No: 07469 Date Printed: 03/02/2022 Date Received : 03/01/2022 Date Analysis : 03/02/2022 Page : 5 of 8
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Lab Number : 01298

Field Id :

Sample Id : ARLHS

Test	Results	SOIL TEST RATINGS					Calculated Cation Exchange Capacity
		Very Low	Low	Medium	Optimum	Very High	
Soil pH	6.4						8.5
Buffer pH	6.85						meq/100g
Phosphorus (P)	42 ppm						Calculated Cation Saturation
Potassium (K)	129 ppm						%K 3.9
Calcium (Ca)	1211 ppm						%Ca 71.2
Magnesium (Mg)	159 ppm						%Mg 15.6
Sulfur (S)							%H 9.4
Boron (B)							Hmeq 0.8
Copper (Cu)							
Iron (Fe)							
Manganese (Mn)							
Zinc (Zn)							K : Mg Ratio
Sodium (Na)							0.23
Soluble Salts							Ca : Mg Ratio
Organic Matter	5.2 % ENR 142						4.56
Nitrate Nitrogen							

SOIL FERTILITY GUIDELINES

Crop : Lawn

Rec Units: LB/1000 SF

(lbs)	LIME	(tons)	N	P ₂ O ₅	K ₂ O	Mg	S	B	Cu	Mn	Zn	Fe
30			4.0	0.5	0	0						
Crop :												
Rec Units:												

Comment :

Soil Test Report: GWMP United States Marine Corp Memorial



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SOIL ANALYSIS

Client : Essential Elements Matt Austin 172 Old Carriage Way Williamsburg VA 23188	Grower : National Park Service PO:	Report No: 22-060-0790 Cust No: 07469 Date Printed: 03/02/2022 Date Received : 03/01/2022 Date Analysis : 03/02/2022 Page : 7 of 8
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Lab Number : 01299

Field Id :

Sample Id : USMC

Test	Results	SOIL TEST RATINGS					Calculated Cation Exchange Capacity
		Very Low	Low	Medium	Optimum	Very High	
Soil pH	6.4						9.3 meq/100g
Buffer pH	6.85						
Phosphorus (P)	41 ppm						Calculated Cation Saturation
Potassium (K)	107 ppm						
Calcium (Ca)	1311 ppm						%K 3.0
Magnesium (Mg)	199 ppm						%Ca 70.5
Sulfur (S)							%Mg 17.8
Boron (B)							%H 8.6
Copper (Cu)							Hmeq 0.8
Iron (Fe)							
Manganese (Mn)							
Zinc (Zn)							K : Mg Ratio
Sodium (Na)							0.18
Soluble Salts							Ca : Mg Ratio
Organic Matter	6.4 % ENR 150						3.96
Nitrate Nitrogen							

SOIL FERTILITY GUIDELINES

Crop : Lawn

Rec Units: LB/1000 SF

(lbs)	LIME (tons)	N	P ₂ O ₅	K ₂ O	Mg	S	B	Cu	Mn	Zn	Fe
30		4.0	0.5	2.0	0						
Crop :											
Rec Units:											

Comment :

