Selection of analysis sites was based on review of land uses along the alternatives to identify locations where the highest CO concentrations might be expected to occur, and where outdoor human activities are likely to occur on a regular basis. Land use along the corridor consists of a mixture of developed and undeveloped lands, with development consisting of a variety of public, semi-public, commercial, and residential uses. The selected sites represent a variety of different land uses along the alternatives and also represent the highest potential CO impacts from the alternatives.

Mesoscale concerns. Concentrations of other pollutants with high correlations to motor vehicle emissions, such as nitrogen oxides and ozone, involve complex chemical reactions and atmospheric transport. As such, concerns about them are regional in nature and meaningful evaluation of them on a project-by-project basis is not possible. Where these pollutants are an issue, they are addressed in air quality emissions inventories and other elements of the State Implementation Plan.

4.13.2 Impacts

The results of the analysis show that estimated one-hour CO concentrations (including background) at the sites would range from approximately 6.0 to 6.5 ppm and eight-hour concentrations (including background) would range from 3.0 to 3.4 ppm. These levels are well below the NAAQS of 35 ppm for one-hour concentrations and 9 ppm for eight-hour concentrations.

The temporary air quality impacts from construction activities, such as equipment exhaust emissions and dust generated by construction equipment, are not expected to be significant. Construction activities are to be performed in accordance with VDOT's *Road and Bridge Specifications*, which are approved as conforming to the SIP and which require compliance with all applicable local, state, and federal regulations pertaining to air quality. Provisions will be included in the construction contract for allaying dust resulting from construction activities.

In conclusion, the project is not expected to interfere with the attainment or maintenance of the NAAQS. CO concentrations at the worst-case sites along the project would not exceed the NAAQS for CO under any scenario. Construction activities would be conducted in accordance with VDOT specifications that are approved by the Virginia Department of Environmental Quality as conforming with the SIP. The temporary air quality impacts from construction are not expected to be significant. However, FHWA will not be able to complete the Final EIS for the project until a conformity determination is completed and the scope of the project to be advanced to design and construction is reflected in the CLRP.

4.14 NOISE

4.14.1 Introduction

The potential noise impact of the proposed alternatives for the Manassas National Battlefield Park Bypass Study was assessed in accordance with FHWA and VDOT noise assessment guidelines. Noise impact is summarized for three separate categories as follows:

- Approach or Exceed NAC Only impact, or "*N*" impact occurs where project noise levels approach or exceed the FHWA Noise Abatement Criteria, but the increase above existing is less than 10 dB.

- Substantial Increase Only impact, or "*S*" impact occurs where the project alternative causes a substantial increase in the existing noise level – 10 dB or more – but the future level is less than 66 dBA L_{eq}. "*B*" impact, or
- Both NAC and Substantial Increase impact, or "B" impact occurs where both conditions exist; i.e. a 10 dB or more increase above the existing noise level and the predicted future noise levels approach or exceed 67 dBA L_{eq}.

4.14.2 Impacts

Considering the length of the corridors, none of the five candidate build alternatives will create extensive noise impact (see **Table 4-18**). The number of impacted properties will range from 13 with Alternative G to 23 with Alternative B. Twenty (20) residential properties and the Fairfax National Golf Course, the Field of Dreams, and the Union Ridge Equestrian Center will be impacted by the 2025 design year with Alternative B. With Alternative D, seventeen (17) residential properties and the golf course and equestrian center will receive design year 2025 impact. In both cases, between fifty and sixty percent of the impact will be as a result of substantial increases in noise levels only ("*S*"). With either alternative, the majority of the impacted residential properties are located on Pageland Lane. Other impacted properties are located on Sudley Road, Bull Run Post Office Road, General Trimbles Lane, Poplar Ford Trail (Alternative D only), and Peaceful Meadow Lane (Alternative B only).

Alternatives A and C would also co-locate with the Route 234 Bypass North Extension, but only from I-66 to approximately the northwest corner of the park where they will separate from the Bypass Extension and continue in a northeasterly direction. With Alternative A, eighteen (18) residential properties and the Fairfax National Golf Course, the Field of Dreams, and the Union Ridge Equestrian Center will receive design year 2025 impact. With Alternative C, the number of impacted residential properties will be reduced to twelve (12). This alternative will also create impact at the golf course and equestrian center. With these two alternatives, approximately ninety percent of the impact on residential properties will be as a result of substantial increases in noise levels only ("*S*"), a significantly higher percentage than with Alternatives B or D. This is primarily a Route 234 Bypass North Extension issue.

Approximately thirty percent of the properties impacted with Alternatives B and D along the Bypass Extension corridor north of the separation with Alternatives A and C will receive design year 2025 noise levels that substantially exceed existing levels and also approach or exceed the 67 dBA NAC. These properties, not impacted with Alternatives A or C, are included in Category "*B*" in Table 5 and reduce the percentage of Category "*S*" impact for Alternatives B and D. The majority of the properties impacted with Alternative A are located on Pageland Lane or Bull Run Post Office Road, while with Alternative C, approximately forty percent of the impacted properties are located on Pageland Lane and only one such property is located on Bull Run Post Office Road. Other impacted properties are located on Bluebird Lane, General Trimbles Lane, Peaceful Meadows Lane and Bull Run Overlook (both Alternative A only), and Poplar Ford Trail (Alternative C only).

Alternative G, whose corridor will also include the Route 234 Bypass North Extension from I-66 to Sudley Road, will produce noise impact on thirteen (13) residential properties, only two (2) of which will not be located on Pageland Lane and resulting from the Bypass Extension. One of the impacted properties is located on Bull Run Post Office Road (BRPO) south of Route 29 and the other one is located on Route 29 (Lee Highway). The BRPO property will receive both types of impact ("*B*"), while the Lee Highway property will be impacted as a result of noise levels approaching or exceeding the 67 dBA NAC ("*N*"). Noise levels will also

approach or exceed 67 dBA in the office park located east of Sudley Road and north of I-66 as a result of Alternative G. However, there are no apparent exterior noise-sensitive activity areas at the office park, and therefore, the facility will not be considered to be impacted.

TABLE 4-18: NOISE IMPACT SUMMARY

		A	B	C	D	G
Exist (2004)		1 du, Church	5 du, Church	1 du, Church	5 du, Church	1 du, Church
No-Action (2025)		1 du, Church	2 du, Church	1 du, Church	2 du, Church	1 du, Church
Build (2025)	Approach or Exceed NAC Only *"N"*	1 du	2 du	1 du	3 du	1 du
	Substantial Increase Only *"S"*	16 Equestrian Center, Golf Course	13 du, Golf Course	11 du, Equestrian Center	10 du	7 du
	Both NAC and Substantial Increase *"B"*	1 du, Equestrian Center, Fields of Dreams	5 du, Equestrian Center, Fields of Dreams	Golf Course	4 du, Golf Course, Equestrian Center	5 du
Build (2025) Total		18 du, Equestrian Center, Golf Course, Fields of Dreams	20 du, Golf Course, Equestrian Center, Fields of Dreams	12 du, Equestrian Center, Golf Course	17 du, Golf Course, Equestrian Center	13 du

Notes: "du" refers to dwelling units. The only Church impacted is Sudley United Methodist Church. The Golf Course impacted is the Fairfax National Golf Course. The Equestrian Center impacted is the Union Ridge Equestrian Center.

The noise analysis has identified only one residential property along any of the Alternative A, C, or G corridors that is currently receiving noise impact and only five such properties along either of the Alternative B or D corridors. Under the design year 2025 No-build condition, impact is predicted at only one residential property along the Alternative A, C, or G corridors and at only two residential properties along either of the Alternative B or D corridors.

In addition to the build alternative corridors, Existing and design year 2025 No-build noise levels have also been predicted throughout the Manassas National Battlefield Park along the Route 234 Sudley Road and Route 29 Lee Highway corridors. The Sudley United Methodist Church is the only noise-sensitive property within the park boundaries currently experiencing noise impact and is also the only such property predicted to experience impact under the No-build condition. Under the 2025 Build condition with any of the alternatives, no impact is predicted at the church. While located within park boundaries but technically not part of the park, two residential properties on Poplar Ford Trail in Sun Rise Hill Farm will be impacted by the design year 2025 with either Alternative C or D. These properties do not currently and will not under No-Action conditions experience noise impact.

4.14.3 Mitigation

FHWA has identified certain noise abatement measures that may be incorporated in projects to reduce traffic noise impact. Abatement measures that have been considered for this project include traffic management, alteration of horizontal and vertical alignment, and construction of noise barriers. Traffic management measures that have been considered for noise abatement include reduced speeds and truck restrictions for the design-year Build Alternatives. Reduced speeds are not an effective noise mitigation measure because a substantial decrease in speed is necessary to provide a meaningful noise reduction. A 10 mph reduction in speed will result in only a 2-dBA decrease in noise level. Truck restrictions would not be considered a feasible noise abatement measure because there are no other suitable routes to which trucks could be diverted.

The alteration of horizontal alignment is limited by the extensive existing development along the project corridors. Meaningful noise reduction at noise-sensitive locations would require large alignment shifts, which would necessitate huge additional property takings and could expose additional sites to project noise. The alteration of vertical alignment is not feasible because depressing the roadway would require taking of additional property for the sloped embankments, or excessive costs for the construction of sound-absorptive retaining walls.

Noise Barriers. The only remaining abatement alternative investigated was the construction of noise barriers. The feasibility and reasonableness of noise barriers was studied at all locations where Build Alternatives would cause noise impacts within 1,000 feet of the road. At distances greater than 1,000 feet, the noise prediction model is not considered especially reliable, and the influence of the alternatives on ambient noise levels would be substantially diminished. Where the construction of noise barriers was found to be feasible, barrier noise reduction was estimated based on roadway, barrier, and receiver geometry, as described below.

Table 4-19 summarizes the noise barriers evaluated and the number of dwelling units protected by the barriers for each alternative. **Table 4-20** through **Table 4-24** describe the results of each alternative. A dwelling unit is "protected" if it is exposed to future noise impact (without a barrier) and would receive at least 5 decibels of noise reduction from a barrier. By comparison, a dwelling unit is "benefited" if it is not exposed to future noise impact, but still receives at least 5 decibels of noise reduction from a barrier designed to protect other homes.

The reasonableness of noise barriers for non-residential noise-sensitive land uses (including churches, schools, and parks and recreation areas) is determined during final design on a case-by-case basis with respect to the type and duration of activity, size of the affected area, severity of impact, total cost, and the amount of noise reduction.

TABLE 4-19: SUMMARY OF NOISE BARRIERS BY ALTERNATIVE

	No-Action	A	B	C	D	G
Number of Barriers	0	11	14	8	13	7
Barrier Length (ft)	0	27,959	31,346	20,001	26,136	14,004
Range Barrier Height (ft)	0	10 to 26	8 to 26	10 to 32	9 to 30	10 to 18
Range Noise Reduction (dB)	0	5 to12	5 to 16	5 to 14	5 to 16	5 to 15
Surface Area (sq. ft.)	0	410,165	464,896	373,805	406,217	197,659

	No-Action	A	B	C	D	G
Noise-sensitive land use Protected/ Benefited	NA	16 du, Golf Course, Equestrian Center, Fields of Dreams	19 du, Golf Course, Equestrian Center, Fields of Dreams	13 du, Golf Course, Equestrian Center/ 1 du	27 du, Golf Course, Equestrian Center/ 1 du	13 du

TABLE 4-20: NOISE BARRIERS EVALUATED FOR ALTERNATIVE A

Barrier No.	Location (Station Number)	Barrier Length (ft)	Range Barrier Height (ft)	Range Noise Reduction (dB)	Surface Area (sq. ft.)	Noise-sensitive land use Protected/ Benefited
1A	West Side 142 to 147 West Side 148 to 160	1,782	13 to 19	5 to 7	29,306	3 Dwelling Units
2A	West Side 196 to 210	1,403	14	5 to 6	19,646	2 Dwelling Unit
3A	West Side 222 to 244	2,189	14	5 to 6	30,651	2 Dwelling Units
4A	West Side 268 to 292	2,400	13	5 to 7	31,197	2 Dwelling Units
5A	East Side 308 to 324	1,584	13	6	20,579	1 Dwelling Unit
6A	South Side 324 to 370	4,493	13	5 to 6	58,420	Golf Course
7A	North Side 368 to 400	3,198	13	5	41,571	2 Dwelling Units
8A	East Side 408 to 414	2,373	26	5 to 8	61,705	3 Dwelling Units
9A	East Side 456 to 482	2,621	14 to 17	5 to 9	40,332	1 Dwelling Unit Equestrian Center
10A	West Side 456 to 482	2,513	17	5 to 12	42,723	Equestrian Center
11A	South Side 374 to 408	3,403	10	5 to 12	34,035	Field of Dreams

TABLE 4-21: NOISE BARRIERS EVALUATED FOR ALTERNATIVE B

Barrier No.	Location (Station Number)	Barrier Length (ft)	Range Barrier Height (ft)	Range Noise Reduction (dB)	Surface Area (sq. ft.)	Noise-sensitive land use Protected/ Benefited
1B	West Side 144 to 148	391	12	5	4,687	1 Dwelling Unit
2B	East Side 204 to 220	1,603	14 to16	5 to 16	24,855	2 Dwelling Units
3B	West Side 198 to 240	4,190	14 to 16	5 to 10	62,241	4 Dwelling Units
4B	East Side 228 to 248	1,999	14	5	27,993	1 Dwelling Unit

TABLE 4-21: NOISE BARRIERS EVALUATED FOR ALTERNATIVE B

Barrier No.	Location (Station Number)	Barrier Length (ft)	Range Barrier Height (ft)	Range Noise Reduction (dB)	Surface Area (sq. ft.)	Noise-sensitive land use Protected/ Benefited
5B	West side 244 to 272	2,819	14	5 to 8	39,466	2 Dwelling Units
6B	West Side 278 to 290	1,202	16 to 18	5	19,623	1 Dwelling Unit
7B	South Side 118 to 126	799	8	6	6,394	1 Dwelling Unit
8B	North Side 132 to 136	396	10	5	3,962	1 Dwelling Unit
9B	South Side 182 to 228	4,513	14	6	63,184	Golf Course
10B	North Side 228 to 258	2,921	14	5	40,892	2 Dwelling Units
11B	East Side 262 to 286	2,371	26	5 to 8	61,658	3 Dwelling Units
12B	East Side 314 to 338	2,429	16	5 to 9	38,861	1 Dwelling Unit Equestrian Center
13B	West Side 314 to 338	2,324	16	5 to 11	37,186	Equestrian Center
14B	South Side 232 to 266	3,389	10	5 to 12	33,894	Field of Dreams

TABLE 4-22: NOISE BARRIERS EVALUATED FOR ALTERNATIVE C

Barrier No.	Location (Station Number)	Barrier Length (ft)	Range Barrier Height (ft)	Range Noise Reduction (dB)	Surface Area (sq. ft.)	Noise-sensitive land use Protected/ Benefited
1C	East Side 142 to 147 East Side 148 to 160	1,687	17 to 29	5 to 6	36,272	3 Dwelling Units
2C	West Side 190 to 212	2,203	21 to 25	5 to 10	53,657	2 Dwelling Units
3C	West Side 222 to 242	1,986	14	5 to 6	27,798	2 Dwelling Units
4C	West Side 268 to 290	2,195	13	5 to 7	28,534	2 Dwelling Units/ 1 Dwelling Unit
5C	South Side 362 to 382	2,001	18	5	36,025	2 Dwelling Units
6C	East Side 432 to 458	2,620	10 to 32	5 to 10	64,469	1 Dwelling Unit Equestrian Center
7C	West Side 432 to 458	2,524	20	5 to 7	50,486	Equestrian Center
8C	North Side 328 to 376	4,785	16	5 to 14	76,564	Golf Course

TABLE 4-23: NOISE BARRIERS EVALUATED FOR ALTERNATIVE D

Barrier No.	Location (Station Number)	Barrier Length (ft)	Range Barrier Height (ft)	Range Noise Reduction (dB)	Surface Area (sq. ft.)	Noise-sensitive land use Protected/ Benefited
1D	West Side 144 to 148	399	12	5	4,784	1 Dwelling Unit
2D	East Side 202 to 220	1,602	14 to 16	5 to 16	24,432	2 Dwelling Units
3D	West Side 198 to 240	4,192	14 to 16	5 to 10	62,249	4 Dwelling Units
4D	East Side 228 to 248	1,997	14	5	27,958	1 Dwelling Unit
5D	West Side 244 to 272	2,820	14	5 to 8	39,475	2 Dwelling Units
6D	West Side 278 to 290	1,208	16 to 18	5	20,528	1 Dwelling Unit
7D	South Side 116 to 130	1,386	10	5 to 7	13,857	2 Dwelling Units/ 1 Dwelling Unit
8D	North Side 130 to 136	602	9	6	5,418	1 Dwelling Unit
9D	North Side 190 to 238	4,779	16	5 to 15	76,460	Golf Course
10D	South Side 224 to 244	1,998	18	5	35,955	2 Dwelling Units
11D	East Side 294 to 320	2,632	10 to 30	5 to 10	59,803	1 Dwelling Unit Equestrian Center
12D	West Side 294 to 320	2,521	14	5 to 8	35,298	Equestrian Center

TABLE 4-24: NOISE BARRIERS EVALUATED FOR ALTERNATIVE G

Barrier No.	Location (Station Number)	Barrier Length (ft)	Range Barrier Height (ft)	Range Noise Reduction (dB)	Surface Area (sq. ft.)	Noise-sensitive land use Protected/ Benefited
1G	West Side 144 to 148	391	12 to 13	5	4,884	1 Dwelling Unit
2G	East Side 202 to 220	1,808	13 to 16	5 to 15	26,109	2 Dwelling Units
3G	West Side 198 to 240	4,190	14 to 16	5 to 10	63,437	4 Dwelling Units
4G	East Side 228 to 248	1,999	14 to 15	5	28,194	1 Dwelling Unit
5G	West Side 244 to 272	2,819	14	5 to 7	39,466	2 Dwelling Units
6G	West Side 278 to 290	1,202	16 to 18	5	19,621	1 Dwelling Unit
7G	East Side 426 to Rte29	1,595	10	5 to 10	15,948	2 Dwelling Units

Feasibility and Reasonableness. Total barrier costs were calculated assuming a unit cost of $16 per square foot ($172 per square meter), per VDOT guidelines. Where noise barriers would be physically feasible and could provide at least 5 decibels of noise reduction, barrier reasonableness was then based on VDOT's cost-effectiveness criterion: a maximum of $30,000 per protected or benefited dwelling unit.

Third Party Funding of Noise Barriers. Upon completion of the final noise barrier design, should a barrier cost exceed the criterion of $30,000 per protected or benefited home, additional funding must be secured before the barrier will receive further consideration. Third-party funding must come from any source other than VDOT or FHWA and must be committed in writing to VDOT within 90 days following public notification. Without the written commitments by the specified deadline, a third-party-funded barrier will not receive further consideration.

4.15 HAZARDOUS MATERIALS

Hazardous substances are defined as any material that poses a threat to human health and or the environment. These wastes are generated as residues or byproducts of industrial, institutional, or residential activities that can pose a substantial or potential hazard to human health or the environment when mismanaged. During early planning of federal actions, or other actions utilizing federal funding or permits, the location of permitted and non-regulated hazardous waste sites are determined using a combination of reasonably ascertainable records, agency coordination, field reconnaissance and interviews to aid in identifying known or potential hazardous waste sites. If known or potential waste sites are identified using these methods, the locations are clearly marked on a map showing their relationship to the alternatives under consideration. If a known or potential hazardous waste site is affected by any Build Alternative, information about the site, the potential involvement, impacts and public health concerns of the affected alternative(s), and the proposed mitigation measures to eliminate or minimize impacts or public health concerns are presented in the draft Environmental Assessment (EA). If any identified Build Alternatives impact a known or potential hazardous waste site, the final EA addresses and resolves the issues raised by the public and government agencies.

The FHWA Technical Advisory 6640.8A recommends a review of potential hazardous materials in the vicinity of the project area to assess potential impacts from construction activities resulting from a federal action that includes acquisition of additional right of way to implement a selected Build Alternative.

4.15.1 Introduction

The Resource Conservation and Recovery Act (RCRA), Toxic Substances Control Act (TSCA), and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regulate hazardous waste sites under federal laws. The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERLCA), also known as Superfund, was created to provide the authority and a source of funding for cleaning up hazardous substances released into the environment. A basic goal of Congress in passing CERCLA was to make those who are in control of property (owners, operators, and contractors) contaminated by hazardous substances financially responsible for their clean up. The Superfund Amendment and Reauthorization Act of 1986 (SARA) amended CERCLA and created an "innocent purchaser" exception to owner responsibility. The current legislative, regulatory, and judicial climate has provided notice to property buyers, developers, and lending institutions of the environmental risks associated with purchasing property. In some cases, the cost of cleaning up a hazardous waste site can far exceed the value of the property. This risk, as well as the "innocent purchaser" defense, has created the need for environmental site assessments.

The methods for this study combined records searches and field investigations. Federal, state and local agency database information received from Vista Information Solutions, Inc. (Vista), a commercial environmental risk management contractor, was reviewed to determine locations in the general study area where hazardous materials-related activities were reported. The following federal and state hazardous materials-related databases were searched by Vista, who utilized VDEQ-maintained records as a basis for their report. The investigation dates of each database's search inquiry by Vista are listed following each applicable database acronym.

Federal databases searched included:

- Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS), July 2001.
- National Priority List (NPL), July 2001.
- Resource Conservation and Recovery Act Information Systems (RCRIS), June 2000.
- Large Quantity Generators (LQG), June 2000.
- Small Quantity Generators (SQG), June 2000.
- Treatment, Storage & Disposal Facilities (TSD), June 2000.
- Corrective Action Reports (CORRACTS), June 2000.
- Emergency Response Notification System (ERNS), December 2000.

State databases searched included:

- State Active Voluntary Remediation Program Sites (SCL), January 2000.
- Solid Waste Disposal Facilities/Landfill Sites (SWLFs), September 2000, July 2001.
- Industrial landfills (SWLF), September 1998.
- Underground Storage Tanks (UST),
- Leaking Underground Storage Tanks (LUST), including Active Recovery Sites, VDEQ regional (PIED and NR) LUST lists, Piedmont Region LUST lists, and Inactive Archive, February 1999-August 2001.
- Above Ground Storage Tanks (AST), August 2001.
- Virginia Pollution Compliant Database (SPILLS), including Incident Response Archives, Northern Region PREP Database, March 1994-August 2001.

The *Vista Report* contains information collected using standard industry investigative techniques, for each identified and mapped site or incident. The report specifically includes information on facility and incident classification, reporting and/or violation statuses, and other regulatory and non-regulatory data, which was synthesized in this text section to identify OHM sources for the project area subject to the proposed federal action.

While the information compiled by Vista was obtained from federal, state, or local agency files/databases, their inclusion on lists and databases does not necessarily indicate the presence of an existing environmental condition or public health threat. Additionally, the Vista *Report* did not specifically investigate the potential for the presence/absence for other environmental contaminants including polychlorinated biphenyls (PCBs), asbestos, radon, or hydrogenated solvents and similar toxic compounds.

After matching municipal address/mapping information with the known sites identified using the database search information, a hazardous materials study area was established to delineate potential construction zones associated with each Candidate Build Alternative. Thereafter, limited field investigations were conducted within the established hazardous materials study area to identify/verify each OHM sources included in the database search report. Additional personal interviews with property managers/tenants/owners/employees who were encountered during field surveys were conducted to help determine property conditions, with emphasis on hazardous materials and observed releases of OHM in visually accessible areas. This was completed to identify any additional OHM sources not reported in the Vista *Report*. Sites identified using these combined methods that could potentially represent a threat to public health are described in detail in tabular and text format herein.

4.15.2 Impacts

Fourteen sites have environmental risks that warrant further investigation during pre-construction or right-of-way acquisition. **Table 4-25** summarizes the OHM sources for each Candidate Build Alternative. Alternative A has the most OHM sources (8). Alternative B has only 4 sites, while Alternatives C, D, and G each have 7, 5 and 4 sites, respectively. The Candidate Build Alternatives also support numerous additional sites of minor environmental risk. Alternatives B and D have 21 and 20 OHM sites respectively. Alternatives G, A, and C have far less; 7, 4 and 3, respectively.

Additional research, supplemental site-specific information, file inspections, and the completion of an ESA would be required to better define and quantify the threats and environmental risks associated with any OHM sources identified in this EIS document.

TABLE 4-25: OHM SOURCES IDENTIFIED BY ALTERNATIVE

Site Name	Address	Regulated Materials	A	B	C	D	G
Superior Paving Corp	15717 Lee Highway	ASTs, OHM Storage/Use, RCRA Materials	No	No	No	No	No
Cardinal Concrete	15717 Lee Highway	ASTs, OHM Storage/Use, RCRA Materials	No	No	No	No	No
Luck Stone – Fairfax Plant	15717 Lee Highway	ASTs, USTs, OHM Storage/Use, RCRA Materials; Industrial Debris	Yes	Yes	Yes	Yes	No
Centreville Land Corporation	15700 Lee Highway	ASTs, OHM Storage/Use, RCRA Materials	Yes	Yes	Yes	Yes	No
Wilson and Sons Property (Truck Maintenance Facility)	15900 Lee Highway	OHM Storage/Use, RCRA Materials (C & D with Electric House)	Yes	No	Yes	Yes	No
Wilson and Sons Property (Commercial Stone Products)	15900 Lee Highway	Motor Fuel ASTs	Yes	No	No	No	No

TABLE 4-25: OHM SOURCES IDENTIFIED BY ALTERNATIVE

Site Name	Address	Regulated Materials	A	B	C	D	G
Danny's Auto Salvage Property	15900C Lee Highway	Fuel/Solvent/Waste ASTs, OHM Storage/Use, RCRA Materials, OHM Spills	Yes	Yes	Yes	Yes	No
Latsios Trust Property	12551 Lee Highway	Promiscuous Dumpsites (3); Buried Materials	No	No	No	No	Yes
Chang Property	7301 Bull Run Post Office Road	OHM/Equipment Storage; Promiscuous Dumpsites (2)	No	No	No	No	No
Miller Property	5207 Goldfinch Drive	Promiscuous Dumpsite; Buried Materials	Yes	No	Yes	No	No
Underwood Property	6305 Pageland Lane	Possible Residential or Farm ASTs, Possible OHM Storage in Barn/Sheds	No	No	No	No	No
Fairfax National LLC Property	16850 Sudley Road	Abandoned Building, Possible OHM Storage	Yes	Yes	No	No	No
Artz Property	15607 Compton Road	OHM and Equipment Storage	No	No	No	No	Yes
Graham Property	15600 Compton Road	OHM and Equipment Storage	No	No	No	No	Yes
Totals			7	4	5	4	3

4.16 GEOLOGICAL RESOURCES

4.16.1 Introduction

Soil erodibility as applied to soils under construction site conditions, is an environmental analysis consideration with respect to its relationship with proper management of construction activities, since poor or inadequate soil management can result in excessive erosion, and sedimentation of water resources. Erodibility is affected by factors including texture (relative proportion of sand, silt, and clay), rock content, permeability, structure, and slope. For this reason, qualitative and quantitative soil erodibility indices were reviewed to determine which erosion-sensitive soil types exist within the study area, and which of those soils, classified as having a high or severe soil erodibility hazard ratings, are intersected by combined Candidate Build Alternatives. These soil series/complexes are compared against those soils having only moderate erodibility hazard, whose limitations are much easier to manage with standard engineering and construction practices. In this way, the major relative soil erodibility construction constraints for each alternative can be quantitatively assessed

The Farmland Protection Policy Act of 1981 (FPPA) includes provisions to minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland to non-agricultural uses, and to assure that federal programs are compatible with state, local, and private programs and policies to protect farmland. If farmland is present, then both the relative value of the farmland and a site assessment are scored in accordance with criteria established by the NRCS. Prime and Unique Farmlands are classified by NRCS

according to soil type, physical condition, and management variables. The USDA defines prime farmland as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber and oil seed crops, and is also available for these purposes. Prime farmland can be cropland, pastureland, forestland, or other land, but not urban land or water. Land designated as prime farmland has the soil quality, growing season, and moisture supply to economically produce sustained high yields of crops when treated and managed according to acceptable farming methods.

4.16.2 Impacts

There are no major soils or geological limitations on road construction alternatives within the study area that have significant environmental consequences. No direct impacts to known quarry operations exist. To the extent feasible, impacts to Luck Stone's Fairfax Plant, located at the eastern termini of Alternatives A, B, C, and D, where intersections with existing US Route 29 would occur, will be minimized to the extent practicable in order to preserve the existing conditions.

Agency coordination included contact with appropriate NRCS District Conservationists and offices/departments of planning/GIS mapping in Fairfax, Prince William, and Loudoun Counties in order to ascertain the status and location of prime farmland soils and/or the presence and location of any unique farmlands, or farmlands of statewide or local importance for FFPA compliance. Coordination with NRCS is ongoing in compliance with FFPA provisions. The preliminary acreage impacts to prime and unique farmland soils are listed in **Table 4-26**. Impacts would range from 40.8 acres to 57.1 acres. The No-Action would not impact any prime and unique farmland soils.

TABLE 4-26: PRIME AND UNIQUE FARMLAND SOILS IMPACT

	No-Action	A	B	C	D	G
Impacted Acres of Prime and Unique Farmland Soils	0	40.8	54.3	46.2	57.1	43.5

4.16.3 Mitigation

Certain soil types require geotechnical analyses to ensure proper construction techniques. To the extent required by existing regulations, implementation of any Build Alternative would necessarily have to comply with the geotechnical reporting requirements associated with soils and geological limitations.

Geotechnical analyses are generally required to avoid or manage any potential problems encountered with radon emissions, if unexpectedly found in the study area during construction-related activities. However, an open-air construction site is unlikely to be affected by radon gas emissions, because they generally pose health risks only in confined spaces. Likewise, during construction, there is a possibility that soils overlying greenstone bedrock could be exposed, causing fibers to become airborne during excavation or other land moving activity. Based on directives from the involved County Health Departments, a compliance plan must be prepared and approved prior to construction.

4.17 SURFACE WATERS

4.17.1 Introduction

The U.S. Army Corps of Engineers (COE) administers regulations for activities affecting waters of the United States (streams, wetlands and other generally defined aquatic habitats) and navigable waters pursuant to Section

404 of the Clean Water Act of 1977, as amended, and Section 10 of the Rivers and Harbors Act of 1899, respectively. There are no navigable waters in the study area subject to jurisdiction under Section 10 of the Rivers and Harbors Act.

VDEQ administers the Virginia Water Protection (VWP) permit program regulation (9 VAC 25-210-10), Section 401 of the Clean Water Act, and the State Water Control Law for activities affecting jurisdictional wetlands, streams, and other waters. Discharges of storm water from construction activities are authorized pursuant to the Virginia Pollutant Discharge Elimination System (VPDES) and the Virginia State Water Control Law. Discharge of stormwater from construction activities to waters within the Commonwealth of Virginia requires authorization from the State Water Control Board, unless they are identified in the Board regulation or policies, which prohibit such discharges.

Since 1972, all states have been required to investigate and monitor the health of their surface waters for contamination. States must also regularly assess the data collected to identify bodies of water that are impaired, and to report these assessments to the U.S. EPA. Additionally, DEQ and VDCR is required, under the 1997 Water Quality Monitoring, Information and Restoration Act, to monitor and assess water quality in Virginia. The monitoring efforts are published biennially as Section 305(b) (water quality) and 303(d) (impaired waters) Reports. The most current report is from 2002. The 2002 Section 303(d) Report also includes lists of state waters, categorized by drainage basin, that are under threat of becoming impaired (listed as 'waters of concern'). The overall water quality for Virginia is assessed based on the ability of citizens to enjoy the designated uses of the waters as provided in the water quality standards. These uses include aquatic life, fish and shellfish consumption, swimming and public water supply.

All waters of the U.S., including wetlands (documented in Section 4.19), within a bandwidth of 500 feet (250 feet on each side of an established preliminary design centerline) for each Candidate Build Alternative corridor were identified. Preliminary information was gathered from various digital sources including the U.S. Fish and Wildlife Service (FWS) National Wetland Inventory (NWI) maps, USDA and county soil maps and reports, select verified COE jurisdictional determinations, county planning documents, aerial photography, and scaled planimetric and topographic maps. Field delineations to locate the boundaries of all waters of the United States on each Candidate Build Alternative alignment were conducted subsequent to the synthesis of this information. Field investigations to identify water resources subject to Clean Water Act and NPS regulatory policy were conducted between September 2003 and January 2004.

4.17.2 Impacts

Impacts to watersheds and surface waters are tabulated in **Table 4-27** and illustrated in **Figure 4-34**. Most of the impacts would be within the Bull Run/Little Bull Run watershed. Such impacts would result in losses of aquatic habitat (see later discussion biological resources). Temporary siltation of streams would occur during construction, but aggressive implementation and monitoring of erosion and sediment control plans would be included in the project to minimize such effects.

Short-term water quality impacts may result from erosion following ground disturbance and earthmoving operations. After entering streams, the eroded material may increase turbidity levels and sedimentation downstream. Suspended solids can harm fish and other aquatic life, if uncontrolled. Deposition of suspended solids may alter the substrate of streambeds, interfere with plant production and fish spawning, smother benthic fauna, and reduce substrate utilization. Eroded material also may contain organic matter and nutrients, such as nitrogen and phosphorus. High inputs of organic matter may increase biochemical oxygen demand thereby

decreasing dissolved oxygen concentrations and reducing water quality. Additionally, inputs of nutrients can increase both turbidity and eutrophication by increasing algae production.

TABLE 4-27: SURFACE WATER IMPACTS

	No-Action	A	B	C	D	G
Total Length of Streams Impacted (Linear Feet)	0	6,200	5,147	5,866	4,572	6,195
Total Length of Stream Likely Impacted (Linear Feet)	0	3,272	3,330	1,840	2,606	2,163
Major Stream Crossings	0	2	1	4	3	1
# of Perennial Streams Crossed	0	9	7	6	5	7
# of Intermittent Streams Crossed	0	2	3	4	2	8
# of Open Waters (Ponds) Present	0	6	2	6	3	13
# of Open Waters (Ponds) Impacted	0	4	2	3	1	6

Long-term water quality and quantity effects can result from increases in impervious surfaces, traffic, and consequent increases in pollutants washed off the road surface directly into receiving streams. Pollutants would include grease, oil, metals, nutrients, nitrogen, deicing salts, roadside vegetation management chemicals, and suspended solids.

Because none of the receiving streams in the project area are elements of any public water supply, the potential for human health effects from roadway runoff is minimal. Additionally, implementation of BMPs will have a positive effect on water quality by treating pollutants prior to discharge into receiving waters. If properly implemented, managed and maintained, BMPs have the potential to treat most public health-related concentrations of pollutants emanating from a construction project of any kind.

4.17.3 Mitigation

Erosion and sediment controls would be implemented to minimize water quality impacts in accordance with the Virginia Pollutant Discharge Elimination System (VPDES) Permit Regulation (9 VAC 25-31-10 *et seq*.), and *Virginia Erosion and Sediment Control Handbook*. Control measures may include berms, dikes, grass swales, bioretention filters, sediment basins, fiber mats, straw silt barriers, netting, mulch, temporary and permanent seeding, and other methods. Construction impacts to in-stream aquatic habitats may be minimized to the extent practicable by avoiding stream relocations and by perpendicular crossings.

In accordance with the *Virginia Stormwater Management Handbook*, temporary and permanent stormwater management measures, including detention basins, vegetative controls, and other measures, would also be implemented on this project to minimize potential degradation of water quality. These measures would reduce or detain discharge volumes and remove pollutants. The requirements and special conditions of any required permits for work in and around surface waters would be incorporated into construction contract documents.


Loudoun
Fairfax
Prince William
Catharpin
Sudley Springs
Manassas National Battlefield Park
Sudley Park (Site)
Fairfax County Park Authority
Fields of Dreams
Conway Robinson Memorial State Forest
Mayhew Park
Bull Run Park
Ben Lomond Park
Ellis L. Bennin Park
Fairmont Park
Crestwood Park
234
659
609
621
705
29
658
66
B&D
B, D&G
A&C
C&D
A&B
A, B, C&D
A, B, C, D&G
G
Sources Fairfax County, Prince William County & Loudoun County
Legend
Manassas National Battlefield Park
Watersheds
Broad Run/Kettle Run
Cub Run
Upper Bull Run/Little Bull Run
N
0
0.5
1
Miles
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-34
Watersheds & Surface Waters
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)

The construction contractor would be required to comply with those conditions and with pollution control measures specified in the approved construction plans.

Compensation of stream impacts will likely be required as part of the acquisition process for federal and state water quality permits. Agency comments and early coordination input should be fully considered by FHWA/NPS in accord with the review process for federal projects. Quantitative requirements for implementation for any CBA would be negotiated during permitting. The Virginia Water Protection General Permit regulation for Linear Transportation Projects requires a minimum 1:1 replacement to loss ratio via stream relocation, restoration, riparian buffer creation, restoration and/or enhancement. The U. S. Army Corps of Engineers generally requires mitigation for impacts to streams that are perennial (R3) and intermittent (R4). The Virginia Department of Environmental Quality requires mitigation for all types of streams, including ephemeral (RE) streams.

The current regulatory climate allows for both on-site and offsite mitigation for impacts to streams. Generally, stream mitigation banks are commonly implemented to accomplish compensatory mitigation requirements off-site when on-site compensation is not practicable or advisable, or when the use of the mitigation bank is environmentally preferable to on-site compensation. Compensation at any one or more mitigation banks with available stream mitigation credit, in the northern Virginia region could offset much of the unavoidable impacts associated with implementation of any CBA.

The anticipated stream compensation required for implementation of each Candidate Build Alternative, and the No-Action Alternative were estimated using standard 1:1 mitigation ratios, multiplied by estimated impact acreages. Approximate stream compensation requirements are presented in **Table 4-28**.

TABLE 4-28: SUMMARY OF STREAM IMPACTS AND COMPENSATION REQUIREMENTS (WITHOUT AVOIDANCE AND MINIMIZATION)

	No-Action	A	B	C	D	G
Linear Feet of Streams Present	0.00	6,200	4,914	5,866	4,339	6,195
Anticipated Stream Impacts	0.00	3,272	3,330	1,840	2,606	2,163
Compensation (1:1 in L.F.)	0.00	3,272	3,330	1,840	2,606	2,163

Notes: Estimated averages do not include avoidance and minimization, implementation of stormwater or drainage designs/improvements, utility access, right-of-way acquisition, etc. Estimated figures do not include potential areas of impact associated with the 234 Interchange, or isolated wetland determinations. All acreage calculations are subject to verification by the regulatory agencies. Final compensation will be determined during the permitting phase.

The amount of streams on each Candidate Build Alternative is relatively similar, ranging from 4,339 linear feet (Alternative D) to 6,200 linear feet (Alternative A). However, based on preliminary engineering and design schematics, it is believed that implementation of Alternative B would result in the greatest amount of stream impacts (3,330 linear feet). Alternative C would likely have the least amount of impact to streams (1,840 linear feet). The other CBAs, in descending order of impacts, would have impacts totaling 3,272 linear feet (Alternative A), 2,606 linear feet (Alternative D), and 2,163 linear feet (Alternative G) of impacts, respectively. The No-Action Alternative would require no mitigation since there are no impacts associated with its implementation.

4.18 GROUNDWATER

4.18.1 Introduction

Subsurface and surface water resources are protected by the US EPA pursuant to the federal Safe Drinking Water Act of 1974, as amended in 1986 and 1996 and include all public drinking water systems and reservoirs, lakes, aquifers, springs, groundwater, and wellhead protection areas, with especial emphasis on EPA-designated Sole Source Aquifers (SSAs). There are no designated SSAs in the study area according to the EPA Sole Source Aquifers Program (October 1999).

The Wellhead Protection (WHP) Program is a pollution prevention and management program used to protect underground-based sources of drinking water. The national WHP Program was established in 1986 by the Safe Drinking Water Act amendments. The law specified that certain program activities, such as delineation, contaminant source inventory, and source management, be incorporated into State Wellhead Protection Programs, which are approved by EPA prior to implementation. Virginia has not yet developed an approved program. Loudoun County is actively developing and planning to implement a well-head protection program to protect groundwater from contamination and ensure an adequate level of drinking water quality for the residents of rural Loudoun and western Loudoun towns that are dependent on groundwater as a water source (Loudoun County Planning Commission, 2001). There are no wellhead protection areas in the study area.

4.18.2 Impacts

Potential impacts to groundwater resources were evaluated based on information from existing published resources. Significant portions of the project area are served by public water supply systems drawing from two intake locations within the Potomac River. Thus domestic drinking water resources drawn from public water supplies by a plurality of the public would not be affected. Sole-source aquifers do not exist within the project area; therefore, these resources would not be affected by any of the proposed actions.

However, a substantial area within the study area utilizes water wells established in shallow aquifers (wells less than 100 feet in depth) in lieu of municipal sources. Older residential properties whose specific locations are not known at this time may have individual onsite septic systems and shallow potable water wells that could be affected by construction activities adjacent or in very close proximity to the wells. The potential for septic systems or individual wells to be displaced or otherwise affected is routinely investigated during the design phase of the project, and impacts to these local resources would be avoided or minimized to the extent possible. Further investigation of potential groundwater well conflicts is discussed in the mitigation section.

Groundwater recharge areas are highly susceptible to contamination wherever they occur. However, none of the study area is among mapped areas in the United States with soils having potentially high risks of groundwater contamination (Stone Environmental, 1996)[1]. Potential adverse effects to groundwater are related to potential infiltration of highway runoff in recharge areas, and covering landscape with impervious surfaces, which reduces the amount of water that can percolate into subsurface aquifers (NVSWCD, 2003). However, within the Triassic basin area, where the residuum and weathered rock zones of the sedimentary materials are most permeable, groundwater is generally of minor concern for most construction sites because the most permeable, water-saturated zones are thin and can be readily drained.

[1] Using the Natural Resources Conservation Service's STATSGO database information as input into the modeling calculations.

4.18.3 Mitigation

Construction of cut slopes sometimes can result in localized lowering of very shallow groundwater levels. In this case, the proposed Candidate Build Alternatives represent an expansion of existing infrastructure where such impacts, if any, would likely have already occurred in the past with other related and unrelated ground disturbances and urbanization effects. Added to the fact that subsurface borings did not encounter groundwater at depths shallower than 17 feet demonstrates that localized groundwater effects are not likely. Increases in impervious surfaces may marginally decrease the amount of infiltration of precipitation into the ground. These adverse effects could be ameliorated using bio-retention or rain garden technology to minimize adverse effects to local infiltration rates. Negligible additional deleterious effects on groundwater resources resulting from proposed actions are expected. Generally, the displacement of wells is considered a design-related issue, so more case-by-case attention to the location and depth, and discharge yield of wells is required to ameliorate any impacts to specific wells within the study area.

Dewatering of very shallow groundwater through highway construction activities can effect local recharge areas in the study area especially in the vicinity of fracture planes and shear zones, where the soils are weakened by physical deformation and chemical alteration. These contact zones, and shear planes, where present, are generally not cemented, and are of critical importance to stability. Failure to account for the presence of tectonically weak zones in saprolite or unweathered rock can cause failure in spread footings used in construction. Shear zones of this type are documented in areas just north of Byron Cameron Avenue, just south of Dulles Airport Road (Route 267), and south of Braddock Road, and at the contact between sandstone bodies and igneous intrusions of diabase and metasedimentary mélange of hornfels between Centerville and the eastern termini of the Build Alternatives. While their presence is at too small a scale to map geologically, their presence can be detected in standardized soil and geotechnical borings.

Potential impacts to unspecified groundwater resources are not necessarily major environmental constraints for the project's purpose and need objectives, especially when municipal water sources as a viable, safe alternative to construction effects, are likely available to many residential customers within the study area who are not currently serviced by municipal supplies in the study area. In areas where municipal water service is not available, potential impacts to groundwater wells used for domestic purposes require careful avoidance, minimization and mitigation procedures to prevent contamination/displacement of existing wells, and lowering of existing water tables, or diminution of groundwater quality. Mitigation for the loss of any localized groundwater resources identified during the design phases of the project could be implemented by providing municipal hookups determined on a case-by-case basis to any adversely affected property owner.

Increased impervious areas associated with highway construction can result in the lowering of shallow, localized water tables. Most, if not all of the construction, can be accomplished without the necessity of deep excavation (>50 feet). Lowering of water tables following local scale construction, can have potential secondary effects, including reduced stream flow recharge, and especially reduced base flow in drought conditions, and potential drought stress on riparian vegetation.

4.19 WETLANDS

4.19.1 Introduction

Executive Order (EO) 11990 – Protection of Wetlands mandates that all federal agencies proactively minimize the destruction, loss, or degradation of wetlands, to preserve, enhance and restore the natural and beneficial

values of wetlands, and to avoid direct or indirect support of new construction in wetlands unless there are no practicable alternatives to such construction and the proposed action includes all practicable measures to minimize harm to wetlands within property administered by NPS. All areas on NPS property that meet the definition of wetland, as defined by the procedures described in the USFWS manual for wetland identification were identified.

The U.S. Army Corps of Engineers (COE) administers regulations for activities affecting waters of the U.S. and navigable waters pursuant to Section 404 of the Clean Water Act of 1977, as amended, and Section 10 of the Rivers and Harbors Act of 1899. Waters of the U.S. are defined by EPA's 404 (b)(1) guidelines as rivers, streams, ponds, and special aquatic sites, such as sanctuaries and refuges, wetlands, mud flats, vegetated shallows, coral reefs, and riffle and pool complexes.

According to the U.S. Coast Guard (1998), there are no navigable waters in the project area subject to jurisdiction under the Rivers and Harbors Act.

All waters of the U.S., including wetlands, within a bandwidth of 500 feet (250 feet on each side of an established preliminary design centerline) for each Candidate Build Alternative corridor were identified. Field delineations to locate the boundaries of all waters of the United States on each Candidate Build Alternative alignment were conducted between September 2003 and January 2004.

Two methods for wetland identification and delineation were used: the Corps of Engineer's method (Environmental Laboratory, 1987) and the NPS *Procedural Manual 77-1: Wetland Protection* (NPS, 2003. The *COE Wetlands Delineation Manual* (Environmental Laboratory, 1987), Department of the Army (DA) guidance (DA, 1992) and COE Norfolk District guidance (COE, 1999a, 1999b) were applied in conducting delineations of jurisdictional areas. Delineations between the upper limits of intermittent streams and lower limits of ephemeral streams followed Norfolk District regulatory guidance (COE, 1999b).

The field methodology used for the boundary delineation included walking transects along wetland/upland transitions, observing and assessing critical changes in topography, plant communities, soils, and hydrology field indicators. Data were collected for both wetland and upland communities and wetland characteristics were recorded on Routine Wetland Determination Data Forms. These forms were prepared pursuant to COE guidance (DA, 1991, 1992) and the 1987 *COE Wetlands Delineation Manual* procedures. An investigated habitat was considered a wetland if field indicators were present for all three of the following technical criteria: vegetation, soils, and hydrology. Areas not possessing all three mandatory criteria were not classified as wetlands.

Vegetation. Dominant plant species sampling data were recorded for the tree, sapling, shrub, herbaceous, and woody vine strata in the immediate vicinity of the observation point. Dominant species were identified for those species having the largest relative basal area (woody overstory), greatest height (woody understory), greatest percentage of areal cover (herbaceous understory), and/or greatest number of stems (woody vines). The dominant woody overstory was identified through an evaluation of the relative basal area (considering both size and number) within the sample plot (30-foot radius). Areal coverage for the herbaceous understory was determined from a 6-foot radius plot.

Soils. Soils data from numerous sources were used in preparation of the delineation and refinement of soil series determinations. Sources for soil data and mapping included the various soil surveys, supplemental unpublished

data from NRCS (Elder, 1989; Porter and others, 1960, 1963), Soil and Water Conservation District offices, Fairfax County Real Property Identification Maps (Fairfax County, 1990), *Hydric Soils of the United States* (USDA, 1991), *Field Indicators of the Hydric Soils in the Mid-Atlantic United States* (USEPA, 1995), and supplemental soil mapping and descriptions from various sources (Fairfax County, 1993; Fairfax County DPWES, 2001a; Hurt and Carlisle, 1998; Loudoun County Cooperative Extension Office 1998; Prince William County, Virginia. 2000). The hydric soil criterion for wetland determinations was considered satisfied when field indicators documenting actively reducing soil conditions were present.

The texture, color, moisture content, and presence of redoximorphic features (*e.g.*, concretions, depletions, nodules) were described for each layer of 18-inch-deep soil profiles. Because much of the study area is underlain by Triassic arkosic shale, the field indicators for hydric soils in red parent material soils (TF2) were strongly considered in the wetland determinations following methods described in the *Field Indicators of Hydric Soils in the Mid-Atlantic United States*, Version 3.2 (USEPA, 1995, as amended). Soil matrix depletions (mottling), if present, were described by abundance, size, and contrast. Alluvial soils with depleted matrices were determined using the TF10 field indicator (USEPA, 1995 as amended).

Hydrology. In order to satisfy the hydrology criterion for wetland determinations, one primary field indicator or at least two secondary indicators of wetland hydrology had to be directly observed or reasonably inferred during the delineation process. Primary field indicators of wetland hydrology include flooding, inundation, soil saturation, watermarks, drift/wrack lines, sediment deposits, and drainage patterns. Secondary indicators include oxidized rhizospheres, water-stained leaves, and local soil survey data for typical surface and/or groundwater levels for individual soil series. Indicators present during field investigations were recorded on the wetland determination data forms.

The Cowardin system of classification, commonly used for categorizing wetland and deepwater habitats, includes among others, palustrine and riverine wetland systems. Within the study area, waters of the U.S. include several palustrine wetland community types, as well as numerous streams in the riverine system. Palustrine wetlands include all non-tidal wetlands dominated by trees, shrubs, persistent emergent plants, mosses or lichens. Within the study area, riverine wetlands include all persistent wetlands and deepwater habitats contained within a channel. Generally, riverine wetlands are unvegetated wetlands, and thus waters of the U.S. for regulatory purposes. However, riverine wetlands are considered wetlands for alternatives impacting NPS property. Cowardin-system wetlands that exist in the northern Virginia Piedmont region, but not within the alternatives footprints, include lacustrine (lake fringe) wetlands.

Several potential wetland areas that were included in the preliminary survey of wetland impacts were eliminated from further consideration as jurisdictional wetlands. These areas included upland stormwater management basins, vegetated roadside ditches and swales, and other habitats.

In addition to the standard COE method for delineating wetlands, implementation of NPS Director's Order 77-1 procedures to identify wetlands on NPS lands within the study area. The purpose of DO 77-1 is to establish NPS policies, requirements, and standards for implementing federal Executive Order (EO) 11990: "Protection of Wetlands" (42 *FR* 26961).

EO 11990, among other things, mandates that NPS proactively minimize the destruction, loss, or degradation of wetlands, to preserve, enhance and restore the natural and beneficial values of wetlands, and to avoid direct or indirect support of new construction in wetlands unless there are no practicable alternatives to such

construction and the proposed action includes all practicable measures to minimize harm to wetlands. The methods to identify wetlands on NPS property within the study area are described in NPS Procedural Manual 77-1: Wetland Protection (NPS, 2003).

Each of the investigated wetlands in the project area was evaluated for the following eight functions: groundwater interchange, floodflow alteration, sediment/shoreline stabilization, sediment/toxicant retention, nutrient removal/retention/transformation, production export, fish and shellfish habitat, and wildlife habitat. In addition, wetlands were also evaluated for the following five values: endangered species habitat, visual quality/aesthetics, educational/scientific value, recreation, and uniqueness/heritage. These are considered principal functions and values, which represent the most dominant or influential physical components of a wetland ecosystem, and/or are considered of special value to society, from a local, regional, and/or national perspective. These functions and values are briefly described below:

- Groundwater Interchange (recharge/discharge): Potential to interact with groundwater. This is a general assessment to determine whether a wetland is acting as a perched, recharge, or discharge system on a local level. Detailed studies conducted over long periods would have to be undertaken to accurately assess groundwater movement in relation to specific wetland sites.
- Floodflow Alteration (storage and desynchronization): Potential to attenuate flood peaks, retain water over prolonged periods, add to the stability of the surrounding ecological system, and protect downstream features of economic or social importance.
- Sediment/Shoreline Stabilization: Ability to dissipate erosive forces and stabilize soils, stream banks, and shorelines.
- Sediment/Toxicant Retention: Ability to act as a trap and filter for sediments in runoff water from surrounding uplands, or upstream eroding wetland areas.
- Nutrient Removal/Retention/Transformation: Ability to trap nutrients entering from runoff water from surrounding uplands, and to process these nutrients into other forms or trophic levels.
- Production Export (Nutrient): Ability to produce and export food or usable products for man or other living organisms.
- Fish and Shellfish Habitat: Suitability as a habitat for fish and shellfish.
- Wildlife Habitat: Suitability as a habitat for animals typically associated with wetlands and the wetland edge, for migrating species, and for species dependent on the wetland at some stage in their life cycle.
- Endangered Species Habitat: Ability to support threatened or endangered species, based on specialized habitat requirements.
- Visual Quality/Aesthetics: Ability to provide pleasing views and/or provide a pleasant contrast to the surrounding landscape.
- Educational/Scientific Value: Suitability as "outdoor classrooms" or as locations for scientific study or research.
- Recreation (Consumptive and Non-consumptive): Ability of wetlands and the associated watercourse to support active and passive recreational opportunities.
- Uniqueness/Heritage: Overall health and appearance, potential as critical habitats, relative importance as a unique wetland class in the geographic region, and ability to perform most of the wetland functions.

4.19.2 Impacts

The full impact to wetlands is based both on the amount of impact, as well as the quality or the ecological and social benefits they provide. The amount and types of wetlands that would be impacted from the alternatives are tabulated in **Table 4-29.** The amount of wetlands that would be partially or entirely displaced would range from 5.08 acres (2.03 ha) to 11.66 acres (4.63 ha) for the Build Alternatives. The No-Action Alternative would have no effect on wetlands. Candidate Build Alternative A would have the largest impact, while Alternative C would have the smallest impact. Palustrine forested wetlands would be the wetland type most heavily impacted by each of the Candidate Build Alternatives.

Wetlands with added habitat value were also field identified and are summarized in **Table 4-30**. Individual wetlands with added habitat value are listed in the detailed tables for each alternative and illustrated in the corresponding figures. These wetlands include vernal ponds, vernal pools, flooded floodplain wetlands, wetlands with very high wildlife or water quality function/capacity, etc.

TABLE 4-29: SUMMARY OF WETLAND IMPACTS (IN ACRES/HECTARES)

Cowardin Class	No-Action		A		B		C		D		G	
	ac	ha	ac	ha	ac	ha	ac	ha	ac	ha	ac	ha
PEM	0	0	3.65	1.46	3.81	1.52	0.44	0.17	1.32	0.53	1.20	0.48
PFO	0	0	5.08	2.03	5.76	2.30	2.61	1.04	3.89	1.56	3.30	1.32
POW	0	0	1.46	0.58	0.58	0.23	0.79	0.32	0.44	0.17	0.81	0.32
PSS	0	0	1.39	0.56	1.51	0.60	1.24	0.49	1.34	0.54	0.19	.07
Total	0	0	11.58	4.63	11.66	4.66	5.08	2.03	6.99	2.79	5.50	2.20

Note: Totals include only direct displacements anticipated within established cut and fill boundaries. Impact amounts may vary as a result of design modifications. Totals do not include any stormwater management facility planning or design displacements that will be required during later design phases of the project if a Build Alternative is implemented.

TABLE 4-30: WETLANDS WITH ADDED HABITAT VALUE

	No-Action	A	B	C	D	G
# of Wetland Areas with Added Habitat Value	0	15	7	10	9	2
Total Acreage of Wetlands with Added Habitat Value	0	8.17	6.04	2.12	2.70	0.80

In addition, National Park Service (NPS) Director's Order 77-1 procedures were implemented to identify wetlands on NPS lands impacted by the Build Alternatives. **Table 4-31** summarizes the Director's Order 77-1 wetland determinations for NPS property on each alternative. As shown in the table, Alternative G would impact the most Director's Order Wetlands on NPS lands, primarily due to the larger footprint of the alternative within the Manassas NBP compared to other alternatives. The estimated totals in Table 4-31 do not account for avoidance and minimization, stormwater facility planning, drainage infrastructure planning, etc.

Wetland impacts, including principal functions and values, are summarized for each alternative in **Tables 4-32** through **Table 4-37**. Wetland impacts are illustrated for each Build Alternative in **Figures 4-35** through

Figure 4-39. The wetland ID numbers listed in the tables correspond with the ID numbers shown on the figures for each alternative.

TABLE 4-31: DIRECTOR'S ORDER 77-1 WETLAND IMPACTS

	No-Action	A	B	C	D	G
Total Acreage of Director's Order 77-1 Wetlands	0	4.5	4.5	5..4	5.3	7.7

Note: Totals include only direct displacements anticipated within established cut and fill boundaries. Impact amounts may vary as a result of design modifications. Totals do not include any stormwater management facility planning or design displacements that will be required during later design phases of the project if a Build Alternative is implemented. Wetlands determined by implementing NPS *Procedural Manual 77-1:Wetland Protection*, using Cowardin and others (1979) for wetland identification and classification purposes.

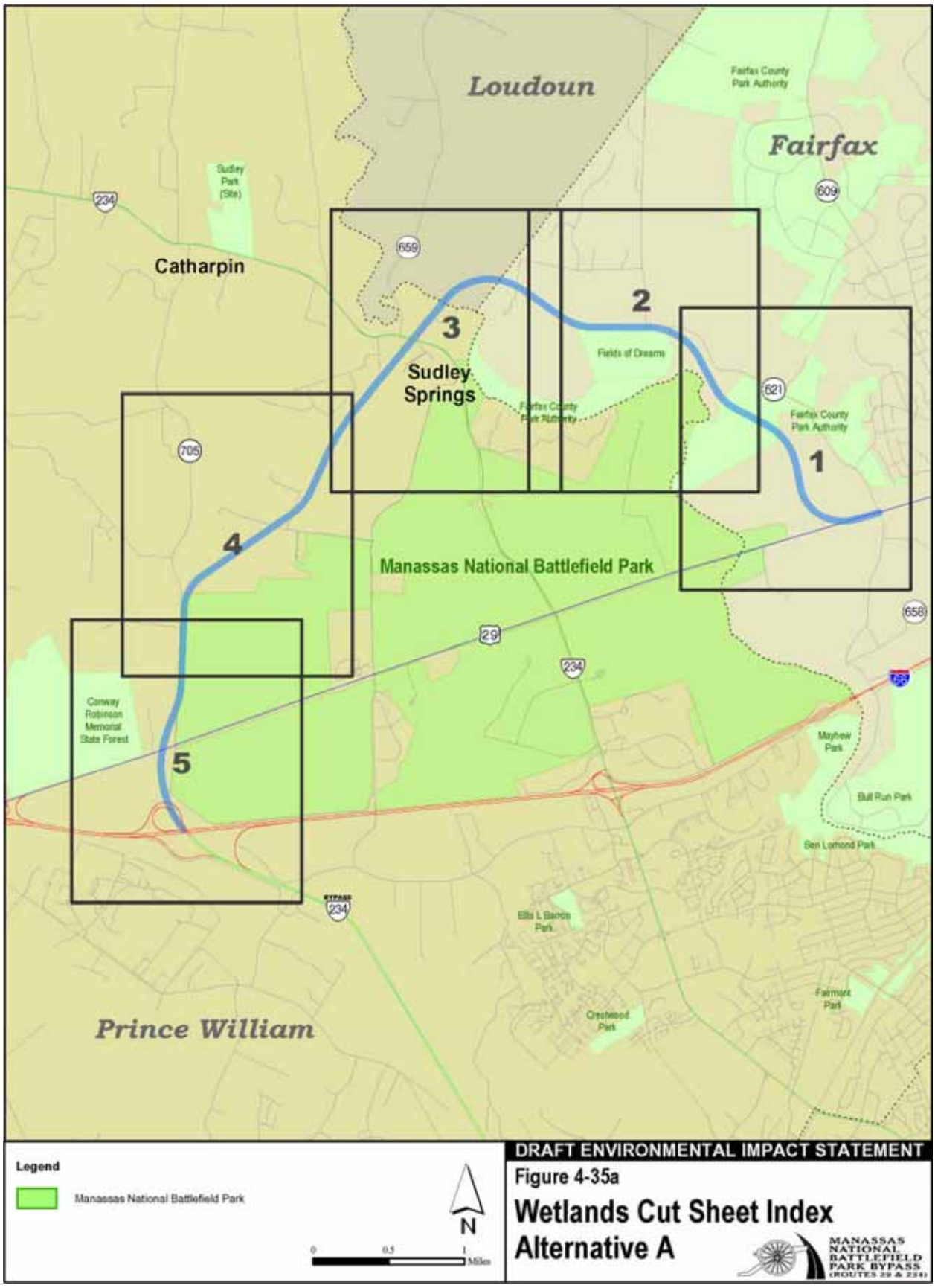
TABLE 4-32: IMPACTED WETLANDS, ALTERNATIVE A

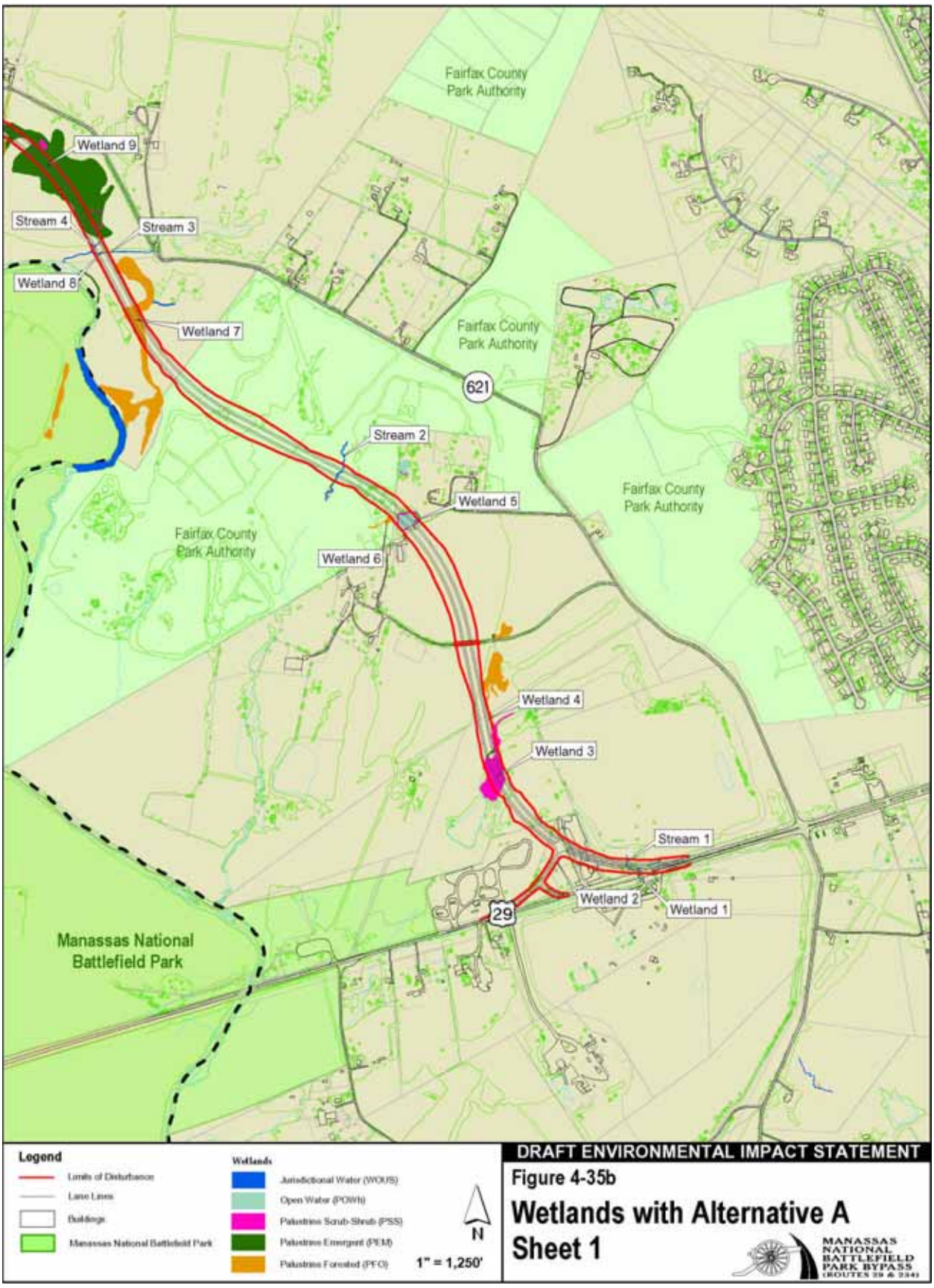
ID No.	Cowardin Class	Principal Functions and Values								Total Area (acres)
		Floodflow Alteration	Groundwater Interchange	Nutrient Removal	Production Export	Sediment/ Toxicant Retention	Sediment Stabilization	Fish and Shellfish Habitat	Wildlife Habitat	
1	PEM			X			X			0.01
2	PEM					X				0.01
3	PSS			X	X	X			X	0.98
	PEM						X			0.03
4	PFO			X		X				0.03
5	**POW**				X	X		X	X	**0.41**
	PSS				X	X			X	**0.07**
	PEM						X			**0.01**
6	PFO		X	X		X				0.01
7	**PFO**	X	X	X	X				X	**0.68**
8	PEM		X				X			0.01
9	**PEM**		X						X	**2.70**
	PFO			X			X			0.02
10	PFO				X	X				0.02
11	PEM			X	X	X		X	X	0.03
	PSS					X	X			0.01
12	PEM	X		X			X			0.01
13	PFO	X		X			X	X	X	0.05

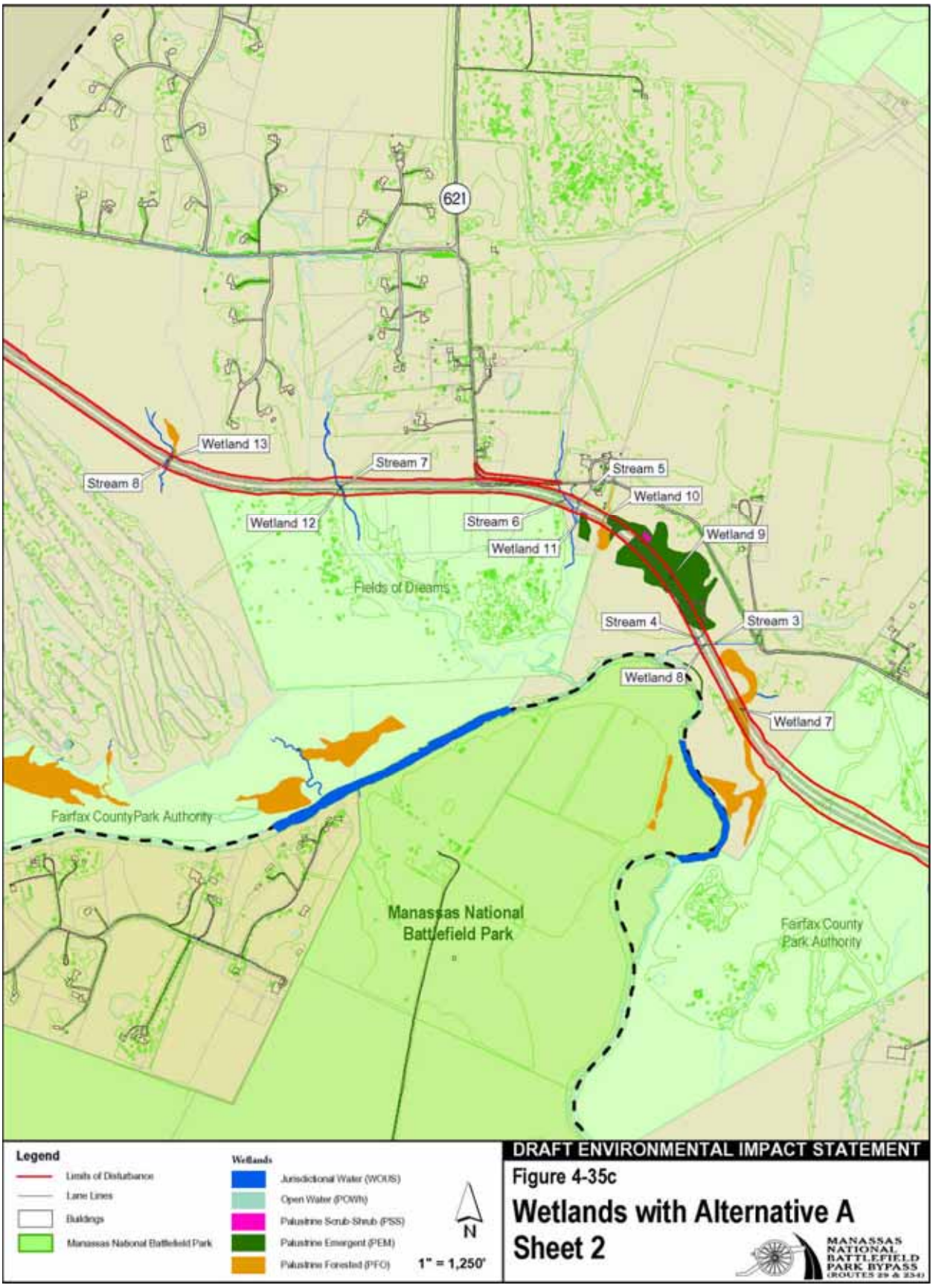
TABLE 4-32: IMPACTED WETLANDS, ALTERNATIVE A

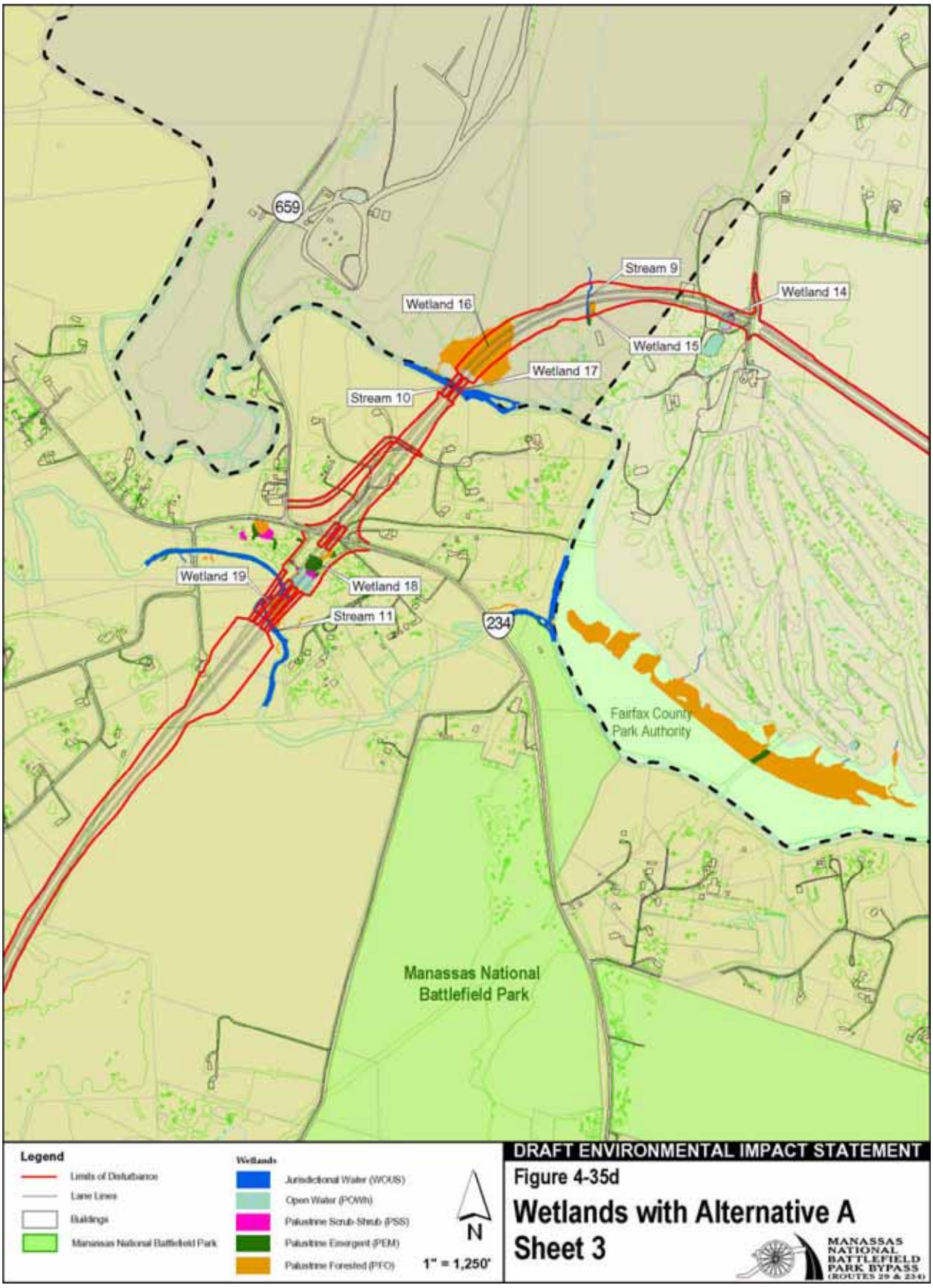
ID No.	Cowardin Class	Principal Functions and Values								Total Area (acres)
		Floodflow Alteration	Groundwater Interchange	Nutrient Removal	Production Export	Sediment/ Toxicant Retention	Sediment Stabilization	Fish and Shellfish Habitat	Wildlife Habitat	
14	**POW**					X		X		**0.14**
	PSS					X	X		X	**0.02**
	PEM					X		X		**0.03**
15	PFO	X	X			X				0.15
	PEM	X		X			X			0.02
16	**PFO**		X	X	X	X			X	**2.59**
17	PFO				X		X			0.03
18	**POW**				X			X	X	**0.59**
	PEM			X		X				**0.42**
	PFO					X	X		X	**0.18**
	PSS					X	X		X	**0.15**
19	**PFO**	X				X	X		X	**0.66**
20	PEM					X			X	0.02
21	PFO		X			X				0.01
22	POW				X			X	X	0.32
	PSS			X			X			0.03
	PEM						X			0.01
23	PFO		X	X		X			X	0.42
	PEM						X			0.02
24	PFO					X			X	0.04
25	PEM		X		X				X	0.17
	PSS		X						X	0.13
	PFO		X	X		X				0.13
26	PEM		X				X			0.02
27	PEM			X		X				0.01
28	**PEM**	X		X		X	X	X		**0.12**
	PFO		X		X	X			X	**0.06**
Total Area										11.58

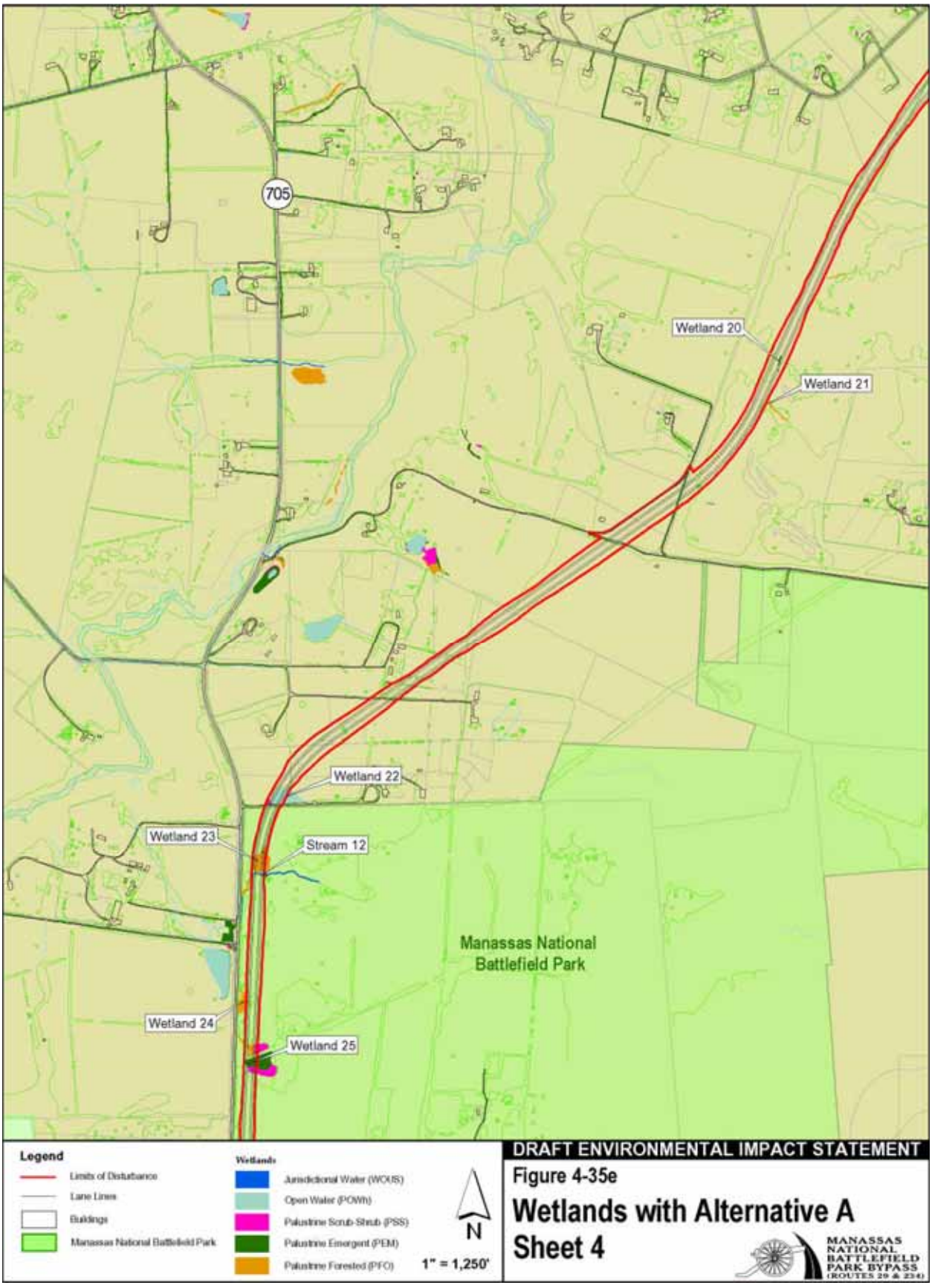
Note: **Bold type** denotes special wetland functions and values associated with indicated habitat.


Loudoun
Fairfax
Prince William
Catharpin
Sudley Springs
Manassas National Battlefield Park
Fairfax County Park Authority
Fields of Dreams
Sudley Park (Site)
Conway Robinson Memorial State Forest
Mayhew Park
Bull Run Park
Ben Lomond Park
Ellis L Barron Park
Fairmont Park
Crestwood Park
1
2
3
4
5
234
659
609
521
705
29
658
66
BYPASS
Legend
Manassas National Battlefield Park
N
0
0.5
1
Miles
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-35a
Wetlands Cut Sheet Index
Alternative A
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)


Fairfax County Park Authority
Wetland 9
Stream 4
Stream 3
Wetland 8
Wetland 7
Fairfax County Park Authority
621
Stream 2
Wetland 5
Fairfax County Park Authority
Fairfax County Park Authority
Wetland 6
Wetland 4
Wetland 3
Stream 1
Wetland 2
Wetland 1
29
Manassas National Battlefield Park
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-35b
Wetlands with Alternative A
Sheet 1
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)


621
Wetland 13
Stream 8
Stream 7
Wetland 12
Stream 6
Stream 5
Wetland 10
Wetland 9
Wetland 11
Fields of Dreams
Stream 4
Stream 3
Wetland 8
Wetland 7
Fairfax CountyPark Authority
Manassas National Battlefield Park
Fairfax County Park Authority
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-35c
Wetlands with Alternative A
Sheet 2
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)


659
Stream 9
Wetland 14
Wetland 16
Wetland 15
Wetland 17
Stream 10
Wetland 19
Wetland 18
Stream 11
234
Fairfax County
Park Authority
Manassas National
Battlefield Park
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-35d
Wetlands with Alternative A
Sheet 3
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)


705
Wetland 20
Wetland 21
Wetland 22
Wetland 23
Stream 12
Manassas National
Battlefield Park
Wetland 24
Wetland 25
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-35e
Wetlands with Alternative A
Sheet 4
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)


Wetland 24
Wetland 25
Conway Robinson
Memorial
State Forest
Manassas National
Battlefield Park
705
29
Wetland 26
Wetland 27
Stream 13
Wetland 28
66
234
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-35f
Wetlands with Alternative A
Sheet 5
MANASSAS
NATIONAL
BATTLEFIELD
PARK BYPASS
(ROUTES 29 & 234)

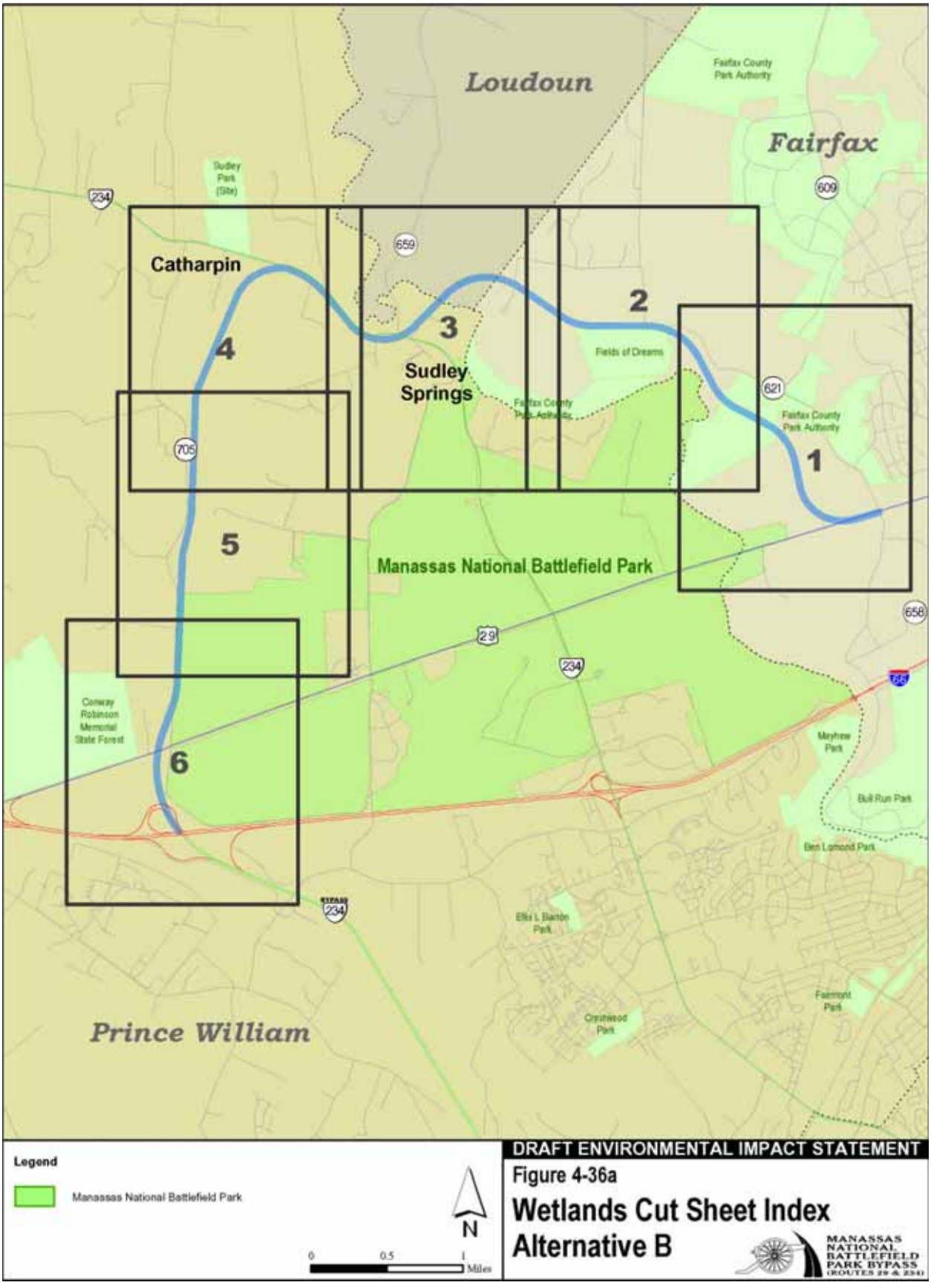
TABLE 4-33: IMPACTED WETLANDS, ALTERNATIVE B

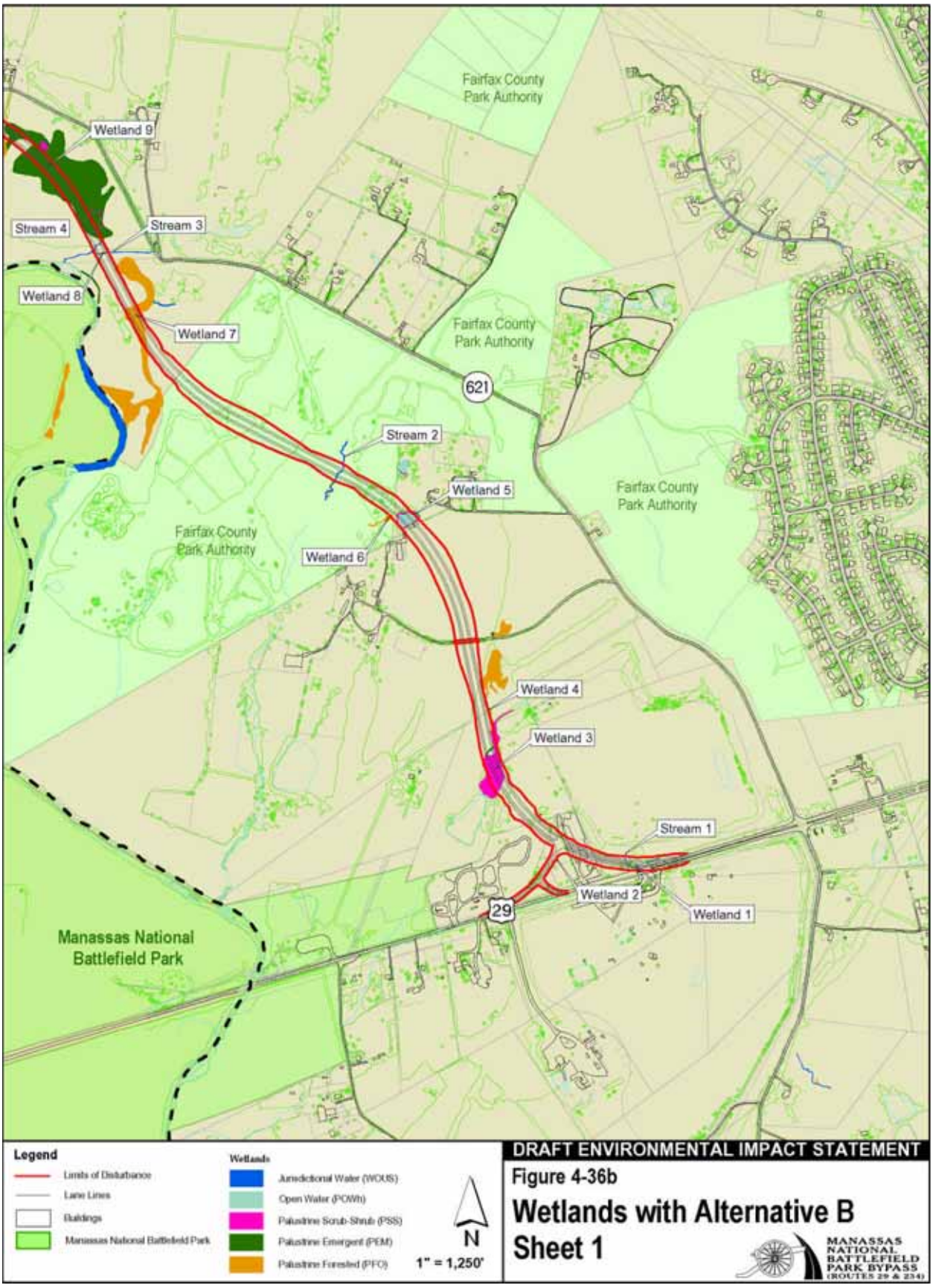
ID No.	Cowardin Class	Principal Functions and Values								Total Area (acres)
		Floodflow Alteration	Groundwater Interchange	Nutrient Removal	Production Export	Sediment/ Toxicant Retention	Sediment Stabilization	Fish and Shellfish Habitat	Wildlife Habitat	
1	PEM			X			X			0.01
2	PEM					X				0.01
3	PSS PEM	X	X	X	 X				X	1.02 0.03
4	PFO			X		X				0.03
5	**POW** **PSS** **PEM**				X X	X X	 X	X	X X	**0.41** **0.07** **0.01**
6	PFO		X	X	X				X	0.01
7	**PFO**		X		X				X	**0.67**
8	PFO	X		X	X	X				0.01
9	**PEM** PFO		X	 X			 X		X	**2.70** 0.02
10	PFO				X	X				0.02
11	PEM PSS			X	X	X X	 X	X	X	0.03 0.01
12	PEM	X		X			X			0.01
13	PFO	X		X			X	X	X	0.05
14	**POW** **PEM** **PSS**					X X X	 X	X X	 X	**0.13** **0.03** **0.02**
15	PFO PEM	X X	X	 X		X	 X			0.15 0.02
16	**PFO**		X	X	X	X			X	**2.67**
17	PFO				X		X			0.02
18	PEM					X				0.01

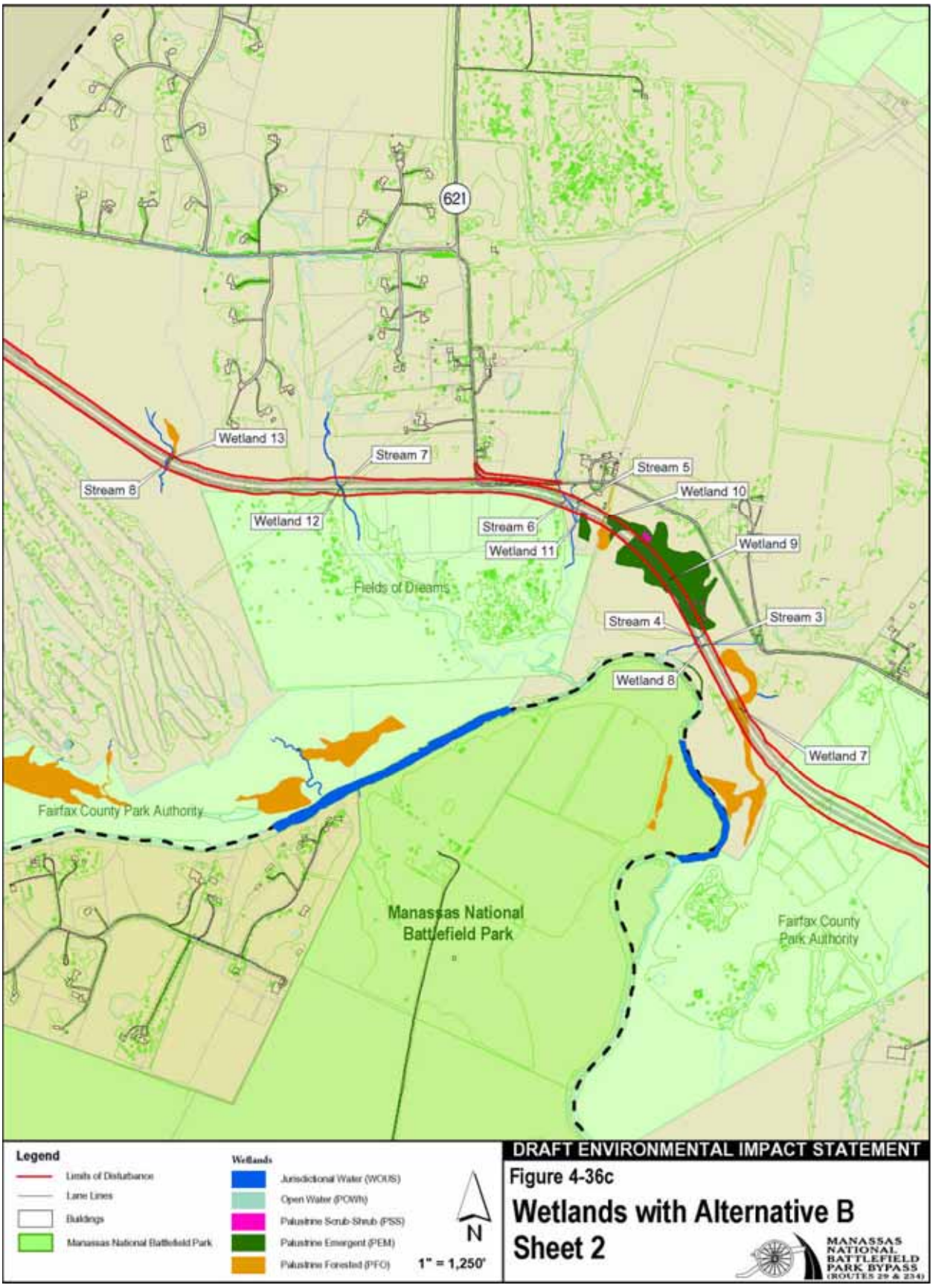
TABLE 4-33: IMPACTED WETLANDS, ALTERNATIVE B

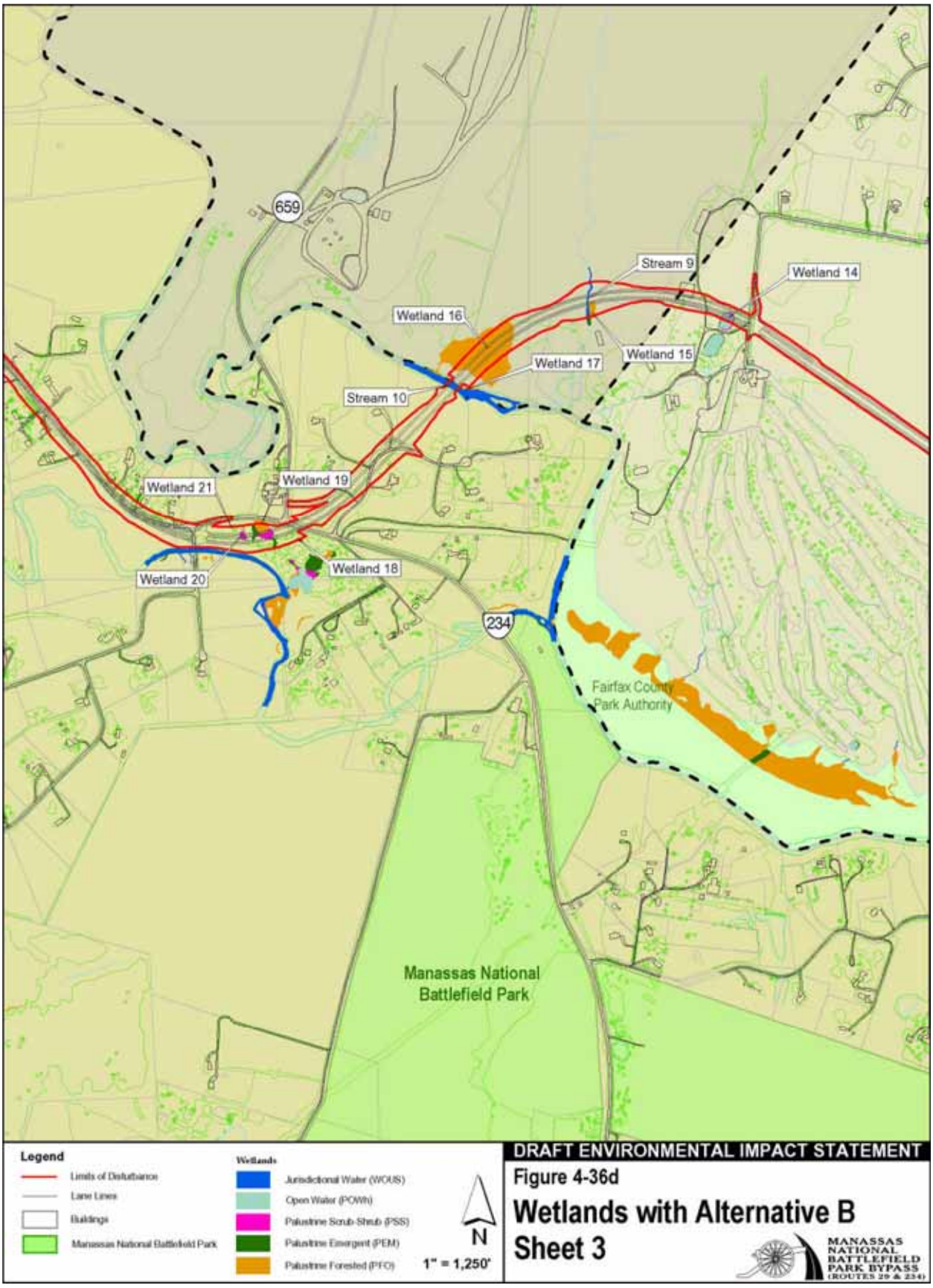
ID No.	Cowardin Class	Principal Functions and Values								Total Area (acres)
		Floodflow Alteration	Groundwater Interchange	Nutrient Removal	Production Export	Sediment/ Toxicant Retention	Sediment Stabilization	Fish and Shellfish Habitat	Wildlife Habitat	
19	PFO					**X**	**X**		**X**	0.20
	PSS					**X**	**X**		**X**	0.15
	PEM			**X**		**X**			**X**	0.15
20	PSS			**X**					**X**	0.07
21	PSS			**X**						0.01
22	PFO			**X**		**X**	**X**			0.01
23	PEM		**X**	**X**			**X**			0.01
24	PFO		**X**	**X**		**X**			**X**	0.07
25	PFO	**X**	**X**	**X**		**X**			**X**	0.60
26	PFO		**X**	**X**		**X**				0.10
	PEM	**X**		**X**			**X**			0.02
27	PEM			**X**	**X**	**X**		**X**	**X**	0.09
	POW				**X**			**X**	**X**	0.04
	PSS			**X**			**X**		**X**	0.01
28	PSS			**X**			**X**			0.01
29	PFO		**X**	**X**		**X**			**X**	0.41
	PEM						**X**			0.02
	PSS			**X**			**X**			0.01
30	PFO					**X**			**X**	0.04
31	PEM		**X**		**X**					0.17
	PSS		**X**						**X**	0.13
	PFO		**X**	**X**		**X**				0.13
32	PEM		**X**				**X**			0.01
33	PEM			**X**		**X**				0.01
34	PFO	**X**	**X**	**X**		**X**	**X**	**X**	**X**	0.55
	PEM	**X**	**X**				**X**	**X**	**X**	0.47
Total Area										11.66

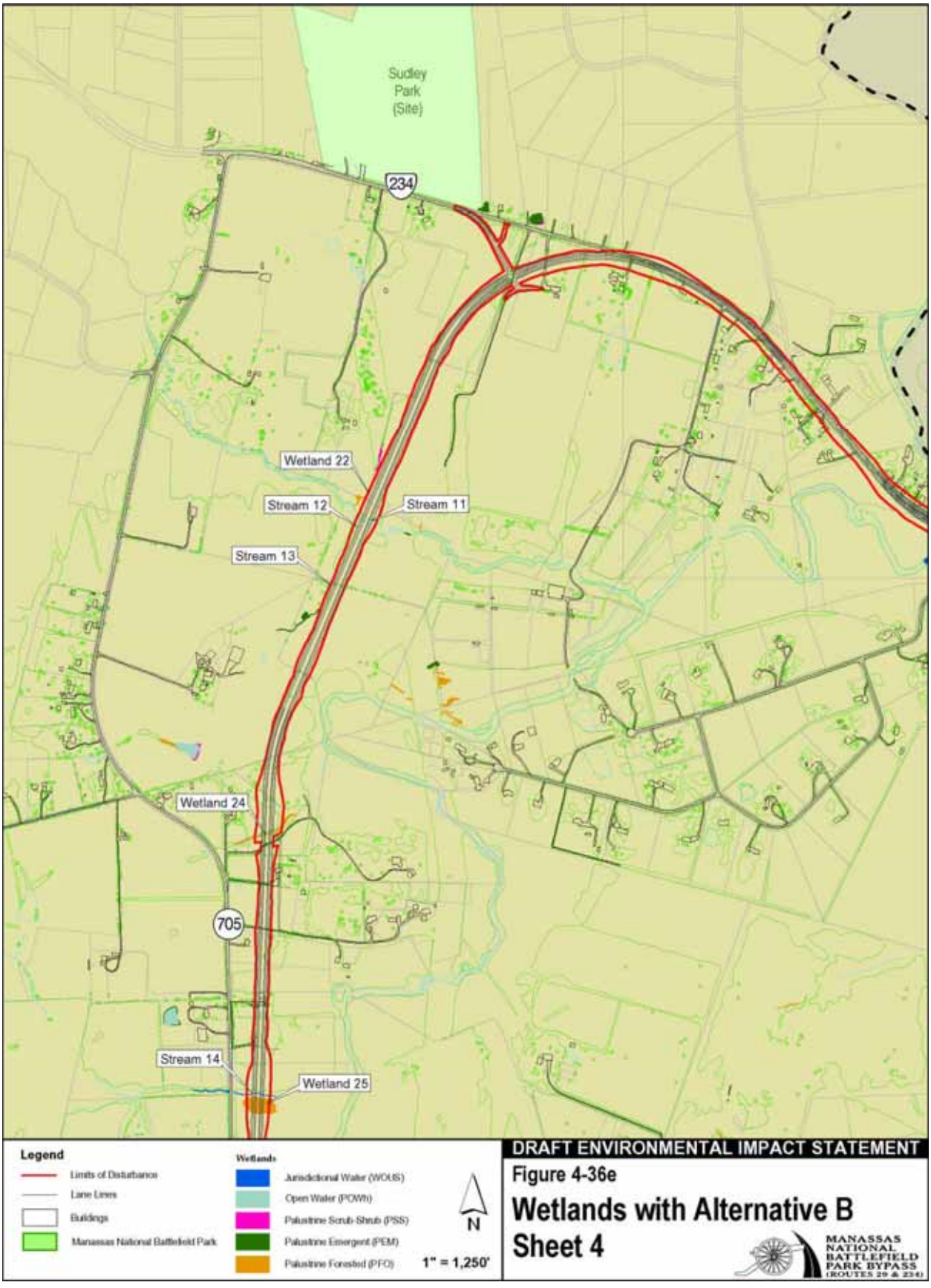
Note: **Bold type** denotes special wetland functions and values associated with indicated habitat.

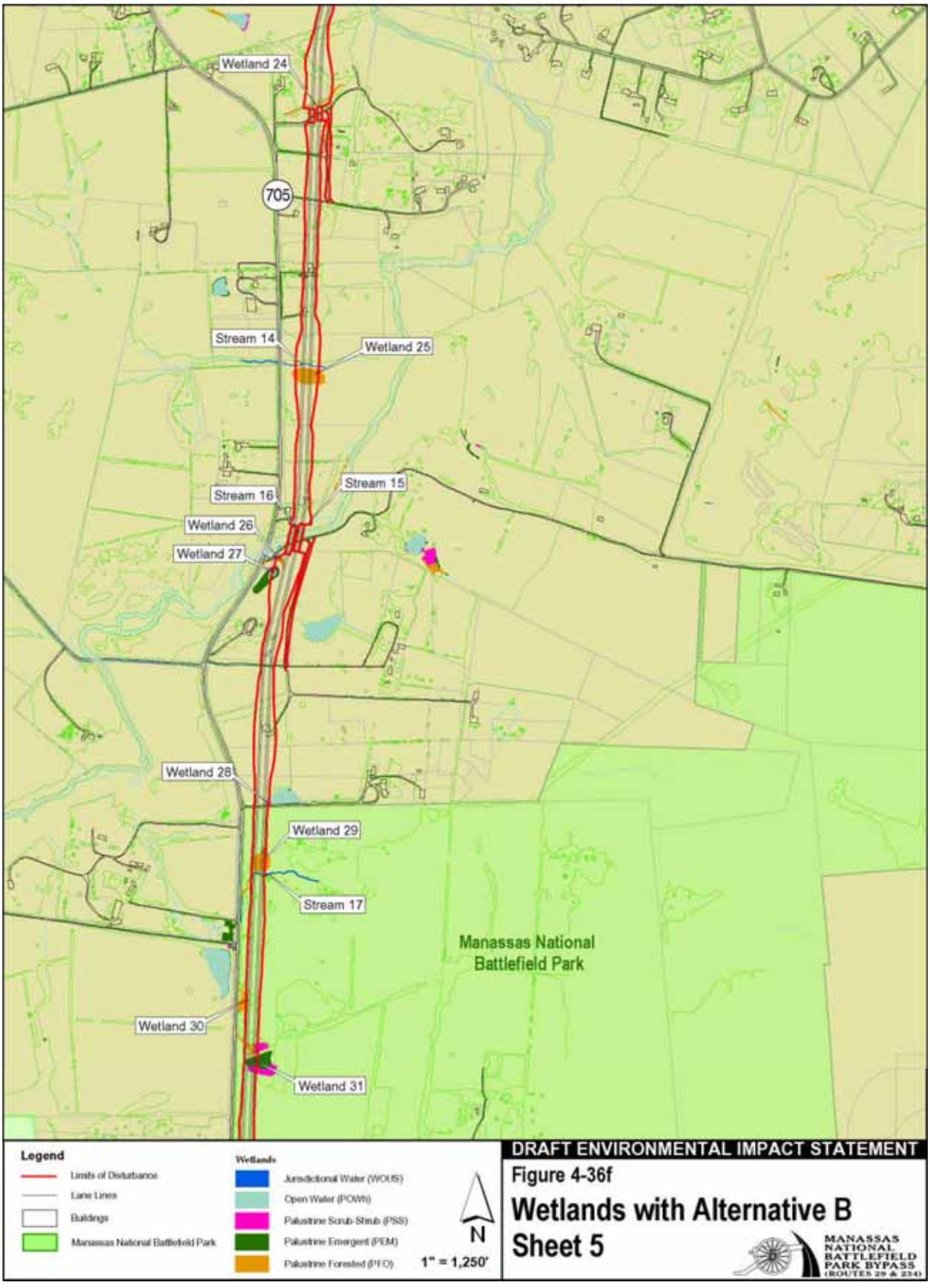

Loudoun
Fairfax
Prince William
Catharpin
Sudley Springs
Manassas National Battlefield Park
Fields of Dreams
Fairfax County Park Authority
Sudley Park (Site)
Conway Robinson Memorial State Forest
Mayhew Park
Bull Run Park
Ben Lomond Park
Ellis L. Barton Park
Fairmont Park
Crestwood Park
1
2
3
4
5
6
234
609
659
621
705
29
658
66
Legend
Manassas National Battlefield Park
N
0
0.5
1
Miles
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-36a
Wetlands Cut Sheet Index
Alternative B
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)


Fairfax County Park Authority
Wetland 9
Stream 4
Stream 3
Wetland 8
Wetland 7
Fairfax County Park Authority
621
Stream 2
Wetland 5
Fairfax County Park Authority
Fairfax County Park Authority
Wetland 6
Wetland 4
Wetland 3
Stream 1
Wetland 2
Wetland 1
29
Manassas National Battlefield Park
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-36b
Wetlands with Alternative B
Sheet 1
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)


621
Wetland 13
Stream 7
Stream 8
Wetland 12
Stream 5
Wetland 10
Stream 6
Wetland 11
Wetland 9
Fields of Dreams
Stream 4
Stream 3
Wetland 8
Wetland 7
Fairfax County Park Authority
Manassas National Battlefield Park
Fairfax County Park Authority
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-36c
Wetlands with Alternative B
Sheet 2
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)


659
Stream 9
Wetland 14
Wetland 16
Wetland 15
Wetland 17
Stream 10
Wetland 21
Wetland 19
Wetland 20
Wetland 18
234
Fairfax County
Park Authority
Manassas National
Battlefield Park
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-36d
Wetlands with Alternative B
Sheet 3
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)


Sudley
Park
(Site)
234
Wetland 22
Stream 12
Stream 11
Stream 13
Wetland 24
705
Stream 14
Wetland 25
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-36e
Wetlands with Alternative B
Sheet 4
MANASSAS
NATIONAL
BATTLEFIELD
PARK BYPASS
(ROUTES 29 & 234)

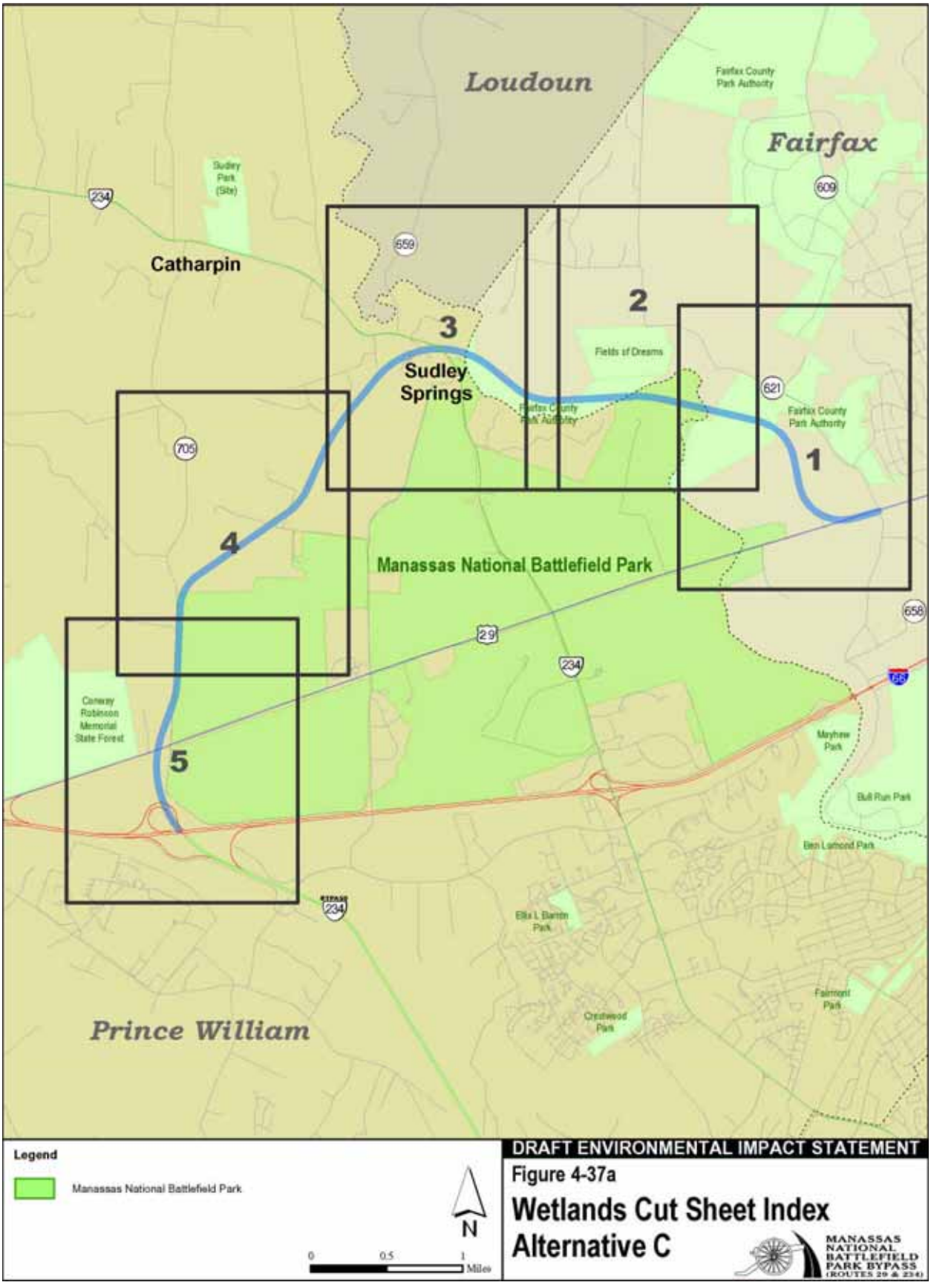

Wetland 24
705
Stream 14
Wetland 25
Stream 16
Stream 15
Wetland 26
Wetland 27
Wetland 28
Wetland 29
Stream 17
Manassas National Battlefield Park
Wetland 30
Wetland 31
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-36f
Wetlands with Alternative B
Sheet 5
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)

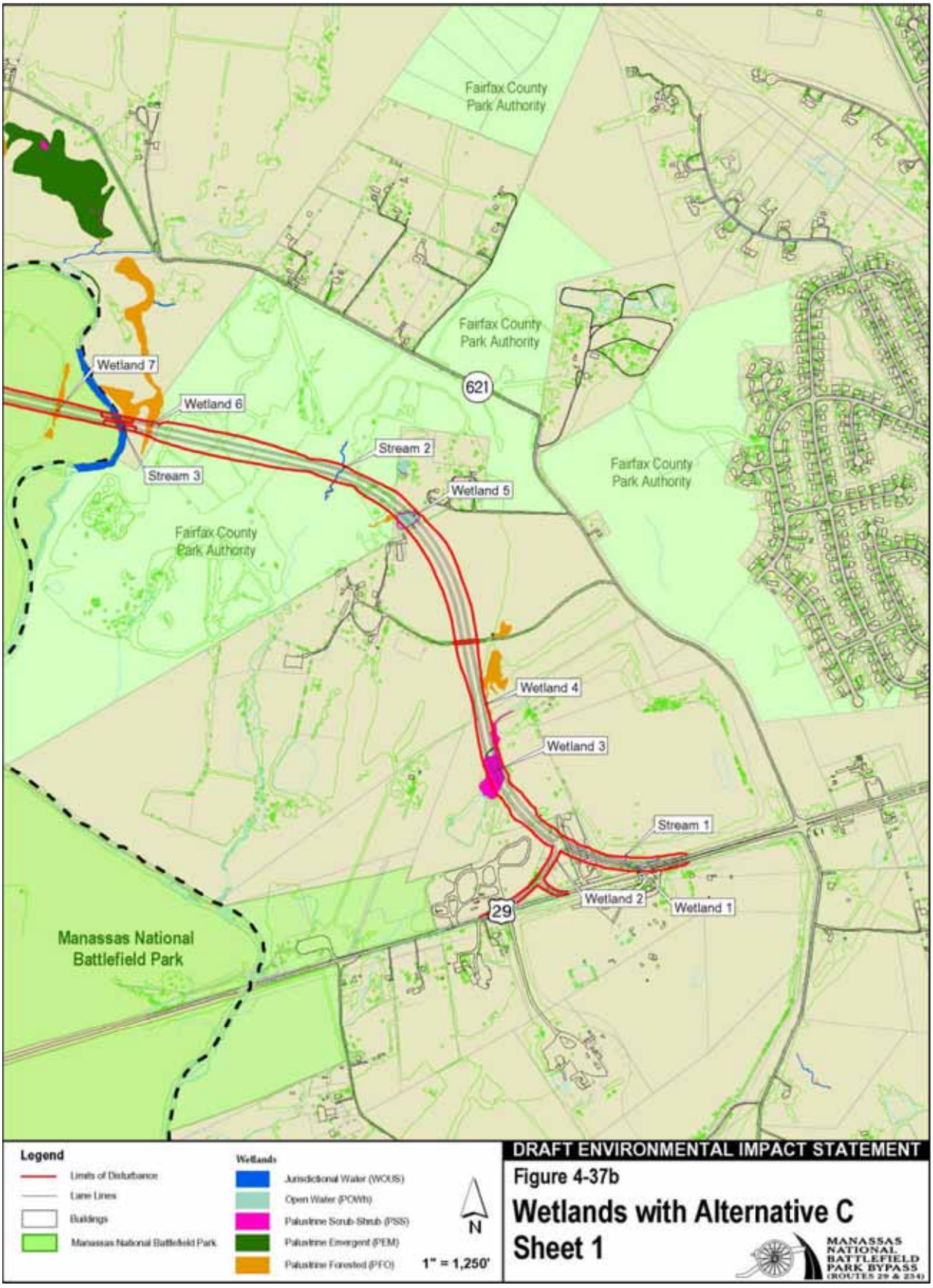

Wetland 30
Wetland 31
Conway Robinson
Memorial
State Forest
Manassas National
Battlefield Park
705
29
Wetland 32
Wetland 33
Wetland 34
Stream 18
66
234
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-36g
Wetlands with Alternative B
Sheet 6
MANASSAS
NATIONAL
BATTLEFIELD
PARK BYPASS
(ROUTES 29 & 234)

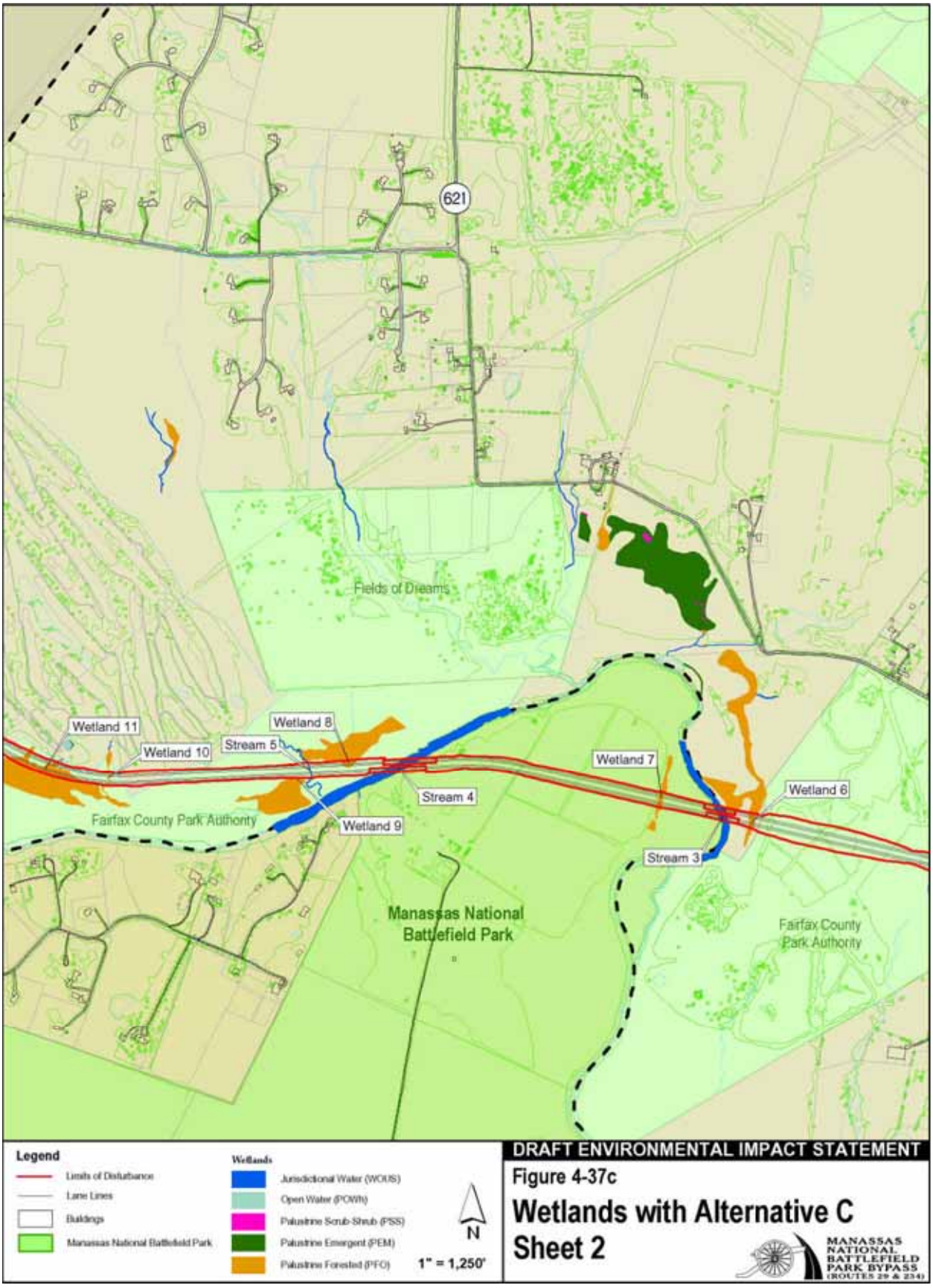
TABLE 4-34: IMPACTED WETLANDS, ALTERNATIVE C

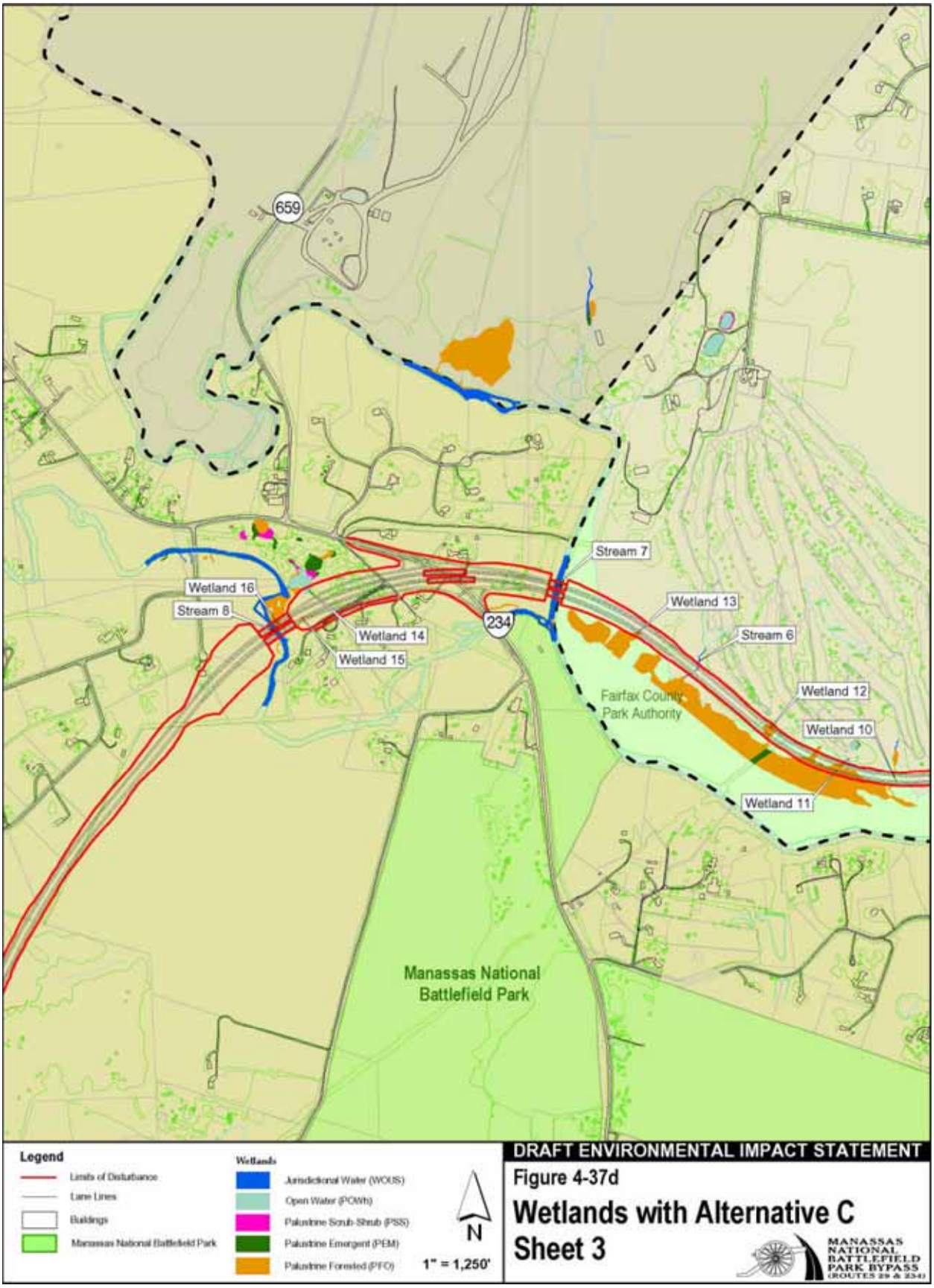
ID No.	Cowardin Class	Principal Functions and Values								Total Area Acres
		Floodflow Alteration	Groundwater Interchange	Nutrient Removal	Production Export	Sediment/ Toxicant Retention	Sediment Stabilization	Fish and Shellfish Habitat	Wildlife Habitat	
1	PEM			X			X			0.01
2	PEM					X				0.01
3	PSS PEM			X	X	X	 X		X	1.01 0.03
4	PFO			X		X				0.03
5	**POW** **PSS** **PEM**				X X	X X	 X	X	X X	**0.40** **0.07** **0.02**
6	PFO		X	X	X				X	0.27
7	**PFO**		X			X			X	**0.12**
8	PFO	X		X	X	X			X	0.14
9	PFO			X						0.01
10	PFO			X		X	X			0.02
11	**PFO**	X		X		X			X	**0.97**
12	PFO		X	X		X				0.22
13	PFO		X	X						0.05
14	POW				X			X	X	0.07
15	PFO		X	X		X			X	0.04
16	PFO	X				X	X		X	0.08
17	PEM					X			X	0.02
18	PFO		X			X				0.01
19	**POW** **PSS** **PEM**			 X	X		X X	X	X	**0.32** **0.03** **0.01**
20	PFO PEM		X	X		X	 X		X	0.42 0.02
21	PFO					X			X	0.04
22	PEM PSS PFO		X X X	 X	X	 X			 X	0.17 0.13 0.13
23	PEM		X				X			0.02
24	PEM			X		X				0.01
25	**PEM** **PFO**	X	 X	X	 X	X X	X	X	 X	**0.12** **0.06**
Total Area										5.08

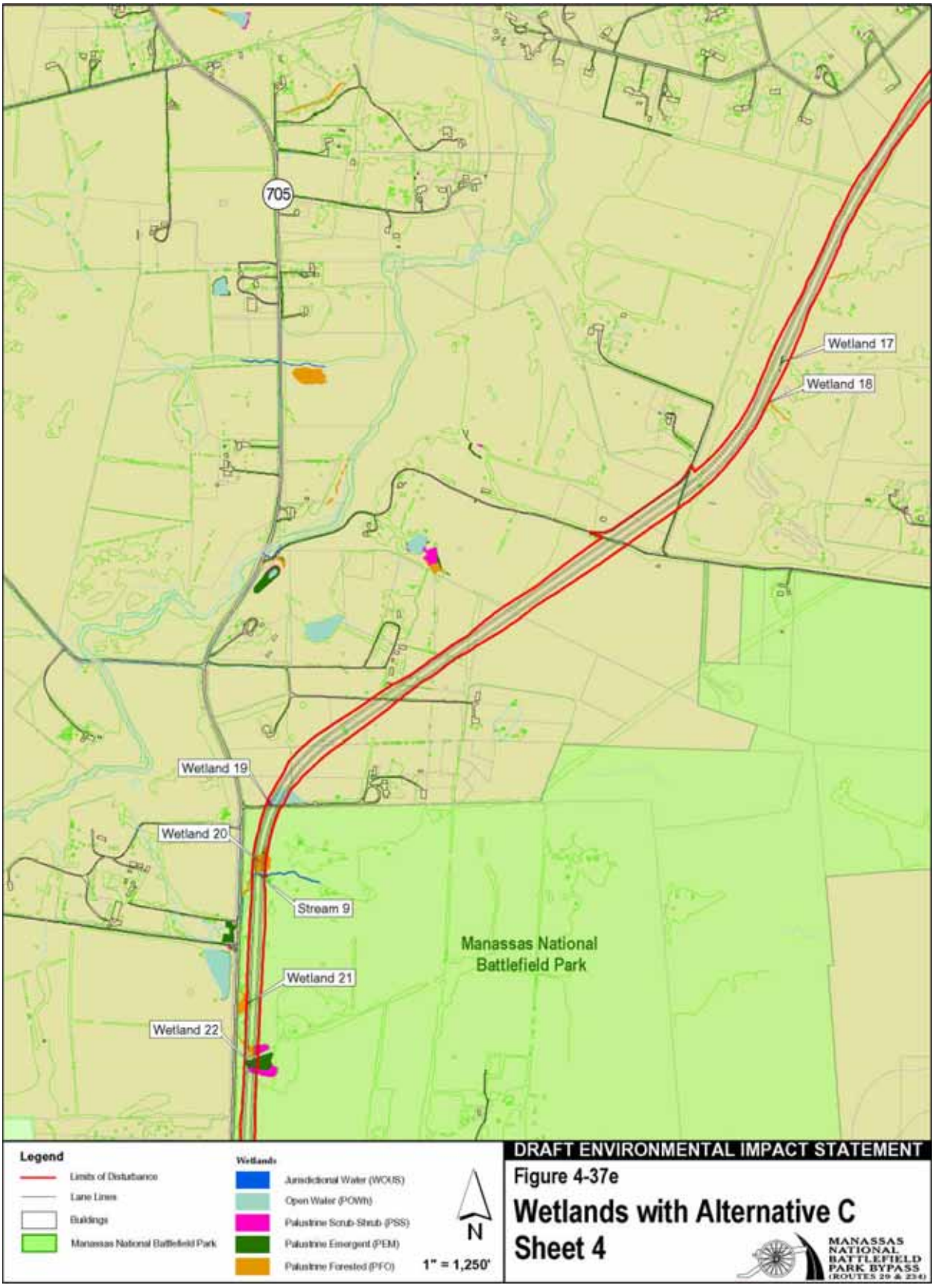
Note: **Bold type** denotes special wetland functions and values associated with indicated habitat.


Loudoun
Fairfax
Prince William
Catharpin
Sudley Springs
Manassas National Battlefield Park
Fairfax County Park Authority
Sudley Park (Site)
Fields of Dreams
Conway Robinson Memorial State Forest
Mayhew Park
Bull Run Park
Ben Lomond Park
Ella L. Bardin Park
Fairmont Park
Crestwood Park
234
609
659
621
705
29
658
66
1
2
3
4
5
Legend
Manassas National Battlefield Park
N
0
0.5
1
Miles
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-37a
Wetlands Cut Sheet Index
Alternative C
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS (ROUTES 29 & 234)


Fairfax County Park Authority
Fairfax County Park Authority
Fairfax County Park Authority
Fairfax County Park Authority
Wetland 7
Wetland 6
Stream 3
Stream 2
Wetland 5
621
Wetland 4
Wetland 3
Stream 1
Wetland 2
Wetland 1
29
Manassas National Battlefield Park
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-37b
Wetlands with Alternative C
Sheet 1
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)


621
Fields of Dreams
Wetland 11
Wetland 10
Stream 5
Wetland 8
Stream 4
Wetland 9
Wetland 7
Wetland 6
Stream 3
Fairfax County Park Authority
Manassas National Battlefield Park
Fairfax County Park Authority
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-37c
Wetlands with Alternative C
Sheet 2
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)


659
234
Stream 7
Wetland 16
Stream 8
Wetland 14
Wetland 15
Wetland 13
Stream 6
Wetland 12
Wetland 10
Wetland 11
Fairfax County Park Authority
Manassas National Battlefield Park
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-37d
Wetlands with Alternative C
Sheet 3
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS (ROUTES 29 & 234)


705
Wetland 17
Wetland 18
Wetland 19
Wetland 20
Stream 9
Manassas National
Battlefield Park
Wetland 21
Wetland 22
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-37e
Wetlands with Alternative C
Sheet 4
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)


Wetland 21
Wetland 22
Conway Robinson
Memorial
State Forest
Manassas National
Battlefield Park
705
29
Wetland 23
Wetland 24
Wetland 25
Stream 10
66
234
Legend
Limits of Disturbance
Lane Lines
Buildings
Manassas National Battlefield Park
Wetlands
Jurisdictional Water (WOUS)
Open Water (POWh)
Palustrine Scrub-Shrub (PSS)
Palustrine Emergent (PEM)
Palustrine Forested (PFO)
N
1" = 1,250'
DRAFT ENVIRONMENTAL IMPACT STATEMENT
Figure 4-37f
Wetlands with Alternative C
Sheet 5
MANASSAS NATIONAL BATTLEFIELD PARK BYPASS
(ROUTES 29 & 234)