

Appendix H

Biological Resources

**Final Environmental Assessment and Section 4(f) Determination
ALP Phase I Improvements at BWI Marshall Airport**

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APPENDIX H:

Biological Resources

The following attachments are included in this appendix to support the biological resources analysis:

- Attachment 1: USFWS Letter with Official Species List and IPaC Resource List, January 14, 2020.
- Attachment 2: MDNR WHS Email Response, April 6, 2017.
- Attachment 3: BWI Marshall Airport Forest Maintenance Plan Update, HNTB and CEM, July 2014.
- Attachment 4: Maryland DNR Forest Maintenance Plan Approval Letter, August 20, 2014.
- Attachment 5: Maryland DNR Environmental Review Program - Email response for fisheries resources, October 7, 2016.
- Attachment 6: Forest Conservation Worksheets for Mitigation Requirements.
- Attachment 7: MDNR WHS, Coordination on Northern Long-eared Bat in the vicinity of BWI Marshall and MTN, Email, 4/11/2019.
- Attachment 8: Biological Assessment for Swamp Pink (*Helonias bullata*) Baltimore/Washington International Thurgood Marshall Airport ALP Phase I Improvements, January 2020.
- Attachment 9: USFWS Determination for Swamp Pink, Letter dated February 19, 2020.
- Attachment 10: USFWS Determination Letter under the Programmatic Biological Opinion on Final 4(d) Rule for the Northern Long-eared Bat, July 16, 2020.

Attachment 1:

**USFWS Letter with Official Species List
and IPaC Resource List**

January 14, 2020



United States Department of the Interior



FISH AND WILDLIFE SERVICE
Chesapeake Bay Ecological Services Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401-7307
Phone: (410) 573-4599 Fax: (410) 266-9127

<http://www.fws.gov/chesapeakebay/>
<http://www.fws.gov/chesapeakebay/endsppweb/ProjectReview/Index.html>

In Reply Refer To:

January 14, 2020

Consultation Code: 05E2CB00-2019-SLI-1151

Event Code: 05E2CB00-2020-E-01094

Project Name: BWI 2016-2020 Improvements

Subject: Updated list of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. This species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

<http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF>

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (<http://www.fws.gov/windenergy/>) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm>; <http://www.towerkill.com>; and <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html>.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
 - USFWS National Wildlife Refuges and Fish Hatcheries
 - Wetlands
-

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Chesapeake Bay Ecological Services Field Office

177 Admiral Cochrane Drive

Annapolis, MD 21401-7307

(410) 573-4599

Project Summary

Consultation Code: 05E2CB00-2019-SLI-1151

Event Code: 05E2CB00-2020-E-01094

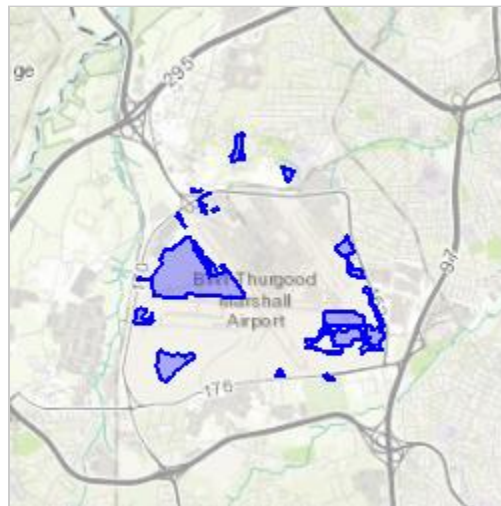
Project Name: BWI 2016-2020 Improvements

Project Type: TRANSPORTATION

Project Description: Maryland Department of Transportation Aviation Administration (MAA) is proposing a number of projects for implementation at Baltimore / Washington International Thurgood Marshall Airport (BWI Marshall Airport).

Project Location:

Approximate location of the project can be viewed in Google Maps: <https://www.google.com/maps/place/39.179080676298355N76.68470208937799W>



Counties: Anne Arundel, MD

Endangered Species Act Species

There is a total of 2 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 1 of these species should be considered only under certain conditions.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries¹, as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

-
1. [NOAA Fisheries](#), also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Northern Long-eared Bat <i>Myotis septentrionalis</i> No critical habitat has been designated for this species. This species only needs to be considered under the following conditions: <ul style="list-style-type: none"> Projects with a federal nexus that have tree clearing = to or > 15 acres: 1. REQUEST A SPECIES LIST 2. NEXT STEP: EVALUATE DETERMINATION KEYS 3. SELECT EVALUATE under the Northern Long-Eared Bat (NLEB) Consultation and 4(d) Rule Consistency key Species profile: https://ecos.fws.gov/ecp/species/9045	Threatened

Flowering Plants

NAME	STATUS
Swamp Pink <i>Helonias bullata</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4333	Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

USFWS National Wildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the [National Wildlife Refuge](#) system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

Wetlands

Impacts to [NWI wetlands](#) and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local [U.S. Army Corps of Engineers District](#).

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

FRESHWATER EMERGENT WETLAND

- [PEM1/SS1C](#)
- [PEM1Ch](#)
- [PEM1F](#)

FRESHWATER FORESTED/SHRUB WETLAND

- [PFO1A](#)
- [PSS1/EM1A](#)

FRESHWATER POND

- [PUBHx](#)

RIVERINE

- [R4SBC](#)
 - [R5UBH](#)
-

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

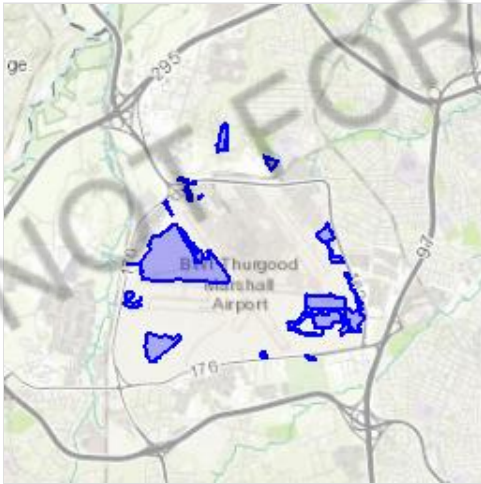
Project information

NAME

BWI 2016-2020 Improvements

LOCATION

Anne Arundel County, Maryland



DESCRIPTION

Maryland Department of Transportation Aviation Administration (MAA) is proposing a number of projects for implementation at Baltimore / Washington International Thurgood Marshall Airport (BWI Marshall Airport).

Local office

Chesapeake Bay Ecological Services Field Office

☎ (410) 573-4599

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177 Admiral Cochrane Drive
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<http://www.fws.gov/chesapeakebay/endsppweb/ProjectReview/Index.html>

NOT FOR CONSULTATION

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population, even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Log in to IPaC.
2. Go to your My Projects list.
3. Click PROJECT HOME for this project.
4. Click REQUEST SPECIES LIST.

Listed species¹ and their critical habitats are managed by the [Ecological Services Program](#) of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries²).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact [NOAA Fisheries](#) for [species under their jurisdiction](#).

1. Species listed under the [Endangered Species Act](#) are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the [listing status page](#) for more information.
2. [NOAA Fisheries](#), also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME

STATUS

Northern Long-eared Bat *Myotis septentrionalis*

Threatened

This species only needs to be considered if the following condition applies:

- Projects with a federal nexus that have tree clearing = to or > 15 acres: 1. REQUEST A SPECIES LIST 2. NEXT STEP: EVALUATE DETERMINATION KEYS 3. SELECT EVALUATE under the Northern Long-Eared Bat (NLEB) Consultation and 4(d) Rule Consistency key

No critical habitat has been designated for this species.

<https://ecos.fws.gov/ecp/species/9045>

Flowering Plants

NAME	STATUS
Swamp Pink <i>Helonias bullata</i> No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/4333	Threatened

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act¹ and the Bald and Golden Eagle Protection Act².

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described [below](#).

1. The [Migratory Birds Treaty Act](#) of 1918.
2. The [Bald and Golden Eagle Protection Act](#) of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern <http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php>
- Measures for avoiding and minimizing impacts to birds <http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php>
- Nationwide conservation measures for birds <http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf>

MIGRATORY BIRD INFORMATION IS NOT AVAILABLE AT THIS TIME

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

[Nationwide Conservation Measures](#) describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. [Additional measures](#) and/or [permits](#) may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS [Birds of Conservation Concern \(BCC\)](#) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the [Avian Knowledge Network \(AKN\)](#). The AKN data is based on a growing collection of [survey, banding, and citizen science datasets](#) and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle ([Eagle Act](#) requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the [AKN Phenology Tool](#).

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the [Avian Knowledge Network \(AKN\)](#). This data is derived from a growing collection of [survey, banding, and citizen science datasets](#).

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: [The Cornell Lab of Ornithology All About Birds Bird Guide](#), or (if you are unsuccessful in locating the bird of interest there), the [Cornell Lab of Ornithology Neotropical Birds guide](#). If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are [Birds of Conservation Concern](#) (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);

2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the [Eagle Act](#) requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the [Northeast Ocean Data Portal](#). The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the [NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf](#) project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the [Diving Bird Study](#) and the [nanotag studies](#) or contact [Caleb Spiegel](#) or [Pam Loring](#).

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to [obtain a permit](#) to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the [National Wildlife Refuge](#) system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

Wetlands in the National Wetlands Inventory

Impacts to [NWI wetlands](#) and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local [U.S. Army Corps of Engineers District](#).

WETLAND INFORMATION IS NOT AVAILABLE AT THIS TIME

This can happen when the National Wetlands Inventory (NWI) map service is unavailable, or for very large projects that intersect many wetland areas. Try again, or visit the [NWI map](#) to view wetlands at this location.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tubercid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

NOT FOR CONSULTATION

Attachment 2:

MDNR WHS Email Response

April 6, 2017

From: [Lori Byrne -DNR-](#)
To: [Lange, Leyla; rbowie@bwiairport.com](#)
Cc: [Katharine McCarthy -DNR-](#)
Subject: BWI Thurgood Marshall Airport Environmental Assessment for Proposed Improvements 2016-2020
Date: Thursday, April 06, 2017 4:11:06 PM

Dear Ms. Lange and Ms. Bowie,

We have reviewed the material sent with this scoping package and only have concerns for the work in the vicinity of Stony Run. Stony Run contains wetlands that are designated in state regulations as Nontidal Wetlands of Special State Concern, and supports several rare, threatened or endangered plant species.

Our concerns for the proposed work in Stony Run focus on one particular area of tree removal, located north of the access road with guidance light towers, west of Stony Run and the sewer easement. There are records for state and federally-listed endangered Swamp Pink (*Helonias bullata*) documented for the immediate area of the proposed tree removal at this site. This occurrence of Swamp Pink could be directly impacted by the work proposed, including impacts from soil compaction and disturbance from equipment in the habitat. Is it possible to confirm that the trees slated for removal at this one area are in fact of the height for necessary removal?

We would also encourage the applicant to take precautions to avoid spreading invasive vegetation into this and the other proposed tree removal locations in Stony Run. Both Japanese Stiltgrass and Wavyleaf Basketgrass have been documented as invasives in this area, and could be further spread by soil disturbance and equipment.

Thank you for the opportunity to review and comment. We look forward to hearing from you.

Lori Byrne

MD Logo.png



dnr.maryland.gov

Lori A. Byrne
Environmental Review Coordinator
Wildlife and Heritage Service
Department of Natural Resources
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Annapolis, MD 21401
410-260-8573 (office)
410-260-8596 (FAX)
lori.byrne@maryland.gov

Attachment 3:

**BWI Marshall Airport
Forest Maintenance Plan Update**

HNTB and CEM

July 2014

FINAL FOREST MAINTENANCE PLAN UPDATE

Baltimore/Washington International Thurgood Marshall Airport



MAA-AE-AE-001
Task 13.2

JULY 2014

Prepared For:

Maryland Aviation Administration
Division of Environmental Planning



Prepared by:

**HNTB Corporation and
Chesapeake Environmental
Management, Inc.**

EXECUTIVE SUMMARY

In 2009, the Maryland Aviation Administration (MAA) created a Forest Maintenance Plan (FMP) for approximately 3,500 acres of contiguous property associated with the Baltimore/Washington International Thurgood Marshall Airport (BWI Marshall), located approximately nine miles southwest of the City of Baltimore, Maryland in Anne Arundel County, along with an additional approximate 400 acres of MAA-owned and maintained property not contiguous with the BWI Marshall campus. The FMP provided a detailed record of existing forest resources as well as areas that could be used for afforestation, identified pertinent State and Federal regulations and mandates governing those resources, and established standard procedures through which effective management of the forest resources could be achieved. The FMP serves as an agreement between the MAA and the Maryland Department of Natural Resources – Forest Service (MDNR) to facilitate MAA maintenance activities regarding forest resources on the BWI Marshall property.

Forest maintenance at BWI Marshall is intended to ensure safe and efficient conditions for the traveling public while fostering environmental protection, stewardship, and resource conservation. Federal statutes regulating the airport property define a) airspaces that must be maintained free of obstructions, b) areas of the property on which specific security measures must be implemented, c) means by which hazards, such as wildlife that could temporarily enter the airspaces and property, should be restricted or managed, and d) requirements of the Clean Water Act. State regulations specifically relevant to the airport's FMP relate to a) the Forest

Conservation Act (FCA), through MDNR, b) water quality, through the Maryland Department of the Environment (MDE), and c) sediment and erosion control, also through MDE.

A total of 244 forest stands were delineated on BWI Marshall property, 123 of which are located on the airport campus property, and 121 located offsite of the campus. The airport campus property is defined as the contiguous property encompassing the terminal and runways. Generally defined as a grouping of trees with similar characteristics that can be distinguished from adjacent groups, individual stands often grow immediately adjacent to one another, so maintenance strategies implemented at any given site on BWI Marshall property may affect multiple stands.

Maintenance strategies implemented at BWI Marshall are intended to prevent or mitigate for potential problems related to one of the following six issue categories:

1. Maintaining safe and efficient regulated surfaces and airspace, including those associated with both existing and planned development of airport facilities;
2. Maintaining a mandatory 10-foot clear zone along security fences and airport perimeter;
3. Maintaining effective visual and physical buffers from adjacent communities;
4. Effectively managing potentially hazardous wildlife;
5. Effectively managing fire hazard potential; and
6. Maintaining good forest health and vitality.

In order to ensure that the FMP provides accurate data and valid recommendations that can be implemented effectively to meet current State and Federal regulations, MAA prepares periodic FMP Updates (FMPUs). The first FMPU was prepared in 2009, followed by this second FMPU in 2013/2014. After a review of previously completed field work, updated mapping, and updated State and Federal regulations, each forest stand was evaluated to determine its potential for containing existing or potential conflicts related to one of the six issue categories. To ensure accuracy in existing vegetation data, it was necessary to field verify the condition of 69 forest stands, all of which had initially been identified as 'conflict stands' during the desktop screening. This field verification was conducted in December 2013 and January 2014.

Analysis revealed that close to half of the forest stands on BWI Marshall property have existing, or potential for, problems requiring maintenance of forest resources. The analysis revealed the following, as they relate to the six issue categories:

1. There were 83 stands or portions of stands identified as having existing or future conflicts with regulated surfaces and airspaces. Mitigation measures recommended in this FMPU include the selective removal of some trees within stands, complete removal of stands, and/or conversion of existing stand composition to species that would not create the conflict.
2. There were 10 stands identified as having existing or the potential for future obstructions to the 10-foot mandatory clear zones along security fences. Consistent mowing

and removal of woody plant material within the clear zones will minimize the potential for conflicts.

3. Three stands were identified as buffers that require maintenance to ensure effective screening for adjacent communities, using preferred species.
4. Although many stands on BWI Marshall property contain downed woody debris and other potential attractants for wildlife considered hazardous to the airport operations, no stands were singled out as requiring immediate attention. Instead, routine maintenance procedures have been established that, when fully implemented across BWI Marshall property, will reduce the wildlife hazard potential to acceptable levels.
5. There were 33 stands identified as having fire hazard potential. Stand thinning, selective limb pruning, and removal of downed woody debris within stands are recommended as a means to minimize fire hazard potential.
6. Consistently scheduled field inspection and monitoring of all stands is recommended to ensure adequate forest health and vitality is maintained, especially for stands known to directly contribute to protection of waterways and wetlands. Control of invasive species and mowing in appropriate areas is recommended long-term.

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List of Acronyms

AFA – Afforestation Area

AIP – Airport Improvement Program

ALP – Airport Layout Plan

BMP – Best Management Practice

BWI Marshall – Baltimore/Washington International Thurgood Marshall Airport

CFR – Code of Federal Regulations

COMAR – Code of Maryland Regulations

ESCP – Erosion Sediment Control Plan

FAA – Federal Aviation Administration

FAR – Federal Aviation Regulations

FCA – Forest Conservation Act

FCP – Forest Conservation Plan

FMPU – Forest Maintenance Plan Update

FSD – Forest Stand Delineation

MAA – Maryland Aviation Administration

MDE – Maryland Department of the Environment

MDNR – Maryland Department of Natural Resources

MSL – Mean Sea Level

OFA – Object Free Area

RMP – Reforestation Master Plan

RSA – Runway Safety Area

USDA – United States Department of Agriculture

WHA – Wildlife Hazard Assessment

WHMP – Wildlife Hazard Management Plan

1 INTRODUCTION

Baltimore/Washington International Thurgood Marshall Airport (BWI Marshall) is located in Anne Arundel County, Maryland, approximately nine miles from the City of Baltimore as illustrated in **Figure 1**. BWI Marshall is owned and operated by the Maryland Aviation Administration (MAA), a modal branch of the Maryland Department of Transportation. MAA owns and maintains approximately 3,500 acres of contiguous property associated with airside operations (runways, taxiways, etc.), landside facilities (terminals, roadways, etc.), and aviation support facilities such as parking areas, maintenance buildings, and a consolidated rental car facility. In addition, MAA owns and maintains approximately 400 acres of offsite properties purchased through a combination of Federal Airport Improvement Program (AIP) funds or other State funds, primarily as part of BWI Marshall's compliance under the Airport Safety and Noise Abatement Act (14 CFR Part 150). **Figure 2** depicts the approximate boundaries of BWI Marshall, and **Figure 3** shows the location of the MAA-owned offsite properties.

While the MAA's primary goal is to provide a safe and efficient environment for the traveling public, MAA is committed to conducting its operations in an environmentally responsible manner and to foster environmental protection, stewardship, and resource conservation (MAA Environmental Policy, October 2006).

1.1 Purpose and Background

The Forest Maintenance Plan Update (FMPU) establishes in detail the MAA's plans to maintain its forest resources, while complying with the pertinent environmental regulations and aviation safety and security

mandates. This FMPU will serve as a planning document from which specific activities and projects will be implemented as needed. All future forest maintenance operations will be based on the recommendations of this plan, and will be in accordance with the standards and guidelines presented herein.

This FMPU includes the following information:

- Regulations pertaining to managing forested areas and Federal Aviation Administration (FAA) regulations pertaining to safety;
- An inventory and assessment of existing forest resources on MAA-owned property;
- A summary of on-airport forest stands/offsite parcels with potential maintenance/safety concerns;
- Maintenance strategies for eliminating safety concerns and maintaining forest resources; and
- Best Management Practices (BMPs) that MAA can incorporate into its maintenance operations, as appropriate.

This FMPU serves as an update to the *Forest Maintenance Plan Update for Baltimore/Washington International Thurgood Marshall Airport* (URS/A.D. Marble & Co. 2009).

This FMPU is based on previous field work performed within the time period of November 2007 through April 2008 and July 2008 through September 2008. Upon completion of a desktop screening and review of existing data, targeted field work was conducted to verify and update specific data. Priority areas were then identified for field verifications. The information is based, in part, on forest stands identified in the

Final Forest Stand Delineation Report for BWI Airport (Greiner, Inc. 1994) and later revised in the *Forest Stand Delineation Report for BWI Airport, Maryland* (SES, 2003). The 2003 Forest Stand Delineation (FSD) report identified 123 individual forest stands.

This FMPU will serve as an agreement between MAA and the Maryland Department of Natural Resources – Forest Service (MDNR), allowing MAA Maintenance to perform the recommended actions without additional review or approval from MDNR. However, this FMPU does not satisfy other regulatory requirements protecting environmental resources such as jurisdictional wetlands or waterways and does not satisfy permitting requirements for these resources. This FMPU only covers the recommended maintenance activities and does not eliminate the need for coordination with MDNR under the Maryland Forest Conservation Act (FCA) for other development activities that disturb more than 40,000 square feet or require a sediment and erosion control permit.

1.2 Regulations

MAA must comply with all Federal and State regulations pertaining to both aviation safety and natural resource management. Relevant Federal and State regulations are described in the following sub-sections.

1.2.1 Federal Regulations

There are four Federal regulations that MAA must comply with in development of the FMPU.

Obstructions

The FAA provides extensive regulations to ensure the safety of the traveling public. These include FAR Part 77 Section 77.25 (14 CFR Part 77.25), which defines the

dimensions and elevations for “imaginary surfaces” for civil airports. MAA must ensure that the airspaces above these imaginary surfaces are free of obstructions. An object is considered an obstruction to air navigation if it is a greater height than any of the imaginary surface elevations. In general, airspace near runways must be cleared to be at the same level (elevation) as the centerline of the runway and the elevation of the approach surface to be kept free of obstructions, which increases with the distance from the centerline of the runway. For forest maintenance purposes, this FMPU assumes the most restrictive elevations prescribed under these regulations.

The following assumptions were used to determine the various surface elevations at BWI Marshall (see **Table 1**).

Table 1
FAR PART 77 SURFACES

Surface	Assumption
Primary Surface	Elevation is the same as the centerline of the runway.
Horizontal Surface	Elevation of 150 feet above the centerline of the runway. As shown by MAA’s Airport Layout Plan, the horizontal surface for BWI Marshall is at an elevation of 296 feet above mean sea level (msl).
Approach Surface	The elevation of the approach surface was assumed to rise at a slope of 34:1 or 50:1 as indicated on the Airport Layout Plan.
Transitional Surface	The elevation of the transitional surface varies; the surface begins at the primary surface and rises at a slope of 7:1 for a distance of approximately 1,600 feet.

Security

FAA regulations as defined in 14 CFR Part 139 (2004) require airport operators to provide a security fence at the airport perimeter and a 10-foot clear zone on either side of the fence to provide rapid and frequent visual inspections by security personnel or surveillance cameras. All vegetation, except maintained turf, must be cleared within 10 feet of a security fence.

Wildlife Hazards

FAA Advisory Circular (AC) No. 150/5200-33B, "*Hazardous Wildlife Attractants on or Near Airports*" (2007) provides guidance on certain land uses that have the potential to attract hazardous wildlife on or near public-use airports. As part of this AC, the FAA recommends that airport operators should ensure that plant varieties attractive to hazardous wildlife are not used on the airport and the operators of airports that are surrounded by woodlands should develop a Wildlife Hazard Assessment (WHA) and Wildlife Hazard Management Plan (WHMP) to protect aviation safety.

Water Quality

The Federal Water Pollution Control Act (Clean Water Act) (33 U.S.C. 1251 – 1376) establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. Section 404 of the Clean Water Act authorizes the Secretary of the Army to issue permits for the discharge or fill materials into waters of the United States, including wetlands.

1.2.2 State Regulations

There are three State regulations that MAA must comply with in development of the FMPU.

Forest Conservation Act

The Maryland General Assembly passed the Maryland FCA in 1991 to preserve the State's forest resources and other sensitive areas during development activities. The FCA requires identification of existing forest stands, protection of the most desirable forest stands, and establishment of new areas where forest can be planted. The FCA requires that prior to the approval of any public or private subdivision, project plan, grading permit, or sediment and erosion control permit on a unit of land 40,000 square feet or greater or clearing of 20,000 square feet of forest, applicants shall submit a Forest Stand Delineation (FSD) and a Forest Conservation Plan (FCP). These documents must be approved by the MDNR before approval can be granted (*State Forest Conservation Technical Manual, Third Edition, 1997*). The provisions of the FCA can be found in the Annotated Code of Maryland (Natural Resources Article, Title 5, Subtitle 16) and the Code of Maryland Regulations (COMAR Title 08, Subtitle 19, Forest Conservation).

Water Quality

Similar to the Federal Clean Water Act requirements, the Maryland Department of the Environment (MDE) Wetlands and Waterways Division requires a Non-tidal Wetlands and Waterways permit for any activity that would alter a non-tidal wetland or its buffer. The Maryland law differs from the Federal law in that it regulates isolated wetlands, wetland buffers, and the 100-year floodplain. The provisions for Non-tidal Wetlands and Waterways regulations can be found in Code of Maryland Regulations (COMAR Title 26, Subtitles 17 and 23).

Sediment and Erosion Control

MDE requires Erosion and Sediment Control Plans (ESCPs) for all proposed land disturbances that exceed 5,000 square feet, or involve more than 100 cubic yards of earth movement (COMAR 26.17.01). As part of the ESCP process, MAA must incorporate BMPs, where possible, as detailed in **Appendix A**. Clearing or grading activities that disturb less than 5,000 square feet of land area, and involve less than 100 cubic yards of earth movement are exempt from the erosion and sediment control provisions.

1.3 Summary

As a state agency responsible for the operation of an FAA-certificated commercial service airport, MAA must comply with both Federal and State regulations. In some cases, the regulations can create conflicts, such as instances where forest protected under the FCA must be cleared to comply with FAR Part 77 requirements. To resolve this potential conflict, Natural Resources Article, Title 5, Subtitle 16 provides for the “cutting or clearing of trees to comply with the requirements of 14 CFR Part 77.25 relating to the objects affecting navigable airspace, provided that the Federal Aviation Administration has determined that the trees are a hazard to aviation.” This provision allows MAA to remove trees that protrude into imaginary surfaces without penalty under the FCA, provided that MDNR has concurred with the location and extent of such obstruction removal. This FCA exemption does not apply to the removal of vegetation within clear zones (as part of 14 CFR Part 139 requirements) or removal of forest habitat (as part of AC 150/5200-33B *Hazardous Wildlife Attractants on or Near Airports* guidelines), which are not exempt from FCA coordination.

Also, MAA cannot eliminate trees or other vegetation in jurisdictional wetlands without appropriate authorization from the U.S. Army Corps of Engineers (USACE) and/or MDE. Jurisdictional wetlands and waterways in the vicinity of BWI Marshall are shown on Figure 3. These Federal and State regulations provide the basis for the recommendations provided in this FMPU.

2 METHODS

Field investigations performed as part of the previous FMPU included review of existing documentation, mapping, and the recommendations and maintenance practices to determine whether they remain consistent with current conditions and operations at BWI Marshall. Field investigations that were completed for this FMPU were limited to the verification of forest stands which were identified as existing or future conflicts during the desktop screening.

2.1 Document Review and Field Investigations

MAA reviewed the following documents in preparation of this FMPU:

- Airport Layout Plan (MAA, 2013),
- Management of Acquired Noise Land for BWI Airport, (MAA, 2010),
- *Forest Maintenance Plan Update for BWI Airport* (URS/Grenier, February 2009 Revised),
- *Forest Stand Delineation Report for BWI Airport, Maryland* (SES, 2003),
- *Final Forest Stand Delineation Report for BWI Airport* (Greiner, Inc., 1994),
- *Forest Stand Delineation Report for Former Ridgewood Mobile Home Park* (SES, 2001),

- Aerial Photography of BWI Marshall (MAA, 2005 and 2007; *MD iMap*, 2013),
- *Forest Conservation Plan for Runway 15L/33R Obstructions Removal* (Baker, 2013), and
- *Forest Conservation Plan for Kitten Branch Stream Mitigation* (Baker, 2013).

Previous field investigations took place between the months of November 2007 to April 2008 and July 2008 to September 2008. As part of these field investigations MAA performed a visual inspection/timber cruise of each of the 123 previously delineated forest stands within the BWI Marshall property to update previously recorded information and identify areas in need of maintenance. MAA also conducted visual inspections/timber cruises for 80 additional parcels which were not included in the previous forest stand delineation or FMP. A change in ownership or parcels identified as lacking forest density were removed from the previously reported totals. MAA recorded the following data for each forest stand/parcel:

- Forest Stand Boundaries (offsite parcels);
- Community succession stage;
- Average tree height and diameter;
- Dominant and co-dominant species composition;
- Common understory and herbaceous species;
- Water resources and topography;
- Forest stand structure and health;
- Management and maintenance needs; and
- Other relevant comments.

MAA photographed and collected data from each stand/parcel, and recorded data on the field data sheets (see **Appendix B** and **Appendix C**). MAA measured the average tree height within each forest area using a clinometer. The approximate stand acreage for each previously identified forest stand was determined by reviewing the most recent FSD. The approximate forest acreage for the offsite parcels was estimated by measuring the extent of forest cover based on 2007 aerial photography and/or by field surveys using handheld Global Positioning Equipment (GPS). The most recent review referenced 2013 aerial imagery to determine any changes in forest cover.

The most recent review of data, including improved planimetric and aerial imagery, indicated a total of 244 forest stands; including 123 onsite and 121 offsite. A total of 76 potential afforestation areas were also identified in addition to the seven (7) existing afforestation areas.

For this FMPU, MAA referenced previously reported data with limited field verification updates, the updated ALP, and Part 77 surface data. The most recent field investigations verifying conflict forest stands were conducted in December 2013 and January 2014. Conflicts were determined based on maximum growth projections and FAR Part 77 Conflict surface elevations. A total of 69 stands were identified as existing conflicts and were priority for field verifications, including 43 onsite and 26 offsite stands. The clinometer methodology was used to measure tree heights. Specific trees were selected to be representative of the stand species composition, including the fastest and tallest growing species, sampled across the entire stand in consideration of topography throughout the stand boundary.

2.2 Analytical Methods

MAA reviewed the collected data regarding each forest stand/offsite area to identify existing and potential maintenance needs. MAA identified forest maintenance needs based on the presence of regulated surfaces and airspace, security fence/airport perimeter concerns, visual buffers, fire hazards, hazardous wildlife, and forest health. The results of these reviews are summarized in Section 3 of this document.

2.2.1 Regulated Surfaces and Airspace

MAA identified the existing height conflicts for each forest stand/offsite area using the FAR Part 77 Airspace Plan shown in the Final ALP (MAA, 2012). MAA calculated a “worst-case” elevation for each stand by assuming the average tree height on the highest topographical point within the stand. Ground elevations were identified using the ALP and the average tree heights were determined using clinometer measurements taken during the previous field survey. Results from the recent (2013/2014) field investigations were used to verify or otherwise correct approximated stand heights. MAA identified stands as containing existing conflicts if the combined elevation of the highest topographical point within the stand and the average tree height within the stand exceeded FAR Part 77 surface restrictions shown on the ALP.

To identify potential obstructions for ultimate conditions, MAA projected average tree heights based on the reported growth rates (Dirr, 1990; and USDA Plants Database, accessed in September 2013), see **Appendix D**. Slow-growing species were reported to have a growth rate less than or equal to 1 foot per year. Species that exhibit medium growth rates increase in size at a rate between 1 and 2 feet per year. Rapid growing species have a growth rate greater

than or equal to 2 feet per year. MAA projected tree heights by adding 5, 8 and 10 feet to the average heights measured in the field based on the growth rates of slow, medium and rapid, respectively, of the dominant species in each stand for worst-case-scenario projections. The projected tree heights generated both current and future additional stand conflicts. The recent field investigations in December 2013 and January 2014 compared manual readings using the clinometer method to the projected tree heights. The data points for individual trees were averaged to determine an overall stand height and used to update reported values. General observations indicated that seven (7) stands were identified as having notable differences between projected heights and actual measured heights. The remaining stands were within 5 – 10 feet of their projected height utilizing growth rates and previously reported heights.

In areas where either ground elevations or FAR Part 77 surface elevations varied, a worst-case scenario was assumed using the lowest obstruction height and the highest tree/ground height elevation to determine potential conflicts. A range of elevations were used to identify potential conflicts in some stands because several FAR Part 77 surfaces were identified (i.e., runways in close proximity or flight paths that cross). This was further refined by isolating contours within forest stand polygons to split out areas creating current conflicts. MAA identified specific maintenance recommendations for stands to reduce the potential for obstructions into FAR Part 77 airspace.

2.2.2 Security Fence/ Airport Perimeter

MAA identified the forest stands that could potentially encroach upon the mandatory 10-foot clear zone using the ALP and

previous FMP report. MAA examined each forest stand adjacent to the perimeter fence during the previous field investigation to determine whether vegetation is currently within the 10-foot clear zone. MAA documented the findings on field data sheets and indicated areas requiring maintenance in Section 3.

2.2.3 Buffers

MAA identified the forest stands that serve as visual buffers to the adjacent communities using the ALP and the previous FMPU report. MAA investigated each buffer area and documented the findings on field data sheets.

2.2.4 Hazardous Wildlife

The United States Department of Agriculture, Animal and Plant Health Inspection Services, Wildlife Services (USDA) prepared a *Wildlife Hazard Management Plan (WHMP) for BWI* in 2002 to manage habitat on and around the airfield to discourage hazardous wildlife from using the area. The WHMP is updated yearly. According to the WHMP, flocking birds and large birds pose the greatest threat to aviation. To support MAA's effort to deter wildlife and support the wildlife hazard management services described in the WHMP, MAA recorded the presence or evidence of wildlife use within the stand during field investigations. MAA identified potential wildlife habitat based on several factors, such as:

- Observations of wildlife and evidence of their presence, such as scat, tracks, fur/feather, nests, etc;
- Elements of forest stand structure, such as contiguous parcels, understory composition and overstory tree density;

- Potential of the species to produce mast, and stands with high numbers of seed- and berry-producing species;
- Areas adjacent to forest stands, such as water bodies and open fields; and
- Areas along forest borders where edge habitat persists, as well as other habitat and food areas, such as snags and downed woody debris.

This FMPU identifies management strategies for each stand to reduce its attractiveness to potentially hazardous wildlife based on the findings presented in the WHMP, previously prepared FMPs, and field observations of existing conditions.

2.2.5 Fire Hazards

Fire is an ecologically important component of certain forested landscapes of North America that helps to naturally reduce the accumulation of woody biomass that can act as a fuel. In many cases, fire suppression has interrupted the natural process of wildfire, resulting in increased fuel sources that could result in a more severe fire if ignited. The increasing interface between forested areas and urban land uses requires the management of forest resources to prevent the destruction of property. One of the most important fire management techniques is the reduction of fuel sources through mechanical clearing or selective burning to reduce wildfire potential.

During the previous field investigations, MAA identified fire control management strategies based on current forest stand conditions. MAA noted areas where dense overstory structure, thick pine needle mats, and downed woody debris were observed. Other factors, such as the width of road cuts

and the proximity to flammable materials were also considered.

2.2.6 Forest Health

The USDA Forest Service Business Plan defines a healthy forest as a condition wherein a forest has the capacity across the landscape for renewal, recovery from a wide range of disturbances, and retention of its ecological resiliency (USDA Forest Service, Forest Health Protection website, accessed October 2013). To characterize the health of individual forest stands on BWI Marshall and surrounding properties, MAA recorded the overall condition, age, structure, and regeneration of each forest stand, while also noting the amount and frequency of downed trees or woody debris, invasive species, or disease.

3 RESULTS

This section presents the results of updates to the previous FMPU (URS/A.D. Marble, 2009). Results presented in this FMPU are similar to past versions, as overall forest composition and maintenance needs of BWI Marshall have changed minimally. Species composition in the surveyed areas ranged from monocultures of separate deciduous and coniferous species to heterogeneous mixtures of the two species types. Deciduous stands were composed mainly of oak-hickory species and maple-tulip poplar species along with less dominant deciduous trees such as persimmon and black gum. Coniferous stands consisted mainly of Virginia pine and pitch pine, with loblolly and white pine interspersed. Most mixed stands of offsite parcels (those parcels disconnected to the contiguous airport campus) included a variety of tree species.

MAA created one map, divided into four quadrants that represented the northwest, northeast, southwest and southeast portions

of the airport, to present forest stand/offsite parcel data (see **Appendix E**). *Appendix E* shows all surveyed forested areas at and around BWI Marshall, summarizes the results of the field investigations, and presents the associated forest management strategies. A table identifying each forest stand and offsite parcel stand, and summarizing the data from previous studies, aerial photography, and field observations about the dominant species and average heights for each area is included in **Appendix F**. A summary of the existing forest stands, afforestation areas, and offsite parcel stands for each quadrant is listed below and shown in *Appendix E*.

- Northwest Quadrant: MAA identified 29 forest stands totaling 275 acres, 53 offsite stands totaling 73 acres, 46 potential afforestation areas totaling 30 acres, for an overall total of 378 acres.
- Northeast Quadrant: MAA identified 13 forest stands totaling 50 acres, 5 offsite stands totaling 14 acres, 2 potential afforestation areas totaling 1 acre, for an overall total of 65 acres.
- Southwest Quadrant: MAA identified 42 forest stands totaling 367 acres, 27 offsite stands totaling 102 acres, and 11 potential afforestation areas totaling 47 acres, for an overall total of 516 acres.
- Southeast Quadrant: MAA identified 39 forest stands totaling 260 acres, 36 offsite stands totaling 72 acres, and 17 potential afforestation areas totaling 16 acres, for an overall total of 348 acres.

3.1 Regulated Surfaces and Airspace

As discussed, MAA identified existing and potential future obstructions based on topographic data, tree height measurements, and projected growth rates. Areas containing conflicts to FAR Part 77 regulated airspace are shown in *Appendix E* and discussed below.

- Northwest Quadrant: 16 forest stands or portions of stands currently contain conflicts.
- Northeast Quadrant: 14 forest stands or portion of stands currently contain conflicts.
- Southwest Quadrant: 2 forest stands or portion of stands currently contain conflicts.
- Southeast Quadrant: 7 forest stands or portion of stands currently contain conflicts.

The ALP (2013) indicated all anticipated improvements for ultimate developed conditions and three phases of facility development. **Table 2** provides the regulated surfaces and airspace conflicts associated with the ALP with the exception of the implementation of future Runway 10R-28L. **Table 3** provides the regulated surfaces and airspace conflicts specific to the implementation of Runway 10R-28L.

**Table 2
Regulated Surfaces and Airspace Conflicts with the ALP
(with the exception of Proposed Runway 10R-28L)**

Stand	Existing Conflict	Future Conflict	Conflict Surfaces
Northwest Quadrant			
FS 2	Yes	No	Transitional
FS 3	Yes	No	Approach
FS 4	Yes	Yes	Transitional
FS 5	Yes	No	Transitional
FS 9	Yes	No	Transitional
FS 10	No	Yes	Transitional
FS 11	No	Yes	Transitional
FS 12	Yes	No	Approach and Transitional
FS 13A	No	Yes	Approach and Transitional
FS 14	Yes	No	Transitional
FS 15	No	Yes	Transitional
FS 16	No	Yes	Transitional
FS 17	Yes	Yes	Transitional
FS 19	Yes	No	Transitional
FS 20	No	Yes	Transitional
FS 21	Yes	No	Transitional
FS 22	Yes	Yes	Transitional
FS 23	Yes	Yes	Transitional
FS 24	Yes	No	Transitional
FS 35	Yes	Yes	Approach and Transitional
FS 35A	Yes	Yes	Approach and Transitional
FS 35B	No	Yes	Approach
OS 8A ST1	Yes	No	Approach and Transitional
OS 8A ST2	No	Yes	Approach and Transitional
OS 8A ST3	No	Yes	Approach and Transitional
OS 8A ST4	No	Yes	Approach
OS 8A ST5	No	Yes	Approach
OS 8D	No	Yes	Approach
OS 9A ST3	No	Yes	Approach
OS 9A ST5	No	Yes	Approach
OS 9A ST6	No	Yes	Approach
Northeast Quadrant			
FS 8	Yes	No	Approach and Transitional
FS 25	Yes	No	Approach and Transitional
FS 29	Yes	No	Transitional
FS 30	Yes	No	Transitional
FS 31	Yes	No	Transitional
FS 32	Yes	No	Transitional
FS 33	Yes	No	Transitional
FS 34	Yes	No	Approach and Transitional
FS 115	Yes	No	Approach and Transitional
OS 15 ST1	Yes	No	Approach
OS 15 ST2	Yes	No	Approach and Transitional
OS 15 ST3	Yes	No	Approach
OS 15 ST4	Yes	No	Approach
OS 15 ST5	Yes	No	Approach

Table 2
**Regulated Surfaces and Airspace Conflicts with the ALP
 (with the exception of Proposed Runway 10R-28L)**

Stand	Existing Conflict	Future Conflict	Conflict Surfaces
Southwest Quadrant			
FS 35	Yes	No	Approach and Transitional
FS 36	No	Yes	Transitional
FS 39	Yes	Yes	Transitional
OS 10D	No	Yes	Approach
OS 10B ST2	No	Yes	Approach and Transitional
Southeast Quadrant			
FS 82	No	Yes	Approach and Transitional
FS 82A	No	Yes	Approach and Transitional
FS 82B	No	Yes	Approach and Transitional
FS 83	No	Yes	Transitional
FS 90	No	Yes	Transitional
FS 91	No	Yes	Transitional
FS 97	Yes	Yes	Transitional
FS 101	Yes	No	Transitional
FS 103	Yes	No	Approach and Transitional
FS 104	Yes	Yes	Approach and Transitional
FS 105	Yes	Yes	Approach and Transitional
FS 107	Yes	No	Approach and Transitional
FS 114	Yes	No	Approach
OS 19 AB	No	Yes	Approach and Transitional
OS 20E	No	Yes	Transitional
OS 20 J	No	Yes	Transitional

Source: CEM analysis, 2013.

Table 3
**Regulated Surfaces and Airspace Conflicts with
 Proposed Runway 10R-28L**

Stand	Conflict Surfaces
Southwest Quadrant	
FS 35	Approach and Transitional
FS 37	Primary and Transitional
FS 40	Primary and Transitional
FS 41	Primary
FS 42	Primary
FS 43	Primary and Transitional
FS 44	Primary and Transitional
FS 45	Primary and Transitional
FS 46	Primary and Transitional
FS 47	Primary and Transitional
FS 48	Primary and Transitional
FS 49	Primary and Transitional
FS 50	Primary and Transitional
FS 51	Primary and Transitional
FS 52	Primary and Transitional
FS 53	Transitional
FS 54	Primary
FS 55	Primary and Transitional
FS 57	Primary and Transitional
FS 58	Approach, Primary and Transitional
FS 59	Approach and Transitional
FS 60	Approach, Primary and Transitional
FS 63	Transitional
FS 64A	Approach and Transitional
FS 71	Approach and Transitional
FS 72	Transitional
FS 73	Transitional
FS 74	Transitional
FS 75	Transitional
FS 76	Transitional
FS 77	Primary and Transitional
OS 10C ST 1	Primary and Transitional
OS 10C ST 2	Transitional
OS 10C ST 3	Approach
OS 14A	Approach
OS 14B ST 1	Transitional
OS 14B ST 2	Approach
OS 14B ST3	Approach
OS 14B ST4	Approach
OS 14B ST 5	Approach
OS 14B ST 6	Approach

Table 3
**Regulated Surfaces and Airspace Conflicts with
 Proposed Runway 10R-28L**

Stand	Conflict Surfaces
Southwest Quadrant	
OS 14C ST A	Approach
OS 14C ST B	Approach
OS 14C ST C	Approach
OS 14C ST D	Approach
OS 14C ST F	Approach
OS 14C ST G	Approach
OS 14C ST I	Approach
OS 14C STK	Approach
Southeast Quadrant	
FS 79	Primary and Transitional
FS 80	Primary
FS 82 A	Transitional
FS 84	Approach and Transitional
FS 85	Approach and Transitional
FS 86	Approach and Transitional
FS 87	Approach and Transitional
FS 88	Approach and Transitional
FS 90	Approach
FS 91	Primary and Transitional
FS 93	Transitional
FS 94	Transitional
FS 95	Primary and Transitional
FS 96	Primary and Transitional
FS 99	Approach
FS 100	Approach and Transitional
FS 106	Approach and Transitional
FS 108	Approach
FS 109	Approach
FS 110	Approach
FS 111	Approach
FS 112	Approach
FS 113	Approach
OS 20H	Approach
OS 20 G	Transitional
OS 20 D ST 1	Transitional
OS 20 D ST 2	Transitional

Source: CEM analysis, 2013.

3.2 Security Fence/ Airport Perimeter

MAA maintains a 10-foot clear zone on each side of the security fence, in compliance with FAR Part 139. The clear zone must be maintained regularly to be free of vegetation, with the exception of maintained turf, to provide an unobstructed view for security cameras focused on the fence line and to facilitate physical inspection of these areas. The 10-foot clear zone must also be able to accommodate emergency access. MAA identified seven areas along the perimeter fence that require maintenance to remove trees and vegetation within the clear zone:

- Forest Stand 13 in the Northwest Quadrant;
- Forest Stand 115 in the Northeast Quadrant; and
- Forest Stands 40, 55, 56, 61, and 62 in the Southwest Quadrant.

3.3 Buffer Areas

MAA provides visual buffers along the property boundaries of select areas onsite (within the contiguous main campus) for BWI Marshall. Nine stands (27, 28, 29, 34, 114, 115, AFA 4, AFA 5, and AFA 8) are currently maintained by enhancing the understory where sparse. Only native species with low-attractiveness to nuisance wildlife are considered for planting in these areas.

3.4 Wildlife Management Areas

MAA, in conjunction with the USDA, routinely surveys the runways and adjoining areas for the presence of wildlife that are potentially hazardous to aircraft, including waterfowl, flocking birds, and deer. Wildlife occurs on airport property because

sustainable food sources and suitable habitat are present. The presence of downed woody debris within a forest stand provides an excellent food source for birds and other wildlife as well (Patton, 1997). Significant amounts of downed woody debris and dense stands of Virginia pine support hazardous concentrations of crows, vultures, and other bird species that exist on MAA property.

3.5 Fire Hazards

Several potential fire hazards were identified during past field investigations. These hazards include the Aircraft Rescue and Fire Fighting training area where flammable agents are used during training exercises. If a fire were to escape this area, it could quickly spread to the surrounding forest stands (42, 44, and 47), which are dominated by Virginia pine and pitch pine. Other areas of concern include stands where dense accumulation of pine needle mats and dead branches are present, which have the potential to ignite and burn quickly. Coniferous stands on MAA-owned property are often dense, which can compound this problem and lead to high fire danger across BWI Marshall.

Other areas of concern include the stands adjacent to the Amtrak rail line right-of-way, which are at an increased risk of fires from sparks generated by passing trains. According the MDNR Forest Service Wildland Fire Management 2012 Annual Wildfire Report, two wildfires in the State of Maryland were attributed to railroads, indicative of the potential risk in areas associated with railroads. Areas at risk include stands 1, 2, 13A, 13B, 35, 37, 38, 64, 64A, OS 1B, OS 1C, and OS 12C.

Pedestrian negligence is not a major concern as the majority of BWI Marshall

Airport has restricted access. However, many of the offsite parcels are easily accessible, and therefore have greater fire hazard potential. Similarly, the forest stands that border the BWI Marshall Hiker/Biker Trail are also more susceptible to acts of negligence. The primary concern in these areas is smoking-related fires, which accounted for ten wildfires in the State of Maryland in 2012. All offsite parcels would potentially be at risk, in addition to 26 forest stands (1, 13, 13B, 14, 38, 40, 41, 55, 56, 57, 58, 60, 61, 62, 63, 65, 66, 69, 74, 77, 78, 80, 82A, 82B, AFA 1, and AFA 8) that border the trail.

3.6 Forest Health

Previous field investigations revealed that forest stands on MAA-owned property generally exhibit good health. Forested areas are typically in the early to mid-successional stage and the dominant species of each stand grows to an average mature height and does not exhibit major problems such as infestation and disease. Understory layers in the majority of stands indicate good structure and healthy growth. Stands with deciduous trees as dominant species are generally characterized by healthy understory layers. Conifer stands do not have understory layers to the same extent as other stands with a lower density canopy due to the low light conditions in the interior.

Although some of the field investigations were conducted in winter months, the herbaceous layer appears to be healthy despite evidence of invasive species such as Japanese honeysuckle (*Lonicera japonica*), common greenbrier (*Smilax rotundifolia*), mile-a-minute (*Persicaria perfoliata*), and multiflora rose (*Rosa multiflora*). Additionally, evidence of deer was observed. Deer browse and other

wildlife browse does not appear to pose a significant problem to forest health.

Some stands contained downed woody debris and snags caused by wind throw, storms, or lightning strikes, particularly those dominated by conifer species. Many stands contain exotic invasive species, such as tree-of-heaven (*Ailanthus altissima*), Norway maple (*Acer platanoides*), and white mulberry (*Morus alba*).

Afforested areas generally lack the attributes of mature forests, such as diverse understory and herbaceous layer.

4 MAINTENANCE RECOMMENDATIONS

This FMPU serves as a tool for MAA's use in airport maintenance operations, future planning, and stewardship of BWI Marshall's forested resources. The specific maintenance recommendations provided in this section are based on the results of previous field investigations, in accordance with the existing regulatory framework, and MAA's Environmental Policy (2006). Based on these factors, MAA's maintenance recommendations for forest stands on BWI Marshall and offsite parcels are presented below. As mentioned previously, the forest composition and maintenance needs of BWI Marshall are assumed to have changed minimally; therefore, many of the recommendations presented in this section are similar to those presented in the previous FMPU (URS/A.D. Marble & Company, 2009).

4.1 Regulated Surfaces and Airspace

MAA developed a maintenance strategy for each forest stand based on the species present, their potential to present conflicts,

and their location within the proposed development areas. Refer to *Appendix F* (Forest Stand Summary Table) for more specific information about airspace conflicts. In each case, MAA considered three strategies to prevent or eliminate conflicts with FAR Part 77 surfaces:

- Selective tree removal,
- Conversion of a forest stand to a lower-growing species, and
- Removal of the entire forest stand.

In cases where individual trees within a stand were identified as obstructions, MAA considered selective removal because it provides long-term solutions and does not pose additional hazards. This method is more effective than tree-topping. Tree-topping is a short-term solution that can compromise the overall tree health and is no longer a strategy employed by MAA.

For approach/departure areas, in which obstructions were likely to recur, MAA considered forest stand conversion or removal of the entire stand. MAA considered conversion to lower growing species whenever possible in an effort to protect water quality. As previously noted, the provisions of the FCA allow for the removal of trees from regulated airspace, and the removal or conversion of forest would be exempt under the FCA. However, these activities require MAA to consult with MDNR Forest Service for concurrence prior to execution as well as mitigation requirements. Agency coordination, including permitting and mitigation, may be required with MDNR Forest Service, the USACE, or the MDE Non-Tidal Wetland and Waterways Division for forest conversions in wetlands or conservation areas.

Stands located in areas associated with the proposed parallel runway (10R-28L) would be removed when the project commences. Construction of the runway would not be exempt from FCA requirements, and MAA would prepare a Forest Conservation Plan (FCP) to identify impacts, forest retention areas, and appropriate mitigation measures at that time.

As shown on **Table 4**, a total of 38 forest stands or portions of the stands are in existing conflict and 36 have the future potential to be in conflict with FAR Part 77 surfaces associated with ultimate conditions.

4.2 Security Fence / Airport Perimeter

MAA must maintain the current perimeter to ensure the 10-foot clear zone. In ten forest stands (13, 34, 38, 40, 55, 56, 61, 62, 69, and 115), routine maintenance would prevent establishment of invasive vines and shrubs. MAA must consult with MDNR Forest Service to obtain appropriate approval for removal of these forest resources (see **Table 5**).

In some instances, the security fence clear zone crosses a regulated wetlands or waterway area. The removal of vegetation from regulated wetlands and waterways is prohibited without prior authorization from the appropriate Federal or State agency. MAA previously obtained a permit to maintain vegetation in areas where streams pass beneath the fence that has since expired (Permit 00-NT-0171/200064103). This specific type of maintenance previously cleared under this authorization is permitted to proceed without further authorization or coordination.

Table 4
Forest Stands within Existing and Potential Future Height Conflicts

Stand	Existing Conflict	Future Conflict	Mitigation Strategy
Northwest Quadrant			
FS 2	Yes	No	Selective Removal
FS 3	Yes	No	Selective Removal
FS 4	Yes	Yes	Conversion
FS 5	Yes	No	Selective Removal
FS 9	Yes	No	Conversion
FS 10	No	Yes	Conversion
FS 11	No	Yes	Conversion
FS 12	Yes	No	Conversion
FS 13A	No	Yes	Selective Removal
FS 14	Yes	No	Selective Removal
FS 15	No	Yes	Selective Removal
FS 16	No	Yes	Selective Removal
FS 17	Yes	Yes	Selective Removal
FS 19	Yes	No	Selective Removal
FS 20	No	Yes	Selective Removal
FS 21	Yes	No	Selective Removal
FS 22	Yes	Yes	Selective Removal
FS 23	Yes	Yes	Selective Removal
FS 24	Yes	No	Selective Removal
FS 35	Yes	Yes	Selective Removal
FS 35A	Yes	Yes	Selective Removal
FS 35B	No	Yes	Selective Removal
OS 8A ST1	Yes	No	Selective Removal
OS 8A ST2	No	Yes	Selective Removal
OS 8A ST3	No	Yes	Selective Removal
OS 8A ST4	No	Yes	Selective Removal
OS 8A ST5	No	Yes	Selective Removal
OS 8D	No	Yes	Selective Removal
OS 9A ST3	No	Yes	Selective Removal
OS 9A ST5	No	Yes	Selective Removal
OS 9A ST6	No	Yes	Selective Removal
Northeast Quadrant			
FS 8	Yes	No	Selective Removal
FS 25	Yes	No	Selective Removal
FS 29	Yes	No	Selective Removal
FS 30	Yes	No	Selective Removal
FS 31	Yes	No	Selective Removal
FS 32	Yes	No	Selective Removal
FS 33	Yes	No	Selective Removal
FS 34	Yes	No	Selective Removal
FS 115	Yes	No	Conversion
OS 15 ST1	Yes	No	Selective Removal
OS 15 ST2	Yes	No	Selective Removal
OS 15 ST3	Yes	No	Selective Removal
OS 15 ST4	Yes	No	Selective Removal
OS 15 ST5	Yes	No	Selective Removal

Table 4
Forest Stands within Existing and Potential Future Height Conflicts

Stand	Existing Conflict	Future Conflict	Mitigation Strategy
Southwest Quadrant			
FS 35	Yes	No	Selective Removal; or Removal ^a
FS 37	No	Yes	Removal ^a
FS 36	No	Yes	Selective Removal
FS 39	Yes	Yes	Selective Removal
FS 40	No	Yes	Removal ^a
FS 41	No	Yes	Removal ^a
FS 42	No	Yes	Removal ^a
FS 43	No	Yes	Removal ^a
FS 44	No	Yes	Removal ^a
FS 45	No	Yes	Removal ^a
FS 46	No	Yes	Removal ^a
FS 47	No	Yes	Removal ^a
FS 48	No	Yes	Removal ^a
FS 49	No	Yes	Removal ^a
FS 50	No	Yes	Removal ^a
FS 51	No	Yes	Removal ^a
FS 52	No	Yes	Removal ^a
FS 53	No	Yes	Removal ^a
FS 54	No	Yes	Removal ^a
FS 55	No	Yes	Removal ^a
FS 57	No	Yes	Removal ^a
FS 58	No	Yes	Removal ^a
FS 59	No	Yes	Removal ^a
FS 60	No	Yes	Removal ^a
FS 63	No	Yes	Removal ^a
FS 64A	No	Yes	Removal ^a
FS 71	No	Yes	Removal ^a
FS 72	No	Yes	Removal ^a
FS 73	No	Yes	Removal ^a
FS 74	No	Yes	Removal ^a
FS 75	No	Yes	Removal ^a
FS 76	No	Yes	Removal ^a
FS 77	No	Yes	Removal ^a
OS 10D	No	Yes	Selective Removal
OS 10B ST2	No	Yes	Selective Removal
OS 10C ST 1	No	Yes	Selective Removal ^a
OS 10C ST 2	No	Yes	Selective Removal ^a
OS 10C ST 3	No	Yes	Selective Removal ^a
OS 14A	No	Yes	Selective Removal ^a
OS 14B ST 1	No	Yes	Selective Removal ^a
OS 14B ST 2	No	Yes	Selective Removal ^a
OS 14B ST3	No	Yes	Selective Removal ^a

Table 4
Forest Stands within Existing and Potential Future Height Conflicts

Stand	Existing Conflict	Future Conflict	Mitigation Strategy
OS 14B ST4	No	Yes	Selective Removal ^α
OS 14B ST 5	No	Yes	Selective Removal ^α
OS 14B ST 6	No	Yes	Selective Removal ^α
OS 14C ST A	No	Yes	Selective Removal ^α
OS 14C ST B	No	Yes	Selective Removal ^α
OS 14C ST C	No	Yes	Selective Removal ^α
OS 14C ST D	No	Yes	Selective Removal ^α
OS 14C ST F	No	Yes	Selective Removal ^α
OS 14C ST G	No	Yes	Selective Removal ^α
OS 14C ST I	No	Yes	Selective Removal ^α
OS 14C STK	No	Yes	Selective Removal ^α
Southeast Quadrant			
FS 79	No	Yes	Removal ^α
FS 80	No	Yes	Removal ^α
FS 82	No	Yes	Conversion
FS 82A	No	Yes	Selective Removal; or Removal ^α
FS 82B	No	Yes	Conversion
FS 83	No	Yes	Conversion
FS 84	No	Yes	Removal ^α
FS 85	No	Yes	Removal ^α
FS 86	No	Yes	Removal ^α
FS 87	No	Yes	Removal ^α
FS 88	No	Yes	Removal ^α
FS 90	No	Yes	Conversion; or Removal ^α
FS 91	No	Yes	Conversion
FS 93	No	Yes	Removal ^α
FS 94	No	Yes	Removal ^α
FS 95	No	Yes	Removal ^α
FS 96	No	Yes	Removal ^α
FS 97	Yes	Yes	Conversion; or Removal ^α
FS 99	No	Yes	Removal ^α
FS 100	No	Yes	Removal ^α
FS 101	Yes	No	Conversion
FS 103	Yes	No	Conversion
FS 104	Yes	Yes	Conversion
FS 105	Yes	Yes	Conversion
FS 106	No	Yes	Removal ^α
FS 107	Yes	No	Conversion
FS 108	No	Yes	Removal ^α
FS 109	No	Yes	Removal ^α
FS 110	No	Yes	Removal ^α
FS 111	No	Yes	Removal ^α
FS 112	No	Yes	Removal ^α
FS 113	No	Yes	Removal ^α
FS 114	Yes	No	Conversion
OS 19 AB	No	Yes	Conversion

Table 4
Forest Stands within Existing and Potential Future Height Conflicts

Stand	Existing Conflict	Future Conflict	Mitigation Strategy
OS 20E	No	Yes	Conversion
OS 20H	No	Yes	Removal ^a
OS 20 G	No	Yes	Removal ^a
OS 20 J	No	Yes	Conversion
OS 20 D ST 1	No	Yes	Removal ^a
OS 20 D ST 2	No	Yes	Removal ^a

Note: ^a - Removal of entire stand is only recommended to accommodate the proposed parallel Runway 10R-28L as depicted on the ALP.

Source: CEM analysis, 2013.

Table 5
Fence Obstructions

Stand	Type of Maintenance Required	Past Observations
13	Mowing to remove small trees, shrubs, and weeds.	Mowing only.
34	Removal of bamboo and trees along fence line.	Bamboo and trees growing in clear zone (near stream).
38	Trimming of tree branches along fence line.	Branches from nearby trees overhanging into clear zone.
40	Mowing to remove small trees, shrubs, and weeds.	Mowing only.
55	Thinning of trees near fence line to prevent future obstructions.	Tall pine trees located close to perimeter fence.
56	Thinning of trees near fence line to prevent future obstructions.	Tall pine trees located close to perimeter fence.
61	Thinning of trees near fence line to prevent future obstructions.	Tall pine trees located close to perimeter fence.
62	Mowing to remove small trees, shrubs, and weeds.	Mowing only.
69	Mowing to remove small trees, shrubs, and weeds.	Small trees and herbaceous species growing in wet area along fence (corner of stand).
115	Mow shrubby invasive weeds, and herbs.	Northern area of stand cleared, slash places inside the stand (Fire Hazard), some tall trees topped. Drainage channel present.

Source: CEM Analysis, 2014.

4.3 Buffer Areas

Select visual buffer areas require maintenance, removal or replacement with scrub-shrub species to avoid conflict with FAR Part 77 airspace. Three stands identified as forest buffers (stands 28, 114, and 115) occur within transitional and approach surfaces, and require maintenance. Also, several of the buffer areas require routine maintenance to ensure the presence of a dense understory layer necessary to provide the desired screening, only native species with low-attractiveness to nuisance wildlife are planted in the buffer areas.

4.4 Wildlife Management

MAA and USDA routinely survey BWI Marshall's runways and adjoining safety areas to identify and manage the presence of hazardous wildlife. The WHMP identifies specific strategies for managing habitat on and near the airport. Wildlife management strategies associated with forested areas includes:

- Reducing all unnecessary trees, shrubs, weeds and plants; establishing non-seeding or small-seeded grass, especially within 200 feet of runways;
- Establishing a hard edge along forest borders to reduce edge habitats and food opportunities for wildlife;
- Removing snags and downed woody debris to the greatest extent practicable; and
- Pruning and thinning dense stands of pines to eliminate roosting areas for bird species.

MAA considered these strategies when evaluating existing conditions and determined that most stands included downed woody debris. In addition, MAA identified some areas in which conifers could be thinned to support wildlife management goals. Neither of these activities requires approval under FCA, but MAA will consult with MDNR Forest Service prior to thinning of dense forest stands within previously designated forest conservation areas. For areas where forest stands would be converted, MAA will refer to their Approved Species List from the Specifications for Performing Landscaping Activities for the MAA (2006).

4.5 Fire Hazards

MAA can take preventative measures to protect forest resources and prevent fires through regular removal of downed woody debris and dead or dying trees to reduce the fuel load (USDA Forest Service, 2006). In addition, MAA can provide breaks in vegetation to contain the spread of fire and to provide access for emergency equipment. Once breaks are established as having a minimum width of 8 to 10 feet, they must be maintained to retain their protective value long term. The breaks in the form of a roadbed should expose the mineral soil and sever roots to prevent the spread of fire across the overstory forest layer.

Stands should have reduced average basal areas so that fire does not spread as quickly. Thinning of a stand is an appropriate technique to reduce basal area and ultimately reduce fire hazard. MAA will coordinate with MDNR Forest Service to obtain proper permits and adhere to regulations prior to commencing thinning operations.

Stands of conifers, commonly dominating areas throughout BWI Marshall, retain branches in the understory layer and can become potential fuel for fires. Pruning of individual trees in a stand will reduce the likelihood of branches being consumed by a fire, although this is a costly technique. Deciduous trees are also susceptible to fire, but have a smaller percentage of dead

limbs in close proximity to the ground, which reduces fire hazard. Future transition of conifer stands to deciduous stands will reduce the overall fire hazard.

Table 6 identifies the stands with potential fire hazards. MAA identified 33 stands during previous (2007/2008) field investigation that required pruning and/or thinning to manage fire hazards.

**Table 6
Potential Fire Hazards**

Stand	Condition	Proposed Action	Schedule
Northwest Quadrant			
13A	Downed woody debris and a mix of Virginia pines in the +6-12 inch DBH size class.	Thin pines to reduce the chance of spreading fires. Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.
14	Stand dominated by Virginia pine in the +6-12 inch DBH size class.	Thin pines to reduce the chance of spreading fires. Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.
16	Stand dominated by Virginia pine in the +6-12 inch DBH size class. Areas of Virginia pine have downed woody debris and +1-2 inch needle mat.	Thin pines to reduce the change of spreading fires. Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.
17	A mix of deciduous species and Virginia pine in the +6-12 inch DBH size class. Areas of Virginia pine have downed woody debris and a +1-2 inch needle mat.	Thin pines to reduce the change of spreading fires. Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.
18	Stand dominated by Virginia pine in the +6-12 inch DBH size class. A +1-2 inch needle mat is present in areas.	Thin pines to reduce the change of spreading fires.	Biannual, monitor status annually.
20	Stand dominated by Virginia pine in the +6-12 inch DBH size class. A +2 inch needle mat and downed woody debris are present in areas.	Thin pines to reduce the change of spreading fires. Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.
22	Stand dominated by Virginia pine in the +6-12 inch DBH size class. Downed woody debris is present throughout the stand.	Thin pines to reduce the change of spreading fires. Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.

Table 6
Potential Fire Hazards

Stand	Condition	Proposed Action	Schedule
Northeast Quadrant			
28	A mix of deciduous trees including black cherry, red oak, black oak and Virginia pine.	Pruning of pines to prevent downed woody debris in clear zone.	Biannual, monitor status annually.
30	A mix of Virginia pine and other deciduous species in the +12-20 inch size class. Areas of Virginia pine have downed woody debris and a +2-3 inch needle mat.	Thin pines to reduce chance of spreading fires. Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.
35B	Stand is dominated by Virginia pine which is beginning to die off, giving way to deciduous species. Downed woody debris is present throughout stand.	Thin pines to reduce chance of spreading fires. Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.
115	A mix of Virginia pine and other deciduous species in the +12-20 inch size class.	Removed downed woody debris to minimize fire danger.	Biannual, monitor status annually.
Southwest Quadrant			
47	Stand is dominated by Virginia pine and Pitch pine in the +6-12 inch DBH size class. Downed woody debris and a +1-2 inch needle mat is present throughout stand.	Thin pines to reduce the chance of spreading fires. Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.
49	Stand is dominated by Virginia pine and pitch pine in the +12-20 inch DBH size class. Downed woody debris and a +1-2 inch needle mat is present throughout stand.	Thin pines to reduce the chance of spreading fires. Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.
57	Stand is dominated by Virginia pine and pitch pine in the +6-12 inch DBH size class. Downed woody debris and a +1-2 inch needle mat is present throughout stand.	Thin pines to reduce the chance of spreading fires. Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.
59	Stand is dominated by Virginia pine and pitch pine in the +6-12 inch DBH size class.	Thin pines to reduce the chance of spreading fires. Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.
61	Stand is dominated by Virginia pine and pitch pine in the +6-12 inch DBH size class.	Thin pines to reduce the chance of spreading fires. Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.

Table 6
Potential Fire Hazards

Stand	Condition	Proposed Action	Schedule
63	Stand dominated by Virginia pine in the +6-12 inch DBH size class. Downed woody debris and a +1-2 inch needle mat are present throughout stand.	Thin pines to reduce the chance of spreading fires. Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.
64A	A mix of deciduous species and Virginia and Pitch pines in the +6-12 inch DBH size class. Downed woody debris is present in the pine portion of stand.	Thin pines to reduce the chance of spreading fires. Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.
70	A mix of white and Virginia pines and southern red oak in the +6-12 inch DBH size class. A +1-2 inch thick needle mat is present in some areas.	Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.
77	Stand dominated by Virginia pine in the +6-12 inch DBH size class. Downed woody debris and a +1 inch needle mat is present throughout stand.	Thin pines to reduce the chance of spreading fires. Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.
82B	Stand dominated by Virginia pine in the +6-12 inch DBH size class. Downed woody debris is present throughout stand.	Thin pines to reduce the chance of spreading fires. Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.
Southeast Quadrant			
85	Stand is dominated by Virginia pine in the +12-20 inch DBH size class. A 1 inch needle mat is present in areas of the stand.	Thin pines to reduce the chance of spreading fires. Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.
90	Stand dominated by Virginia pine in the +6-12 inch DBH size class. Downed woody debris is present throughout stand.	Thin pines to reduce the chance of spreading fires. Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.
92	A mix of deciduous species and Virginia pine in the +6-12 inch DBH size class. Downed woody debris is present throughout stand.	Thin pines to reduce the chance of spreading fires. Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.
94	A mix of deciduous species and Virginia pine in the +6-12 inch DBH size class. Downed woody debris is present along edges of stand.	Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.
95	A mix of deciduous species and Virginia pine in the +6-12 inch DBH size class. Downed woody debris is present throughout stand.	Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.

Table 6
Potential Fire Hazards

Stand	Condition	Proposed Action	Schedule
96	A mix of deciduous species and Virginia pine in the +6-12 inch DBH size class. Downed woody debris is present throughout stand.	Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.
100	Stand is dominated by Virginia pine in the +6-12 inch DBH size class. Downed woody debris is present throughout stand.	Thin pines to reduce the chance of spreading fires. Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.
102	Stand is dominated by Virginia pine in the +6-12 inch DBH size class. Downed woody debris and a +1 inch needle mat are present throughout stand.	Thin pines to reduce the chance of spreading fires. Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.
105	A mix of species including oaks, red maple, Virginia pine, and pitch pine. Downed woody debris is present throughout stand.	Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.
106	Stand is dominated by Virginia pine and southern red oak in the +12-20 inch DBH size class. Pines are starting to die off.	Remove downed woody debris to minimize fire danger.	Biannual, monitor status annually.
107	A mix of species including oak and Virginia pine. Dead trees located throughout the stand, some downed woody debris.	Remove dead trees and downed woody debris to minimize fire danger.	Biannual, monitor status annually.
113	Stand is dominated by Virginia pine in the +6-12 inch DBH size class. Downed woody debris and piles of slash are present throughout stand.	Thin pines to reduce the chance of spreading fires. Remove downed woody debris to minimize fire danger.	Complete within one year.

Source: MAA field investigation, 2007/8.

4.6 Forest Health

MDNR Forest Service requires forest stands to be maintained so that current structure is sustained or improved to help protect water quality. Forest stands and recently afforested areas should be inspected regularly for disease, insect infestation, and the presence of exotic invasive species. To maintain forest health and water quality, snags and downed woody debris should be

removed and stands thinned to reduce fire danger. Invasive exotics should be controlled with mechanical or chemical management. Afforestation areas are presently in good health and must be maintained. Mowing a minimum of twice annually, in addition to invasive exotic management, is necessary to maintain health.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

All forest stands on MAA-owned property will require maintenance due to planning for ultimate conditions. MAA will need to remove regulated airspace obstructions, potential wildlife attractants, and fire hazards, while maintaining security clear-zones, visual buffer areas, and general forest health. Maintenance strategies presented in this FMPU are a continuation of previously documented strategies.

Obstructions

MAA must adhere to FAR Part 77 guidelines to ensure safety in regulated airspace. As part of the FMPU, MAA requested the *BWI Marshall Obstruction Removal Review for Development of the FMP and RMP Updates (August, 2013)*. The purpose of this document is to utilize new survey data from 2011 to conservatively project the growth of surveyed trees and quantify future obstructions specific to Runways 10-28 and 15L-33R (See **Appendix G**). This study identified 581 potential individual tree obstructions. MAA identified approximately 109 forest stands that conflict with regulated airspace or have the potential to do so in the future. In most stands, MAA can selectively remove individual trees to eliminate conflicts.

For stands located at the end of approach/departure surface, it is more appropriate to remove the entire stand or convert the stand to lower-growing tree or shrub species. MAA identified 16 stands for which conversion is warranted to eliminate existing or future conflicts. MAA identified

28 stands where removal of the entire stand is necessary attributed to the proposed Runway 10R-28L. Although obstruction removal is permitted under the FCA, all conversion or removal activities must be performed with the concurrence of MDNR Forest Service in advance of the initiation of maintenance.

Fence Lines and Buffers

Visual buffer areas should be maintained to allow trees and shrubs to mature while remaining below obstruction heights identified by FAR Part 77. While providing visual screens, MAA must also provide a clear line of sight within 10 feet of the security fence in accordance with FAR Part 139 regulations. Eight stands were identified as requiring maintenance. Mowing will be necessary in the areas in accordance with existing permits.

Existing Forests and Afforestation Areas

Afforestation areas should be maintained to ensure forest health and protect water quality. Stands should be cleared of downed woody debris to prevent the accumulation of fuel loads and discourage habitat and food sources. Maintenance supporting the eradication or control of invasive exotics and pests should be performed on a regular basis to sustain the health of existing forests.

5.2 Summary of Maintenance Recommendations

Based on the findings of this FMPU, the maintenance strategies defined in **Table 7** should continue to be a part of routine maintenance for all forested areas on BWI Marshall.

Table 7
Summary of Maintenance Recommendations

Conservation Areas	
Keep forest conservation areas free of invasive plant species whenever possible. Monitor stand health to maintain conservation areas over the long term.	Complete quarterly, monitor annually. Priority.
Wildlife Management	
Remove all dead tree limbs as well as large downed woody debris to the extent that is practical to reduce the amount of insects and their larvae that could be sources of food and attractants for birds. Snags could also be used as nest and perching or roosting sites for birds and dens for other wildlife and should be removed.	Complete biannually, monitor annually. Priority.
In areas where clearing to the stump is recommended, control stump sprouts with herbicide application. If the stumps begin to rot, removal is recommended to eliminate insects and their larvae, which could be sources of food and thus attractants for birds.	Complete annually, monitor every 6 months.
Whenever dioecious species are recommended, use males to prevent fruit and berry production and reduce the attractiveness to wildlife.	Complete at time of planting, monitor success annually.
Use native species that are not attractive to wildlife (see Appendix H). For species that are not inexpensive and readily available from state nurseries or plant suppliers, consider arrangements for contract growing in state nurseries.	Complete at time of planting, monitor success annually.
Fire Danger	
Thin conifer stands to between 60 – 110 square feet per acre, prune individual conifer trees up to 10 feet, and remove downed woody debris to reduce the threat of quickly spreading fires.	Complete within one year, monitor annually. Priority.
To control fire, plant species of hardwood trees and shrubs that are "inflammable" which may act as "antifire ladders," when intermixed with conifers to prevent the spread of fire into conifer crowns (Perry, 1994).	Complete at time of planting, monitor success annually.
Maintain road widths of at least 8-10 feet between stands to act as fire breaks to prevent fires from jumping between stands. Create fire breaks in large stands if necessary.	Complete annually, monitor monthly.
General Maintenance	
Continue to monitor individual tree heights in approach paths to prevent obstructions and conflicts.	Monthly. Priority.
Thin stands of Virginia and pitch pines as necessary so that they compose no more than 75% of a stand's basal area. Criteria for removal of individual trees or thinning of stands includes presence of existing bird roosts, potential impacts to water quality or erosion control, and whether the stand is located in a development area that will eventually be cleared.	Complete within one year, monitor annually. Priority.

Table 7
Summary of Maintenance Recommendations

Control exotic/invasive species with herbicides, where appropriate, on a routine basis.	Quarterly, monitor annually. Priority.
To maximize benefit of forest products, conduct logging/ removal of undesirable trees (due to species, location, and height) immediately prior to forest clearing for the proposed parallel runway or other large development projects.	Conduct immediately prior to forest clearing.
If clear cutting is necessary for large projects, do so on a staggered schedule so that the formerly interior forest trees can adapt to withstand wind over a period of time.	Complete at time of construction.
Thin conifer stands to between 60 – 110 square feet per acre to reduce lower basal area and increase forest health. Remove tall trees that interfere with object free areas, while maintaining forest structure and aesthetic value.	Conduct biannually, monitor annually.
To control tree loss and potential damage due to wind-throw, eliminate all Virginia pines occurring in stands within 100 feet of any road, structure, or other paved surface.	Complete within one year, monitor annually.

5.3 Best Management Practices

Regulatory agencies, such as MDE and MDNR Forest Service, have developed strategies known as BMPs to protect natural resources. *Appendix A* presents these strategies which are required for the following actions:

- Clearing and maintaining security fence zones;
- Managing forested, scrub-shrub, and other vegetated areas, including activities such as selective clearing or thinning, and maintenance; and
- Converting forested areas to scrub-shrub habitat or turf.

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Appendix A

Best Management Practices (BMPs)

Best Management Practices for Forest Harvests

Maryland State law and regulations require that a sediment control plan be developed and approved before undertaking any earth disturbing activity in excess of 5,000 square feet. To assist loggers and landowners in meeting this requirement, the Maryland Department of the Environment (MDE) and the Department of Natural Resources (DNR) have developed a **Compliance Agreement for the Standard Erosion and Sediment Control Plan for Forest Harvest Operations** (also referred to as a **Standard Plan**). This plan lists the general sediment control requirements for each harvest and may be obtained at any Soil Conservation District office. Other regulations concerning forest harvest operations require approved Standard Plans, e.g., Nontidal Wetlands and Chesapeake Bay Critical Areas.

The State of Maryland offers each county the ability to enforce the minimum requirements of these laws and regulations within their own county system. This is referred to as "delegation." These counties receiving delegation must prove they will enforce at least the minimum requirements of State law and regulation regarding soil erosion and sedimentation. Some counties have increased the requirements for insuring no sedimentation or soil erosion will occur as result of a forest harvest. If you do not know the requirements of a particular county, contact the Soil Conservation District office in that county or the resident Department of Natural Resources forester.

When a harvest is planned on private property, it is necessary to go to the local Soil Conservation District office to obtain the **Compliance Agreement for the Standard Erosion and Sediment Control Plan for Forest Harvest Operations (Standard Plan)** and have it approved. Harvests on State and Federal land require plan approval by MDE. A provision of the plan requires that the landowner also agree to follow the sediment control requirements.

Requirements of the Standard Plan

The potential for loss of sediment from a forest harvest site is greatest at three general locations: entrance points to the site, forest access system (haul roads, skid trails and landings), and adjacent to watercourses. The Standard Plan, therefore, emphasizes sediment control in these areas. Instructions for installing the required sediment control practices are listed in a document entitled Soil Erosion and Sediment Control Guidelines for Forest Harvest Operations in Maryland. This document is available for a fee by calling the Maryland Department of the Environment at (410) 631-3000.

The primary requirements for these areas are as follows.

1. Site Entrance

Access points to the site which lead from a paved road must be protected with stone, wood chips, corduroy logs, wooden mats or other materials which will prevent soil or mud from being tracked onto the road. It is also necessary to prevent the existing drainage pattern from being blocked or damaged by the access construction. A

culvert placed underneath the road entrance is the most effective way to maintain proper drainage.

2. Trails and Landings

Advance planning of the location of roads, trails and landings is an effective way to minimize the potential for soil erosion. Locating roads and trails along natural contours and minimum slopes will reduce the need for substantial cutting and filling operations.

When planning the road system avoid stream crossings whenever possible as they create one of the greatest potential sediment pollution hazards. Permits for a "Temporary Access Crossing" for streams may be required. You should check with the Maryland Department of the Environment Water Management Administration before proceeding.

3. Waterway Protection

Protecting watercourses from runoff and equipment damage is the most critical aspect of sediment control during harvest operations. Improper stream crossings, soil disturbance adjacent to streams, and logging debris left in streams may result in sediment pollution and flooding.

To protect streams and other watercourses, the Standard Plan requires that uncut buffer strips be left on either side of the watercourse. The undisturbed buffer will intercept sediment-laden water and filter out the sediment. Equipment is to be kept out of buffer areas to prevent soil compaction. If soil within a buffer becomes compacted, rainwater will not soak into the soil as effectively, and may enter the stream as sediment pollution. Runoff into streams also increases the volume of flow, thereby accelerating streambank erosion and flooding potential.

Additional Requirements

In addition to the practices listed for the above areas, it is necessary to stabilize certain portions of the harvest site with seed and/or mulch to prevent future erosion. This requirement generally applies to roads, trails and landings which would not regenerate natural vegetation because of steep slopes.

Modification of Standard Plans

Situations may arise when it is not possible, even with careful planning, to comply with all the requirements of the Standard Plan. The slope of the land may be such that road cuts or fills, roads, trails or landings must exceed requirements of the Standard Plan. If all the conditions of the Standard Plan can not be met it is necessary to have a plan amendment prepared by a licensed forester prior to Soil Conservation District approval of the plan. The modification can be prepared either by State or private consultant foresters.

It is important that two types of information be included with plan modifications. The first is the location of the modification and the second is the specific sediment control to be used. The location of the modification should be described on a sketch of the job site (or whatever map is required by a particular county). Once the area where a plan modification is to occur has been identified, it is necessary to describe the extra precautions that will be taken to ensure adequate sediment control. For example, if road grades are to exceed fifteen percent, and turnouts are to be used to drain water from the road, the location of the turnouts should be noted on the plan sketch. To prevent water from the turnout from creating side bank erosion it may be necessary to install stone at the point where the water

is discharged. The location of the stone should also be identified on the plan modification sketch.

Another example would be where a landing must be located on a slope exceeding ten percent. It may be necessary to install a silt fence or straw bale dike on the down-slope side of the landing to act as a sediment barrier.

In this case, the location of sediment controls and the type of final stabilization to be used at the landing should be noted on the plan. In summary, the important thing to remember is that it is necessary to identify the location and describe the specific sediment controls to be used whenever a plan modification is prepared.

Buffer Management Plans

The Standard Plan requires that uncut buffer zones, called **Streamside Management Zones (SMZ)**, be maintained on all sides of perennial or intermittent streams, rivers, lakes, ponds, bogs or marshes. The width of the buffer is dependent upon the slope of the land adjacent to the watercourse. Because of the high potential for soil compaction, erosion and stream damage, roads, trails and harvesting equipment are not allowed in the buffer except as approved in a "Modification of the Standard Plan" or to provide access to approved stream crossings.

The Standard Plan does, however, allow limited harvesting within the buffer provided that a "Buffer Management Plan" is prepared by a licensed forester. "Buffer Management Plans" need to be very specific in describing which trees are to be cut, what precautions for sediment control will be taken, and where the sediment controls will be located. The location of any harvesting within a buffer must be identified on a sketch of the buffer. The sediment controls to be used for waterway protection and topography within the buffer must also be located on this sketch.

"Buffer Management Plans" should be prepared according to the following guidelines.

- A. A sketch shall be prepared which identifies all buffer areas to which the management plan applies. The location of any road, trails or stream crossings shall be noted on the sketch. Harvesting within a buffer will require the installation of specific sediment control measures and seeding and/or mulching of soil exposed during the harvest. The sketch should also note the location of any sediment controls, such as silt fence or straw bale dikes that are to be used.
- B. The objective of the "Buffer Management Plan" is to ensure that an effective wooded buffer (60 square feet/acre minimal basal area of evenly distributed trees, which are 6 inches or greater in diameter) of acceptable growing stock remains after harvest and that there is minimal damage to the humus and litter layers within the buffer.
- C. Stream crossings are to be avoided and are to be allowed only when access to the other side is not possible within the bounds of the owner's land. Streams draining more than 400 acres or 100 acres if the stream is a designated trout stream (contact WRA for trout waters) may not be crossed except in accordance with a stream crossing permit. Streams draining less than 100 acres will not require a permit, but crossings should be constructed in accordance with the guidelines presented in the specifications for stream crossings listed in later chapters. A sketch identifying any crossing locations shall be included in the plan.
- D. Except for stream crossings, no roads or trails shall be permitted within buffer zones without a plan modification. With a plan modification, use of wheeled or tracked equipment shall be limited so that the humus layer will not be removed or

compacted to limit its water holding capacity. Damage to the humus layer will be repaired immediately.

- E. The approximate basal area to be removed and retained shall be specified in the plan, as well as the method of harvest and provisions to ensure that sufficient regeneration is established. Any restriction on harvesting during adverse weather conditions should also be included.
- F. Trees scheduled for removal are to be individually marked with paint at eye level and at the base to facilitate enforcement and avoid confusion during the harvest.
- G. No material originating outside the buffer zone may be deposited within the buffer.
- H. Trees should be felled away from the streambanks thereby keeping the tops and slash well away from the water and in such position that they can not be moved into the stream by flood waters.
- I. Any exposed soil within the buffer shall be seeded and mulched according to the requirement of final stabilization. This notation must appear in the "Buffer Management Plan."
- J. Any proposed activity within the buffer strip must not lead to contamination of a watercourse by sediment or any other pollutant.

Each site must be evaluated on its own individual characteristics and limitations. The above list represents a guide upon which to build in order to achieve water quality goals. The Maryland Department of Natural Resources Forest Service wants to know if this service is helpful for you or your company, please send comments and/or suggestions to [Maryland DNR](#).

Appendix B

Field Investigation – Photographs

Note: The field investigation photographs are included on the provided disc

Appendix C

Field Investigation – Field Data Sheets

Note: The field data sheets are included on the provided disc

Appendix D

Tree Height Table

Appendix D
Height Table

COMMON NAME	BOTANICAL NAME	MAXIMUM TREE HEIGHT				AVG. MAX.	GROWTH RATE
		Petrides	Brown	Dirr	USDA		
Hedge maple	<i>Acer campestre</i>	N/A	N/A	40	N/A	40	N/A
Red maple	<i>Acer rubrum</i>	40	132	120	90	96	rapid
Tree of heaven	<i>Ailanthus altissima</i>	100	66	60	50	69	rapid
Pignut hickory	<i>Carya glabra</i>	90	99	100	90	95	slow
Mockernut hickory	<i>Carya tomentosa</i>	80	99	N/A	100	93	slow
Persimmon	<i>Diospyrus virginiana</i>	50	66	60	50	57	moderate
Green ash	<i>Fraxinus pennsylvanica</i>	70	82.5	80	70	76	rapid
Sweetgum	<i>Liquidambar styraciflua</i>	120	132	120	100	118	rapid
Tulip poplar	<i>Liriodendron tulipifera</i>	100	198	150	120	142	rapid
Blackgum	<i>Nyssa sylvatica</i>	60	99	50	95	76	moderate
Pitch pine	<i>Pinus rigida</i>	60	66	100	80	77	rapid
White pine	<i>Pinus strobus</i>	110	99	150	150	127	rapid
Scotch pine	<i>Pinus sylvestris</i>	50	82.5	90	110	83	rapid
Virginia pine ¹	<i>Pinus virginiana</i>	40	99	40	70	85	rapid
Loblolly pine	<i>Pinus taeda</i>	100	98.5	90	100	97	rapid
Sycamore	<i>Platanus occidentalis</i>	130	148.5	150	100	132	rapid
Large-tooth aspen	<i>Populus grandidentata</i>	40	82.5	70	65	64	rapid
Black cherry	<i>Prunus serotina</i>	80	99	100	80	90	rapid
Sawtooth oak	<i>Quercus acutissima</i>	N/A	N/A	45	70	58	rapid
White oak	<i>Quercus alba</i>	80	99	100	100	95	slow
Southern red oak	<i>Quercus falcata</i>	80	99	80	100	90	slow
Pin oak	<i>Quercus palustris</i>	80	99	100	100	95	rapid
Willow oak	<i>Quercus phellos</i>	80	82	60	100	81	slow
Chestnut oak	<i>Quercus prinus</i>	70	99	70	80	80	slow
Northern red oak (red oak)	<i>Quercus rubra</i>	80	99	100	100	95	moderate
Black oak	<i>Quercus velutina</i>	80	99	N/A	90	90	moderate
Black locust	<i>Robinia pseudo-acacia</i>	80	99	80	80	85	rapid
Sassafras	<i>Sassafras albidum</i>	50	49.5	60	75	59	slow

N/A- Not Available

Sources:

Brown, Russell G. and Melvin L. Brown. 1992. Woody Plants of Maryland. Port City Press, Baltimore, Maryland.

Dirr, Michael A. 1990. Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses. Stripes Publishing Company, Champaign, Illinois.

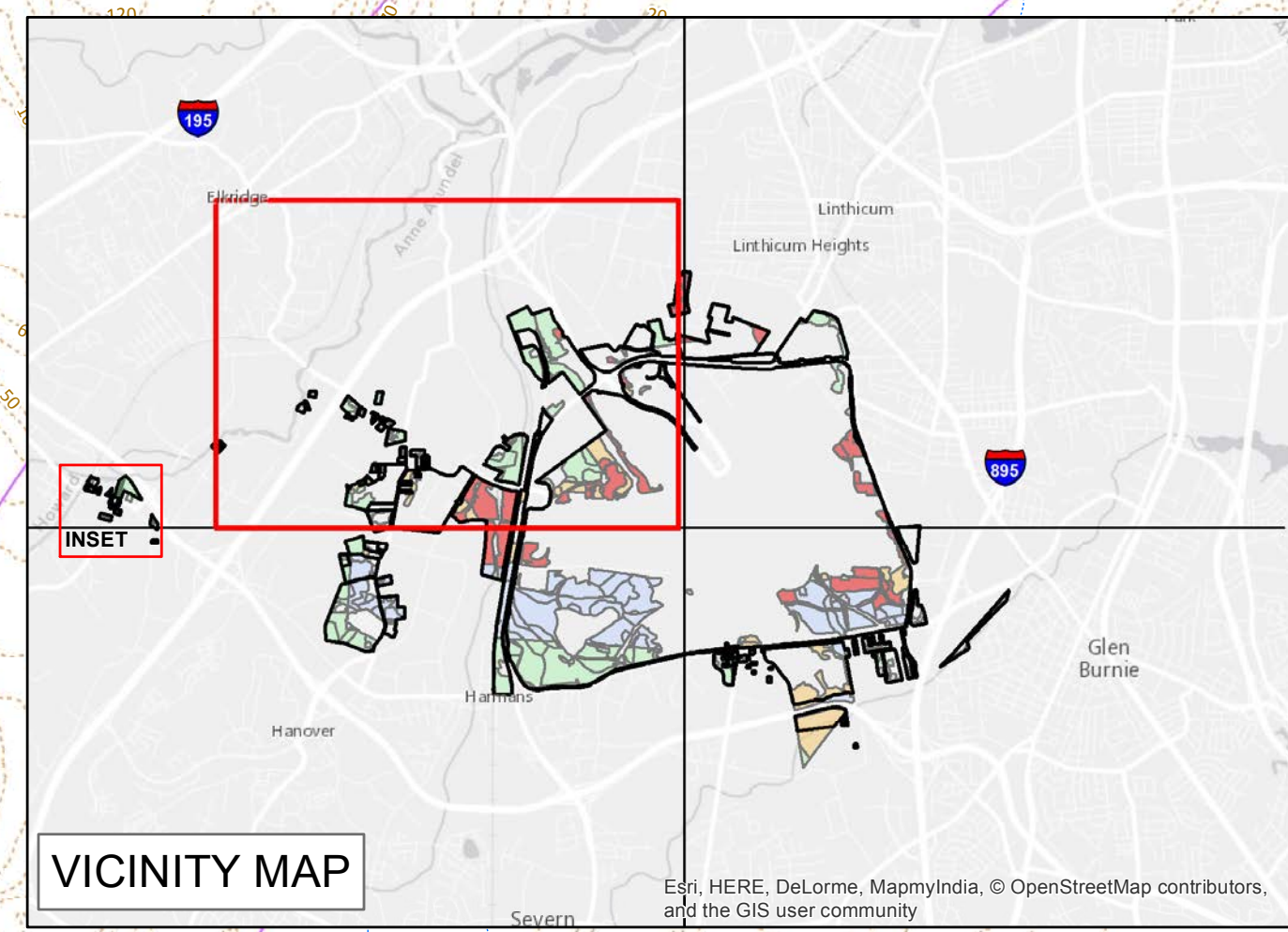
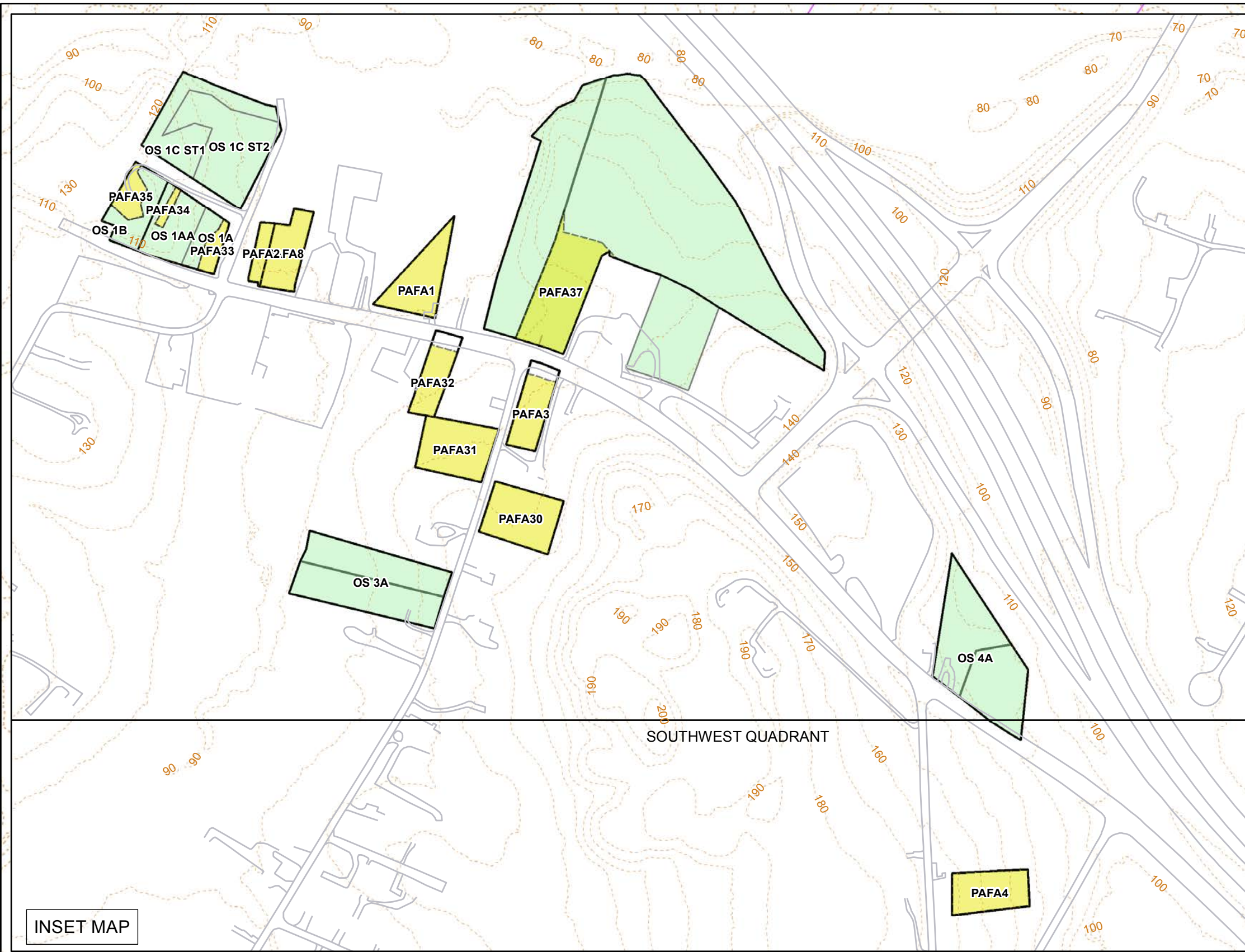
Petrides, George A. and Janet Wehr. 1988. Peterson Field Guides: A Field Guide to Eastern Trees. Houghton Mifflin Company, New York, NY.

United States Department of Agriculture, Natural Resources Conservation Service. 2003. Plants Database. <<http://plants.usda.gov>>, accessed 1/29/2008.

¹ - Field investigations indicated existing Virginia pine heights of 75-85 feet. For this species, the Petrides and Dirr values were excluded from determining the average maximum height.

Appendix E

Forest Maintenance Areas



FOREST MAINTENANCE PLAN UPDATE

APPENDIX E

Forested Areas, Imaginary Surfaces & Conflicts Quadrant NW

COUNTY: ANNE ARUNDEL
DATE: FEBRUARY 2014

SCALE: 1" = 400'
SHEET: 1 OF 4

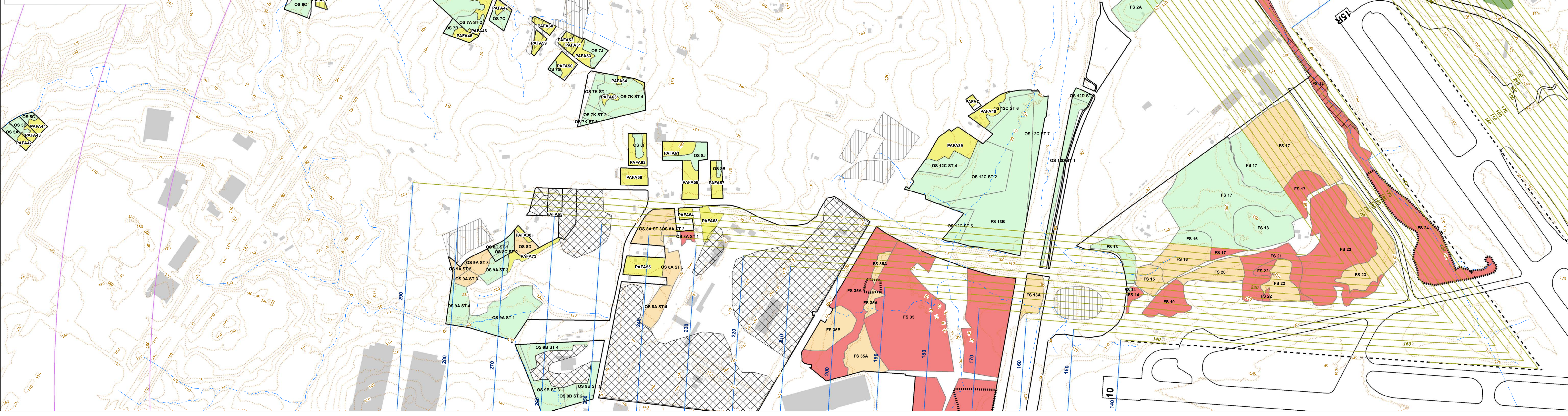
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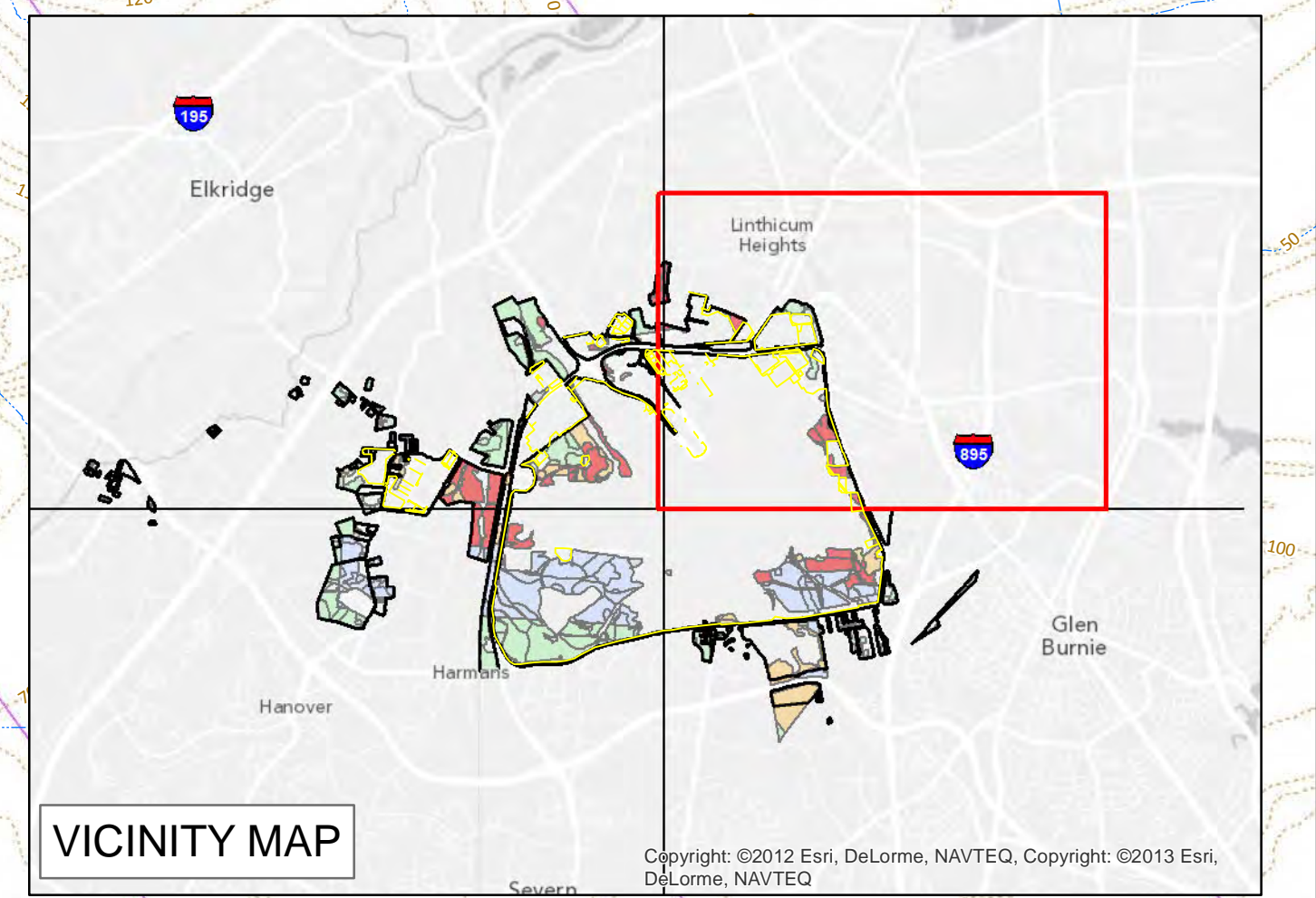
LEGEND

- Approach Surface
- Transitional Surface
- Horizontal Surface
- Object Free Zone
- Offsite Parcels
- Selective Removal/Tree Clearing
- Released Properties
- Removed Forest Stands

FOREST STANDS

- Runway 10R-28L Future Conflict
- No Existing Conflict
- Future Conflict
- Existing Conflict
- Existing Afforestation
- Potential Afforestation





FOREST MAINTENANCE PLAN UPDATE

APPENDIX E

Forested Areas, Imaginary Surfaces & Conflicts Quadrant NE

COUNTY: ANNE ARUNDEL
DATE: FEBRUARY 2014

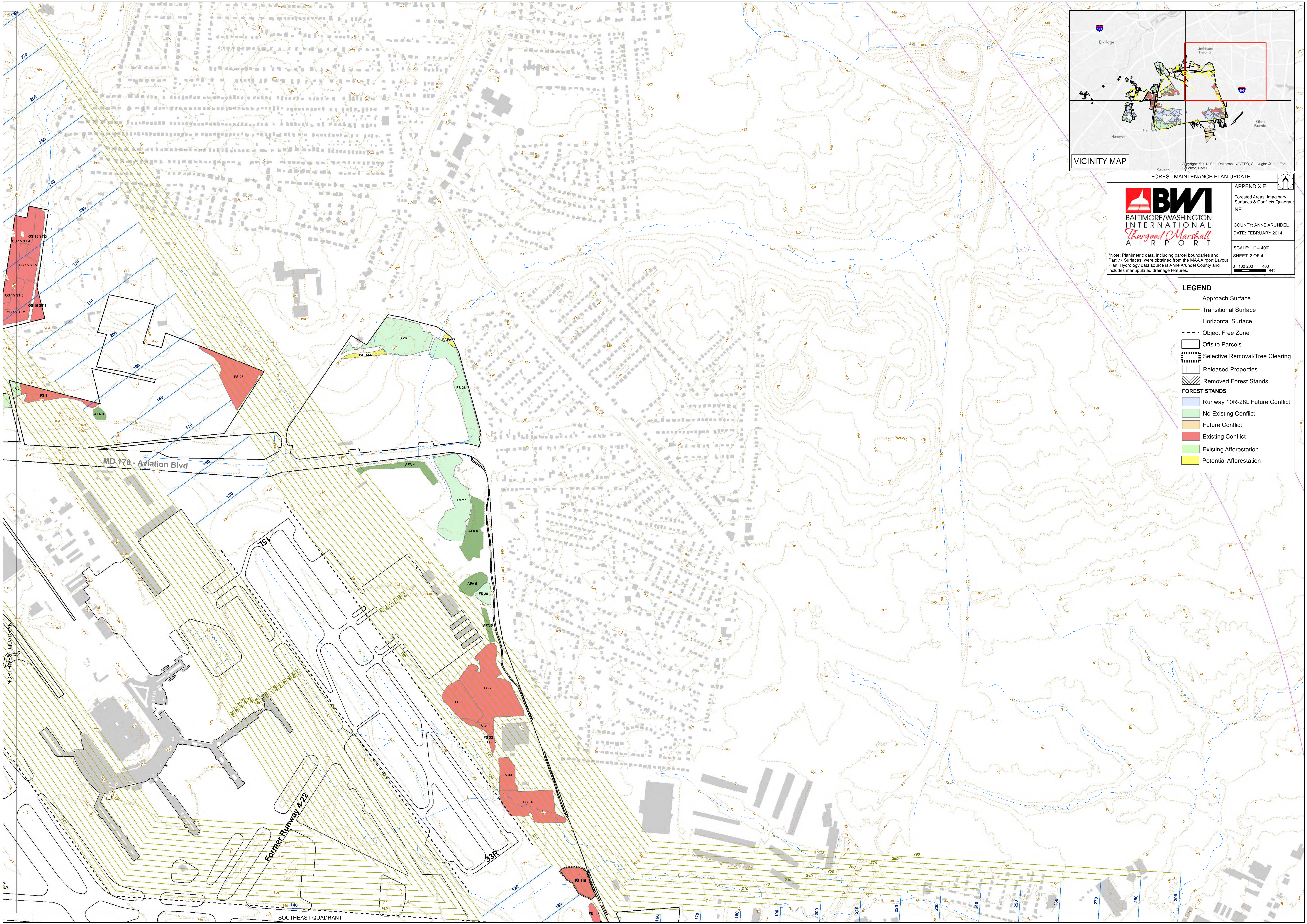
SCALE: 1" = 400'
SHEET: 2 OF 4

LEGEND

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- Transitional Surface
- Horizontal Surface
- Object Free Zone
- Offsite Parcels
- Selective Removal/Tree Clearing
- Released Properties
- Removed Forest Stands

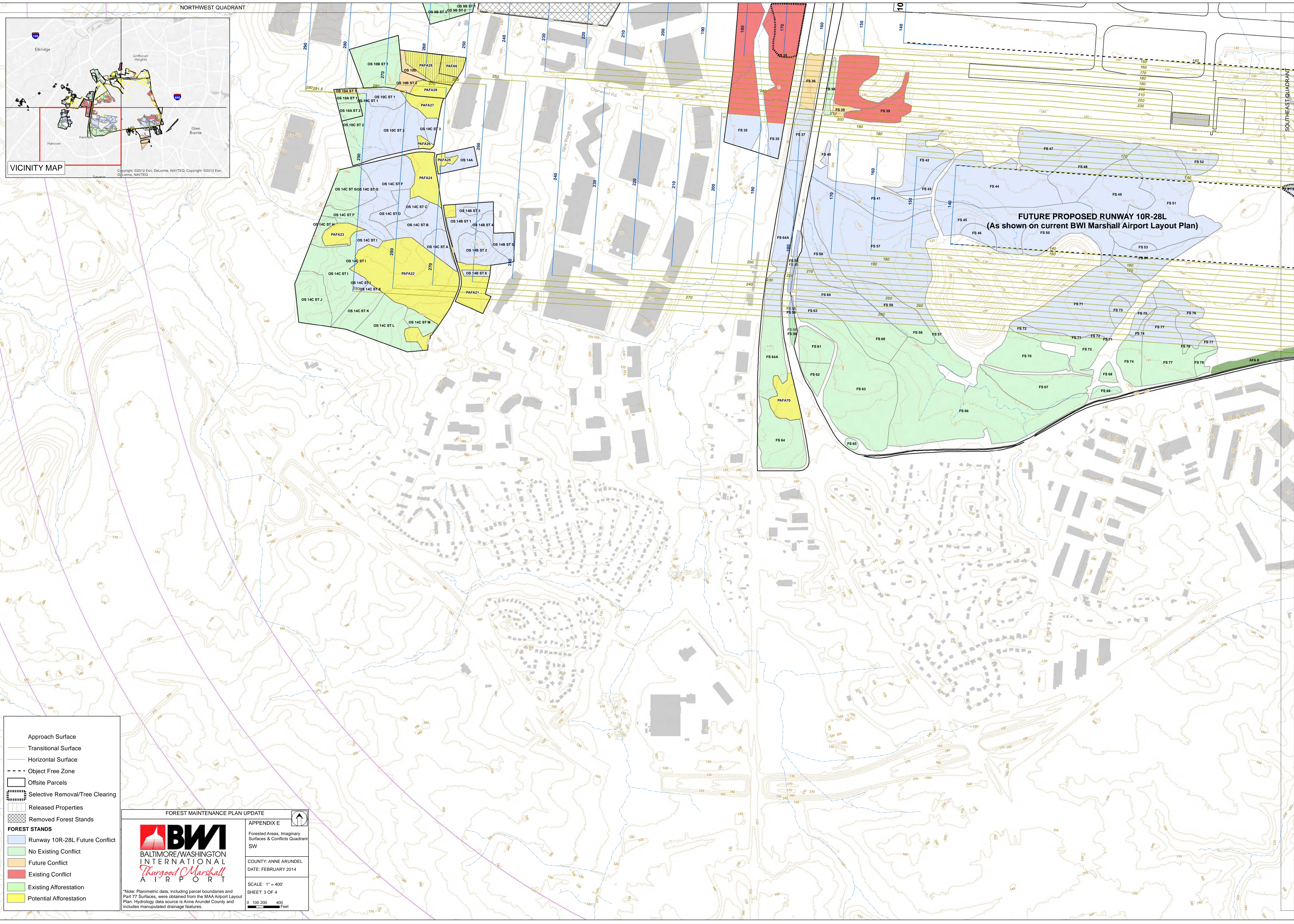
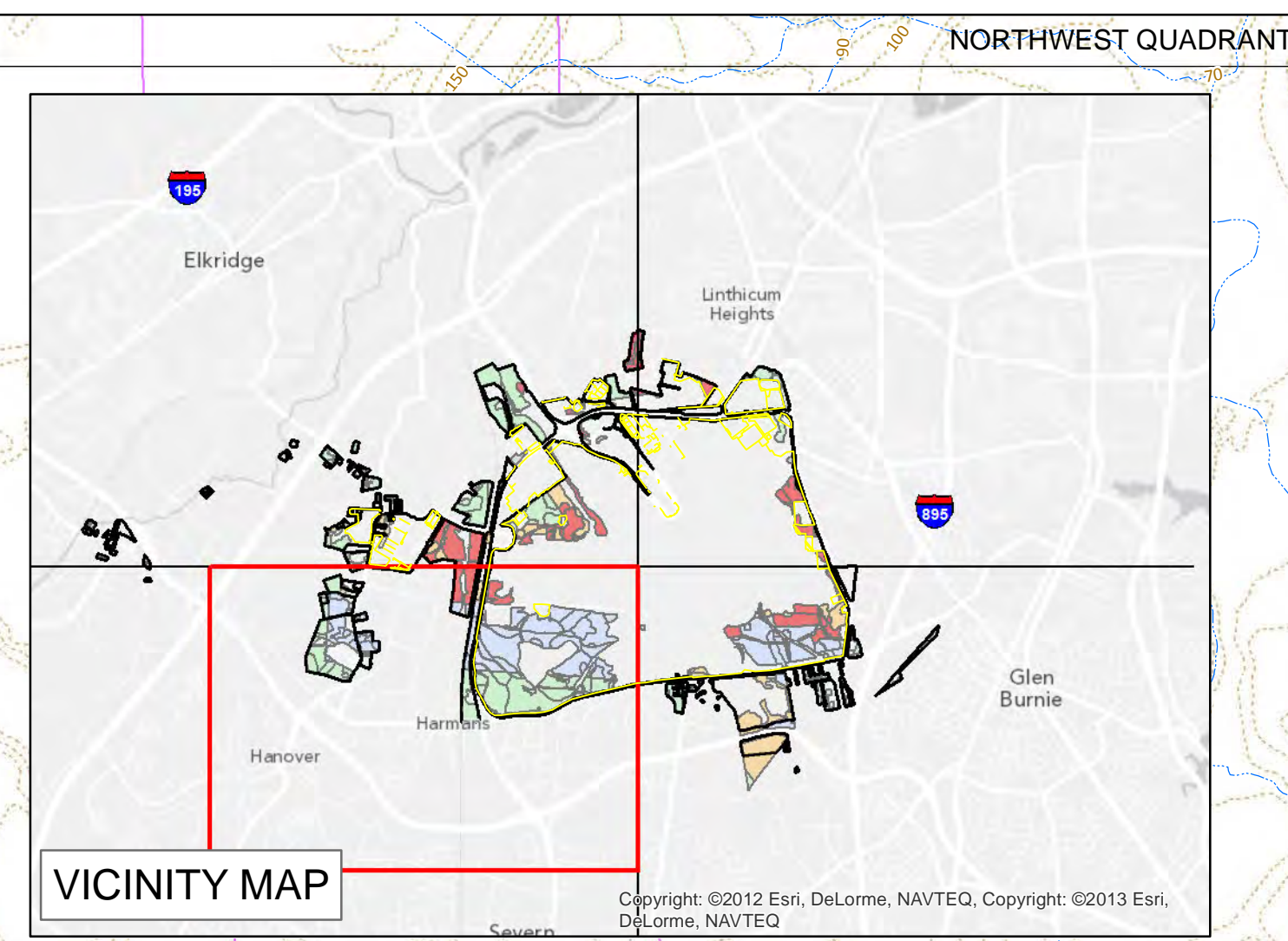
FOREST STANDS

- Runway 10R-28L Future Conflict
- No Existing Conflict
- Future Conflict
- Existing Conflict
- Existing Afforestation
- Potential Afforestation



OS 15 ST 6
OS 15 ST 4
OS 15 ST 5
OS 15 ST 3
OS 15 ST 1
OS 15 ST 2

NORTHWEST QUADRANT



FUTURE PROPOSED RUNWAY 10R-28L
 (As shown on current BWI Marshall Airport Layout Plan)

- Approach Surface
- Transitional Surface
- Horizontal Surface
- Object Free Zone
- Offsite Parcels
- Selective Removal/Tree Clearing
- Released Properties
- Removed Forest Stands
- FOREST STANDS**
- Runway 10R-28L Future Conflict
- No Existing Conflict
- Future Conflict
- Existing Conflict
- Existing Afforestation
- Potential Afforestation



*Note: Planimetric data, including parcel boundaries and Part 77 Surfaces, were obtained from the MAA Airport Layout Plan. Hydrology data source is Anne Arundel County and includes manipulated drainage features.

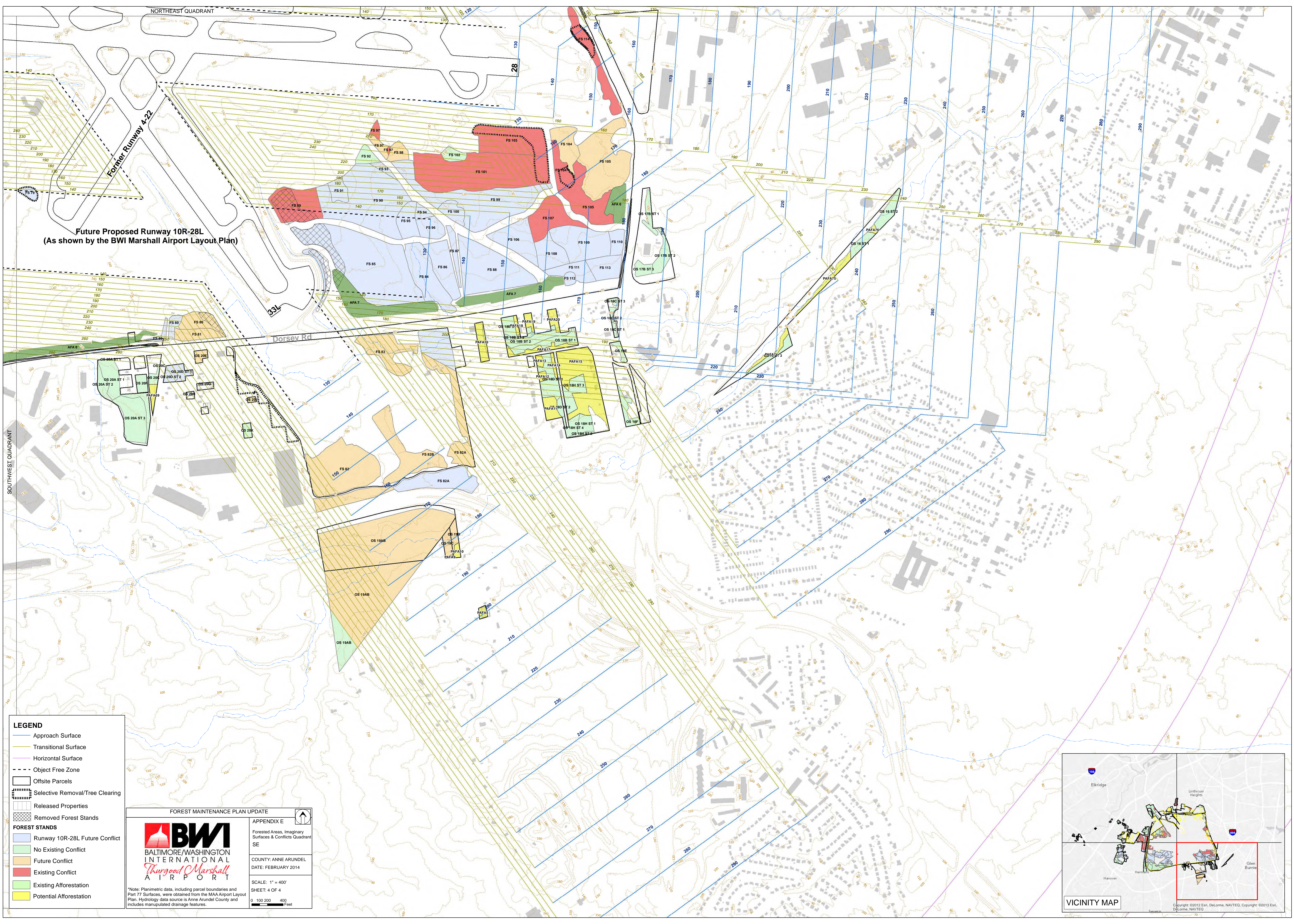
FOREST MAINTENANCE PLAN UPDATE

APPENDIX E
 Forested Areas, Imaginary Surfaces & Conflicts Quadrant SW

COUNTY: ANNE ARUNDEL
 DATE: FEBRUARY 2014

SCALE: 1" = 400'
 SHEET: 3 OF 4

0 100 200 400 Feet



Future Proposed Runway 10R-28L
(As shown by the BWI Marshall Airport Layout Plan)

LEGEND

- Approach Surface
- Transitional Surface
- Horizontal Surface
- - - Object Free Zone
- ▭ Offsite Parcels
- ▨ Selective Removal/Tree Clearing
- ▩ Released Properties
- ▧ Removed Forest Stands

FOREST STANDS

- ▭ Runway 10R-28L Future Conflict
- ▭ No Existing Conflict
- ▭ Future Conflict
- ▭ Existing Conflict
- ▭ Existing Afforestation
- ▭ Potential Afforestation

FOREST MAINTENANCE PLAN UPDATE

BWIM
BALTIMORE/WASHINGTON
INTERNATIONAL
Thurgood Marshall
AIRPORT

APPENDIX E
Forested Areas, Imaginary Surfaces & Conflicts Quadrant SE

COUNTY: ANNE ARUNDEL
DATE: FEBRUARY 2014

SCALE: 1" = 400'
SHEET: 4 OF 4

*Note: Planimetric data, including parcel boundaries and Part 77 Surfaces, were obtained from the MAA Airport Layout Plan. Hydrology data source is Anne Arundel County and includes manipulated drainage features.

VICINITY MAP

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Appendix F

Forest Stand Summary Table

Stand	Quadrat	Size (Ac)	Canopy Description	Average Growth Rate (ft/yr)	2013 Maximum Height (ft)	Maximum Height (ft)	Projected Future Height (ft)	Year of Maximum Height	2013 Maturity	2020 Maturity	2030 Maturity	Elevation Restrictions Minimum (ft)	Elevation Restrictions Maximum (ft)	Part 77 Existing Conflict	Part 77 Future Conflict	Conflict with 06R.26L7	Part 77 Conflict Runway	Existing Maintenance Concern	Maintenance Strategy	Topography	Wetlands	Comments		
FS 1	NE	0.73	Red oak, White oak	Slow	75	110	110	2013	N	N	N	204	244	N	N	N		I		Sloped	Yes, and stream	Adjacent to Main train tracks		
FS 2	NW	25.59	Red maple, Sycamore	Fast	98	93	105	188	2	0	2015	5	101	N	N	N	A	AG		Sloped	Yes, and stream	Adjacent to Main train tracks		
FS 3	NW	4.89	Virginia pine, Loblolly pine, White oak	Fast	80	80	118	198	17	11,1330	2024	133	N	N	N					Flat	Yes	Adjacent to Main train tracks		
FS 4	NW	0.53	Red oak, White oak	Medium	80	95	95	184	180	17	11,1330	2024	133	N	N	N					Flat	Yes	Adjacent to Main train tracks	
FS 5	NW	27.03	White pine	Fast	62	59	120	212	235	23	2013	N	N	N	N	N		I			Sloped	Yes	Adjacent to Main train tracks	
FS 6	NW	1.68	Cherry, Red maple	Fast	93	100	110	190	190	17	11,1330	2024	133	N	N	N		I			Flat	Yes	Adjacent to Main train tracks	
FS 7	NW	10.09	Virginia pine, Chestnut oak	Fast	90	107	122	237	5	2	2015	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
FS 8	NW	11.25	Black locust	Fast	82	86	100	185	180	15	2015	N	N	N	N	N		I			Flat	Yes	Adjacent to Main train tracks	
FS 9	NW	13.10	Black locust	Fast	49	55	99	147	184	30	15	2013	N	N	N	N	N		I			Sloped	Yes, and stream	Adjacent to Main train tracks
FS 10	NW	4.89	Black locust	Fast	49	55	99	147	184	30	15	2013	N	N	N	N	N		I			Sloped	Yes, and stream	Adjacent to Main train tracks
FS 11	NW	1.20	Black locust	Fast	65	72	110	190	190	17	11,1330	2024	133	N	N	N					Flat	Yes	Adjacent to Main train tracks	
FS 12	NW	4.00	Red maple	Fast	63	68	100	163	196	31	15.9	2025.9	N	N	N	N	N				Flat	Yes	Adjacent to Main train tracks	
FS 13A	NW	1.51	Southern red oak, Virginia pine	Fast	65	69	99	155	185	50	25	2013	N	N	N	N	N					Sloped	Yes, and stream	Adjacent to Main train tracks
FS 13B	NW	0.28	Loblolly pine, Black gum	Fast	65	69	99	155	185	50	25	2013	N	N	N	N	N					Sloped	Yes, and stream	Adjacent to Main train tracks
FS 14	NW	6.52	White pine	Fast	59	102	191	217	0	0	2013	N	N	N	N	N		I			Sloped	Yes	Adjacent to Main train tracks	
FS 15	NW	1.86	White pine	Fast	59	102	191	217	0	0	2013	N	N	N	N	N		I			Sloped	Yes	Adjacent to Main train tracks	
FS 16	NW	4.74	White pine	Fast	59	102	191	217	0	0	2013	N	N	N	N	N		I			Sloped	Yes	Adjacent to Main train tracks	
FS 17	NW	14.98	White pine	Fast	59	102	191	217	0	0	2013	N	N	N	N	N		I			Sloped	Yes	Adjacent to Main train tracks	
FS 18	NW	5.10	Black locust, Red maple	Fast	71	69	104	178	233	0	0	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks
FS 19	NW	0.50	White pine	Fast	59	102	191	217	0	0	2013	N	N	N	N	N		I			Sloped	Yes	Adjacent to Main train tracks	
FS 20	NW	2.72	White pine	Fast	59	102	191	217	0	0	2013	N	N	N	N	N		I			Sloped	Yes	Adjacent to Main train tracks	
FS 21	NW	0.50	White pine	Fast	59	102	191	217	0	0	2013	N	N	N	N	N		I			Sloped	Yes	Adjacent to Main train tracks	
FS 22	NW	3.24	White pine	Fast	66	101	171	236	20	15.9	2025.9	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
FS 23	NW	2.29	White pine	Fast	66	101	171	236	20	15.9	2025.9	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
FS 24	NW	8.39	White pine	Fast	66	101	171	236	20	15.9	2025.9	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
FS 25	NW	8.29	White pine	Fast	66	101	171	236	20	15.9	2025.9	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
FS 26	NW	1.51	Red maple	Fast	78	98	131	238	31	15.9	2025.9	N	N	N	N	N					Sloped	Yes, and stream	Adjacent to Main train tracks	
FS 27	NW	0.26	Red maple	Fast	78	98	131	238	31	15.9	2025.9	N	N	N	N	N					Sloped	Yes, and stream	Adjacent to Main train tracks	
FS 28A	NW	13.44	Red maple	Fast	78	98	131	238	31	15.9	2025.9	N	N	N	N	N					Sloped	Yes, and stream	Adjacent to Main train tracks	
FS 28B	NW	13.44	Red maple	Fast	78	98	131	238	31	15.9	2025.9	N	N	N	N	N					Sloped	Yes, and stream	Adjacent to Main train tracks	
OS 1A	NW	0.18	Silver maple, White pine	Fast	107	104	152	229	227	77	38.9	2025.9	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks
OS 1B	NW	0.35	Silver maple, White pine	Fast	107	104	152	229	227	77	38.9	2025.9	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks
OS 1C	NW	1.75	Black walnut, Red maple	Fast	107	104	152	229	227	77	38.9	2025.9	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks
OS 1C-1	NW	0.95	Black walnut, Red maple	Fast	107	104	152	229	227	77	38.9	2025.9	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks
OS 1C-2	NW	0.80	Black walnut, Red maple	Fast	107	104	152	229	227	77	38.9	2025.9	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks
OS 2A	NW	0.59	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-1	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-2	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-3	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-4	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-5	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-6	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-7	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-8	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-9	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-10	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-11	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-12	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-13	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-14	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-15	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-16	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-17	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-18	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-19	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-20	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-21	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-22	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-23	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-24	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-25	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-26	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-27	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-28	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-29	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-30	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-31	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-32	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-33	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-34	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-35	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-36	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-37	NW	1.05	White pine	Fast	142	142	204	282	282	33	2013	N	N	N	N	N					Sloped	Yes	Adjacent to Main train tracks	
OS 2A-38	NW	1.05	White pine	Fast	142	142	204	282	282	33	201													

Appendix G

BWI Marshall Obstruction Removal Review for
Development of the FMP and RMP Updates
(Draft Final)

BWI Marshall Obstruction Removal Review for Development of the FMP and RMP Updates

[DRAFT FINAL]

Prepared by:

[HNTB Corporation]

[8/20/2013]

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ATTACHMENTS

Appendix A: Tree Growth Assumptions

Appendix B: Obstruction Analysis Assumptions and Results

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INTRODUCTION

This effort is a component of the 2013 Baltimore/Washington International Thurgood Marshall Airport (BWI Marshall) Forest Maintenance Plan (FMP) and Reforestation Management Plan (RMP) updates that are being conducted to update the 2009 BWI Marshall FMP and RMP studies. The previous efforts utilized survey data from 2005 that was collected for the preparation of the BWI Marshall Master Plan and Airport Layout Plan (ALP) Update.

Since the completion of the 2009 FMP and RMP study, new survey data was flown in 2011 for use in identifying obstructions. The focus of this effort is to conservatively project the growth of surveyed trees and quantify future obstructions to approach and departure surfaces at BWI Marshall.

1 Study Area

The study area includes the entire property of BWI Marshall, the neighboring vicinities, and the extents of the surfaces being assessed. Surfaces extend well beyond the bounds of the airport property and terminate as far beyond the airport property as 50,000 feet (i.e. FAA OEI OIS) from each runway end. **Figure 1** depicts the vicinity of BWI Marshall, the airport property line, tree stands as delineated in the 2009 FMP, and surveyed wetlands. These features are depicted separately from the obstruction analysis figures in the following section to serve as a point of reference and to allow the content of the obstruction figures to remain as focused as possible.

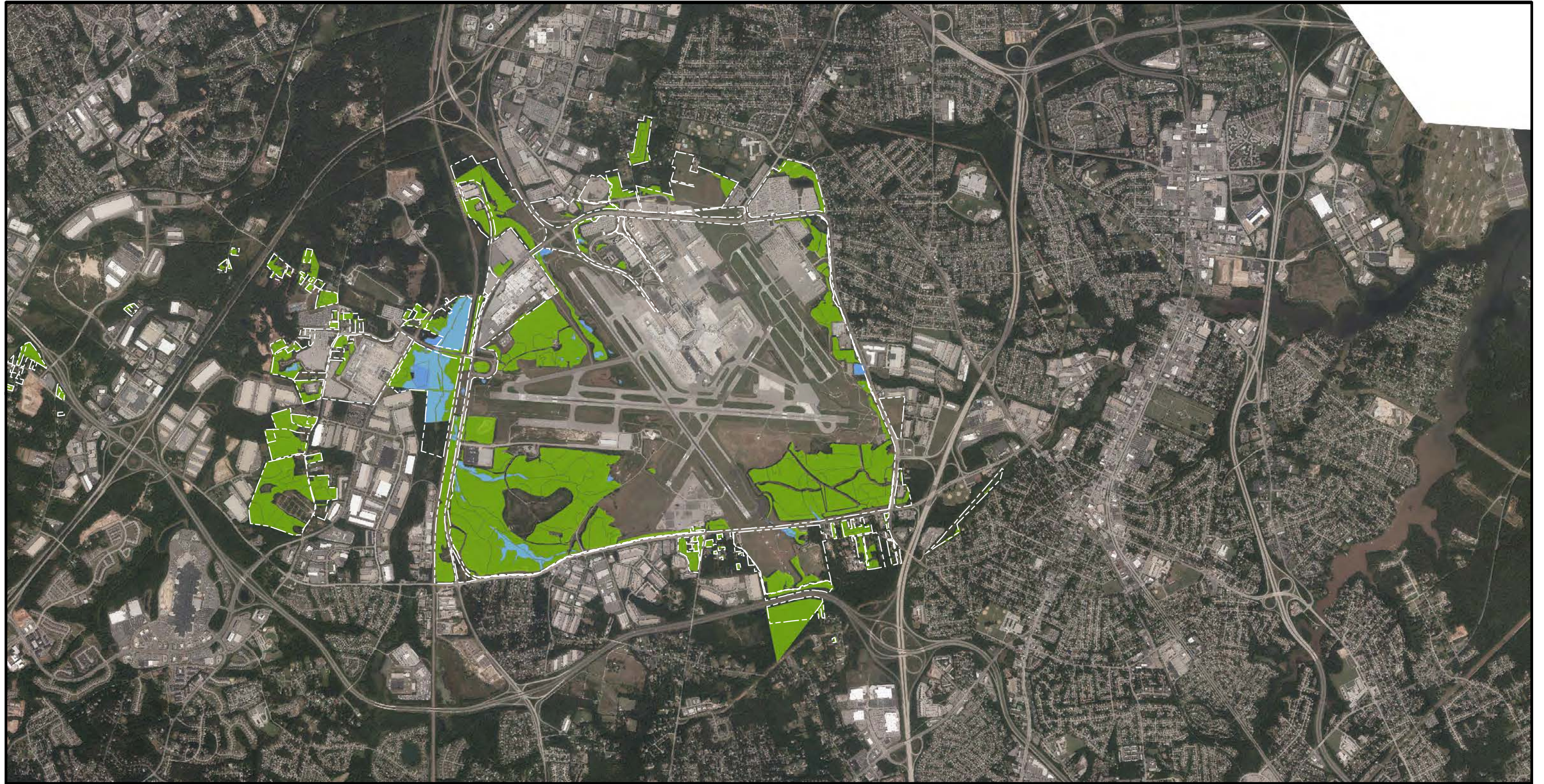
2 Overview of Data Analyzed

Two key data sources were utilized in the conduct of this analysis:




- 2011 obstruction data for Runways 10-28 and 15R-33L; and the
- 2005 obstruction data for Runway 15L-33R

The point data were provided in Microsoft excel format (via MAA, ADCI, JMT, and Baker) which contained key information on each point in the database. Each point has the following main pieces of information associated with it: point id, latitude/longitude, elevation, type of object, etc.

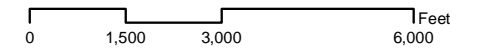
The 2011 data were only collected for Runways 10-28 and 15R-33L. Per the Maryland Aviation Administration (MAA), HNTB was directed to use the 2005 obstruction data for Runway 15L-33R. The heights of vegetative obstructions, defined by 2005 obstruction data, were then adjusted to account for growth that occurred since the data were captured. This adjustment theoretically renders the data current with the 2011 data. The process to adjust the data is described in Section 3.



LEGEND

-  Existing Property Line
-  Wetland
-  Tree Stand

Study Area
Figure 1



3 Process and Assumptions Overview

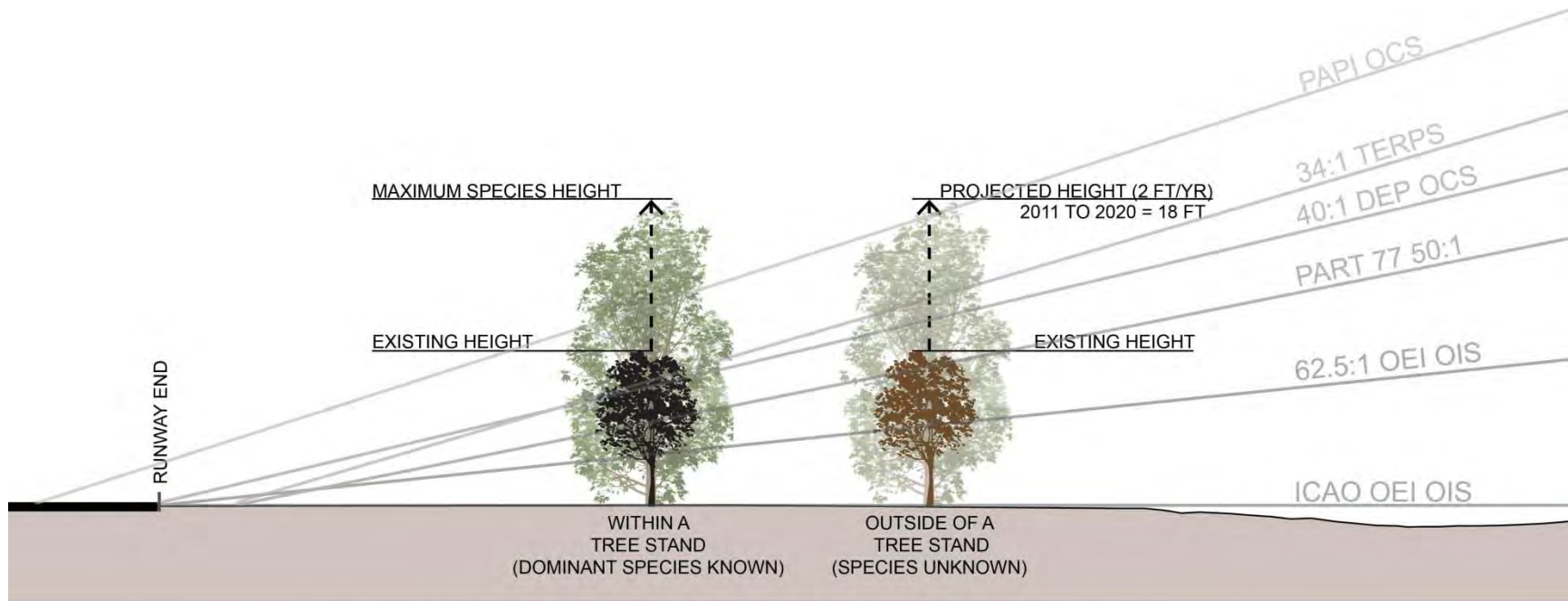
To meet the objective of quantifying future obstructions to approach and departure surfaces, a significant amount of data processing was required to prepare a suitable dataset of surveyed objects. It should be emphasized that the approach taken is a conservative/worst case scenario to determine areas that could potentially/eventually grow into penetrations so that obstruction removal will be undertaken one last time.

The following steps were included in this process:

- The 2005 and 2011 point data were obtained from MAA in Microsoft Excel format.
- The heights of 2005 vegetative points were then adjusted by 10-feet (per MAA direction) to account for growth that occurred since the data were captured, rendering the 2005 data theoretically current with the 2011 data.
- The 2005 and 2011 data were then combined to form a single database of vegetative points.
 - The process of combining the two databases involved a significant amount of editing and manipulation to overcome some limitations of the data. Only above ground level (AGL) height values were provided with the 2011 data. This required merging the data with mean sea level (MSL) ground elevations from a separate database of the same source but in CAD format.
- Two separate Runway Safety Area (RSA) improvement projects are in the process of being initiated, both of which have an obstruction removal component. To achieve the objective of providing an updated and long-term look at potential BWI Marshall obstructions, trees being removed as part of the RSA projects were identified in the database as being “removed” from further consideration in this analysis. The points will remain in the database but have been tagged with attributes identifying them as being removed per their respective projects.
 - Based on information provided from JMT the relevant points in the database that would be removed in the RSA obstruction removal project (as part of MAA-CO-13-015, Runways 10-28, 15R-33L Obstruction Clearing Project) were tagged with attributes identifying them as being removed using the following method: the direction was to identify points in the 2011 data that fall within a 20-foot radius of vegetative obstructions identified in the 2005 data for removal. For points that fell within a wetland, no radius was applied; the specific tree identified would be removed.
 - A CAD drawing of a second obstruction removal project (MAA-CO-13-004: BWI Marshall Runway 15R-33L Standards Compliance Earthwork Package) was provided, which clearly identifies a polygon of trees that are to be removed. The associated points in the database were tagged with attributes identifying them as being removed as part of the MAA-CO-13-004: BWI Marshall Runway 15R-33L Standards Compliance Earthwork Package.

- Based on maximum tree heights and growth rates provided in the 2009 FMP, the points were again adjusted to reflect maximum potential growth. The general approach follows and is illustrated in **Figure 2**. A detailed explanation of the approach taken and the background of the assumptions used is provided in **Appendix A**.
 - If the points fell within the tree stands identified in the 2009 FMP HNTB was able to determine the maximum height for the dominant species in that tree stand. In that case the maximum published tree height (out of four heights considered) in the study were assumed.
 - If the points fell outside of the tree stands, it was not possible to identify the species. In that case the tree heights were adjusted using the most aggressive annual growth rate published in the study; 2 feet per year out to 2020 (18 feet of growth).

Figure 2 - Tree Growth Methodology



THIS GRAPHIC IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE

Note: In a small number of occasions trees within a stand exceeded the max species height due to unknown factors. In these cases the annual growth rate was applied.

Source: HNTB Corporation.

4 Obstruction Analysis

Using the adjusted points as described above, an analysis was conducted for each of the surfaces specified in the Airport Layout Plan (ALP) as well as the FAA One Engine Inoperative Obstacle Identification Surface (OEI OIS) and International Civil Aviation Organization (ICAO) OEI OIS. The analysis was based on the proposed runway configuration through Phase I (through 2020) as depicted in the latest approved ALP at the commencement of this work (ALP is dated February 2011 with Pen & Ink changes). The runways and associated surfaces assessed are summarized in **Table 1**. A detailed explanation of the surfaces analyzed, surface specifications (at the time of this analysis), design guidelines and results by runway end are provided in **Appendix B**.

The analysis was conducted by utilizing a computer-based modeling application and Geographic Information Systems (GIS) analysis tool that would analyze the object location against the geometry of each of the surfaces in question. The modeling tool would generate a tabular summary of identified obstructions. The points identified were then displayed in GIS over an aerial base.

Table 1
Summary of Surfaces/Runways Assessed

Surface	Runway End					
	10	28	15R	33L	15L	33R
OFZ	●	●	●	●	●	●
PAPI OCS	●	●	●	●	●	●
34:1 TERPS Approach	●	●	●	●	●	●
40:1 Departure OCS	●	●	●	●	●	●
Part 77 (50:1 On-Airport, 34:1 off airport)	●	●	●	●	●	●
62.5:1 OEI OIS	●	●	●	●	●	●
ICAO OEI Surface	●	●	●	●	●	●

Note: Runway 4-22 not included as it will be converted to Taxiway P in the near future.

Source: HNTB Corporation.

This analysis does not include the assessment of Runway 4-22 as it will be converted to Taxiway P during the planning period. Also, the proposed outboard parallel Runway 10R-28L and extension to Runway 33L are not included in the analysis as they are proposed beyond the timeframe covered in this analysis.

4.1 Results Summary

Based on the analysis conducted, results have been summarized and broken into two categories; on-airport obstructions (part 77 only) and on and off airport obstructions for all relevant surfaces.

A summary table and figures have been created to document the results. **Table 2** provides a summary of the total number of points identified as obstructions and the estimated acreages. The main purpose of the accompanying figures is to depict the analyzed surfaces, number of documented vegetative points that penetrate the surfaces and an *estimate* of potential obstruction removal acreage. The output and acreages calculated were developed applying a 20-foot canopy around each tree and then connecting the exterior limits of the nearby canopies. Where tree stands or distinct groups of trees were evident the exterior limits of entire stand acreage was calculated. This was conservatively done to overcome the limitation of surveyed tree data where *every tree* is not accounted for with a specific point.

On-airport obstructions are illustrated on **Figure 3 - Part 77 Surfaces and On-Airport Projected Obstructions**. This figure depicts standard Part 77 surfaces and on-airport penetrations to these surfaces. The extents of the surfaces are not shown as obstructions are primarily close-in to the Airport.

For on and off-airport obstructions see **Figures 4** through **10**, as follows:

- **Figure 4** – OFZ and On and Off-Airport Projected Obstructions
- **Figure 5** – PAPI and On and Off-Airport Projected Obstructions
- **Figure 6** – TERPS Approach and On and Off-Airport Projected Obstructions
- **Figure 7** – Departure OCS and On and Off-Airport Projected Obstructions
- **Figure 8** – Part 77 Surfaces and On and Off-Airport Projected Obstructions
- **Figure 9** – FAA OEI OIS (62.5:1) and On and Off-Airport Projected Obstructions
- **Figure 10** – ICAO OEI OIS and On and Off-Airport Projected Obstructions

It should be noted that **Figure 8** documents both on- and off-airport obstructions to Part 77 surfaces. Off-airport obstructions to Part 77, however are identified (only) with the application of the 34:1 approach surface (off-airport horizontal and transitional surfaces were not assessed). This non-standard depiction has been documented to reflect the obstruction clearing agreement between the MAA and the FAA.

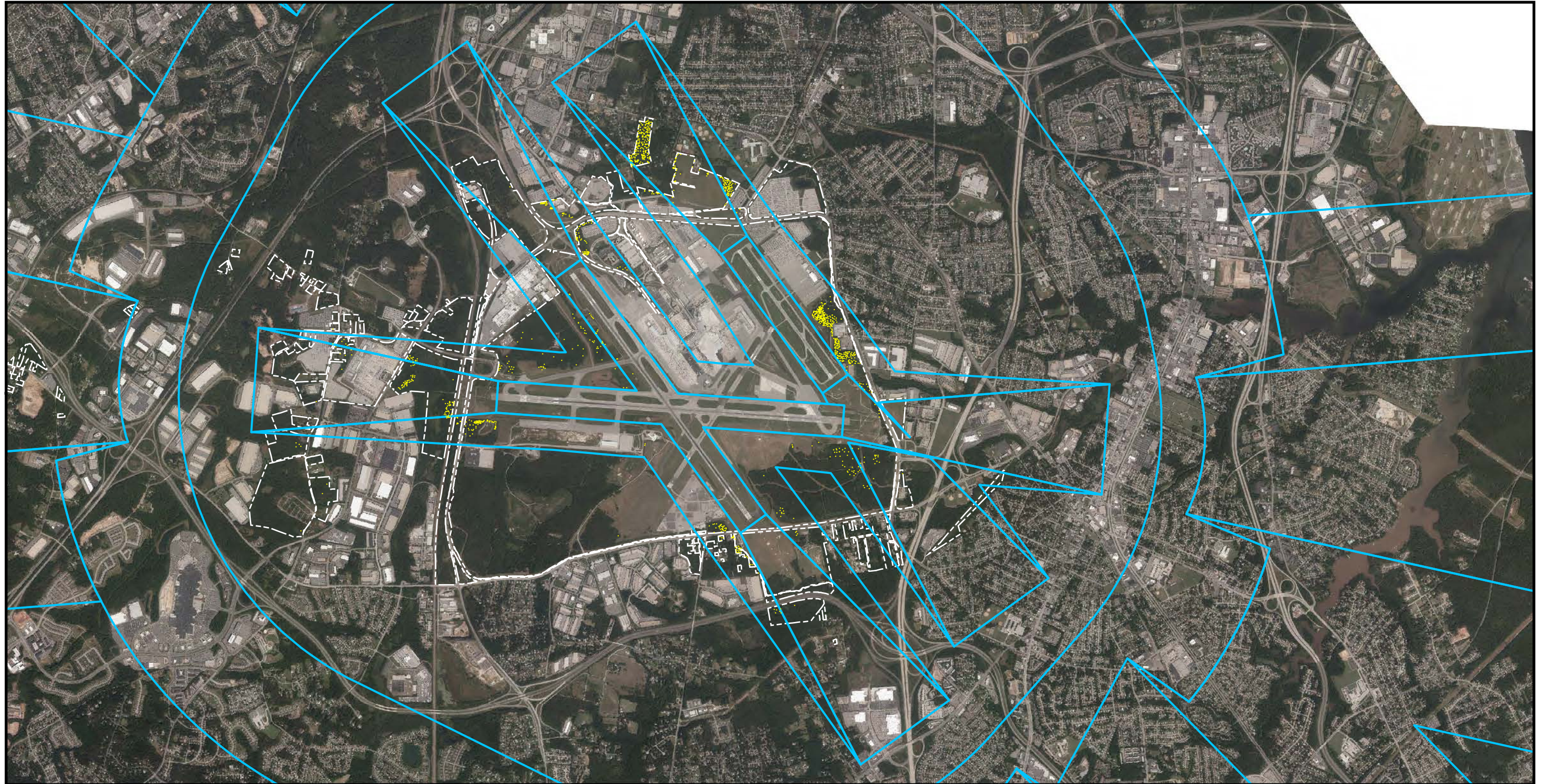
Table 2
Obstruction Results Summary

Surface ¹	# of Vegetative Points²	Estimated Acreage of Penetrations²
OFZ	7	0.3
PAPI OCS	117	5
34:1 TERPS Approach	1075	30
40:1 Departure OCS	2445	87
Part 77	2501	90
FAA 62.5:1 OEI OIS	2613	83
ICAO OEI Surface	1654	61

Note: ¹ Surface type/slope analyzed based on ALP as specified per runway end.

² Totals include both on and off-airport identified obstructions. For subtotals of each, see the respective figures 3 through 10.

Source: HNTB Corporation.

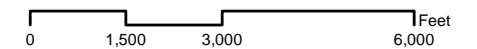


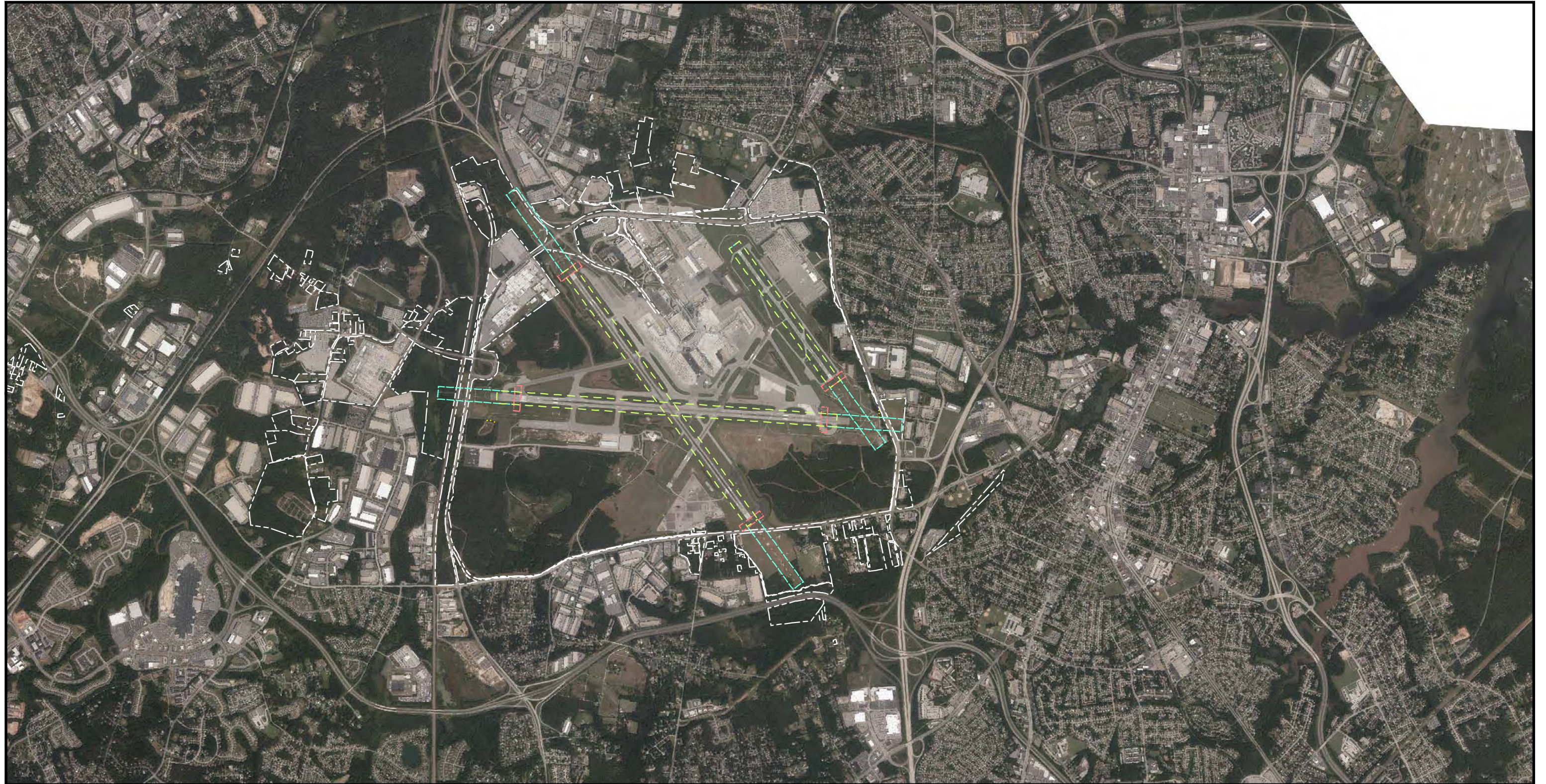
LEGEND

- Tree Intrusion (On-Airport)
- ▭ Part 77 Surface
- Existing Property Line

1,353 Tree Intrusions (On-Airport)
63 Approximate Acres

Part 77 Surfaces and On-Airport Projected Obstructions
Figure 3





LEGEND

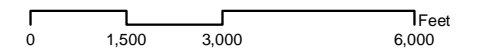
- Tree Intrusion (On-Airport)
- Runway OFZ
- Inner-Approach OFZ
- Precision OFZ
- Existing Property Line

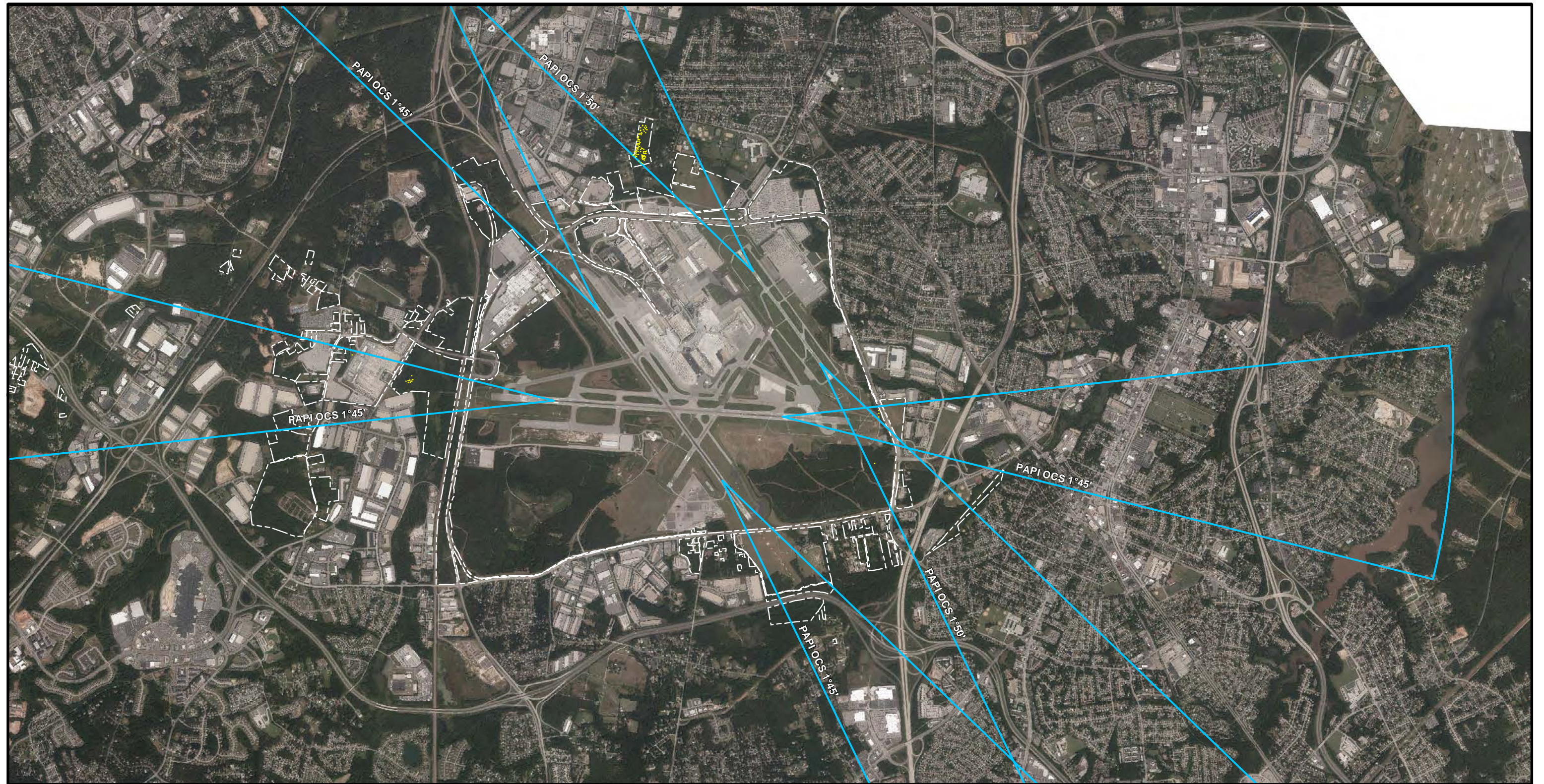
7 Tree Intrusions (On-Airport)
0.3 Approximate Acres

No Tree Intrusions (Off-Airport)

Note: OFZ Transitional surfaces modeled but not shown.

OFZ and On and Off-Airport Projected Obstructions
Figure 4





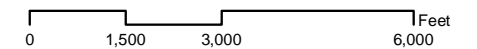
LEGEND

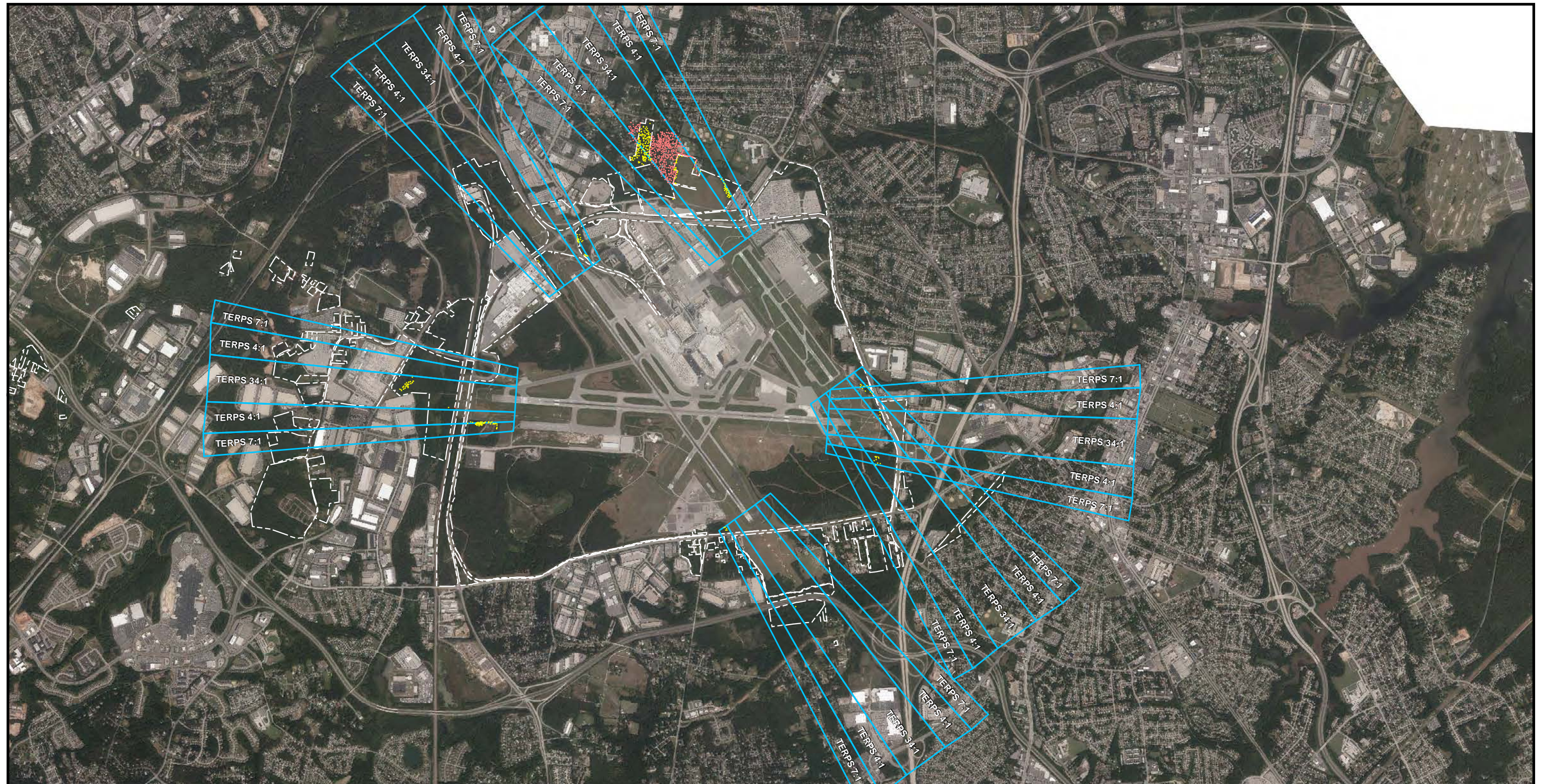
- Tree Intrusion (On-Airport)
- PAPI OCS Surface
- Existing Property Line

117 Tree Intrusions (On-Airport)
5 Approximate Acres

No Tree Intrusions (Off-Airport)

PAPI and On and Off-Airport Projected Obstructions
Figure 5





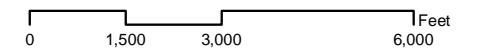
LEGEND

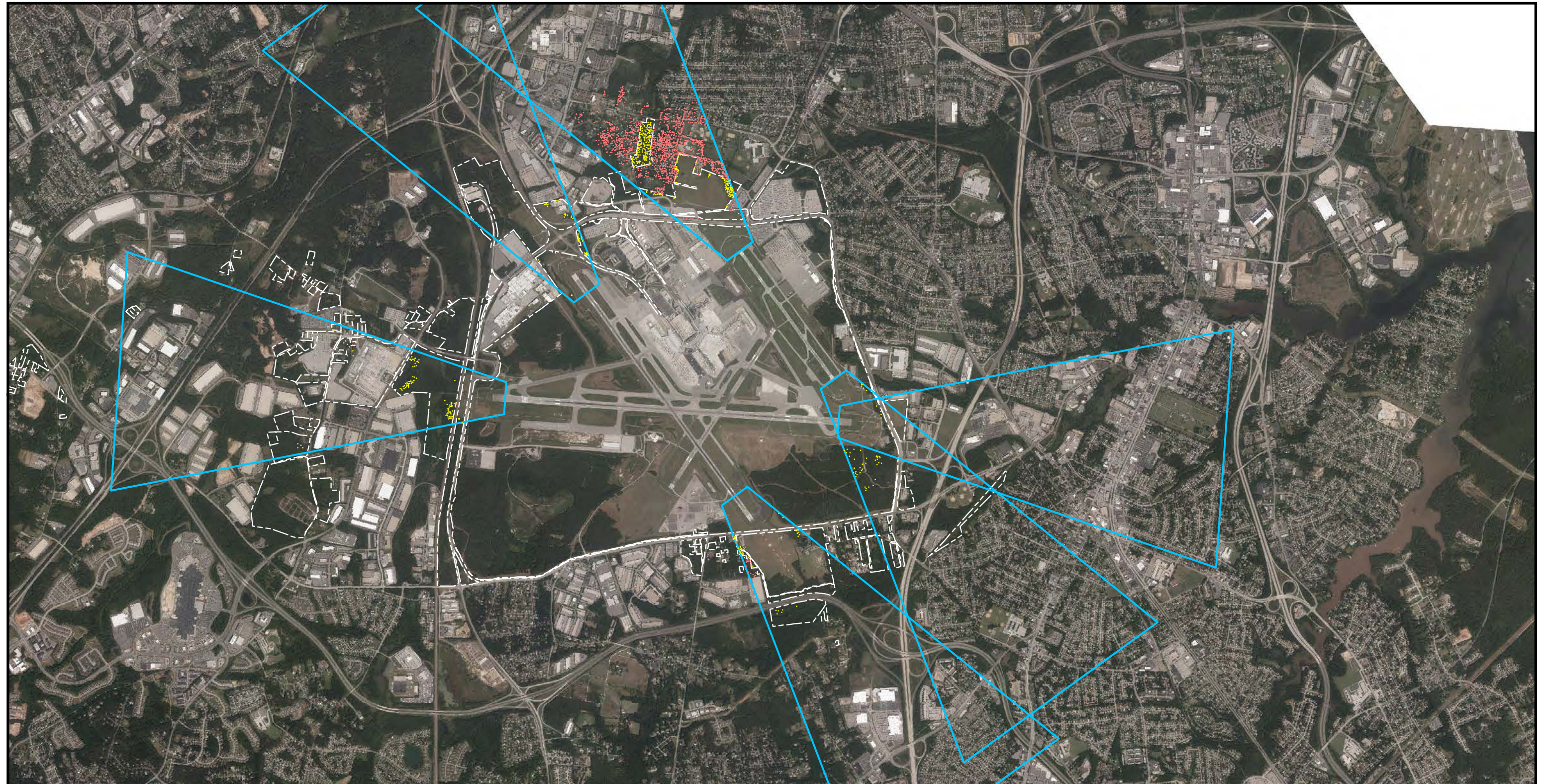
- Tree Intrusion (On-Airport)
- Tree Intrusion (Off-Airport)
- TERPS Approach Surface
- Existing Property Line

394 Tree Intrusions (On-Airport)
14 Approximate Acres

681 Tree Intrusions (Off-Airport)
16 Approximate Acres

TERPS Approach and On and Off-Airport Projected Obstructions
Figure 6





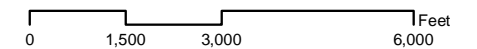
LEGEND

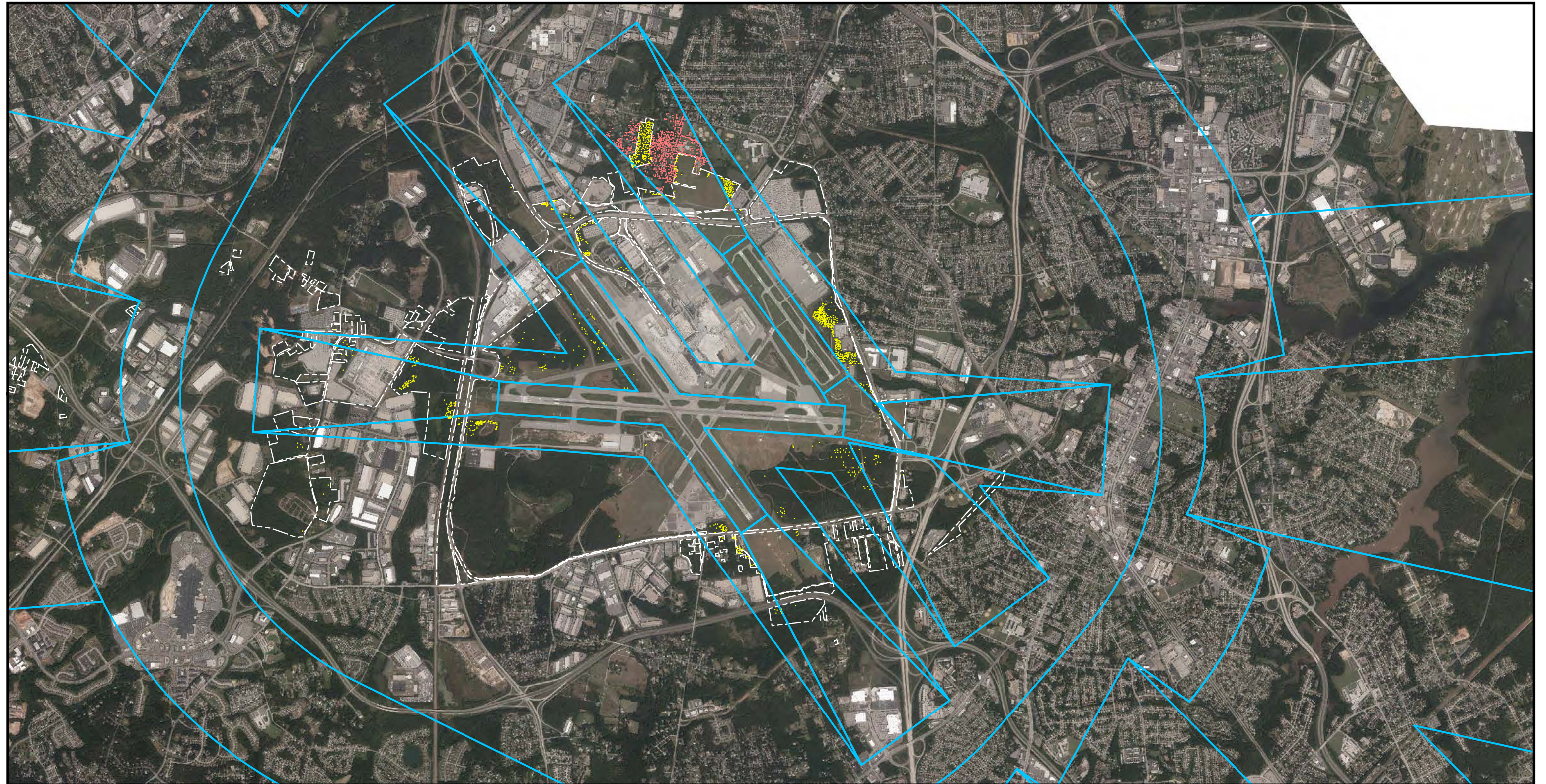
- Tree Intrusion (On-Airport)
- Tree Intrusion (Off-Airport)
- Departure OCS Surface
- Existing Property Line

611 Tree Intrusions (On-Airport)
28 Approximate Acres

1,834 Tree Intrusions (Off-Airport)
59 Approximate Acres

Departure OCS and On and Off-Airport Projected Obstructions
Figure 7





LEGEND

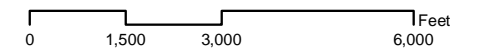
- Tree Intrusion (On-Airport)
- Tree Intrusion (Off-Airport)
- Part 77 Surface
- Existing Property Line

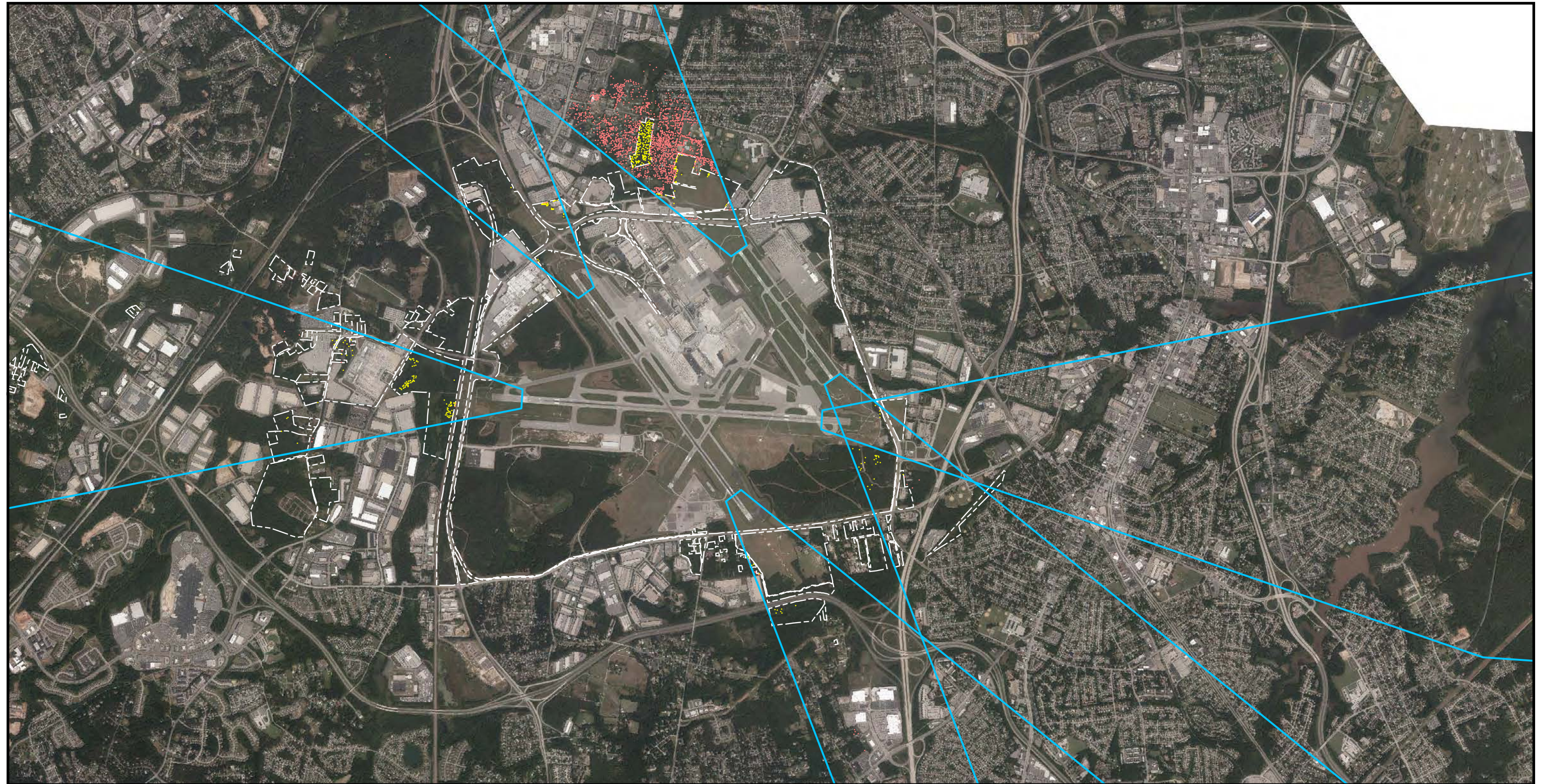
1,353 Tree Intrusions (On-Airport - 50:1 Approaches)
63 Approximate Acres

1,148 Tree Intrusions (Off-Airport - 34:1 Approaches)
27 Approximate Acres

Part 77 Surfaces and On and Off-Airport Projected Obstructions

Figure 8





LEGEND

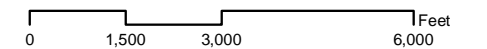
- Tree Intrusion (On-Airport)
- Tree Intrusion (Off-Airport)
- FAA 62.5:1 OEI OCS Surface
- Existing Property Line

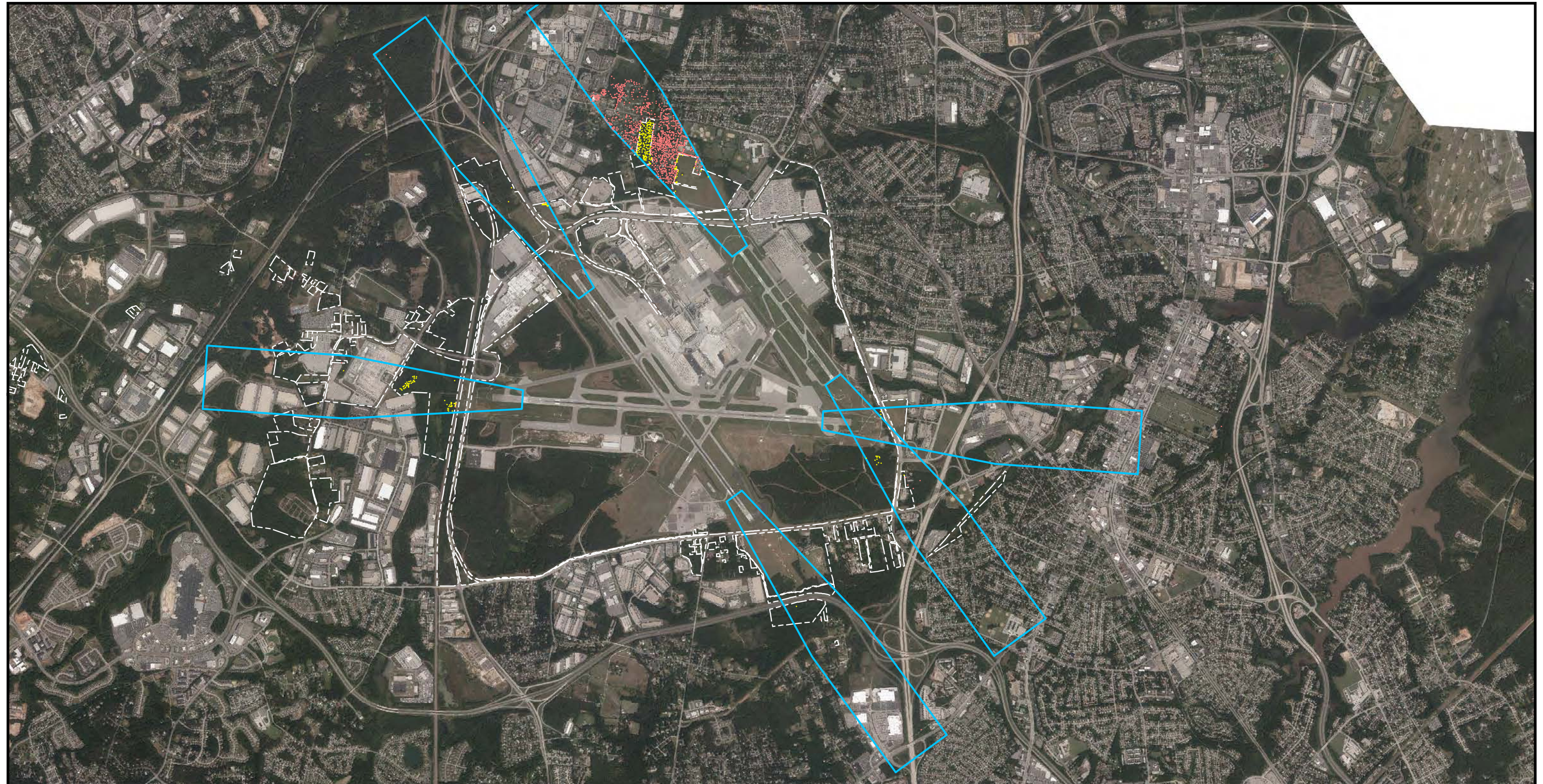
485 Tree Intrusions (On-Airport)
22 Approximate Acres

2,128 Tree Intrusions (Off-Airport)
61 Approximate Acres (Limited by Extents of Survey)

FAA OEI OIS (62.5:1) and On and Off-Airport Projected Obstructions

Figure 9





LEGEND

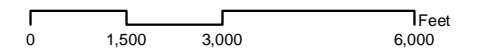
- Tree Intrusion (On-Airport)
- Tree Intrusion (Off-Airport)
- ICAO OEI OIS Surface
- Existing Property Line

331 Tree Intrusions (On-Airport)
16 Approximate Acres

1,323 Tree Intrusions (Off-Airport)
45 Approximate Acres (Limited by Extents of Survey)

ICAO OEI OIS and On and Off-Airport Projected Obstructions

Figure 10



Appendix A – Tree Growth Assumptions

A.1 Data Source: February 2009 BWI Marshall FMP Update

A key component of this effort is based on applying projected growth potential to the surveyed data (tree heights) which are being analyzed. This is being undertaken to assess and quantify future potential obstructions to approach and departure surfaces. As such, this effort relies heavily upon data contained in the 2009 BWI Marshall FMP Update. Of interest to this study is the identification of dominant and co-dominant species of trees in delineated tree stands, maximum tree heights for those species, and a range of growth rates by species. The information therein guided the assumptions used in determining appropriate growth rates to apply to the obstacle survey data.

Particularly, assumptions were sourced from information found in the appendices of the FMP Update document. The following were referenced:

A.1.1 Species Data Table

Table A.1, taken from the FMP Update, includes general information about different species including four different sources for maximum tree heights, and growth rates (slow, medium, fast) for each species.

**Table A.1
Species Data Table**

COMMON NAME	BOTANICAL NAME	MAXIMUM TREE HEIGHT				AVG. MAX.	GROWTH RATE
		Petrides	Brown	Dirr	USDA		
Hedge maple	Acer campestre	N/A	N/A	40	N/A	40	N/A
Red maple	Acer rubrum	40	132	120	90	96	rapid
Tree of heaven	Ailanthus altissima	100	66	60	50	69	rapid
Pignut hickory	Carya glabra	90	99	100	90	95	slow
Mockernut hickory	Carya tomentosa	80	99	N/A	100	93	slow
Persimmon	Diospyros virginiana	50	66	60	50	57	moderate
Green ash	Fraxinus pennsylvanica	70	82.5	80	70	76	rapid
Sweetgum	Liquidambar styraciflua	120	132	120	100	118	rapid
Tulip poplar	Liriodendron tulipifera	100	198	150	120	142	rapid
Blackgum	Nyssa sylvatica	60	99	50	95	76	moderate
Pitch pine	Pinus rigida	60	66	100	80	77	rapid
White pine	Pinus strobus	110	99	150	150	127	rapid
Scotch pine	Pinus sylvestris	50	82.5	90	110	83	rapid
Virginia pine	Pinus virginiana	40	99	40	70	62	rapid
Loblolly pine	Pinus taeda	100	98.5	90	100	97	rapid
Sycamore	Platanus occidentalis	130	148.5	150	100	132	rapid
Large-tooth aspen	Populus grandidentata	40	82.5	70	65	64	rapid
Black cherry	Prunus serotina	80	99	100	80	90	rapid
Sawtooth oak	Quercus acutissima	N/A	N/A	45	70	58	rapid
White oak	Quercus alba	80	99	100	100	95	slow
Southern red oak	Quercus falcata	80	99	80	100	90	slow
Pin oak	Quercus palustris	80	99	100	100	95	rapid
Willow oak	Quercus phellos	80	82	60	100	81	slow
Chestnut oak	Quercus prinus	70	99	70	80	80	slow
Northern red oak	Quercus rubra	80	99	100	100	95	moderate
Black oak	Quercus velutina	80	99	N/A	90	90	moderate
Black locust	Robinia pseudo-acacia	80	99	80	80	85	rapid
Sassafras	Sassafras albidum	50	49.5	60	75	59	slow

N/A- Not Available

Sources:

Brown, Russell G. and Melvin L. Brown. 1992. Woody Plants of Maryland. Port City Press, Baltimore, Maryland.

Dirr, Michael A. 1990. Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses. Stipes Publishing Company, Champaign, Illinois.

Petrides, George A. and Janet Wehr. 1988. Peterson Field Guides: A Field Guide to Eastern Trees. Houghton Mifflin Company, New York, NY.

United States Department of Agriculture, Natural Resources Conservation Service. 2003. Plants Database. <http://plants.usda.gov>, accessed 1/29/2008.

Source: 2009 FMP Update, URS Corporation.

A.1.2 Forest Maintenance Plan Field Sheets

Appendix C, Forest Maintenance Plan Field Sheets of the FMP Update summarizes the conditions observed for each forest stand surveyed. The sheets contain detailed documentation of dominant canopy species which were used in the analysis to determine maximum growth heights for trees in stands.

A.1.3 Forest Stand Summary Table

Appendix G, Forest Stand Summary Table, includes a summary of what was found in the FMP field sheets, as well as a summary of height calculations for each forest stand. The table includes a description of the canopy (species), year 2008 tree heights, current (2008) stand heights, and future stand heights (2012). **Table A.2**, Forest Stand Summary Table is contained at the end of Appendix A.

A.2 Methodology for Determining Forest Stand Growth Rates and Maximum Tree Heights by Forest Stand

The 2005 and 2011 survey data (tree heights) needed to be projected into the critical year (2020). For surveyed trees within a forest stand, the maximum tree species height (maximum height potential for a particular species) was used as the critical-year height. However, growth rates were determined and existing tree heights were projected into the critical year. In the rare cases where the projected tree height exceeded the maximum tree species height, the projected tree height was used as the critical-year height.

A.2.1 Determining the Dominant Canopy Tree Species in Each Forest Stand

For trees in a forest stand, both the maximum tree species height and the projected height (using current height and growth rate to calculate future height) were determined by reviewing the available data listed previously. This required knowledge of tree species contained in the forest stands.

The 2009 BWI Marshall FMP Update Forest Stand Summary Table was the main source of information as it contained, among other items, dominant canopy species for each forest stand. If the Forest Stand Summary Table did not contain adequate species information for a forest stand to determine a growth rate and maximum tree species height, the FMP Update Field Sheets were consulted. Furthermore, if this was not sufficient to determine the appropriate species, judgment was used to determine the species, given the more common species in the area according to the other FMP Update Field Sheets. In cases where FMP Update Field Sheets listed tree species that were not included in the Species Data Table, judgment was used to determine a substitute tree. For example, Silver Maple was substituted with Red Maple, as researching the two species revealed similar growth and size characteristics.

A.2.2 Determining Species Characteristics of Each Forest Stand

Once the dominant canopy species of each forest stand were determined, the growth rates and maximum potential tree heights could be determined for each forest stand.

For each forest stand in Forest Stand Summary Table, it was determined that the growth rates used for the 2009 BWI FMPU were 1, 1.5 and 2 feet per year for slow-, moderate- and rapid-growing tree species, respectively. For consistency, the same growth rates were used this study.

For the growth rates, the most critical (fastest) growth rate of any dominant canopy species was used, as these trees would grow the fastest and create the greatest potential obstruction to navigable airspace.

Knowing the tree species contained in each forest stand, maximum potential tree heights were determined from **Table A.1**, Species Data Table. Of the four study sources listed in the table, the maximum (worst case) was used. Once the species-specific maximum tree heights were determined, the dominant canopy species were considered for each forest stand, and the largest maximum tree height for these species was utilized as the maximum potential tree height.

A.2.3 Applying Species Characteristics to Trees

For trees contained within forest stands, the resulting future tree height was determined by taking the maximum of the maximum tree species height or the projected tree height (using growth rates) as described in the previous section.

For trees not contained within forest stands, a projected tree height was calculated by taking the existing height and adding a conservative (high) growth rate of 2 feet per year. This methodology was applied as there was no species information contained with the tree survey data for trees outside of forest stands.

**Table A.2
Forest Stand Summary Table**

Stand	acres (mi ²)	Species Description	2007 Average Height	Topography	Wetlands	Comments	Max Topo Point	Current Stand Height	Future Stand Height	Firewood Production ²	Firewood Cost/AC	Conflict w/ 2012?	Conflict w/ 2013?	Fort 77 Conflict Runway	Existing Maintenance Concerns	Maintenance Strategy	Possible Afforestation Area (ak.)
Forest Stand Summary Table- Northwest Quadrant																	
1	10.6	Red Oak/White Oak	65-70	Sloped	Yes, and stream	Adjacent to Marc train tracks	99	169	173	290-296	N	N	N		G	I	
2	23.0	Red Maple/Sycamore	75-80	Sloped	Yes, and stream	Adjacent to Marc train tracks	93	173	181	160-240	Y	Y	N	A, F (15R-33L)	A, G	SR, I	
2A	3.5	V. Pine/ Loblolly/ White Oak	60-70	Top of ridge	No	None	127	197	218	240-296	N	N	N				
3	15.1	Red Oak/White Oak	65-70	Sloped	Yes, and stream	Adjacent to Marc train tracks	93	165	169	150-220	N	N	N		G	I	
4	0.8	Virginia Pine	20-30	Sloped	drainage ditch	None	143	198	206	180-240	Y	Y	N	T (15R-37L)	A, G	SR, I	
5	0.5	Virginia Pine	65-70	Low, flat	possible	None	130	220	228	260-280	N	N	N		G	I	
6	1.6	Chestnut Oak/Red Maple	60-65	Sloped to N	No	Old paved road through mid site	145	210	216	296+	N	N	N		G	I	
7	8.3	Virginia Pine/Chestnut Oak	60-65	Sloped	empty channel	None	137	222	228	240-296	N	N	N				
9	2.9	Tulip Poplar/Chestnut Oak	60-65	sloped	Yes, and stream	Stream mitigation site	120	205	213	160-250	Y	Y	N	T (15R-33L)	A, G	SR, I	
10	2.2	Black Locust	40-45	sloped	Yes, and stream	Stream mitigation site	99	144	152	160-200	N	N	N		G	I	
11	0.6	Black Locust	40-45	sloped	Stream	Stream mitigation site	140	185	193	220-280	N	N	N		D	RD	
12	5.4	Red Maple	30-35	Flat	Stream	None	100	155	163	140-160	Y	Y	N	T (15R-33L)	A	SR	
13	2.0	Virginia Pine	30-35	Sloped	empty channel	None	130	185	193	220-296	N	N	N		C	M	
13A	2.0	S. Red Oak/ Virginia Pine	30-35	Flat	empty channel	Underground cable line	90	125	131	160-220	N	N	N		B	T, RW	
13B	39.1	Loblolly/Red Maple/Blk. Gum	80-85	Flat	Yes, & Stone Run	Wetland of Special State Concern	90	175	183	240-296	N	N	N		G	I	
14	1.1	Virginia Pine	60-65	Sloped to W	No	None	132	197	205	180-220	Y	Y	N	T (10-28)	A, B	SR, T, RW	
15	1.7	Virginia Pine/ Red Maple	40-45	Sloped to W	Yes empty channel	None	127	172	180	200-260	N	N	N				
16	4.7	Virginia Pine	40-45	Flat	Yes empty channel	None	150	193	203	220-296+	N	N	N		R	T, RW	
17	25.2	Blk. Cherry/ Red Maple	55-60	Hilly	possible	Thick pine mat, buildings remains	168	228	236	210-296+	Y	Y	N	T (15R-33L) & (10-28)	A, B	SR, T, RW	
18	5.2	Virginia Pine	55-60	Flat	No	Thick pine mat	148	208	216	296+	N	N	N		B	T	
19	2.6	Black Locust	40-45	Flat	No	None	149	194	202	180-240	Y	Y	N	T (10-28)	A, G	SR, I	
20	2.8	Virginia Pine	35-40	Sloped	No	None	155	195	203	220-280	N	N	N		B	T, RW	
21	4.2	Red Maple	55-60	Flat	No	None	152	212	220	220-296+	N	Y	N				
22	3.3	Virginia Pine	45-50	Flat	No	None	151	201	209	220-280	N	Y	N				
23	20.2	Red Maple	60-65	Sloped	possible	None	147	212	220	200-296	Y	Y	N	T (10-28, 15R-37L)	A	SR	
24	9.2	Red Maple	50-55	Flat	Yes, and stream	None	110	165	173	140-200	Y	Y	N	T (15R-33L)	A	SR	
35	53.2	Loblolly Pine	80-85	Flat	Yes, PFO and PEM	Wetland of Special State Concern	96	181	189	160-200	Y	Y	N	A (10-28)	A, E	SR, MA	
35A	24.3	Tulip Poplar	70-75	Sloping to S	adjacent	None	100	175	187	190-200	N	N	N		D	RD	
35B	3.9	Virginia Pine	70-75	Flat	No	None	101	176	184	190-200	N	N	N		H, D	T, RW, RD	
AFA1	3.4	Big Tooth Aspen	15-20	Flat	drainage ditch	Afforestation area	109	139	137	160-220	N	N	N				
AFA2	1.2	Spruce, W. Pine, Orn. Cherry	25-30	Sloped to N	No	Afforestation area	166	196	204	240-280	N	N	N				
OS 1A	0.2	Silver Maple/White Pine	30-40	Gently Sloping	No	Former home site				296+	N	N	N		G	I	0.2
OS 1AA	0.3	Silver Maple/White Pine	30-40	Gently Sloping	No	Former home site				296+	N	N	N		G	I	0.1
OS 1B	0.3	American Elm, White Ash	30-60	Gently Sloping	No	Former home site				296+	N	N	N		G	I	0.2
OS 1C ST 1	0.9	Black Walnut, Red Maple	60-70	Sloping	Creek along N side	Former home site				296+	N	N	N		G	I	0.0
OS 1C ST 2	0.9	Black Locust, White Ash	30-40	Sloping	No	Former home site				296+	N	N	N		G	I	0.0
OS 2A ST 1	5.5	Tulip Poplar	60-60	Sloping	Creek along N side	None				296+	N	N	N		G, D	I, RD	0.0
OS 2A ST 2	1.0	Tulip Poplar, Sycamore	50-60	Sloping	Creek along N side	Afforestation near road frontage				296+	N	N	N		G	I	1.3
OS 2A ST 3	0.3	Red Maple, Black Cherry	45-50	Sloping	No	Middle of site				296+	N	N	N		G	I	0.0
OS 3A	1.7	Black Walnut, Tulip Poplar	45-50	Sloping	No	Abandoned homestead				296+	N	N	N				1.7
OS 4A	1.6	Pin Oak, Red Maple	45-50	Sloping	No	Former homestead				296+	N	N	N		G	I	1.8
OS 5A	0.3	Sycamore, Tulip Poplar	30-40	Sloping	Possible wetland area	Some light dumping on site				296+	N	N	N		G	I	0.5
OS 5B	0.3	Sycamore, Red Maple	30-40	Sloping	Intermittent channel	Former homestead				296+	N	N	N		G	I	0.4
OS 5C	0.4	Chestnut Oak, Black Locust, Tulip Poplar	60-70	Flat	Possible wetland area	Large cleared area, few large trees				296+	N	N	N		G	I	0.5
OS 6A	1.0	Mixed	50-60	Flat	Possible floodplain	Former homestead, mostly cleared				296+	N	N	N		G	I	1.0
OS 6B	0.6	Red Maple, Black Locust, Sycamore	50-60	Flat	No	Former homestead				296+	N	N	N		G	I	0.6
OS 6C	0.8	White Pine, Tulip Poplar	50-60	Flat	Yes	Former homestead				296+	N	N	N		G	I	0.5
OS 7A ST 1	2.5	Red Maple, Tulip Poplar	45-50	Gently Sloped	Small Wetland area	Former homestead				296+	N	N	N				2.4
OS 7A ST 2	0.6	Virginia Pine	45-50	Gently Sloped	No	Former homestead				296+	N	N	N				
OS 7B	0.5	Red Oak, Black Cherry, Pin Oak, Tulip Poplar, Red Maple	45-50	Gently Sloped	No	Former homestead				296+	N	N	N				0.5
OS 7C	0.5	Maple	45-50	Flat	Possible microhabitat	Former homestead				296+	N	N	N				0.8
OS 7D	1.9	Red Maple, Virginia Pine	45-50	Flat	No	forested area behind homestead				296+	N	N	N		D	RD	0.0
OS 7E	0.0	Red Maple	12-20	Flat	Small empty channel	Former homestead				296+	N	N	N				0.5
OS 7F	0.0	Mixed	60+	Flat	No	Former homestead				296+	N	N	N				0.6
OS 7G	0.0	Mixed	45-50	Gently Sloped	No	Former homestead				296+	N	N	N				1.2
OS 7H	0.0	No real canopy present	0	Flat	Wetland mitigation site	Wetland mitigation site				296+	N	N	N				0.3
OS 7I	0.0	No real canopy present	0	Flat	Wetland mitigation site	Wetland mitigation site				296+	N	N	N				0.4

**Table A.2
Forest Stand Summary Table (Cont'd)**

Stand	Size (acres)	Canopy Description	2007 Average Height	Topography	Wetlands	Comments	Max. Top Point	Current Stand Height	Future Stand Height	Firewise Restriction*	Existing Contig. C	Conflicts w/ 3017	Conflicts w/ 108-2817	Part 77 Conflicts (Rows)	Existing Maintenance Concern	Maintenance Strategy	Possible Mitigation Area (ac.)
OS 7J	1.5	Red Maple, Sycamore	55-50'	Flat	Flagged wetland	Wetland mitigation site (westerly)				296+	N	N	N		G	I	1.0
OS 7K ST1	0.9	Red Maple, Black Walnut, Black Locust	20-30'	Gently Sloped	No	None				296+	N	N	N		G	I, RW	0.0
OS 7K ST2	0.2	Virginia Pine	65-70'	Gently Sloped	No	None				296+	N	N	N			RW	0.0
OS 7K ST3	0.2	Tulip Poplar, Sycamore	70-75'	Gently Sloped	Drainage ditch	None				296	N	N	N				0.0
OS 7K ST4	4.0	Red Maple, Sycamore, White Oak	55-60'	Gently Sloped	No	Former homestead				296	N	N	N		D	RD, M	4.0
OS 8A ST1	1.1	Mixed	50-60'	Flat	No	Former homestead	165	225	233	250-260	N	Y	N	A,T(10-28)		M	1.1
OS 8A ST2	0.5	Virginia Pine	50-60'	Flat	No		175	235	243	240-245	N	Y	N	T(10-28)	G	I	0.0
OS 8A ST3	2.4	Silver Maple, Red Maple	40-50'	Flat	No	Former homestead	180	250	258	235-280	N	Y	N	A,T(10-28)		M	2.4
OS 8A ST4	1.5	Loblolly Pine	50-55'	Flat	No	Plantation	160	215	223	235-240	N	N	N				0.0
OS 8A ST5	1.0	Loblolly Pine, White Pine, Black Cherry, Black Locust	45-50'	Flat	No	None	165	215	223	230-235	N	N	N		G	I	0.0
OS 8B	0.3	Black Locust, Virginia Pine	45-50'	Gently Sloped	No	Former homestead				296+	N	N	N			M	1.0
OS 8C ST1	0.3	Loblolly Pine, Virginia Pine	30-55'	Gently sloping	No	Plantation	150	185	193	270-275	N	N	N				0.0
OS 8C ST2	0.8	Mixed	60-65'	Gently sloping	No	None	150	215	223	270-275	N	N	N		D	RD	0.1
OS 8D	0.3	Virginia Pine, Sycamore	60-65'	Gently sloping	No	Former homestead	150	215	223	265-270	N	N	N				0.0
OS 8I	1.2	Mixed	45-50'	Flat	No	Present homestead				296+	N	N	N			M	0.9
OS 8J	0.5	White Pine, Virginia Pine	25-20'	Gently Sloped	No	None				296+	N	N	N		D, G	RD, I, M	3.2
OS 8J	0.3	Black Locust	45-50'	Gently Sloped	No	Former homestead				296+	N	N	N				0.0
OS 9A ST1	1.2	Loblolly Pine, Virginia Pine	30-35'	Gently Sloped	No	Plantation	150	185	193	270-280	N	N	N				0.0
OS 9A ST2	1.3	Virginia Pine, Red Oak	70-75'	Gently Sloped	No	None	150	225	231	270-275	N	N	N		D	RW, RD	0.0
OS 9A ST3	0.6	Virginia Pine, Tulip Poplar	70-75'	Gently Sloped	No	None	140	215	223	275-280	N	N	N			RW	0.0
OS 9A ST4	2.5	Virginia Pine, Tulip Poplar	70-75'	Gently Sloped	No	None	125	200	208	275-285	N	N	N			RW	0.0
OS 9A ST5	0.9	Sycamore, Tulip Poplar	70-75'	Gently Sloped	No	None	135	210	218	275-285	N	N	N		D	RD	0.0
OS 9A ST6	1.9	Loblolly Pine	40-50'	Gently Sloped	No	Plantation	150	200	208	270-285	N	N	N				0.0
OS 9A ST7	0.8	Virginia Pine	50-60'	Gently Sloped	No	None	150	210	218	270-285	N	N	N			RW	0.0
OS 9A ST8	4.7	Virginia Pine, Red Maple, Tulip	65-70'	Gently Sloped	Yes	Drainage ditch	115	185	193	260-275	N	N	N			RW	0.0
OS 9B ST1	1.0	Loblolly Pine	40-50'	Flat	No	Plantation	145	195	203	245-255	N	N	N				0.0
OS 9B ST2	0.8	White Oak, Red Maple, Red Oak	75-80'	Gently Sloped	No	Forested area around bus maintenance facility	145	225	233	250-255	N	N	N			RW	0.0
OS 9B ST3	2.4	Red Maple, White Oak, White Ash	70-75'	Flat	Yes	Forested area around bus maintenance facility	130	205	213	255-260	N	N	N		G	I, RW	0.0
OS 9B ST4	1.7	Loblolly Pine	50-55'	Flat	No	Forested area around bus maintenance facility	140	195	203	250-265	N	N	N		G	I	0.0
OS 12A	1.0	Norway Maple, Red Maple	70-75'	Gently Sloped	No	Former homestead				296+	N	N	N		G	I	0.0
OS 12B	2.8	White Pine, Virginia Pine, Red Maple	65-70'	Gently Sloped	No	Former homestead				296+	N	N	N		D	RD	0.5
OS 12C ST1	0.1	Virginia Pine	50-60'	Flat	No	None				296+	N	N	N				0.0
OS 12C ST2	0.5	Black Cherry, Norway Maple, Silver Maple	50-60'	Flat	No	None				296+	N	N	N		G	I	1.5
OS 12C ST3	9.9	Red Maple, Tulip Poplar, River Birch	60-70'	Gently sloped	Yes	None				296+	N	N	N		G	I, RW	0.0
OS 12C ST4	2.2	Tulip Poplar, Silver Maple, Willow Oak, Cottonwood	50-60'	Gently sloped	No	Former homestead				296+	N	N	N		G, D	I, RD	3.0
OS 12C ST5	1.2	Tulip Poplar, Red Maple	60-65'	Flat	Yes	Area next to FS-13B	70	135	143	260-296	N	N	N				0.0
OS 12C ST6	1.1	Black Willow, Red Maple, Sycamore	45-50'	Gently sloped	Yes	Area next to FS-13B				296+	N	N	N		G	I	1.0
OS 12C ST7	2.1	Red Maple, S. White Oak, Tulip Poplar	50-60'	Flat	Yes	Area next to FS-13B				296+	N	N	N				0.0
OS 12D ST1	3.3	Virginia Pine, Loblolly Pine	50-55'	Flat	Small wetlands	DWI base and bike trail	85	140	148	240-295+	N	N	N		D	RD, RW	0.0
OS 12D ST2	1.0	Red Maple, Virginia Pine, Tulip Poplar	60-65'	Gently sloped	Small wetlands	Railroad right-of-way fence				296+	N	N	N				0.0
OS 12E	0.0	Red Maple	30-35'	Flat	No	Parking lot				296+	N	N	N				0.8
OS 12F	0.0	-	-	Flat	No	Parking lot and small grassy area				296+	N	N	N				0.2
Betha Property ST1	1.4	Red Maple, Black Gum	45-50'	Flat	PFO and PSM wetlands	Present homestead w/ forest behind				296+	N	N	N				2.4
Betha Property ST2	0.4	Virginia Pine	65-70'	Flat	No	Present homestead w/ forest behind				296+	N	N	N		D	RD, RW	

**Table A.2
Forest Stand Summary Table (Cont'd)**

Stand	Size (acres)	Canopy Description	2007 Average Height	Topography	Wetlands	Comments	Max Topo Foot	Current Stand Height	Future Stand Height	Flammability Restriction*	Existing Conflict?	Confined to 2015?	Confined to 10R-21L?	Part 77 Conflict Rows	Existing Maintenance Concern	Maintenance Strategy	Possible Afforestation Area (ac.)
Bothon Property ST3	2.6	Red Maple, Virginia Pine	55-60'	Flat	Yes, isolated	Present homestead w/ forest behind				295-	N	N	N		D	RD	
Forest Stand Summary Table- Southwest Quadrant																	
Stand	Size (acres)	Canopy Description	2007 Average Height	Topography	Wetlands	Comments	Max Topo Foot	Current Stand Height	Future Stand Height	Flammability Restriction*	Existing Conflict?	Confined to 2015?	Confined to 10R-21L?	Part 77 Conflict Rows	Existing Maintenance Concern	Maintenance Strategy	Possible Afforestation Area (ac.)
36	3.4	Red Maple	40-45'	Flat	Yes, PFO	Next to Marc train tracks	95	140	148	160-260'	N	N	N				
37	3.4	Red Maple	43-50'	Flat	Yes, PFO and stream	Next to Marc train tracks	92	142	150	260-296'	N	N	N				
38	1.4	Red Oak/ V. Pine/ Sweet Gum	60-65'	Flat	No	None	103	142	150	170-280'	N	N	N		C	TP	
39	11.6	V. Pine/ Tulip Poplar/ R. Maple	65-70'	Sloped	Stream & SWM	None	129	199	207	160-296'	Y	Y	N	T(10-28)	A	SR	
40	0.4	Red Maple/ Pitch Pine	50-55'	Flat	No	None	90	145	153	296+	N	N	N		C	M	
41	8.5	White Oak/ Red Maple	60-65'	Flat	Yes, PFO and stream	None	105	170	178	180-296'	N	N	N				
42	6.9	Virginia Pine/ Pitch Pine	65-70'	Rolling	No	None	142	212	220	270-296'	N	Y	N				
43	1.5	Virginia Pine/ Blk. Oak	65-70'	Sloping	Yes, adjacent	None	130	300	204	226-280'	N	N	N				
44	17.0	Pine/ S. Red Oak/ T. P. / R. Maple	65-70'	Flat	empty drainage	None	140	210	218	210-296'	Y	Y	Y	I			
45	13.2	Red Maple/ Chestnut Oak	65-70'	Sloping	Yes, PFO areas	None	143	213	219	140-220'	Y	Y	Y	P, H, I			
46	1.9	Pitch Pine	65-70'	Top of hill	No	None	145	215	223	140-180'	Y	Y	Y	P, H, T			
47	7.5	Virginia Pine/ Pitch Pine	60-65'	Flat	No	Adjacent to fire training area	151	216	224	280-296'	N	N	N		B	T, RW	
48	10.0	Red Maple	55-60'	Flat	possible PFO	None	154	214	222	220-296'	N	Y	N		F	SR, I	
49	5.2	Virginia Pine/ Pitch Pine	60-65'	Flat	No	thick pine mat	153	218	226	180-296'	Y	Y	Y	T	B	T, RW	
50	8.9	Northern Red Oak	60-65'	Sloped to N	drainage ditch	None	145	210	210	140-200'	Y	Y	Y	P, H, T			
51	21.9	V. Pine/ Red Oak/ Red Maple	65-70'	Rolling	No	None	180	350	354	160-296'	Y	Y	Y	T	F	SR	
52	2.5	R. Oak/ Blk. Locust/ Persimmon	65-70'	Flat	No	None	185	355	261	280-296'	N	N	N		F	SR	
53	0.7	V. Pine/ Black Oak	40-45'	Sloping	No	None	150	195	206	140-160'	Y	Y	Y	T			
54	5.9	Oak/ Red Maple/ Hickory	60-65'	Sloping	No	Old foundation in woods	148	215	217	140-180'	Y	Y	Y	P, H, T	F	SR	
55	1.0	S. Red Oak/ Virginia Pine	60-65'	Flat	No	None	110	175	181	150-160'	Y	Y	Y	A, T	C	TP	
56	0.8	Virginia Pine	50-65'	Steep slope	No	None	120	185	195	150-160'	Y	Y	Y	A, T	C	TP	
57	33.9	Pitch Pine/ Virginia Pine	65-70'	Sloping	Yes	None	135	205	211	140-240'	Y	Y	Y	P, A, T, H	B	T, RW	
58	6.1	Pitch Pine/ Red Maple	65-70'	Flat	Yes	None	100	165	178	140-240'	Y	Y	Y	A, T			
59	7.2	Pitch Pine/ Virginia Pine	60-65'	Flat	Stream (Clark Branch)	None	110	180	188	140-180'	Y	Y	Y	P, A, T, H	B	T, RW	
60	13.0	Red Maple/ Sweet Gum	70-75'	Sloping	drainage ditches	None	129	204	212	140-220'	Y	Y	Y	P, A, T, H			
61	3.2	Pitch Pine/ Virginia Pine	55-60'	Flat to hilly	No	None	140	200	208	180-240'	Y	Y	Y	T	C, B	TE, T, RW	
62	2.4	Pitch Pine/ V. Pine/ Red Maple	75-80'	Sloping	empty drainage	None	145	225	233	230-296'	N	Y	Y	I	C	IF	
63	26.9	Virginia Pine	75-80'	Flat to sloped	No	None	145	210	218	140-195'	Y	Y	Y	A, T	B, G	T, RW, I	
64	8.9	Virginia Pine/ Pitch Pine	35-40'	Flat	possible	Dumped materials in woods	150	196	198	296+	N	N	N		D	RD	
61A	15.8	Virginia Pine/ S. Red Oak	35-40'	Flat	No	Next to Marc train tracks	115	155	161	160-296'	N	Y	Y	A, T	B	T, RW	
65	0.4	Red Maple/ Green Ash	30-35'	Flat	No	None	150	185	193	296+	N	N	N		G	I	
66	44.0	Red Maple/ Tulip Poplar	60-65'	Flat	Yes, PFO and stream	Access road washed out at stream	135	200	208	170-296+	Y	Y	Y	T	E, G	MA, I	
67	9.4	Virginia Pine/ Black Oak	60-65'	Flat	No	None	121	186	192	210-280'	N	N	N				
68	0.9	Southern Red Oak	60-65'	Flat	No	None	125	200	204	290-230'	Y	Y	N				
69	1.2	Red Maple	50-55'	Low Flat	possible, and stream	None	115	170	178	230-260'	N	N	N		C, F, G	M, SR, I	
70	8.1	White Pine/ S. Red Oak	45-50'	Flat	No	None	70	120	126	140-220'	N	N	N		B	RW	
71	16.7	Southern Red Oak	45-50'	Flat to sloped	No	None	153	203	209	140'	Y	Y	Y	P, H			
72	5.9	Virginia Pine/ Sawtooth Oak	45-50'	Flat	No	Planted portions of site	140	190	196	140-220'	Y	Y	Y	P, H, T	D	RD	
73	1.5	Virginia Pine/ S. Red Oak	45-50'	Flat	No	None	150	200	205	140'	Y	Y	Y	P, H			
74	3.4	Red Maple	45-50'	Flat with berms	No	None	140	190	198	140-220'	Y	Y	Y	P, H, T	G	I	
75	0.8	N. Red Oak/ S. Red Oak	55-60'	Flat	No	None	145	205	209	140'	Y	Y	Y	P, H	F	SR	
76	3.6	Southern Red Oak	55-60'	Low, flat	No	None	150	210	214	140-160'	Y	Y	Y	P, H, T	F	SR	
77	12.5	Virginia Pine	55-60'	Flat	No	thick pine mat	145	205	213	140-220'	Y	Y	Y	P, A, T, H	B	T, RW	
78	1.5	Red Maple	50-55'	Low, flat	No	None	145	200	208	140-200'	Y	Y	Y	T, A (5-22)	A	C	
OS 10A ST1	1.1	Virginia Pine, Tulip Poplar White Oak, Black Gum	70-75'	Rolling	No	Part of large forested tract	155	235	243	280-296'	N	N	N				0.0
OS 10A ST2	1.3	Sycamore	75-80'	Gently sloped	Yes	Dry stream channels	135	215	233	280-296'	N	N	N				0.0
OS 10B ST1	7.4	Virginia Pine	65-70'	Gently sloped	No	None	170	240	248	265-280'	N	N	N		D, G	RD, RW, I	0.0
OS 10B ST2	1.2	Virginia Pine, Red Maple	25-30'	Flat	No	Former homestead Former limestone with large wooded tract behind	170	200	206	260-285'	N	N	N		D	RD, RW	1.9
OS 10C ST1	2.9	Virginia Pine	70-75'	Flat	No	None	170	245	253	260-280'	N	N	N				0.0
OS 10C ST2	13.4	Red Oak, Red Maple, White Oak	85-90'	Gently sloped	Yes	Former homestead with large wooded tract behind	185	275	283	260-296'	Y	Y	Y	A, T	D	RD, RW	2.3

**Table A.2
Forest Stand Summary Table (Cont'd)**

Stand	Size (acres)	Canopy Description	2007 Average Height	Topography	Wetlands	Comments	Max Topo Point	Current Stand Height	Former Stand Height	Elevation Reduction*	Existing Conflict	Conflict in 2017	Conflict w/ 10R-24L	Part 77 Conflict Row(s)	Existing Maintenance Concern	Maintenance Strategy	Possible Afforestation Area (ac.)
OS 10C S13	1.3	Virginia Pine, River Birch, Red Maple	50-55'	Flat	No	Adjacent to Ridge Road	185	220	228	230-236	N	N	N		G	I	0.0
OS 10D	0.0	Virginia Pine	15-20'	Gently sloped	No	Former homestead, mostly cleared				296-	N	N	N		D, G	RD, I, M	4.3
OS 10E	0.0	Norway Spruce, Blue Spruce	5-10'	Flat	No	Former homestead, not forested area				296-	N	N	N			M	1.6
OS 14A	2.1	Red Maple, Virginia Pine, Willow Oak, Chestnut Oak,	50-55'	sloped	Flagged wetland	Former homestead	175	230	238	240-250	N	N	N		D, G	RD, I	0.7
OS 14B ST1	3.9	Sweet Gum, Tulip Poplar	70-75'	Flat	No	Former homestead	205	280	288	235-250	Y	Y	Y		D	RD	0.6
OS 14B ST2	0.2	Virginia Pine	70-75'	Flat	No	None	215	290	298	230-245	Y	Y	Y	A		RW	0.0
OS 14B ST3	0.3	American Holly	75-40'	Flat	No	None	185	225	251	240-245	N	N	N			T	0.0
OS 14B ST4	1.4	River Birch, Black Cherry	35-40'	Flat	No	Old foundation in woods	200	240	248	235-240	Y	Y	Y	A	D	RD	0.0
OS 14B ST5	1.8	Virginia Pine, Red Oak	65-70'	Gently sloped	No	None	195	265	271	230-235	Y	Y	Y	A	D, G	RD, I	0.0
OS 14B ST6	0.3	Red Maple, Red Oak, Green Ash, Sweet Gum	45-50'	Flat	No	Old fence row	185	225	233	235-245	N	N	N			M	4.4
OS 14C ST A	2.6	Virginia Pine, Chestnut Oak, Sweet Gum, Pin Oak	70-75'	Flat	No	Former Ridgewood MHP	183	266	268	240-250	Y	Y	Y	A			0.0
OS 14C ST B	4.6	Red Maple	40-45'	Gently sloped	Yes	Former Ridgewood MHP	185	250	258	245-265	N	N	N		G, D	I, RD	0.0
OS 14C ST C	0.9	Virginia Pine, Red Maple, Persimmon	50-55'	Flat	No	Former Ridgewood MHP	175	250	258	250-255	N	N	N		G	I	0.0
OS 14C ST D	2.6	Virginia Pine, Red Maple, Magnolia Hickory	50-55'	Gently sloped	No	Former Ridgewood MHP	165	220	228	255-270	N	N	N		G	I	0.0
OS 14C ST E	5.0	Red Maple, Sweet Gum, Black Locust, Black Cherry	50-55'	Gently sloped	Yes	Former Ridgewood MHP	160	215	223	260-280	N	N	N		G, D	I, RD	0.0
OS 14C ST F	5.6	White Oak, Tulip Poplar, Virginia Pine, Loblolly Pine	75-80'	Flat	No	Former Ridgewood MHP	160	240	248	265-280	N	N	N				0.0
OS 14C ST G	1.5	Red Maple, Sweet Gum, Sassafras, Black Cherry	50-55'	Gently sloped	Yes	Former Ridgewood MHP	155	210	218	270-280	N	N	N		G	I	0.0
OS 14C ST H	11.3	Virginia Pine, Pin Oak, N. Red Oak	75-80'	Gently sloped	Yes	Former Ridgewood MHP	165	245	253	265-285	N	N	N		D	RD, RW	0.0
OS 14C ST J	5.8	Virginia Pine	75-80'	Gently sloped	No	Former Ridgewood MHP	165	245	251	275-2785	N	N	N				0.0
OS 14C ST K	4.1	Virginia Pine	75-80'	Gently sloped	No	Former Ridgewood MHP	175	255	263	260-275	N	Y	Y	A		RW	0.0
OS 14C ST L	6.7	Red Maple, Sweet Gum, Black Cherry	60-70'	Gently sloped	No	Former Ridgewood MHP	220	290	298	250-270	Y	Y	Y	A	D	RD	0.0
OS 14C ST M	1.6	Virginia Pine, Loblolly Pine, Black Cherry	60-70'	Gently sloped	No	Former Ridgewood MHP	215	285	295	245-255	Y	Y	Y	A	D, G	RD, I	0.0
OS 14C ST N	4.9	Virginia Pine, Red Maple	50-55'	Flat	No	Former Ridgewood MHP	170	225	253	255-270	N	N	N			RW	0.0
OS 14C	0.0					Former Ridgewood MHP											27.7

Forest Stand Summary Table- Northeast Quadrant																	
Stand	Size (acres)	Canopy Description	2007 Average Height	Topography	Wetlands	Comments	Max Topo Point	Current Stand Height	Former Stand Height	Elevation Reduction*	Existing Conflict	Conflict in 2017	Conflict w/ 10R-24L	Part 77 Conflict Row(s)	Existing Maintenance Concern	Maintenance Strategy	Possible Afforestation Area (ac.)
8	3.9	Virginia Pine/Red Maple	30-35'	Sloped	No	None	156	191	199	190-260	Y	Y	N	T (15L-33R)	A	SR	
25	4.8	White Oak/Red Maple	65-70'	Flat	Yes	None	195	265	271	170-240	Y	Y	N	T (15L-33R)	A, D, G	SR, I, RD	
26	14.0	Virginia Pine/Red Maple	50-55'	Flat	Drainage & stream	None	160	215	223	240-295+	N	N	N		G	I	
27	5.6	S. Red Oak	50-55'	Flat	possible	None	130	185	189	220-260	N	N	N		G	I	
28	1.0	Bk. Cherry/ R. Oak/ Bk. Oak	60-65'	Flat	No	None	141	206	210	200-220	Y	Y	N	T, A (4-22)	A, B, G	C, T, I	
29	9.7	V. Pine/ Oak/ Red Maple	60-65'	Flat	No	None	128	193	204	160-260	Y	Y	N	T (15L-33R)	A, G	SR, I	
30	3.4	V. Pine/Oak	65-70'	Flat in hilly	No	Looks like old home site	135	205	209	140-180	Y	Y	N	T (15L-33R)	A, B	SR, T, RW	
31	0.7	Oak/Hickory/ Tulip Poplar	70-75'	Sloped	No	None	110	183	189	140-180	Y	Y	N	T (15L-33R)	A, G, F	SR, I	
32	0.4	Oak/Hickory/ V. Pine	55-60'	Flat	No	None	110	170	176	160-180	Y	Y	N	T (15L-33R)	A	SR	
33	1.8	White Oak/ S. Red Oak	65-70'	Flat	No	Former MAA picnic area	100	170	174	120-180	Y	Y	N	T (15L-33R)	A	SR	
34	5.5	Tulip Poplar	70-75'	Flat	Stream	None	95	170	178	120-200	Y	Y	N	T (15L-33R)	A, C, G	SR, M, R, I	
115	2.2	V. Pine/Oak/T. P. R. Maple	55-60'	Flat	Stream	Outfall from SWM on site	85	145	156	120-160	Y	Y	N	T (15L-33R)	C, B, D	M, RW, RD	
AFA3	0.5	N/A	0	Flat	No	Not planted site	165	165	165	180	N	N	N				
AFA4	1.9	W. Pine, Spruce, Orn. Cherry	20-25'	Hill side	drainage ditch	Afforestation area	142	167	175	240-296+	N	N	N			I	
AFA5	5.7	Scotch Pine, White Pine	20-25'	Sloped	No	Afforestation area	136	161	169	210-250	N	N	M		G	I	
OS 15 ST 1	1.1	Virginia Pine, S. Red Oak	60-70'	Sloped	No	None	175	245	253	215-235	Y	Y	N	A (15L-33R)	A, G	SR, I	0.0
OS 15 ST 2	3.1	Big Tooth Aspen, Black Cherry, S. Red Oak, Virginia Pine,	45-50'	Flat	No	None	205	255	263	215-230	Y	Y	N	A (15L-33R)	A, G	SR, I	0.0
OS 15 ST 3	1.1	Virginia Pine, Red Maple	35-40'	Flat	No	None	200	240	248	220-230	Y	Y	N	A (15L-33R)	A	SR, T	

**Table A.2
Forest Stand Summary Table (Cont'd)**

Stand	Size (acres)	Canopy Description	2007 Average Height	Topography	Wetlands	Comments	Max Topo Point	Current Stand Height	Future Stand Height	Elevation (Feet/ASL)*	Soil-type Conflicts?	Conflicts in 2012?	Conflicts in 2013-14?	Fire 77 Conflict (Dunn)	Existing Maintenance Concern	Maintenance Strategy	Possible Afforestation Area (ac.)
OS 15 ST 4	3.8	Virginia Pine, Red Oak, Big Tooth Aspen, Tulip Poplar	70-75	Gently Sloping	No	None	210	285	293	225-240	Y	Y	N	A (15L-33R)	A, G	SR, RW, I	0.0
OS 15 ST 5	3.5	Virginia Pine	60-70	Gently Sloping	No	None	200	270	278	225-240	Y	Y	N	A (15L-33R)	A, G	SR, RW, I	0.0
Forest Stand Summary Table- Southeast Quadrant																	
Stand	Size (acres)	Canopy Description	2007 Average Height	Topography	Wetlands	Comments	Max Topo Point	Current Stand Height	Future Stand Height	Elevation (Feet/ASL)*	Soil-type Conflicts?	Conflicts in 2012?	Conflicts in 2013-14?	Fire 77 Conflict (Dunn)	Existing Maintenance Concern	Maintenance Strategy	Possible Afforestation Area (ac.)
79	0.6	Black Locust	35-40'	Flat	No	None	159	194	199	180-220'	Y	Y	N	T (4-22)	A, G	R, I	
80	3.1	Red Maple	60-65'	Rolling	empty drainage	None	120	185	198	140'	Y	Y	Y	P, H (and 15R-33L)	A, G	C or R, I	
81	1.7	Virginia Pine/Red Maple	60-65'	Rolling with some	empty drainage	None	125	190	203	140'	Y	Y	Y	P, H (and 15R-33L)	A	C or R	
82	12.4	Virginia Pine/S. Red Oak	25-30'	Flat	No	None	100	130	136	150-200'	N	N	N		G	I	
82A	3.7	V. Pine/S. Red Oak/Blk. Cherry	20-25'	Flat	No	None	85	110	118	160-180'	N	N	N		E, G	MA, I	
82B	5.8	Virginia Pine	30-35'	Flat	No	None	95	130	138	150-170'	N	N	N		B	T, RW	
83	3.9	R. Maple/Tulip Poplar/AW Oak	65-70'	Flat	Yes PFO & PEM	None	142	212	220	163-170'	Y	Y	Y	A	G	I	
84	5.8	Red Maple	55-60'	Flat	possible, & Phelps Hr.	Access road through site	96	156	164	170-220'	N	N	N		E, F, G	MA, SR, I	
85	21.3	Virginia Pine	55-60'	Flat to sloped	No	thick pine mat	127	187	195	169-240'	Y	Y	Y	A, T (and 15R-33L)	B, F	T, RW, SR	
86	4.2	Virginia Pine	60-65'	Flat to sloped	No	None	105	170	178	180-220'	N	N	Y	A, T (and 15R-33L)			
87	1.1	Virginia Pine/Red Maple	60-65'	Flat	No	Power lines through site	110	175	185	180-260'	N	Y	Y	A, T (and 15R-33L)	H	MA	
88	10.2	Southern Red Oak	60-65'	Flat	No	None	110	175	179	180-240'	N	N	N		D	RD	
89	5.1	Virginia Pine	60-65'	Flat	No	None	131	196	204	160-240'	Y	Y	N	I (15R-33L)	A	SR	
90	15.2	Virginia Pine	53-60'	Rolling	No	None	153	193	201	220-296'	N	N	N		B	T, RW	
91	1.4	Persimmon/R. Maple/Cherry	60-65'	Sloped	empty drainage	None	131	196	204	280-296'	N	N	N		F	SR	
92	0.9	V. Pine/S. Red Oak/N. Red Oak	60-65'	Flat	No	None	110	175	181	220-260'	N	N	N		B	T, RW	
93	0.6	Oak/R. Maple/Blk. Cherry	35-40'	Rolling	No	None	110	150	154	240-280'	N	N	N		F	SR	
94	0.7	V. Pine/S. Red Oak/R. Maple	55-60'	Flat	No	None	105	165	173	260-296'	N	N	N		B	RW	
95	2.3	V. Pine/N. Red Oak/S. Red Oak	60-65'	Flat	No	None	97	162	173	220-296'	N	N	N		B, F	RW, SR	
96	2.0	Virginia Pine/S. Red Oak	65-70'	Flat	No	Power lines through site	115	185	191	230-280'	N	N	N		B	RW	
97	1.3	Virginia Pine/S. Red Oak	40-45'	Flat	No	None	125	170	176	180-240'	N	N	N				
98	1.1	Virginia Pine	50-55'	Flat	No	None	120	175	183	210-240'	N	N	N				
99	12.6	Oak/Hickory	50-55'	Rolling	No	None	130	185	180	160-296+	Y	Y	Y	T (15L-33R)			
100	1.5	Virginia Pine	60-65'	Flat to Rolling	No	None	125	190	198	260-296+	N	N	N		H	T, RW	
101	16.8	Virginia Pine/S. Red Oak	60-65'	Flat	No	None	130	195	201	160-296+	Y	Y	N	T, A (15L-33R)	A	SR	
102	1.0	Virginia Pine	40-50'	Flat	No	None	135	185	191	200-240'	N	N	N		B	T, RW	
103	6.9	Southern Red Oak	65-70'	Flat	empty channel	None	115	185	191	140-220'	Y	Y	N	A, T (15L-33R)	A	SR	
104	5.1	Virginia Pine	40-45'	Flat	No	None	105	150	158	140-170'	Y	Y	N	A (15L-33R)	A	SR	
105	15.0	Oak/V. Pine/R. Maple/Pitch	60-65'	Sloped	No	None	105	165	170	140-180'	Y	Y	N	A (15L-33R)	A, B	SR, RW	
106	4.4	V. Pine/S. Red Oak	60-65'	Flat	No	Afforestation area adjacent	120	185	191	200-260'	N	N	N		B	SR	
107	4.5	Blk. Oak/S. Red Oak/V. Pine	45-50'	Flat	No	None	122	172	178	176-240'	Y	Y	N	A, T (15L-33R)	A, B	SR, RW	
108	3.0	Oak/V. Pine	60-65'	Flat	No	None	110	175	181	200-240'	N	N	N				
109	6.0	V. Pine/Black Oak	50-55'	Flat	No	None	110	165	173	180-220'	N	N	N				
110	1.3	V. Pine/Red Oak/Black Oak	60-65'	Flat	No	None	88	153	157	180'	N	N	N				
111	2.2	S. Red Oak/ Virginia Pine	50-55'	Flat	No	None	85	140	146	180-210'	N	N	N				
112	0.5	Virginia Pine	40-45'	Flat	No	Afforestation area adjacent	85	130	138	210'	N	N	N				
113	2.6	Virginia Pine	55-60'	Flat	No	Some dumping of tree material	85	145	153	190-200'	N	N	N		B, D	T, RW, RD	
114	3.8	White Pine/Oak/R. Maple	55-60'	Flat	No	None	97	152	160	140-180'	Y	Y	N	A (15L-33R and 10-28)	A, F	C, SR	
AFA6	1.9	V. Pine/W. Pine, Spruce	20-25'	Flat	No	Afforestation area	105	139	138	180'	N	N	N				
AFA7	9.9	White Pine	20-25'	Flat	No	Afforestation area	135	160	168	180-210'	N	N	Y	A, T			
AFA8	5.7	Hedge Maple/Pine, H. Pear	15-20'	Flat	No	Afforestation area	158	178	186	140-200'	Y	Y	Y	P, H, A, T			
OS 16 ST 1	0.4	Tulip Poplar, White Oak, Red Maple, S. Red Oak, Virginia Pine	60-70'	Gently Sloping	large emergent wetland	Powerline ROW	40	110	118	280-296	N	N	N				0.0
OS 16 ST 2	0.1	Red Maple, Black Willow	20-30'	Stream Bank	large emergent wetland	Powerline ROW	40	70	78	270-285	N	N	N				0.0
OS 16 ST 3	1.3	Tulip Poplar, Red Maple, S. Red Oak, Virginia Pine, Black Gum	55-60'	Gently Sloping	large emergent wetland	Powerline ROW	45	105	113	230-235	N	N	N				0.0
OS 17A	0.0	Alantibus	15-20'	Flat	No	Grassy field with small stand of Alantibus	80	100	108	160	N	N	N		M		0.0
OS 17B ST 1	0.6	Virginia Pine	30-40'	Gently Sloping	No	State Police Barracks	103	140	148	185-190	N	N	N				0.0

**Table A.2
Forest Stand Summary Table (Cont'd)**

Stand	Size (Acres)	Canopy Description	SWT Average Height	Topography	Wetlands	Comments	Max Tree Foot	Current Stand Height	Canopy Store Height	Season (6/20/100)*	Isotopy Corridor	Canfield in 70 (77)	Canfield in 100 (81)	Part 77 Classified Parkway	Longline Maintenance Category	Maintenance Strategy	Possible Afforestation Area (ac.)
OS 17B ST 2	2.3	Red Oak, White Oak, Mockernut, Hickory	65-70	Flat	No	State Police Barracks	90	160	168	190-205	N	N	N		F	SR	0.0
OS 17B ST 3	0.7	Virginia Pine	90-65	Flat	No	State Police Barracks	75	140	148	195-220	N	N	N			RW	0.0
OS 18A	0.1	Mixed	30-40	Flat	No	Mostly empty field	90	130	134	190	N	N	N			M	0.5
OS 18B ST 1	1.7	Mixed	65-70	Flat	No	Former nursery/residential	90	160	164	195-215	N	N	N		F	SR	1.0
OS 18B ST 2	1.8	Tulip Poplar	85-90	Gently Sloping	No	Stream fringe	75	165	169	195-215	N	N	N		G, D	I, RD	0.0
OS 18B ST 3	0.6	Black Willow, Red Maple	90-45	Gently Sloping	Yes, PFO & PFM	Stream fringe	70	115	119	195-210	N	N	N				0.0
OS 18B ST 4	1.0	Chestnut Oak, White Oak	55-60	Gently Sloping	No	former homestead	75	135	139	195-200	N	N	N			M	0.0
OS 18C ST 1	0.3	Black Locust	30-35	hilly	Roadside drainage	Corner of Dorsey & Stewart	75	110	118	220-225	N	N	N		G	I	0.0
OS 18C ST 2	0.1	Black Willow	45-50	Flat	Yes, PFO & PFM	Corner of Dorsey & Stewart	60	110	118	210-220	N	N	N		F, G	I	0.0
OS 18C ST 3	0.3	S. Red Oak, Black Walnut	45-50	Flat	No	Corner of Dorsey & Stewart	70	120	128	200-210	N	N	N				0.0
OS 18D ST 1	2.4	Red Maple, S. Red Oak, Black Locust	20-55	Flat	No	Former homestead	55	150	158	205-215	N	N	N				0.0
OS 18D ST 2	0.6	Virginia Pine, S. Red Oak	65-65	Flat	No	Former homestead	90	155	163	210-215	N	N	N			RW	0.0
OS 18D																	1.8
OS 18E	0.9	Red Oak, Virginia Pine	25-30	Flat	Roadside drainage	Residential/ commercial use site	90	120	128	220-230	N	N	N				0.0
OS 18F	0.4	Mixed	40-45	Flat	No	Former homestead	85	130	136	225-225	N	N	N		F	SR, M	1.2
OS 18G	0.0	Red Oak, Pin Oak, Red Maple	45-50	Flat	No	Former homestead	80	130	134	230-225	N	N	N		F	SR, M	1.7
OS 18H ST 1	0.9	Virginia Pine	20-25	Flat	No	Former homestead	80	105	109	215-225	N	N	N		F	T	0.0
OS 18H ST 2	0.2	Virginia Pine, Red Oak	75-80	Flat	No	Former homestead	75	155	159	220-225	N	N	N		D	RD	0.0
OS 18H ST 3	1.7	Virginia Pine, S. Red Oak	50-60	Gently Sloping	No	Former homestead	95	155	159	210-220	N	N	N		D	RD	0.0
OS 18H ST 4	1.2	Red Oak, Virginia Pine	50-60	Flat	No	Former homestead	80	140	144	210-215	N	N	N		D	RD	0.0
OS 18H																M	3.2
OS 19A/B	40.4	Tulip Tree, Red Maple, Virginia Pine, S. Red Oak, White Pine, White Oak	70-80	Gently Sloping	Streams, wetland	Large wooded lot	100	180	188	165-296	Y	Y	N	A, T (15R-33L)	A, F	SR	0.0
OS 19C	0.7	Tulip Tree, Red Maple	60-65	Gently Sloping	Streams, wetland	Former homestead	70	135	143	180-190	N	N	N		F	M, SR	0.1
OS 19D	0.6	Tulip Tree, Red Maple	60-65	Gently Sloping	Streams, wetland	Former homestead	70	135	143	180-185	N	N	N		F	M, SR	0.3
OS 19E	0.0	Red Maple, S. Red Oak	40-45	Flat	No	Former roadside	85	140	148	205	N	N	N			M	0.3
OS 20A ST 1	2.0	Virginia Pine	60-70	Flat	No	Disturbed Site	135	205	211	140-296	Y	Y	Y, T		D, A	RD, RW	0.6
OS 20A ST 2	0.9	Tree of Heaven	30-40	Flat	No	Disturbed Site	150	170	176	150-220	Y	Y	Y, T		G, A	SR, I	0.0
OS 20A ST 3	3.9	S. Red Oak, Virginia Pine	35-40	Flat	No	Disturbed Site	130	170	176	200-296	N	N	N		D	RD, T	0.0
OS 20B	0.0	Mixed- Disturbed Area	15-25	Flat	No	Mostly cleared/ mowed area	140	165	171	140-160	Y	Y	Y, T		A	M, SR	0.5
OS 20C	0.0	Mixed- disturbed area	15-25	Flat	No	Mostly cleared/ mowed area	140	165	171	140-230	Y	Y	Y, T		A	M, SR	1.5
OS 20D ST 1	0.8	Virginia Pine	75-80	Flat	No	None	150	210	218	140-170	Y	Y	Y, T		A	RW, SR	0.0
OS 20D ST 2	0.5	Red Maple, Tree of Heaven	45-50	Flat	No	None	150	180	188	150-180	Y	Y	Y, T		G, A	I	0.0
OS 20E	0.7	S. Red Oak	70-75	Flat	No	None	130	205	209	140	Y	Y	Y, P, T		A	SR	0.0
OS 20F	0.0	Mixed	15-25	Flat	No	None	135	160	166	160-200	Y	Y	Y, T		A	SR	0.8
OS 20G	0.2	S. Red Oak	75-80	Flat	No	Former homestead	120	200	206	160-180	Y	Y	Y, T		A	SR	0.2
OS 20H	0.3	Virginia Pine	60-70	Flat	No	Disturbed Site, some dumping	120	190	196	190-205	Y	Y	Y, T		A	SR	0.0
OS 20I		Virginia Pine, Atlantans	30-35	Flat	No	Loc behind current residence	115	140	145	210-220	N	N	N			M	0.2
OS 20J	0.2	V. Pine, Atlantans, HT, Aspen	25-30	Flat	No	None	115	145	153	175-190	N	N	N		F, G	SR, I	0.0
OS 20K	0.4	Virginia Pine	40-45	Flat	No	None	110	155	161	210-240	N	N	N		F, G	SR, I	0.0

LEGEND

Maintenance Category:	Maintenance Strategy:	Part 77 Parkway:
A- Part 77 Hand Paved	R- Removal	T- Transitional
	SR- Selective Removal	A- Approach
	C- Conversion	P- Primary
B- Fire Hazard:	RW- Removal of downed woody debris	H- Horizontal
	T- Thinning of stand	
C- Fence Obstruction:	M- Mowing	
	TP- Thinning of trees along fence line	
D- Dumped Materials:	RD- Removal of Dumped material	
E- Access Road:	MA- Maintain Access Road	
F- Wildlife Attraction:	SR- Selective Removal	
G- High % Invasive Species:	I- Removal of Exotic Invasives	

Source: 2009 FMP, URS Corporation.

Appendix B – Obstruction Analysis Assumptions and Results

B.1 Introduction

This section reviews obstacle clearance criteria for each surface and summarizes surface penetration analysis results by runway end. It should be noted that the results by runway end include all surveyed points and have not been modified to exclude points for the RSA obstruction removal projects. Additionally some points are counted as obstructions under multiple runways where surfaces overlap.

Regulations defining the size, shape, and location of each study surface have also been included for future reference. Please note that figures in this appendix are for illustration purposes only and are not to scale.

B.2 Key Parameters and Study Surface Regulations

This section presents key parameters and criteria for the study surfaces as defined by the FAA or ICAO. A computer-based modeling application was developed to analyze object locations and heights to determine whether they penetrate the study surfaces. It investigated whether an obstacle falls into and penetrates the study surface and then calculates the amount of penetration per object identified.

B.2.1 Study Runways

Obstacles were examined for the following runways (study runways):

- Runway 10-28
- Runway 15R-33L
- Runway 15L-33R

See **Table B.1** for the latitude, longitude, and elevations (above MSL) of the study runways and displaced thresholds by runway end.

Table B.1**Study Runway and Displaced Threshold Coordinates and Elevations**

Runway	Latitude	Longitude	Elevation (ft)
10	N39 10 29.0898	W76 41 22.6260	139.0
28	N39 10 21.4755	W76 39 09.6336	126.2
15R	N39 11 07.3006	W76 40 55.1730	138.6
33L	N39 09 51.1323	W76 39 44.6142	129.2
15L	N39 11 14.5443	W76 39 48.7449	141.5
33R	N39 10 34.4480	W76 39 11.6300	114.1
RWY 10 DT (a)	N39 10 28.6922	W76 41 15.6638	141.2
RWY 28 DT (a)	N39 10 21.9840	W76 39 18.4928	129.8
RWY 15R DT (a)	N39 11 04.8955	W76 40 52.9443	137.8
RWY 33L DT (a)	N39 09 55.1412	W76 39 48.3266	131.2
Airport Reference Point	N39 10 32.6200	W76 40 08.3730	141.5

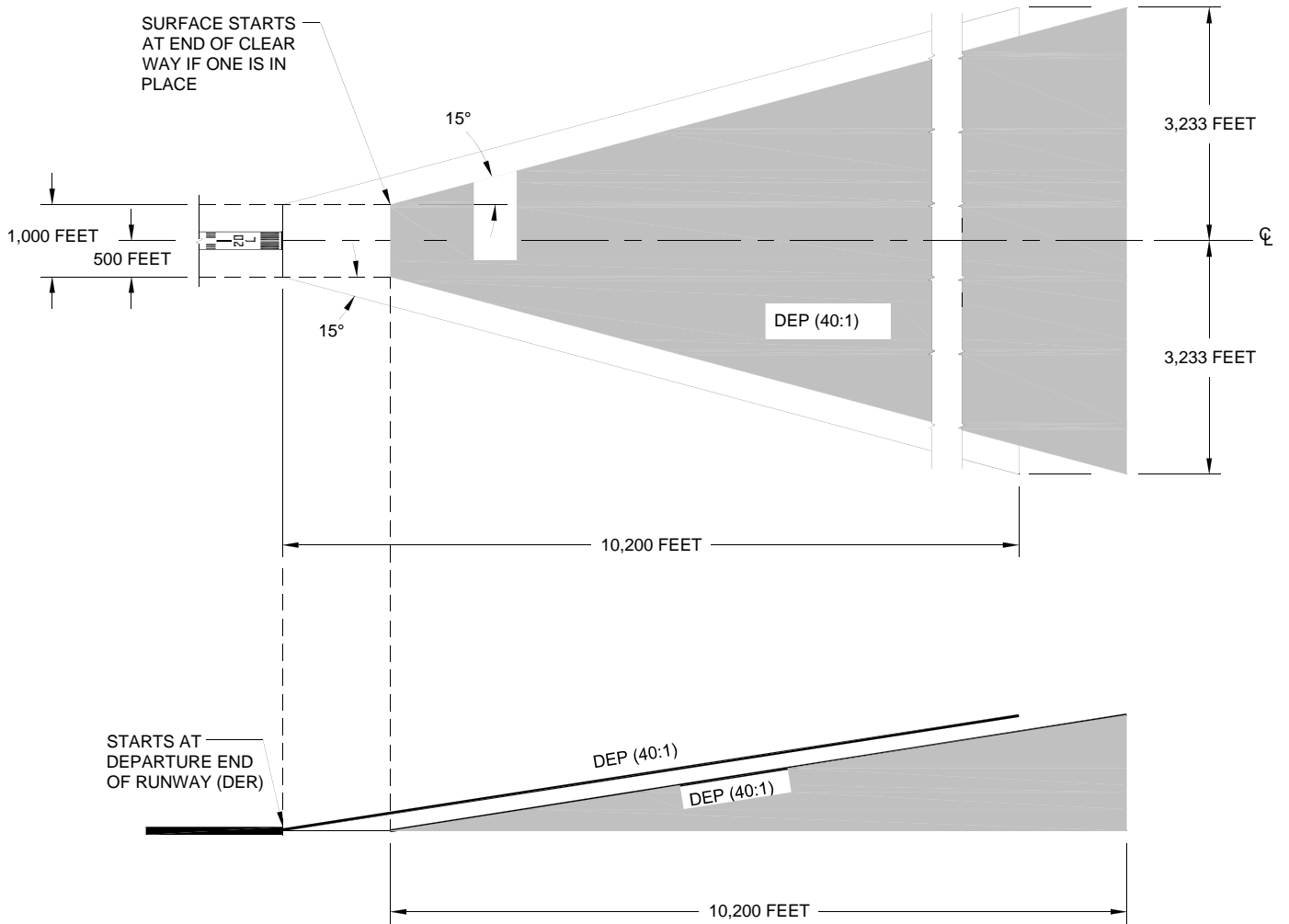
Note (a): DT - Displaced Threshold.

Source: BWI Marshall Airport Layout Plan (ALP), February 2011.

B.2.2 Departure Obstacle Clearance Surface (OCS)

The departure OCS is defined as a volume of airspace above the extension of the runway centerline which allows pilots to follow standard departure procedures when clear. It starts at the far end of the clearway at the elevation of the clearway at that point. The clearway is the area that extends beyond the runway end available for the completion of takeoff operations of turbine-powered aircraft. For runways without a designated clearway, the departure OCS starts at the end of the Takeoff Distance Available (TODA), also called the Departure End of the Runway (DER), at the elevation of the DER. It employs a trapezoid shape and extends along the runway centerline at a slope of 40 (horizontally) to 1 (vertically). Its shape and clearance criteria are defined in FAA Advisory Circular (AC) 150/5300-13a, Paragraph 303c: 'Departure Surfaces'. **Figure B-1** shows, in detail, the departure OCS surface size, shape and orientation.

Figure B-1: Departure OCS Surface for Instrument Runways (40:1).

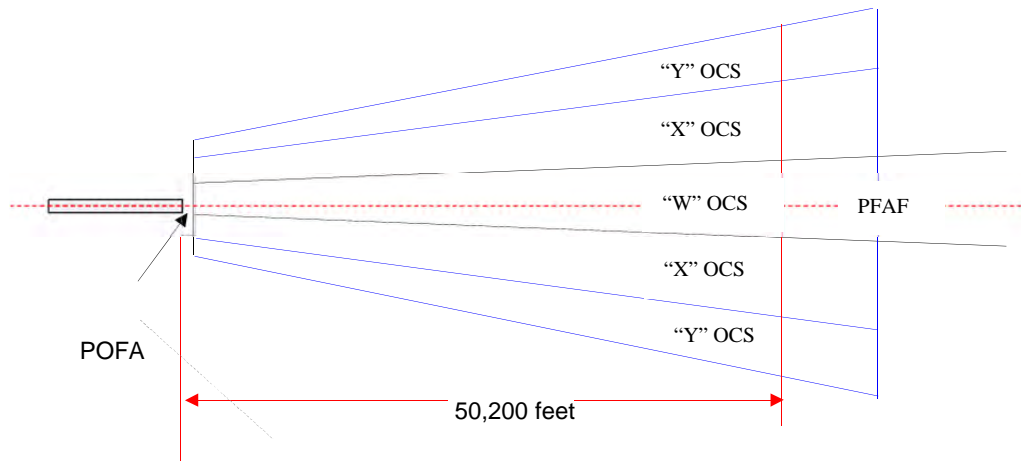


Source: FAA Advisory Circular (AC) 150/5300-13a, Figure 3-4.

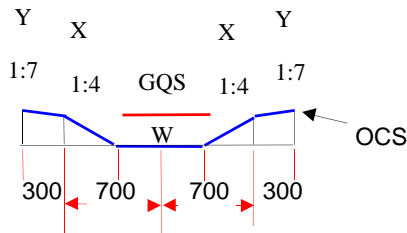
B.2.3 Terminal Instrument Procedures (TERPS) Approach Surface

Approach surfaces are designed to allow pilots to approach airport runways in both visual and instrument conditions. The TERPS approach surface protects the use of the runway under instrument conditions. As all the study runways are equipped with ILS to provide precision instrument guidance, the TERPS 34:1 approach surface applies. It consists of three OCS surfaces, the W, X, and Y surfaces. The surfaces start 200 feet from the approach threshold and end at the Precision Final Approach Fix (PFAF) (shown in **Figure B-2**). The TERPS Approach Surface shape and clearance criteria are defined in the FAA Order 8260.3B: "United States Standard for Terminal Instrument Procedures (TERPS)".

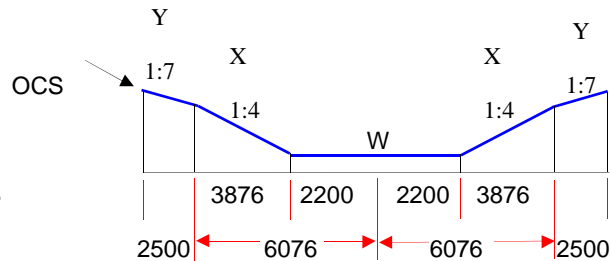
Figure B-2: TERPS Approach Surface (34:1).



Cross Section at
200 feet from RWT



Cross Section at
50200 feet from RWT



Source: FAA Order 8260.3B, Figure 3-1.

B.2.4 Precision Approach Path Indicator (PAPI) Obstacle Clearance Surface (OCS)

The PAPI lighting system provides visual approach slope guidance. It is usually installed 50 feet from the left runway edge when the optical system is viewed from the approach zone. The dimensions of the PAPI OCS is defined in the FAA AC 150/5340-30g, Paragraph 7.5.d.(4): 'PAPI Obstacle Clearance Surface (OCS)'. The PAPI OCS starts 300 feet from the PAPI system. **Table B.2** shows the distance from PAPI systems to runway ends and PAPI OCS slopes for each study runway. The surface splays 10 degrees to either side of the extended runway centerline and projects four statute miles from its point of origin. It is projected into the approach zone one degree less than the aiming angle of the third light unit from the runway for an L-880 system, or the outside light unit for L-881 system. In this study, the PAPI OCS is analyzed at slopes of 1° 45' (1.75 degrees) for runway 10/28 and 15R/33L and 1° 50' (1.83 degrees) for runway 15L/33R. **Figure B-3** shows the dimension of PAPI OCS surface.

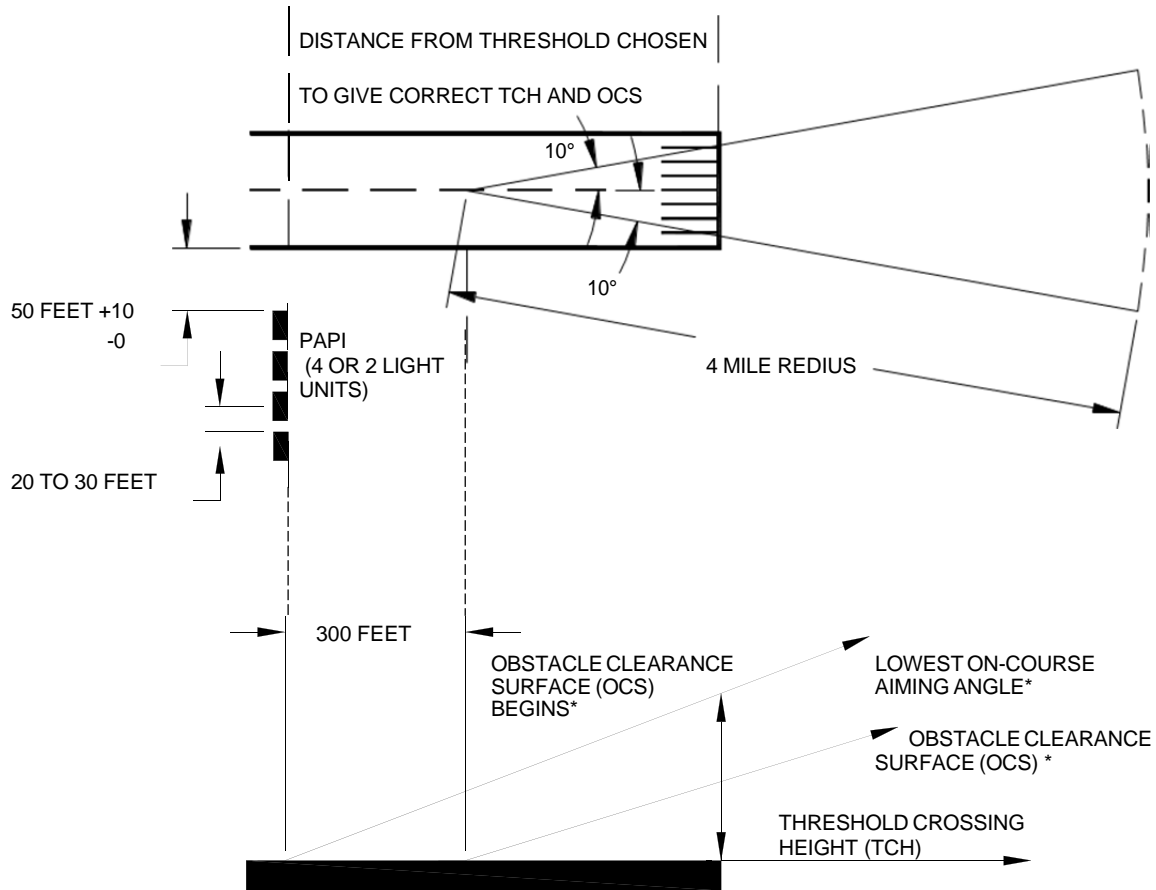
Table B.2

Distance between PAPI Systems and Runway Ends and PAPI OCS Slopes.

RWY ID	PAPI Distance to RWY End (ft)	PAPI OCS Slope (Degrees)
10	1,894	1.75
28	2,004	1.75
15R	1,707	1.75
33L	1,755	1.75
15L	1,100	1.83
33R	902	1.83

Source: HNTB Corporation.

Figure B-3: PAPI OCS Dimension.



PAPI OCS ANGLE = LOWEST ON-COURSE AIMING ANGLE - 1 DEGREE

NOTES:

1. THE VISUAL GLIDE PATH ANGLE IS THE CENTER OF THE ON-COURSE ZONE, AND IS A NOMINAL 3 DEGREES WHEN MEASURED FROM THE HORIZONTAL SURFACE OF THE RUNWAY.
 - A. FOR NON-JET RUNWAYS, THE GLIDE PATH MAY BE RAISED TO 4 DEGREES MAXIMUM TO PROVIDE OBSTACLE CLEARANCE.
 - B. IF THE PAPI GLIDE PATH IS CHANGED TO A HIGHER ANGLE FROM THE NOMINAL 3 DEGREES, IT MUST BE COMMUNICATED IN A NOTICE TO AIRMAN (NOTAM) AND PUBLISHED IN THE AIRPORT FACILITY DIRECTORY.
2. PAPI OBSTACLE CLEARANCE SURFACE (OCS).
 - A. THE PAPI OCS PROVIDES THE PILOT WITH A MINIMUM APPROACH CLEARANCE.
 - B. THE PAPI MUST BE POSITIONED AND AIMED SO NO OBSTACLES PENETRATE ITS SURFACE.
 - (1) THE OCS BEGINS 300 FEET [90M] IN FRONT OF THE PAPI SYSTEM.
 - (2) THE OCS IS PROJECTED INTO THE APPROACH ZONE ONE DEGREE LESS THEN AIMING ANGLE OF THE THIRD LIGHT UNIT FROM THE RUNWAY FOR AN L-880 SYSTEM, OR THE OUTSIDE LIGHT UNIT FOR AN L-881 SYSTEM.

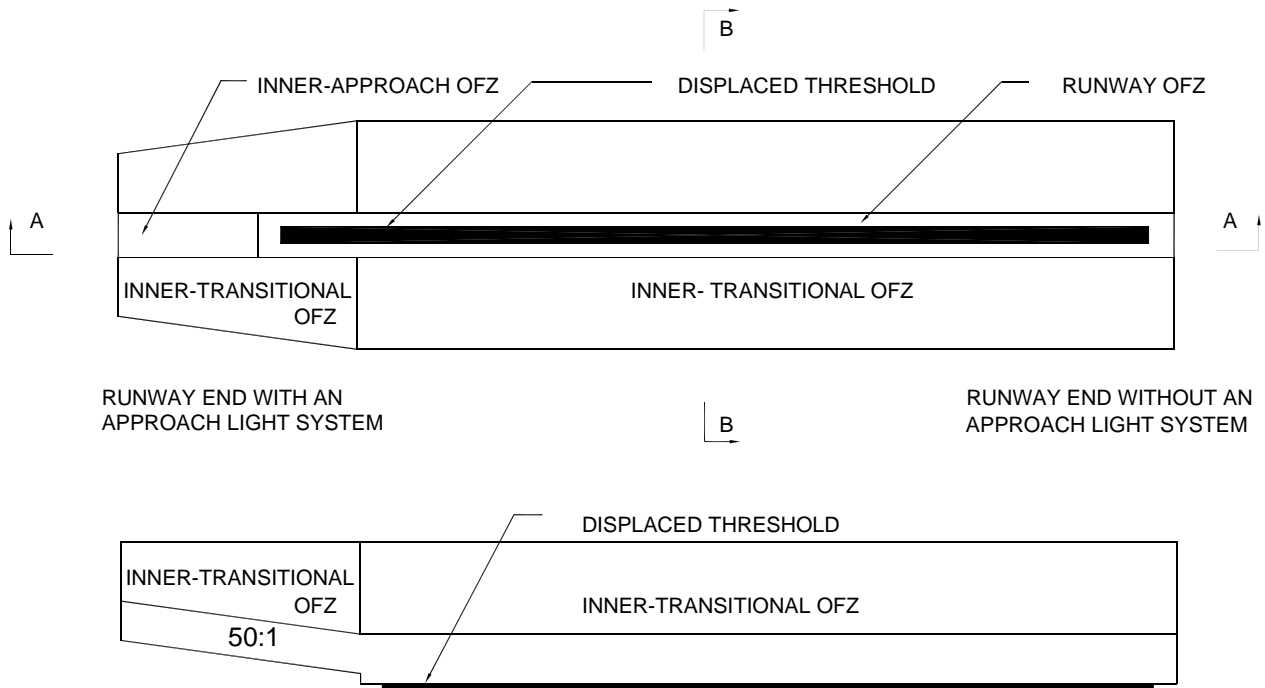
Source: FAA AC 150/5340-30g, Figure 80.

B.2.5 Object Free Zone (OFZ)

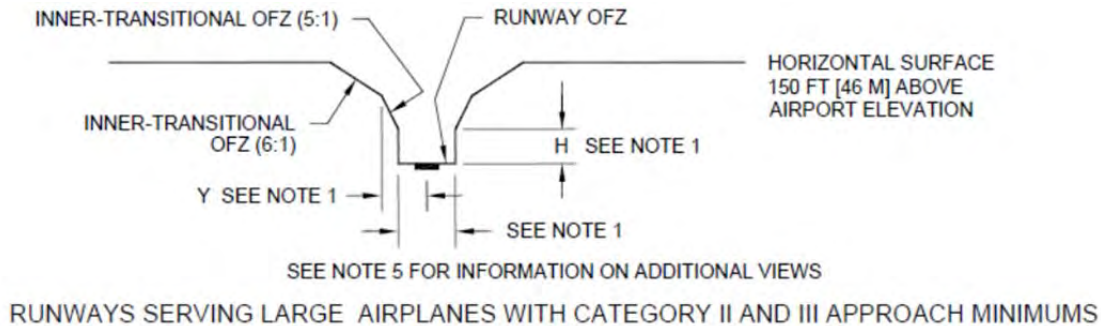
The OFZ obstacle clearance standard precludes aircraft and other object penetrations, except for frangible Navigation Aids (NAVAIDS) for navigation purposes. It is composed of a Runway OFZ (ROFZ), a Precision OFZ (if applicable), an inner-approach OFZ, and an inner-transitional OFZ.

The FAA OFZ standard can be found in AC 150/5300-13a, Paragraph 308ⁱ. **Figure B-4** illustrates the plan view of the OFZ surfaces and **Figure B-5** shows the sectional view. Each component is discussed in the following section.

Figure B-4: OFZ for Operations on Runways by Large Aircraft with Lower than 3/4 Statute Mile (1.2 km) Approach Visibility Minimums.



Note 1: See **Figure 6** for sectional view.
 Source: FAA AC 150/5300/13a, Figure 3-12.

Figure B-5: Sectional View of the OFZ Surface.

Note 1: Calculated by **Equation 1**.
Source: AC 150/5300-13a, Figure 3-13.

B.2.5.1 Runway Obstacle Free Zone (ROFZ)

The ROFZ is defined as a volume of airspace centered above the runway centerline. The ROFZ dimension and obstacle clearance criteria are defined in the FAA AC 150/5300-13a, Paragraph 308: 'Obstacle Free Zone (OFZ)'. Its elevation is the same as the elevation of the nearest point on the runway centerline. The ROFZ extends 200 feet beyond each end of the runway. Its width is as follows;

- (1) For operations by small aircraft:
 - a. 300 feet for runways with lower than 3/4 statute mile approach visibility minimums.
 - b. 250 feet for operations on other runways by small aircraft with approach speeds of 50 knots or more.
 - c. 120 feet for operations on other runways by small aircraft with approach speeds of less than 50 knots.
- (2) 400 feet for operations by large aircraft.

For the BWI Marshall runways, the 400 feet width standard applies.

B.2.5.2 Inner-Approach OFZ

The inner-approach OFZ is defined as a volume of airspace centered on the approach area. It applies only to runways equipped with an Approach Lighting System (ALS). The inner-approach OFZ begins 200 feet from the runway threshold at the same elevation as the runway threshold and extends 200 feet beyond the last light unit in the ALS. **Table B.3** shows the distance between runway ends and the end of inner-approach OFZ. Its width is the same as the ROFZ and rises at a slope of 50 (horizontal) to 1 (vertical) from its beginning.

Table B.3

Distance between Runway Ends and the End of Inner-Approach OFZ.

RWY ID	Distance between the End of Inner-Approach OFZ to RWY End (ft)
10	2,052
28	2,052
15R	2,310
33L	2,109
15L	200
33R	2,610

Source: HNTB Corporation.

B.2.5.3 Inner-Transitional OFZ

The inner-transitional OFZ is defined as a volume of airspace along the sides of the ROFZ and inner-approach OFZ. It applies only to runways with lower than 3/4 statute mile approach visibility minimums. Since the BWI Marshall runways are categorized as CAT-II/III runways, the following criteria apply:

- The inner-transitional OFZ begins at the edges of the ROFZ and inner-approach OFZ, then rises to a height “H” (calculated in **Equation 1**)
- Then it slopes 5 (horizontal) to 1 (vertical) out to a distance “Y” (calculated in **Equation 1**)
- Then it slopes 6 (horizontal) to 1 (vertical) out to a height of 150 feet above the established airport elevation

Equation 1: Formula for Height “H” and Distance “Y”.

$$H_{\text{feet}} = 53 - 0.13(S_{\text{feet}}) - 0.0022(E_{\text{feet}})$$

$$Y_{\text{feet}} = 440 + 1.08(S_{\text{feet}}) - 0.024(E_{\text{feet}})$$

S_{feet} is the most demanding wingspan of the runway

E_{feet} is the runway threshold elevation above sea level

Runways 10, 28, 15R, and 33L have approach capabilities with minima lower than 3/4 mile. Both runways 10/28 and 15R/33L are designed to accommodate large aircraft up to Design Group D-V. Runway 15L/33R is designed to support Design Group B-III aircraft operations. The minima for runway 15L and 33R approaches are higher than 3/4 mile, therefore the inner-transitional OFZ does not apply. **Table B.4** and **Table B.5** show the Design Group defined by the FAA and ICAO.

Table B.4
FAA Design Group.

Group #	Wingspan (ft [m])	Tail Height (ft [m])
I	<49' (<15m)	<20' (<6m)
II	49' - < 79' (15m - < 24m)	20' - < 30' (6m - < 9m)
III	79' - < 118' (24m - < 36m)	30' - < 45' (9m - < 13.5m)
IV	118' - < 171' (36m - < 52m)	45' - < 60' (13.5m - < 18.5m)
V	171' - < 214' (52m - < 65m)	60' - < 66' (18.5m - < 20m)
VI	214' - < 262' (65m - < 80m)	66' - < 80' (20m - < 24.5m)

Source: FAA AC 150/5300-13a, Airport Design Airplane Design Group.

Table B.5
ICAO Design Group.

Group #	Wingspan (ft [m])	Outer Main Gear Wheel Span (ft [m])
A	<49' (<15m)	<14.8' (<4.5m)
B	49' - < 79' (15m - < 24m)	14.8' - < 19.7' (4.5m - < 6m)
C	79' - < 118' (24m - < 36m)	19.7' - < 29.5' (6m - < 9m)
D	118' - < 171' (36m - < 52m)	29.5' - < 45.9' (9m - < 14m)
E	171' - < 214' (52m - < 65m)	29.5' - < 45.9' (9m - < 14m)
F	214' - < 262' (65m - < 80m)	45.9' - < 52.5' (14m - < 16m)

Source: ICAO Annex 14 – Aerodrome Reference Code Element 2, Table 1-1.

The maximum wingspan for the Design Group D-V is 214' (65m) and B-III 118' (36m). The height “H” and distance “Y” were calculated based on the maximum wingspan and runway end elevation using **Equation 1**. **Table B.6** shows the “H” and “Y” values for each study runway.

Table B.6
Height “H” and Distance “Y” for Study Runways.

Runway ID / DT (a)	Category	Max. Wingspan (ft)	Elevation (ft)	H (ft)	Y (ft)
10	D-V	214	139.0	24.9	667.8
28	D-V	214	126.2	24.9	668.1
15R	D-V	214	138.6	24.9	667.8
33L	D-V	214	129.2	24.9	668.0
RWY 10 DT (a)	D-V	214	141.2	24.9	667.7
RWY 28 DT (a)	D-V	214	129.8	24.9	668.0
RWY 15R DT (a)	D-V	214	137.8	24.9	667.8
RWY 33L DT (a)	D-V	214	131.2	24.9	668.0

Note: (a) DT – Displaced Threshold.

Note: Runway 15L/33R minima is higher than ¾ mile, therefore the inner-transitional OFZ does not apply.
Sources: FAA AC 150/5300-13a and HNTB Analysis.

B.2.5.4 Precision Obstacle Free Zone (POFZ)

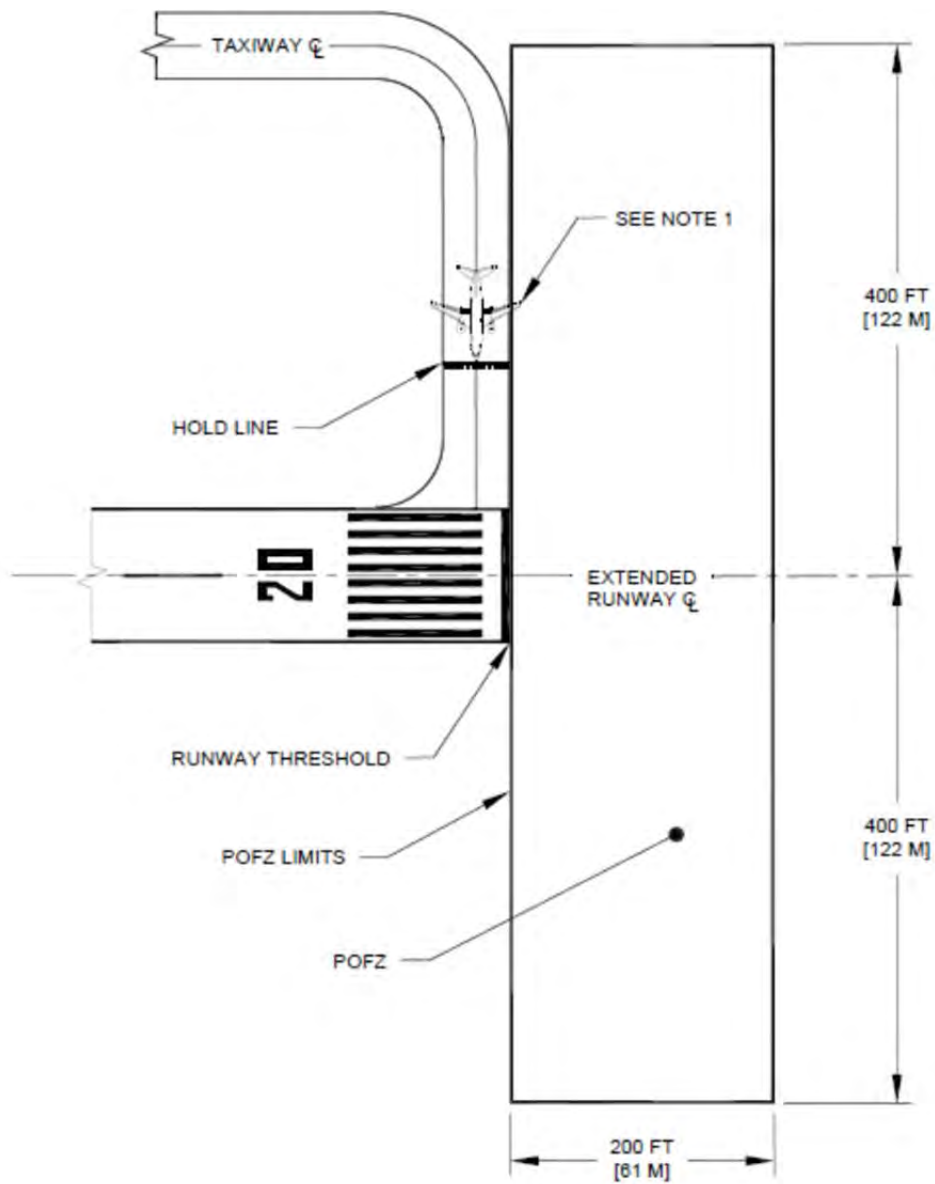
The POFZ is defined as a volume of airspace above an area beginning at the threshold elevation and centered on the extended runway centerline (200 feet long by 800 feet wide). The surface is in effect only when all of the following operational conditions are met:

- (1) The approach includes vertical guidance.
- (2) The reported ceiling is below 250 feet (76m) or visibility is less than ¾ statute mile (1.2km) (or Runway Visual Range (RVR) is below 4,000 feet (1,219m)).
- (3) An aircraft is on final approach within 2 miles (3.2 km) of the runway threshold.

The FAA AC 150/5300-13a states ‘When the POFZ is in effect, the wing of an aircraft holding on a taxiway waiting for runway clearance may penetrate the POFZ; however neither the fuselage nor the tail may penetrate the POFZ. Vehicles up to 10 feet (3 m) in height necessary for maintenance are also permitted in the POFZ.’

Figure B-6 illustrates the POFZ zone without a displaced threshold and **Figure B-7** illustrates the POFZ with a displaced threshold.

Figure B-6: POFZ without Displaced Threshold.

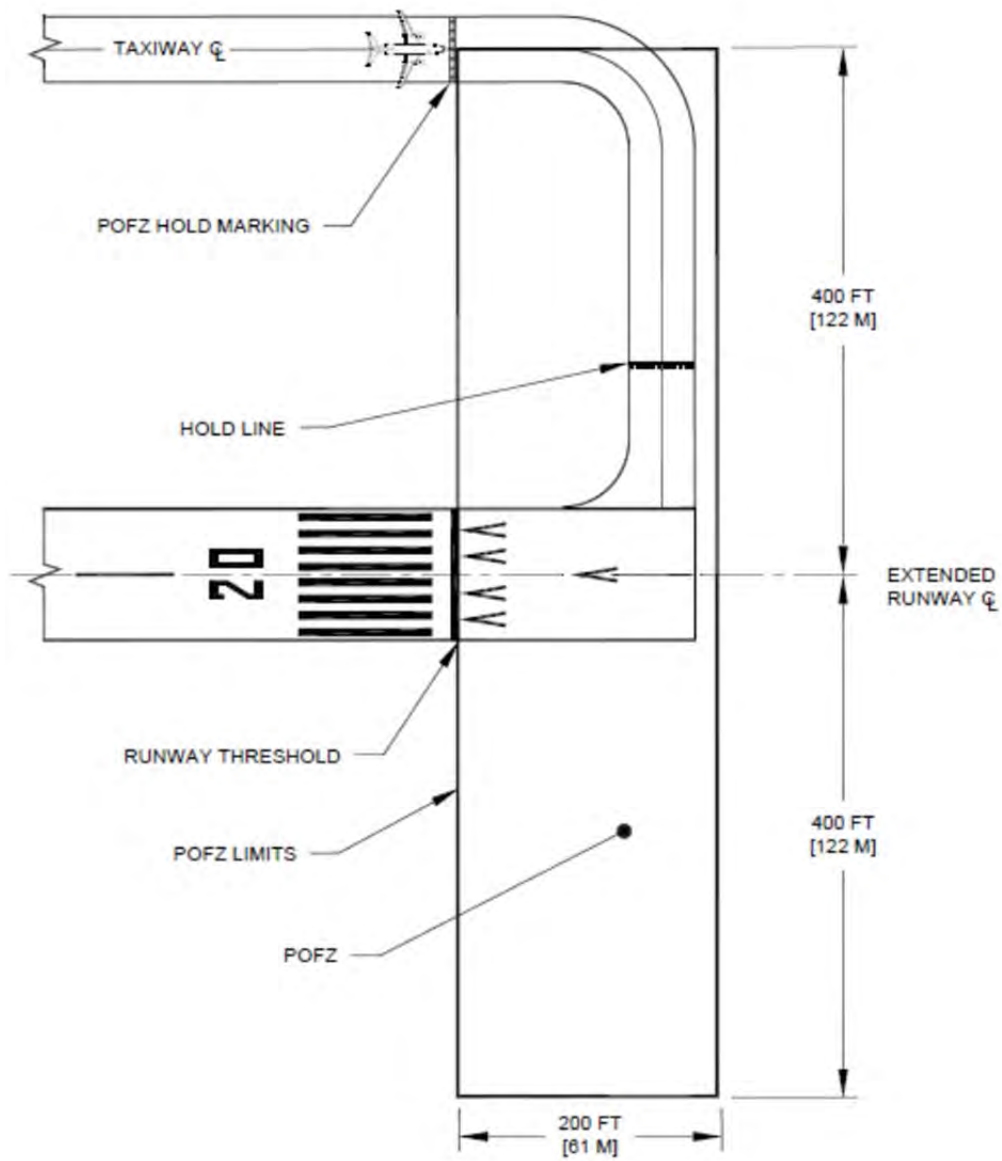


Note:

1: When the POFZ is in effect, a wing of an aircraft on a taxiway waiting for runway clearance may penetrate the POFZ; however, neither the fuselage nor the tail may infringe on the POFZ.

Source: AC 150/5300-13a, Figure 3-14.

Figure B-7: POFZ with Displaced Threshold.

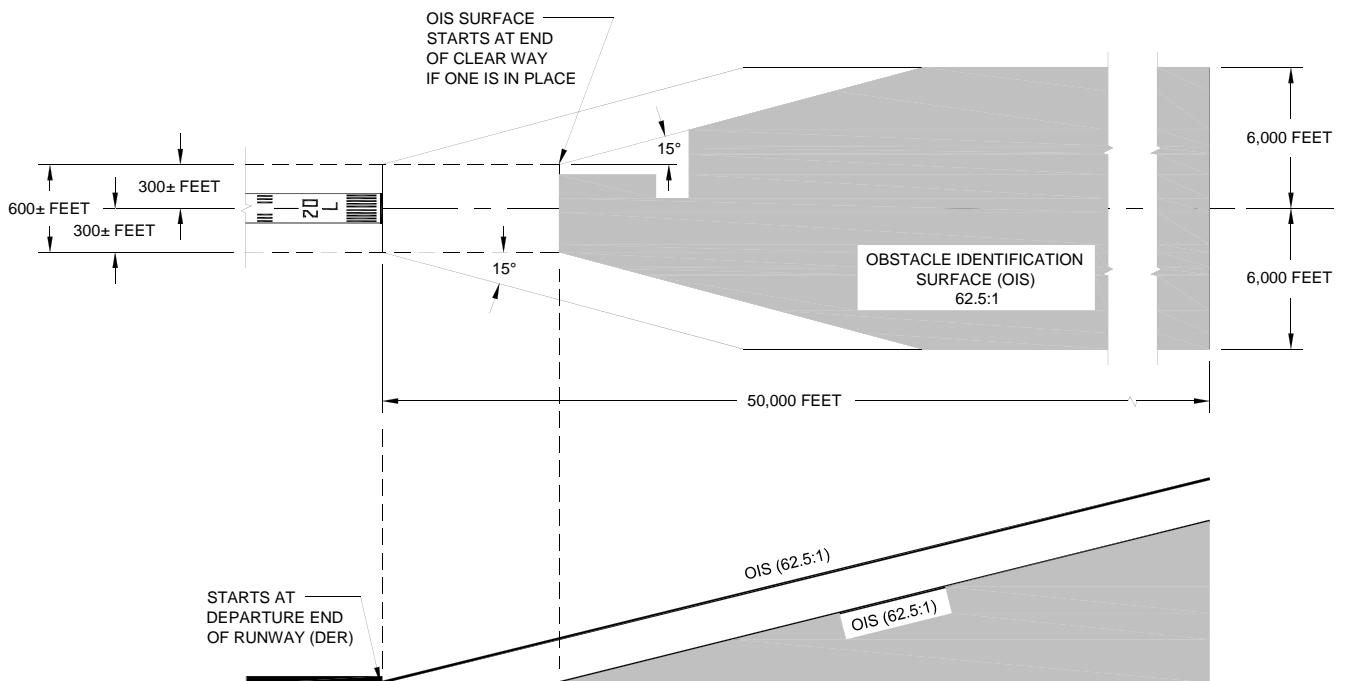


Source: AC 150/5300-13a, Figure 3-15.

B.2.6 One Engine Inoperative (OEI) Obstacle Identification Surface (OIS)

The FAA OEI OIS is defined as a volume of airspace centered above the extension of the runway centerline. It is designed to protect departure procedures under a one-engine-out situation. It starts at the end of clearway if one is in place, or at the Departure End of the Runway (DER) for runways without a clearway. It employs a trapezoid shape horizontally and a slope of 62.5:1 vertically. The surface starts at the end of TODA at a width of 600 feet (300 feet either side of extended runway centerline). It then expands at an angle/splay of 15 degrees until it reaches 12,000 feet. From that point, it stops expanding and continues out at 6,000 feet on either side until it reaches 50,000 feet in total length. **Figure B-8** shows the size, shape and orientation of the OEI OIS surface. It should be noted that the OEI OIS surface is currently excluded from FAA guidance and is not enforced as a surface that airports must maintain clear of obstacles.

Figure B-8: OEI OIS Surface Standard.



Source: FAA AC 150/5300-13, Change 9, Figure A2-4.

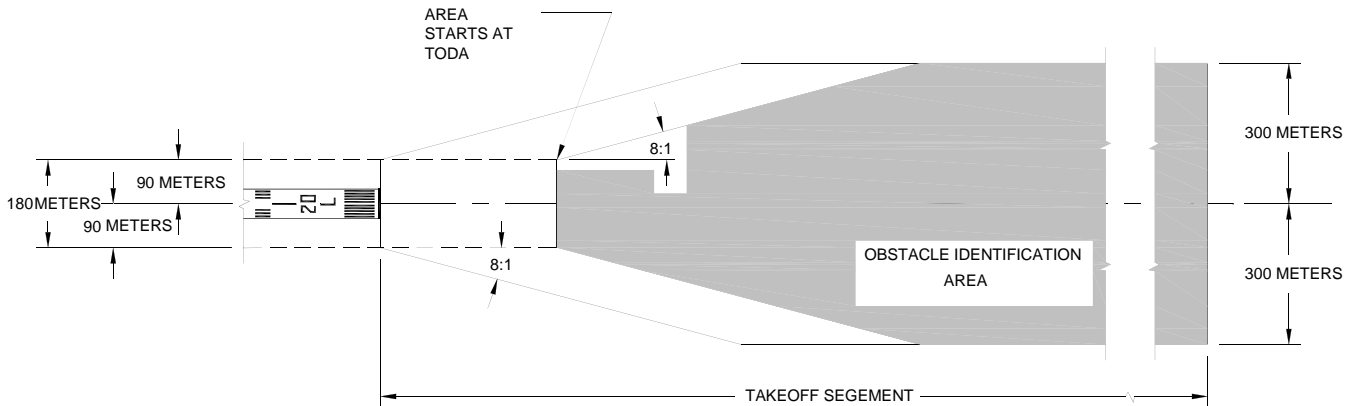
B.2.7 ICAO OEI Identification Area

Many U.S. carriers utilize the FAA OEI OIS described in the last section to determine the lateral splay of the OEI OIS surface. Most foreign flag carriers, many cargo carriers, and some U.S. carriers utilize the ICAO splay. ICAO hasn't published general guidance on the slope of the OEI obstacle identification area. The current regulation states aircraft must clear any obstacle by 35 feet under OEI condition. The actual obstacle clearance surface needed for any given flight depends on the aircraft type, aircraft weight, available runway length, wind speed and direction, temperature, pressure altitude, and obstacle locations and heights.

For IFR straight-out and IFR departures with no greater than 15 degrees of heading change or VFR by day with greater than 15 degrees of heading change, the horizontal dimension starts at the end of TODA at a width of 180 meters (90 meters either side of runway extended centerline). It then expands at a uniform rate of 8 (horizontally) to 1 (vertically) until it reaches 600m. From that point, it stops expanding and continues out at 300m on either side to the end of the takeoff segment. **Figure B-9** illustrates the size, shape and orientation of the ICAO OEI identification area.

This study identifies obstacles within the obstacle identification area.

Figure B-9: ICAO OEI Obstacle Identification Area.



Source: ICAO Annex 6, Attachment C, Example 3.

B.3 Obstruction Analysis Results

The following section presents detailed results of the obstruction analyses conducted. The results are organized by runway (by runway end), by surface type, and are summarized in **Tables B.7** through **B.41**. It should be noted that the results by runway end in the following sections include all surveyed points and have not been modified to exclude points for the RSA obstruction removal projects. Additionally some points are counted as obstructions under multiple runways where surfaces overlap.

B.3.1 Runway 10/28

B.3.1.1 Departure OCS Analysis

Table B.7

Obstacle Analysis Results – Runway 10/28 – Departure OCS Surface.

Obstacle Analysis Summary			
Surface	Penetration	Total	Percent of Total
Outside Study Surface	N	5,597	95.4%
Departure OCS Surface - Runway 28	Y	140	2.4%
Departure OCS Surface - Runway 28	N	41	0.7%
Departure OCS Surface - Runway 10	Y	86	1.5%
Departure OCS Surface - Runway 10	N	5	0.1%
Grand Total		5,869	100.0%

Source: HNTB Corporation.

Table B.8

Obstruction Type Analysis – Runway 10/28 – Departure OCS Surface.

Obstruction Type Analysis		
Obstruction Type	Total	Percent of Total
TREE	176	77.9%
VEG-TREE	45	19.9%
VERTICAL STRUCTURE	2	0.9%
BLDG	2	0.9%
OL-ON-BLDG	1	0.4%
Grand Total	226	100.0%

Source: HNTB Corporation.

B.3.1.2 TERPS Approach Surface Analysis

Table B.9

Obstacle Analysis Results – Runway 10/28 – TERPS Approach Surface.

Obstacle Analysis Summary			
Surface	Penetration	Total	Percent of Total
TERPS Approach Surface - Runway 28	Y	41	0.7%
TERPS Approach Surface - Runway 28	N	12	0.2%
TERPS Approach Surface - Runway 10	Y	43	0.7%
TERPS Approach Surface - Runway 10	N	50	0.9%
TERPS Approach Surface - 7:1 - Runway 28	N	183	3.1%
TERPS Approach Surface - 7:1 - Runway 10	Y	33	0.6%
TERPS Approach Surface - 7:1 - Runway 10	N	61	1.0%
TERPS Approach Surface - 4:1 - Runway 28	Y	38	0.6%
TERPS Approach Surface - 4:1 - Runway 28	N	39	0.7%
TERPS Approach Surface - 4:1 - Runway 10	Y	31	0.5%
TERPS Approach Surface - 4:1 - Runway 10	N	70	1.2%
Outside Study Surface	N	5,268	89.8%
Grand Total		5,869	100.0%

Source: HNTB Corporation.

Table B.10

Obstruction Type Analysis – Runway 10/28 – TERPS Approach Surface.

Obstruction Type Analysis		
Obstruction Type	Total	Percent of Total
TREE	141	75.8%
VEG-TREE	45	24.2%
Grand Total	186	100.0%

Source: HNTB Corporation.

B.3.1.3 PAPI OCS Surface - 1° 45'

Table B.11

Obstacle Analysis Results – Runway 10/28 – PAPI OCS Surface (1° 45').

Obstacle Analysis Summary			
Surface	Penetration	Total	Percent of Total
Outside Study Surface	N	5,696	97.1%
PAPI OCS Surface - 1.75 Degrees - Runway 28	Y	55	0.9%
PAPI OCS Surface - 1.75 Degrees - Runway 28	N	6	0.1%
PAPI OCS Surface - 1.75 Degrees - Runway 10	Y	14	0.2%
PAPI OCS Surface - 1.75 Degrees - Runway 10	N	98	1.7%
Grand Total		5,869	100.0%

Source: HNTB Corporation.

Table B.12

Obstruction Type Analysis – Runway 10/28 – PAPI OCS Surface (1° 45').

Obstruction Type Analysis		
Obstruction Type	Total	Percent of Total
TREE	36	52.2%
VEG-TREE	33	47.8%
Grand Total	69	100.0%

Source: HNTB Corporation.

B.3.1.4 Object Free Zone (OFZ) Analysis

**Table B.13
Obstacle Analysis Results – Runway 10/28 – OFZ.**

Obstacle Analysis Summary			
Surface	Penetration	Total	Percent of Total
Outside Study Surface	N	5,665	96.5%
Runway Obstacle Free Zone	Y	7	0.1%
Inner Transitional 5:1 OFZ Surface - Runway 28	Y	41	0.7%
Inner Transitional 5:1 OFZ Surface - Runway 28	N	75	1.3%
Inner Approach OFZ Surface - Runway 28	N	2	0.0%
Inner Transitional 5:1 OFZ Surface - Runway 10	Y	4	0.1%
Inner Transitional 5:1 OFZ Surface - Runway 10	N	57	1.0%
Precision Obstacle Free Zone	Y	1	0.0%
Inner Approach OFZ Surface - Runway 10	N	15	0.3%
Inner Transitional 6:1 OFZ Surface - Runway 10	N	2	0.0%
Grand Total		5,869	100.0%

Source: HNTB Corporation.

**Table B.14
Obstruction Type Analysis – Runway 10/28 – OFZ.**

Obstruction Type Analysis		
Obstruction Type	Total	Percent of Total
VEG-TREE	24	45.3%
TREE	21	39.6%
VERTICAL STRUCTURE	8	15.1%
Grand Total	53	100.0%

Source: HNTB Corporation.

B.3.1.5 FAA OEI OIS Surface Analysis

Table B.15

Obstacle Analysis Results – Runway 10/28 – FAA OEI OIS.

Obstacle Analysis Summary			
Surface	Penetration	Total	Percent of Total
Outside Study Surface	N	5,616	95.7%
OEI OIS Surface - Runway 28	Y	158	2.7%
OEI OIS Surface - Runway 28	N	4	0.1%
OEI OIS Surface - Runway 10	Y	83	1.4%
OEI OIS Surface - Runway 10	N	8	0.1%
Grand Total		5,869	100.0%

Source: HNTB Corporation.

Table B.16

Obstruction Type Analysis – Runway 10/28 – FAA OEI OIS.

Obstruction Type Analysis		
Obstruction Type	Total	Percent of Total
TREE	178	73.9%
VEG-TREE	45	18.7%
VERTICAL STRUCTURE	12	5.0%
POLE	4	1.7%
CHIMMNEY/SMOKESTACK	2	0.8%
Grand Total	241	100.0%

Source: HNTB Corporation.

B.3.1.6 ICAO OEI Surface Analysis

Table B.17

Obstacle Analysis Results – Runway 10/28 – ICAO OIS Surface.

Obstacle Analysis Summary		
Surface	Total	Percent of Total
Outside Study Surface	5,732	97.7%
OEI ICAO Surface - Runway 10	40	0.7%
OEI ICAO Surface - Runway 28	97	1.7%
Grand Total	5,869	100.0%

Source: HNTB Corporation.

Table B.18

Obstruction Type Analysis – Runway 10/28 – ICAO OIS Surface.

Obstruction Type Analysis		
Obstruction Type	Total	Percent of Total
TREE	96	70.1%
VEG-TREE	20	14.6%
VERTICAL STRUCTURE	12	8.8%
POLE	6	4.4%
NAVAID	2	1.5%
BUILDING	1	0.7%
Grand Total	137	100.0%

Source: HNTB Corporation.

B.3.2 Runway 15R/33L

B.3.2.1 Departure OCS Analysis

Table B.19

Obstacle Analysis Results – Runway 15R/33L – Departure OCS Surface.

Obstacle Analysis Summary			
Surface	Penetration	Total	Percent of Total
Outside Study Surface	N	5,637	96.0%
Departure OCS Surface - Runway 15R	Y	93	1.6%
Departure OCS Surface - Runway 15R	N	22	0.4%
Departure OCS Surface - Runway 33L	Y	58	1.0%
Departure OCS Surface - Runway 33L	N	59	1.0%
Grand Total		5,869	100.0%

Source: HNTB Corporation.

Table B.20

Obstruction Type Analysis– Runway 15R/33L – Departure OCS Surface.

Obstruction Type Analysis		
Obstruction Type	Total	Percent of Total
TREE	147	97.4%
POLE	2	1.3%
VERTICAL STRUCTURE	1	0.7%
SIGN	1	0.7%
Grand Total	151	100.0%

Source: HNTB Corporation.

B.3.2.2 TERPS Approach Surface Analysis

Table B.21

Obstacle Analysis Results – Runway 15R/33L – TERPS Approach Surface.

Obstacle Analysis Summary			
Surface	Penetration	Total	Percent of Total
TERPS Approach Surface - Runway 33L	Y	1	0.0%
TERPS Approach Surface - Runway 33L	N	4	0.1%
TERPS Approach Surface - Runway 15R	N	7	0.1%
TERPS Approach Surface - 7:1 - Runway 33L	Y	11	0.2%
TERPS Approach Surface - 7:1 - Runway 33L	N	147	2.5%
TERPS Approach Surface - 7:1 - Runway 15R	Y	12	0.2%
TERPS Approach Surface - 7:1 - Runway 15R	N	78	1.3%
TERPS Approach Surface - 4:1 - Runway 33L	N	57	1.0%
TERPS Approach Surface - 4:1 - Runway 15R	Y	14	0.2%
TERPS Approach Surface - 4:1 - Runway 15R	N	60	1.0%
Outside Study Surface	N	5,478	93.3%
Grand Total		5,869	100.0%

Source: HNTB Corporation.

Table B.22

Obstruction Type Analysis – Runway 15R/33L – TERPS Approach Surface.

Obstruction Type Analysis		
Obstruction Type	Total	Percent of Total
TREE	38	100.0%
Grand Total	38	100.0%

Source: HNTB Corporation.

B.3.2.3 PAPI OCS Surface - 1° 45'

Table B.23

Obstacle Analysis Results – Runway 15R/33L – PAPI OCS Surface (1° 45').

Obstacle Analysis Summary			
Surface	Penetration	Total	Percent of Total
Outside Study Surface	N	5,823	99.2%
PAPI OCS Surface - 1.75 Degrees - Runway 33L	N	14	0.2%
PAPI OCS Surface - 1.75 Degrees - Runway 15R	N	32	0.5%
Grand Total		5,869	100.0%

Source: HNTB Corporation.

There are NO obstructions for the Runway 15R/33L PAPI OCS Surface (1° 45').

B.3.2.4 Object Free Zone (OFZ) Analysis

**Table B.24
Obstacle Analysis Results – Runway 15R/33L – OFZ.**

Obstacle Analysis Summary			
Surface	Penetration	Total	Percent of Total
Outside Study Surface	N	5,589	95.2%
Runway Obstacle Free Zone	Y	16	0.3%
Runway Obstacle Free Zone	N	1	0.0%
Inner Transitional 5:1 OFZ Surface - Runway 33L	N	86	1.5%
Inner Transitional 6:1 OFZ Surface - Runway 33L	N	11	0.2%
Precision Obstacle Free Zone	Y	1	0.0%
Inner Transitional 5:1 OFZ Surface - Runway 15R	N	149	2.5%
Inner Transitional 6:1 OFZ Surface - Runway 15R	N	16	0.3%
Grand Total		5,869	100.0%

Source: HNTB Corporation.

**Table B.25
Obstruction Type Analysis – Runway 15R/33L – OFZ.**

Obstruction Type Analysis		
Obstruction Type	Total	Percent of Total
VERTICAL STRUCTURE	17	100.0%
Grand Total	17	100.0%

Source: HNTB Corporation.

B.3.2.5 FAA OEI OIS Surface Analysis

Table B.26

Obstacle Analysis Results – Runway 15R/33L – FAA OEI OIS.

Obstacle Analysis Summary			
Surface	Penetration	Total	Percent of Total
Outside Study Surface	N	5,757	98.1%
OEI OIS Surface - Runway 15R	Y	32	0.5%
OEI OIS Surface - Runway 15R	N	9	0.2%
OEI OIS Surface - Runway 33L	Y	58	1.0%
OEI OIS Surface - Runway 33L	N	13	0.2%
Grand Total		5,869	100.0%

Source: HNTB Corporation.

Table B.27

Obstruction Type Analysis – Runway 15R/33L – FAA OEI OIS.

Obstruction Type Analysis		
Obstruction Type	Total	Percent of Total
TREE	79	87.8%
COMMUNICATION TOWER	6	6.7%
OL-ON-TWR	2	2.2%
BUILDING	1	1.1%
ANTENNA	1	1.1%
POLE	1	1.1%
Grand Total	90	100.0%

Source: HNTB Corporation.

B.3.2.6 ICAO OEI Surface Analysis

Table B.28

Obstacle Analysis Results – Runway 15R/33L – ICAO OIS Surface.

Object Analysis Summary		
Surface	Total	Percent of Total
Outside Study Surface	5,837	99.5%
OEI ICAO Surface - Runway 15R	7	0.1%
OEI ICAO Surface - Runway 33L	25	0.4%
Grand Total	5,869	100.0%

Source: HNTB Corporation.

Table B.29

Obstruction Type Analysis – Runway 15R/33L – ICAO OIS Surface.

Obstruction Type Analysis		
Obstruction Type	Total	Percent of Total
TREE	25	78.1%
NAVAID	2	6.3%
POLE	2	6.3%
ANTENNA	1	3.1%
WATER TOWER	1	3.1%
VERTICAL STRUCTURE	1	3.1%
Grand Total	32	100.0%

Source: HNTB Corporation.

B.3.3 Runway 15L/33R

B.3.3.1 Departure OCS Analysis

Table B.30

Obstacle Analysis Results – Runway 15L/33R – Departure OCS Surface.

Obstacle Analysis Summary			
Surface	Penetration	Total	Percent of Total
Outside Study Surface	N	2,512	42.8%
Departure OCS Surface - Runway 33R	Y	2,270	38.7%
Departure OCS Surface - Runway 33R	N	750	12.8%
Departure OCS Surface - Runway 15L	Y	316	5.4%
Departure OCS Surface - Runway 15L	N	21	0.4%
Grand Total		5,869	100.0%

Source: HNTB Corporation.

Table B.31

Obstruction Type Analysis – 15L/33R – Departure OCS Surface.

Obstruction Type Analysis		
Obstruction Type	Total	Percent of Total
TREE	1,246	48.2%
VEG-TREE	1,225	47.4%
POLE	45	1.7%
POLE-LITE	37	1.4%
POLE-UTIL	6	0.2%
BLDG	5	0.2%
BUILDING	5	0.2%
OL-ON-POLE	4	0.2%
VERTICAL STRUCTURE	4	0.2%
VEG-BUSH	2	0.1%
BLDG/SIGNS	2	0.1%
FENCE	2	0.1%
SIGN	1	0.0%
OL-ON-LITE-POLE	1	0.0%
POLE-SIGNAL	1	0.0%
Grand Total	2,586	100.0%

Source: HNTB Corporation.

B.3.3.2 TERPS Approach Surface Analysis

Table B.32

Obstacle Analysis Results – Runway 15L/33R – TERPS Approach Surface.

Obstacle Analysis Summary			
Surface	Penetration	Total	Percent of Total
TERPS Approach Surface - Runway 33R	Y	12	0.2%
TERPS Approach Surface - Runway 33R	N	17	0.3%
TERPS Approach Surface - Runway 15L	Y	764	13.0%
TERPS Approach Surface - Runway 15L	N	476	8.1%
TERPS Approach Surface - 7:1 - Runway 33R	Y	2	0.0%
TERPS Approach Surface - 7:1 - Runway 33R	N	59	1.0%
TERPS Approach Surface - 7:1 - Runway 15L	Y	5	0.1%
TERPS Approach Surface - 7:1 - Runway 15L	N	554	9.4%
TERPS Approach Surface - 4:1 - Runway 33R	Y	114	1.9%
TERPS Approach Surface - 4:1 - Runway 33R	N	173	2.9%
TERPS Approach Surface - 4:1 - Runway 15L	Y	158	2.7%
TERPS Approach Surface - 4:1 - Runway 15L	N	1,121	19.1%
Outside Study Surface	N	2,414	41.1%
Grand Total		5,869	100.0%

Source: HNTB Corporation.

Table B.33

Obstruction Type Analysis – Runway 15L/33R – TERPS Approach Surface.

Obstruction Type Analysis		
Obstruction Type	Total	Percent of Total
VEG-TREE	583	55.3%
TREE	468	44.4%
POLE-LITE	1	0.1%
VEG-BUSH	1	0.1%
POLE	1	0.1%
VERTICAL STRUCTURE	1	0.1%
Grand Total	1,055	100.0%

Source: HNTB Corporation.

B.3.3.3 PAPI OCS Surface - (1° 50')

Table B.34

Obstacle Analysis Results – Runway 15L/33R – PAPI OCS Surface (1° 50').

Obstacle Analysis Summary			
Surface	Penetration	Total	Percent of Total
Outside Study Surface	N	3,984	67.9%
PAPI OCS Surface - 1.83 Degrees - Runway 33R	Y	3	0.1%
PAPI OCS Surface - 1.83 Degrees - Runway 33R	N	23	0.4%
PAPI OCS Surface - 1.83 Degrees - Runway 15L	Y	99	1.7%
PAPI OCS Surface - 1.83 Degrees - Runway 15L	N	1,760	30.0%
Grand Total		5,869	100.0%

Source: HNTB Corporation.

Table B.35

Obstruction Type Analysis – Runway 15L/33R – PAPI OCS Surface (1° 50').

Obstruction Type Analysis		
Obstruction Type	Total	Percent of Total
VEG-TREE	57	55.9%
TREE	45	44.1%
Grand Total	102	100.0%

Source: HNTB Corporation.

B.3.3.4 Object Free Zone (OFZ) Analysis

Table B.36

Obstacle Analysis Results – Runway 15L/33R – OFZ.

Obstacle Analysis Summary			
Surface	Penetration	Total	Percent of Total
Outside Study Surface	N	5,853	99.7%
Runway Obstacle Free Zone	Y	2	0.0%
Runway Obstacle Free Zone	N	12	0.2%
Inner Approach OFZ Surface - Runway 33R	Y	1	0.0%
Precision Obstacle Free Zone	N	1	0.0%
Grand Total		5,869	100.0%

Source: HNTB Corporation.

Table B.37

Obstruction Type Analysis – Runway 15L/33R – OFZ.

Obstruction Type Analysis		
Obstruction Type	Total	Percent of Total
VERTICAL STRUCTURE	2	66.7%
NAVD-AIRF-LITE	1	33.3%
Grand Total	3	100.0%

Source: HNTB Corporation.

B.3.3.5 FAA OEI OIS Surface Analysis

Table B.38

Obstacle Analysis Results – Runway 15L/33R – FAA OEI OIS.

Obstacle Analysis Summary			
Surface	Penetration	Total	Percent of Total
Outside Study Surface	N	2,849	48.5%
OEI OIS Surface - Runway 33R	Y	2,742	46.7%
OEI OIS Surface - Runway 33R	N	18	0.3%
OEI OIS Surface - Runway 15L	Y	251	4.3%
OEI OIS Surface - Runway 15L	N	9	0.2%
Grand Total		5,869	100.0%

Source: HNTB Corporation.

Table B.39

Obstruction Type Analysis – Runway 15L/33R – FAA OEI OIS.

Obstruction Type Analysis		
Obstruction Type	Total	Percent of Total
TREE	1,411	47.1%
VEG-TREE	1,219	40.7%
POLE	87	2.9%
FENCE	64	2.1%
BUILDING	45	1.5%
POLE-LITE	45	1.5%
BLDG	27	0.9%
POLE-UTIL	25	0.8%
VEG-BUSH	13	0.4%
VERTICAL STRUCTURE	11	0.4%
SIGN	10	0.3%
COMMUNICATION TOWER	5	0.2%
ROAD	4	0.1%
OL-ON-POLE	3	0.1%
BLDG/SIGNS	3	0.1%
BLDG-CHMNY	3	0.1%
OL-ON-TWR	2	0.1%
VERTICAL POINT	2	0.1%
GROUND	2	0.1%
FLAGPOLE	1	0.0%
OL-ON-BLDG	1	0.0%
BLDG-CHMNY-POT	1	0.0%
RAILROAD	1	0.0%
DIVING PLATFORM	1	0.0%
POLE-SIGNAL	1	0.0%
POLE-FLAG	1	0.0%
MISC	1	0.0%
STEEPLE	1	0.0%
OL-ON-LITE-POLE	1	0.0%
ANTENNA	1	0.0%
NAVD-AIRF-LITE	1	0.0%
Grand Total	2,993	100.0%

Source: HNTB Corporation.

B.3.3.6 ICAO OEI Surface Analysis

Table B.40

Obstacle Analysis Results – Runway 15L/33R – ICAO OIS Surface.

Obstacle Analysis Summary		
Surface	Total	Percent of Total
Outside Study Surface	4,083	69.6%
OEI ICAO Surface - Runway 15L	45	0.8%
OEI ICAO Surface - Runway 33R	1,741	29.7%
Grand Total	5,869	100.0%

Source: HNTB Corporation.

Table B.41

Obstruction Type Analysis – Runway 15L/33R – ICAO OIS Surface.

Obstruction Type Analysis		
Obstruction Type	Total	Percent of Total
TREE	791	44.3%
VEG-TREE	777	43.5%
FENCE	63	3.5%
POLE	41	2.3%
POLE-LITE	21	1.2%
BUILDING	20	1.1%
POLE-UTIL	15	0.8%
BLDG	13	0.7%
VEG-BUSH	10	0.6%
ROAD	7	0.4%
VERTICAL STRUCTURE	5	0.3%
SIGN	5	0.3%
BLDG-CHMNY	3	0.2%
GROUND	3	0.2%
VERTICAL POINT	2	0.1%
OL-ON-POLE	2	0.1%
NAVAID	2	0.1%
DIVING PLATFORM	1	0.1%
NAVD-AIRF-LITE	1	0.1%
FLAGPOLE	1	0.1%
RAILROAD	1	0.1%
POLE-FLAG	1	0.1%
OL-ON-BLDG	1	0.1%
Grand Total	1,786	100.0%

Source: HNTB Corporation.

Appendix H

Recommended Plant Species

Perennials, Ground Covers, Annuals & Bulbs

Scientific name	Common name
<i>Achillea millefolium</i>	Common Yarrow
<i>Alchemilla mollis</i>	Lady's Mantle
<i>Aster novae-angliae</i>	New England Aster
<i>Astilbe</i> spp.	Astilbe
<i>Carex glauca</i>	Blue Sedge
<i>Carex grayi</i>	Morningstar Sedge
<i>Carex stricta</i>	Tussock Sedge
<i>Ceratostigma plumbaginoides</i>	Leadwort/Plumbago
<i>Chelone glabra</i>	White Turtlehead
<i>Chrysanthemum</i> spp.	Chrysanthemum
<i>Convallaria majalis</i>	Lily-of-the-Valley
<i>Coreopsis lanceolata</i>	Lanceleaf Tickseed
<i>Coreopsis rosea</i>	Rosy Coreopsis
<i>Coreopsis tinctoria</i>	Golden Tickseed
<i>Coreopsis verticillata</i>	Threadleaf Coreopsis
<i>Dryopteris erythrosora</i>	Autumn Fern
<i>Dryopteris marginalis</i>	Leatherleaf Wood Fern
<i>Echinacea purpurea</i> 'Magnus'	Magnus Coneflower
<i>Epigaea repens</i>	Trailing Arbutus
<i>Eupatorium coelestinum</i>	Hardy Ageratum
<i>Eupatorium hyssopifolium</i>	Hyssopleaf Thoroughwort
<i>Eupatorium maculatum</i>	Joe-Pye Weed
<i>Eupatorium perfoliatum</i>	Boneset
<i>Eupatorium purpureum</i>	Sweet Joe-Pye Weed
<i>Geranium maculatum</i>	Wild Geranium
<i>Hedera helix</i>	English Ivy
<i>Hemerocallis</i> spp.	Daylily
<i>Hibiscus moscheutos</i>	Rose Mallow
<i>Hosta</i> spp.	Plantain Lily
<i>Hydrangea quercifolia</i>	Oakleaf Hydrangea
<i>Iris sibirica</i>	Siberian Iris
<i>Iris versicolor</i>	Blue Flag Iris
<i>Lantana camara</i>	Yellow Sage
<i>Liatris spicata</i>	Gay-feather
<i>Liriope muscari</i>	Blue Lily-turf
<i>Liriope variegata</i>	Variegated Liriope
<i>Lobelia cardinalis</i>	Cardinal Flower
<i>Lobelia siphilitica</i>	Blue Cardinal Flower
<i>Lonicera sempervirens</i>	Coral Honeysuckle
<i>Narcissus</i> spp.	Daffodil
<i>Nepeta x faassenii</i>	Catmint
<i>Onoclea sensibilis</i>	Sensitive Fern
<i>Osmunda cinnamomea</i>	Cinnamon Fern
<i>Pelargonium x domesticum</i>	Martha Washington Geranium
<i>Peltandra virginica</i>	Arrow Arum
<i>Perovskia abrotanoides</i>	Caspian/Russian Blue Sage
<i>Phlox stolonifera</i>	Creeping Phlox
<i>Polygonum aubertii</i>	Silver Lace Vine
<i>Polystichum acrostichoides</i>	Christmas Fern

Perennials, Ground Covers, Annuals & Bulbs

Scientific name	Common name
<i>Rudbeckia fulgida</i>	Orange Coneflower
<i>Rudbeckia hirta</i>	Black-eyed Susan
<i>Salvia nemorosa</i>	May Night Salvia
<i>Saururus cernuus</i>	Lizards Tail
<i>Schizachyrium scoparium</i>	Little Bluestem
<i>Sedum spectabile</i>	Stonecrop
<i>Sisyrinchium campestre</i>	Prairie Blue-eyed Grass
<i>Solidago rugosa</i>	Goldenrod
<i>Thelypteris noveboracensis</i>	New York Fern
<i>Tiarella cordifolia</i>	Foam Flower
<i>Tulipa spp.</i>	Tulip
<i>Verbena canadensis</i>	Rose Verbena
<i>Vernonia noveboracensis</i>	New York Ironweed
<i>Veronica spp.</i>	Speedwell
<i>Vinca minor</i>	Periwinkle
<i>Yucca filamentosa</i>	Adam's-needle Yucca

Trees (large, medium, small, ornamental & evergreen)

Scientific Name	Common Name
<i>Abies concolor</i>	White Fir
<i>Abies nordmanniana</i>	Nordman Fir
<i>Acer campestre</i>	Hedge Maple
<i>Acer palmatum 'Sango-Kaku'</i>	Coralbark Japanese Maple
<i>Acer rubrum</i>	Red Maple (seedless cultivars such as 'Celzam', 'Karpick', and 'Somerset' only)
<i>Acer x freemanii</i>	Freeman Maple (seedless cultivars such as 'Autumn Blaze', 'Celebration', 'Marmo' and 'Scarlet Sentinel' only)
<i>Betula nigra</i>	River Birch
<i>Carpinus betulus 'Fastigiata'</i>	Upright European Hornbeam
<i>Carpinus caroliniana</i>	American Hornbeam
<i>Cedrus atlantica</i>	Blue Atlas Cedar
<i>Cedrus deodora</i>	Deodor Cedar
<i>Cercidiphyllum japonicum</i>	Katsura tree
<i>Cercis canadensis</i>	Eastern Redbud
<i>Chionanthus virginicus 'Floyd'</i>	White Fringetree (male cultivar)
<i>Cryptomeria japonica</i>	Japanese Cedar
<i>Cupressocyparis x leylandii</i>	Leyland Cypress
<i>Fraxinus americana</i>	White Ash (seedless cultivars such as 'Autumn Applause', 'Autumn Purple', 'Champaign County', 'Rosehill' and 'Skyline' only)
<i>Fraxinus pennsylvanica</i>	Green Ash (seedless cultivars such as 'Aerial', 'Bergeson', 'Honeyshade', 'Marshalls Seedless', 'Newport', 'Patmore' and 'Robinhood' only)
<i>Ginkgo biloba</i>	Ginko (male cultivars only)
<i>Gleditsia triacanthos var. inermis</i>	Thornless Common Honeylocust (seedless cultivars such as 'Imperial', 'Shademaster', 'Skyline', and 'Sunburst' only)
<i>Ilex opaca</i>	American Holly (male cultivars such as 'Jersey Knight' only)
<i>Koelreutarea paniculata</i>	Golden Raintree
<i>Lagerstroemia indica</i>	Crape Myrtle
<i>Liriodendron tulipifera</i>	Yellow Poplar
<i>Liquidambar styraciflua</i>	Sweetgum
<i>Magnolia x loebneri</i>	Loebneri Magnolia
<i>Magnolia x soulangiana</i>	Saucer Magnolia
<i>Magnolia stellata</i>	Star Magnolia
<i>Magnolia virginiana</i>	Sweetbay Magnolia
<i>Malus spp.</i>	Flowering Crabapple (non-fruiting cultivars such as 'American Beauty', 'Prince Georges', and 'Spring Snow' only)
<i>Ostrya virginiana</i>	American Hophornbeam
<i>Oxydendrum arboreum</i>	Sourwood
<i>Picea abies</i>	Norway Spruce
<i>Picea glauca</i>	White Spruce
<i>Picea omorika</i>	Serbian Spruce
<i>Picea pungens</i>	Colorado Spruce
<i>Pinus echinata</i>	Shortleaf Pine

Trees (large, medium, small, ornamental & evergreen)

Scientific Name	Common Name
<i>Pinus mugo</i>	Mugo Pine
<i>Pinus rigida</i>	Pitch Pine
<i>Pinus strobus</i>	Eastern White Pine
<i>Pinus taeda</i>	Loblolly Pine
<i>Pinus thunbergii</i>	Japanese Black Pine
<i>Pinus virginiana</i>	Virginia Pine
<i>Platanus occidentalis</i>	American Sycamore
<i>Populus deltoides</i>	Eastern Cottonwood
<i>Populus grandidentata</i>	Bigtooth Aspen
<i>Prunus spp.</i>	Flowering Cherry (non-fruiting cultivars only)
<i>Prunus serrulata</i>	Japanese Flowering Cherry (non-fruiting cultivars such as 'Kwanzan' only)
<i>Prunus x yedoensis</i>	Yoshino Cherry (non-fruiting cultivars only)
<i>Salix nigra</i>	Black Willow
<i>Sophora japonica</i>	Japanese Scholartree
<i>Stewartia pseudocamellia</i>	Japanese Stewartia
<i>Styrax japonicus</i>	Japanese Snowbell
<i>Syringa reticulata</i>	Japanese Tree Lilac
<i>Taxodium distichum</i>	Bald Cypress
<i>Thuja occidentalis</i>	American Arborvitae
<i>Tilia americana</i>	American Linden
<i>Tilia cordata</i>	Littleleaf Linden
<i>Tilia tomentosa</i>	Silver Linden
<i>Tsuga canadensis</i>	Canadian Hemlock
<i>Tsuga caroliniana</i>	Carolina Hemlock
<i>Ulmus americana</i>	American Elm
<i>Ulmus parvifolia</i>	Chinese Elm
<i>Ulmus pumila</i>	Siberian Elm
<i>Zelkova serrata</i>	Japanese Zelkova

Shrubs (large, medium, small, ornamental & evergreen)

Scientific name	Common name
<i>Abelia "Edward Goucher"</i>	Edward Goucher Abelia
<i>Abelia x grandiflora</i>	Glossy Abelia
<i>Acer campestre</i>	Hedge Maple
<i>Berberis x mentorensis</i>	Mentor Barberry
<i>Buddleia davidii</i>	Butterfly Bush
<i>Calluna vulgaris</i>	Common Heather
<i>Clethra alnifolia</i>	Sweet Pepperbush
<i>Cotoneaster dammeri</i>	Bearberry Cotoneaster
<i>Deutzia gracilis</i>	Slender Deutzia
<i>Euonymus americanus</i>	Strawberry Bush
<i>Euonymus kiautschovicus</i>	Spreading Euonymus
<i>Forsythia x intermedia</i>	Border Forsythia
<i>Forsythia suspensa</i>	Weeping Forsythia
<i>Forsythia viridissima</i>	Greenstem Forsythia
<i>Hamamelis vernalis</i>	Vernal Witchhazel
<i>Hamamelis virginiana</i>	Common Witchhazel
<i>Hydrangea arborescens</i>	Smooth Hydrangea
<i>Hydrangea quercifolia</i>	Oakleaf Hydrangea
<i>Hypericum patulum</i>	Goldencup St. Johnswort
<i>Hypericum frondosum</i>	Golden St. Johnswort
<i>Ilex spp.</i>	Holly species (male cultivars only)
<i>Ilex x attenuata "Fosteri"</i>	Foster's Holly (male cultivars only)
<i>Ilex crenata</i>	Japanese Holly (male cultivars such as 'Glass', 'Green Dragon', 'Green Island', 'Helleri', 'Howard', 'Northern Beauty' and 'Sentinel' only)
<i>Ilex x "Edward J. Stevens"</i>	Edward Stevens Holly
<i>Ilex glabra</i>	Inkberry (male cultivars such as 'Chamzin' and 'Shamrock' only)
<i>Ilex x meserveae</i>	Meserve Hybrid Hollies (male cultivars such as 'Blue Boy', 'Blue Prince', 'Blue Stallion', and 'China Boy' only)
<i>Ilex opaca</i>	American Holly (male cultivars such as 'Jersey Knight' only)
<i>Ilex verticillata</i>	Winterberry (male cultivars such as 'Jackson', 'Jim Dandy', 'Johnny Come Lately', 'Quansoo', and 'Southern Gentleman' only)
<i>Itea virginica</i>	Virginia Sweetspire
<i>Jasminum nudiflorum</i>	Winter Jasmine
<i>Juniperis conferta</i>	Shore Juniper
<i>Juniperis chinensis</i>	Chinese Juniper (male cultivars such as 'Globosa' and 'Pfitzeriana Glauca' only)
<i>Juniperis horizontalis</i>	Creeping Juniper (male cultivars such as 'Fountain', 'Glomerata', 'Jade River', 'Jade Spreader', 'Plumosa' and 'Plumosa Compacta Youngstown' only)
<i>Juniperis procumbens</i>	Jaggarden Juniper (male cultivars only)
<i>Juniperis sabina</i>	Savin Juniper (male cultivars only)
<i>Juniperis scopulorum</i>	Rocky Mountain Juniper (male cultivars such as 'Gray Gleam', 'Medora', and 'Silver King' only)
<i>Kalmia latifolia</i>	Mountain Laurel
<i>Lavandula angustifolia</i>	Common Lavender
<i>Leucothoe axillaris</i>	Fetterbush

Shrubs (large, medium, small, ornamental & evergreen)

Scientific name	Common name
<i>Ligustrum japonicum</i>	Japanese Privet
<i>Lindera benzoin</i>	Spicebush (use male cultivars such as 'Green Gold' and 'Rubra' only)
<i>Magnolia virginiana</i>	Sweetbay Magnolia
<i>Microbiota decussata</i>	Russian Arborvitae
<i>Myrica pennsylvanica</i>	Northern Bayberry (male cultivars such as 'Myrman' only)
<i>Nandina domestica</i>	Heavenly Bamboo (non-fruiting cultivars such as 'Atropurpurea Nana' only)
<i>Osmanthus heterophyllus</i>	False-holly
<i>Photinia x fraseri</i>	Fraser Photinia
<i>Prunus laurocerasus</i>	Common Cherrylaurel (only cultivars with non-showy fruit such as 'Schipkaensis' only)
<i>Pyracantha koidzumii</i>	Formosa Firethorn
<i>Rhododendron arborescens</i>	Sweet Azalea
<i>Sarcococca hookeriana</i>	Sweetbox
<i>Spiraea</i> spp.	Meadowsweet
<i>Spiraea nipponica</i> 'Snowmound'	Snowmound Spiraea
<i>Syringa vulgaris</i>	Common Lilac
<i>Taxus baccata</i>	English Yew (male cultivars only)
<i>Taxus x media</i>	Anglojap Yew (male cultivars such as 'Amherst', 'Brownii', 'Hatfieldii' and 'Sebian' only)
<i>Viburnum x burkwoodii</i>	Burkwood Viburnum
<i>Viburnum plicatum</i> var. <i>tomentosum</i>	Doublefile Viburnum (use non-fruiting cultivars such as 'Roseum' only)
<i>Viburnum rhytidophyllum</i>	Leatherleaf Viburnum
<i>Weigela florida</i>	Old-fashioned Wegelia

Grasses (Ornamental, Turf, Erosion Control)

Scientific name	Common name
<i>Agrostis gigantea</i>	Redtop
<i>Agrostis perennans</i>	Upland Bentgrass
<i>Agrostis stolonifera</i>	Creeping Bentgrass
<i>Andropogon scoparius</i>	Little Bluestem
<i>Calamagrostis x acutiflora</i>	Feather Reed Grass
<i>Calamagrostis arundinacea</i> 'Karl Foerster'	Foerster's Feather Reed Grass
<i>Calamagrostis stricta</i>	Slimstem Reed Grass
<i>Festuca arundinacea</i>	Certified turf-type Tall Fescue
<i>Festuca longifolia</i>	Hard Fescue
<i>Festuca rubra</i> var. <i>commutata</i>	Chewings Fescue
<i>Lolium multiflorum</i>	Annual Ryegrass
<i>Lolium perenne</i>	Perennial Ryegrass
<i>Miscanthus sinensis</i> var. <i>gracillimus</i>	Maiden Grass
<i>Panicum virgatum</i>	Switch-grass
<i>Pennisetum alopecuroides</i>	Fountain Grass
<i>Pennisetum alopecuroides</i> 'Hameln'	'Hameln' Fountain Grass
<i>Pennisetum alopecuroides</i> 'Little Bunny'	'Little Bunny' Fountain Grass
<i>Pennisetum villosum</i>	Feathertop
<i>Poa palustris</i>	Fowl Bluegrass
<i>Poa pratensis</i>	Kentucky Bluegrass

Attachment 4:

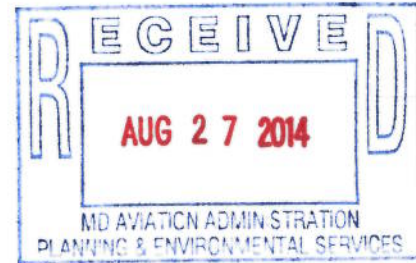
Maryland Department of Natural Resources (MDNR)

Forest Maintenance Plan Approval Letter

August 20, 2014



Martin O'Malley, Governor
Anthony G. Brown, Lt. Governor
Joseph P. Gill, Secretary
Frank W. Dawson III, Deputy Secretary



August 20, 2014

Robin Bowie
Maryland Aviation Administration
P.O. Box 8766
BWI Airport, MD 21240-0766

RE: final Forest Maintenance Plan Update Baltimore/Washington International Thurgood Marshall Airport
July 2014

Dear Ms. Bowie:

Upon review of the final Forest Maintenance Plan Update Baltimore/Washington International Thurgood Marshall Airport July 2014, I have the following comments based on my June 4, 2014 letter:

The document has been revised per my June 4, 2014 review letter and is acceptable for use as a forest maintenance plan.

1) The document references a forest conservation exemption incompletely. - REVISED

(7) Any activity conducted on a single lot of any size or a linear project provided that:

- (i) The activity does not result in the cutting, clearing, or grading of more than 20,000 square feet of forest; and*
- (ii) The activity on the lot or linear project will not result in the cutting, clearing, or grading of any forest that is subject to the requirements of a previous forest conservation plan prepared under this subtitle; [NRA 5-1602(b)]*

State property is generally composed of many individual lots as the state is not required to "subdivide" the property into one lot or parcel after purchasing adjacent lots. I do recall that this scenario is true on parts of your property. Would it apply to the entire inside fence and outside fence area? Would it be easier for future submittals to make the assumption that the entire property, inside and outside, are not a single lot and not apply this exemption?

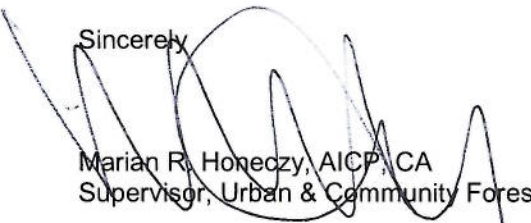
There is also the (ii) language that affects your property. This should be mentioned if the part of the exemption language is mentioned.

2)The property adjacent to the Timbuktu restaurant is marked as released in the draft plan. Has this already occurred? If so, where has the required mitigation as per approved forest conservation plans, located on that property been relocated? - REVISED

3)Remove Appendix B. This appendix is a copy of the statute which does get amended frequently. The current statute would apply to the projects, not Appendix B's version. - REVISED

If you have any questions with my comments I can be reached at (410) 260-8511 or via email at marian.honeczy@maryland.gov

Sincerely,



Marian R. Honeczy, AICP, CA
Supervisor, Urban & Community Forestry

Attachment 5:

Maryland DNR Environmental Review Program

Email response for fisheries resources

October 7, 2016

From: [Robin Bowie](#)
To: [Kim Hughes](#); [Caroline Pinegar](#); [Leyla Lange](#)
Subject: MD DNR comments, response to fisheries resources scoping request, BWI Airport Improvement Projects, 2016-2020, AA County
Date: Friday, October 07, 2016 3:24:44 PM

See below.

Sent via the Samsung GALAXY S® 5, an AT&T 4G LTE smartphone

----- Original message -----

From: Greg Golden -DNR- <greg.golden@maryland.gov>
Date: 10/7/16 2:41 PM (GMT-05:00)
To: Robin Bowie <rbowie@bwiairport.com>
Subject: MD DNR comments, response to fisheries resources scoping request, BWI Airport Improvement Projects, 2016-2020, AA County

MD DNR Environmental Review Program has reviewed your request for fisheries resources scoping (anadromous finfish or other fish) related to the BWI Airport proposed improvement projects, 2016-2020. Please consider this email response as our official comments and response for the request.

As noted in your request information, the subject streams in your project area (Stony Run, Cabin Branch, and Sawmill Creek) are designated as Use I Streams by the State of MD. Typically, instream work is not allowed in Use I streams from March 1 through June 15, inclusive, of any year.

The three streams are similar in nature regarding fisheries resources. Their headwater reaches and tributaries are nearby, adjacent, and/or within the study area and airport boundaries. The perennial reaches of the streams and their tributaries support communities of several warmwater fish species typical of small streams in central Maryland. The spawning periods of these fish species will be protected by the instream work restriction period referenced above.

Migratory anadromous fish, including river herring, white perch, and yellow perch are likely to spawn in the lower reaches of each of these tributaries, closer to tidal waters. These species will also be protected by the referenced restriction period. Yellow perch, typically protected by a slightly earlier restriction period, are found further downstream from your project area so the single restriction period referenced here will apply for your study area for the minor types of activities you have described.

These fish species will also benefit from careful application of sediment and erosion control measures in upland areas for your projects.

If you have any questions on the comments above, please contact me at your convenience.

Greg Golden
Environmental Review Program

MD Department of Natural Resources

[410-260-8331](tel:410-260-8331)

please note my new email address: greg.golden@maryland.gov



Maryland now features 511 traveler information!

Call 511 or visit: www.md511.org



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**Attachment 6:
Forest Conservation Worksheets
for Mitigation Requirements**

Forest Conservation Worksheet

Relocate Taxiways F&R (ALP Alternative)

Net Tract Area

A.	Total Tract Area	A =	<u>111.00</u>
B.	Deductions	B =	<u> </u>
C.	Net Tract Area	C =	<u>111.00</u>

Land Use Category

Input the number "1" under the appropriate land use zoning, and limit to only one entry

ARA	MDR	IDA	HDR	MPD	CIA
0	0	1	0	0	0

D.	Afforestation Threshold (Net Tract Area x 15%)	D =	<u>16.65</u>
E.	Conservation Threshold (Net Tract Area x 20%)	E =	<u>22.20</u>

Existing Forest Cover

F.	Existing Forest Cover within the Net Tract Area	F =	<u>5.06</u>
G.	Area of Forest Above Conservation Threshold	G =	<u>0.00</u>

Break Even Point

H.	Break Even Point	H =	<u>5.06</u>
I.	Forest Clearing Permitted Without Mitigation	I =	<u>0.00</u>

Proposed Forest Clearing

J.	Total Area of Forest to be Cleared	J =	<u>5.06</u>
K.	Total Area of Forest to be Retained	K =	<u>0.00</u>

Planting Requirements

L.	Reforestation for Clearing Above the Conservation Threshold	L =	<u>0.00</u>
M.	Reforestation for Clearing Below the Conservation Threshold	M =	<u>10.12</u>
N.	Credit for Retention above the Conservation Threshold	N =	<u>0.00</u>
P.	Total Reforestation Required	P =	<u>10.12</u>
Q.	Total Afforestation Required	Q =	<u>11.59</u>
R.	Total Planting Requirement	R =	<u>21.71</u>

Sq. Ft. 945,687.60

PIL \$94,568.76

Forest Conservation Worksheet

Taxiway U3 (ALP)

Net Tract Area

A.	Total Tract Area	A =	<u>5.10</u>
B.	Deductions	B =	<u>0.00</u>
C.	Net Tract Area	C =	<u>5.10</u>

Land Use Category

Input the number "1" under the appropriate land use zoning, and limit to only one entry

ARA	MDR	IDA	HDR	MPD	CIA
0	0	1	0	0	0

D.	Afforestation Threshold (Net Tract Area x 15%)	D =	<u>0.77</u>
E.	Conservation Threshold (Net Tract Area x 20%)	E =	<u>1.02</u>

Existing Forest Cover

F.	Existing Forest Cover within the Net Tract Area	F =	<u>0.00</u>
G.	Area of Forest Above Conservation Threshold	G =	<u>0.00</u>

Break Even Point

H.	Break Even Point	H =	<u>0.00</u>
I.	Forest Clearing Permitted Without Mitigation	I =	<u>0.00</u>

Proposed Forest Clearing

J.	Total Area of Forest to be Cleared	J =	<u>0.00</u>
K.	Total Area of Forest to be Retained	K =	<u>0.00</u>

Planting Requirements

L.	Reforestation for Clearing Above the Conservation Threshold	L =	<u>0.00</u>
M.	Reforestation for Clearing Below the Conservation Threshold	M =	<u>0.00</u>
N.	Credit for Retention above the Conservation Threshold	N =	<u>0.00</u>
P.	Total Reforestation Required	P =	<u>0.00</u>
Q.	Total Afforestation Required	Q =	<u>0.77</u>
R.	Total Planting Requirement	R =	<u>0.77</u>

Sq. Ft. 33,323.40

PIL \$3,332.34

Forest Conservation Worksheet

Relocate Taxiway U3 (Sponsor's Preferred Alternative)

Net Tract Area

A.	Total Tract Area	A =	<u>10.80</u>
B.	Deductions	B =	<u>0.00</u>
C.	Net Tract Area	C =	<u>10.80</u>

Land Use Category

Input the number "1" under the appropriate land use zoning, and limit to only one entry

ARA	MDR	IDA	HDR	MPD	CIA
0	0	1	0	0	0

D.	Afforestation Threshold (Net Tract Area x 15%)	D =	<u>1.62</u>
E.	Conservation Threshold (Net Tract Area x 20%)	E =	<u>2.16</u>

Existing Forest Cover

F.	Existing Forest Cover within the Net Tract Area	F =	<u>0.00</u>
G.	Area of Forest Above Conservation Threshold	G =	<u>0.00</u>

Break Even Point

H.	Break Even Point	H =	<u>0.00</u>
I.	Forest Clearing Permitted Without Mitigation	I =	<u>0.00</u>

Proposed Forest Clearing

J.	Total Area of Forest to be Cleared	J =	<u>0.00</u>
K.	Total Area of Forest to be Retained	K =	<u>0.00</u>

Planting Requirements

L.	Reforestation for Clearing Above the Conservation Threshold	L =	<u>0.00</u>
M.	Reforestation for Clearing Below the Conservation Threshold	M =	<u>0.00</u>
N.	Credit for Retention above the Conservation Threshold	N =	<u>0.00</u>
P.	Total Reforestation Required	P =	<u>0.00</u>
Q.	Total Afforestation Required	Q =	<u>1.62</u>
R.	Total Planting Requirement	R =	<u>1.62</u>

Sq. Ft. 70567.20

PIL \$7,056.72

Forest Conservation Worksheet International Terminal Area Terminal Taxiway Filletts/Shoulders (ALP Alternative)

Net Tract Area

A.	Total Tract Area	A =	<u>14.60</u>
B.	Deductions	B =	<u> </u>
C.	Net Tract Area	C =	<u>14.60</u>

Land Use Category

Input the number "1" under the appropriate land use zoning, and limit to only one entry

ARA	MDR	IDA	HDR	MPD	CIA
0	0	1	0	0	0

D.	Afforestation Threshold (Net Tract Area x 15%)	D =	<u>2.19</u>
E.	Conservation Threshold (Net Tract Area x 20%)	E =	<u>2.92</u>

Existing Forest Cover

F.	Existing Forest Cover within the Net Tract Area	F =	<u>0.00</u>
G.	Area of Forest Above Conservation Threshold	G =	<u>0.00</u>

Break Even Point

H.	Break Even Point	H =	<u>0.00</u>
I.	Forest Clearing Permitted Without Mitigation	I =	<u>0.00</u>

Proposed Forest Clearing

J.	Total Area of Forest to be Cleared	J =	<u>0.00</u>
K.	Total Area of Forest to be Retained	K =	<u>0.00</u>

Planting Requirements

L.	Reforestation for Clearing Above the Conservation Threshold	L =	<u>0.00</u>
M.	Reforestation for Clearing Below the Conservation Threshold	M =	<u>0.00</u>
N.	Credit for Retention above the Conservation Threshold	N =	<u>0.00</u>
P.	Total Reforestation Required	P =	<u>0.00</u>
Q.	Total Afforestation Required	Q =	<u>2.19</u>
R.	Total Planting Requirement	R =	<u>2.19</u>

Sq. Ft. 95,396.40

PIL \$9,539.64

Forest Conservation Worksheet

New Infill Pavement Near Taxiways T, P and 'Future" P (ALP Alternative)

Net Tract Area

A.	Total Tract Area	A =	<u>11.60</u>
B.	Deductions	B =	<u> </u>
C.	Net Tract Area	C =	<u>11.60</u>

Land Use Category

Input the number "1" under the appropriate land use zoning, and limit to only one entry

ARA	MDR	IDA	HDR	MPD	CIA
0	0	1	0	0	0

D.	Afforestation Threshold (Net Tract Area x 15%)	D =	<u>1.74</u>
E.	Conservation Threshold (Net Tract Area x 20%)	E =	<u>2.32</u>

Existing Forest Cover

F.	Existing Forest Cover within the Net Tract Area	F =	<u>0.00</u>
G.	Area of Forest Above Conservation Threshold	G =	<u>0.00</u>

Break Even Point

H.	Break Even Point	H =	<u>0.00</u>
I.	Forest Clearing Permitted Without Mitigation	I =	<u>0.00</u>

Proposed Forest Clearing

J.	Total Area of Forest to be Cleared	J =	<u>0.00</u>
K.	Total Area of Forest to be Retained	K =	<u>0.00</u>

Planting Requirements

L.	Reforestation for Clearing Above the Conservation Threshold	L =	<u>0.00</u>
M.	Reforestation for Clearing Below the Conservation Threshold	M =	<u>0.00</u>
N.	Credit for Retention above the Conservation Threshold	N =	<u>0.00</u>
P.	Total Reforestation Required	P =	<u>0.00</u>
Q.	Total Afforestation Required	Q =	<u>1.74</u>
R.	Total Planting Requirement	R =	<u>1.74</u>

Sq. Ft. 75,794.40

PIL \$7,579.44

Forest Conservation Worksheet

Relocate Taxiways K&L (ALP Alternative)

Net Tract Area

A.	Total Tract Area	A =	<u>7.90</u>
B.	Deductions	B =	<u> </u>
C.	Net Tract Area	C =	<u>7.90</u>

Land Use Category

Input the number "1" under the appropriate land use zoning, and limit to only one entry

ARA	MDR	IDA	HDR	MPD	CIA
0	0	1	0	0	0

D.	Afforestation Threshold (Net Tract Area x 15%)	D =	<u>1.19</u>
E.	Conservation Threshold (Net Tract Area x 20%)	E =	<u>1.58</u>

Existing Forest Cover

F.	Existing Forest Cover within the Net Tract Area	F =	<u>0.00</u>
G.	Area of Forest Above Conservation Threshold	G =	<u>0.00</u>

Break Even Point

H.	Break Even Point	H =	<u>0.00</u>
I.	Forest Clearing Permitted Without Mitigation	I =	<u>0.00</u>

Proposed Forest Clearing

J.	Total Area of Forest to be Cleared	J =	<u>0.00</u>
K.	Total Area of Forest to be Retained	K =	<u>0.00</u>

Planting Requirements

L.	Reforestation for Clearing Above the Conservation Threshold	L =	<u>0.00</u>
M.	Reforestation for Clearing Below the Conservation Threshold	M =	<u>0.00</u>
N.	Credit for Retention above the Conservation Threshold	N =	<u>0.00</u>
P.	Total Reforestation Required	P =	<u>0.00</u>
Q.	Total Afforestation Required	Q =	<u>1.19</u>
R.	Total Planting Requirement	R =	<u>1.19</u>

Sq. Ft. 51,618.60

PIL \$5,161.86

Forest Conservation Worksheet

Isolation/Ron Apron (ALP)

Net Tract Area

A.	Total Tract Area	A =	<u>36.00</u>
B.	Deductions	B =	<u>0.00</u>
C.	Net Tract Area	C =	<u>36.00</u>

Land Use Category

Input the number "1" under the appropriate land use zoning, and limit to only one entry

ARA	MDR	IDA	HDR	MPD	CIA
0	0	1	0	0	0

D.	Afforestation Threshold (Net Tract Area x 15%)	D =	<u>5.40</u>
E.	Conservation Threshold (Net Tract Area x 20%)	E =	<u>7.20</u>

Existing Forest Cover

F.	Existing Forest Cover within the Net Tract Area	F =	<u>0.00</u>
G.	Area of Forest Above Conservation Threshold	G =	<u>0.00</u>

Break Even Point

H.	Break Even Point	H =	<u>0.00</u>
I.	Forest Clearing Permitted Without Mitigation	I =	<u>0.00</u>

Proposed Forest Clearing

J.	Total Area of Forest to be Cleared	J =	<u>0.00</u>
K.	Total Area of Forest to be Retained	K =	<u>0.00</u>

Planting Requirements

L.	Reforestation for Clearing Above the Conservation Threshold	L =	<u>0.00</u>
M.	Reforestation for Clearing Below the Conservation Threshold	M =	<u>0.00</u>
N.	Credit for Retention above the Conservation Threshold	N =	<u>0.00</u>
P.	Total Reforestation Required	P =	<u>0.00</u>
Q.	Total Afforestation Required	Q =	<u>5.40</u>
R.	Total Planting Requirement	R =	<u>5.40</u>

Sq. Ft. 235,224.00

PIL \$23,522.40

Forest Conservation Worksheet

Isolation/RON Apron (Sponsor's Preferred Alternative)

Net Tract Area

A.	Total Tract Area	A =	<u>36.90</u>
B.	Deductions	B =	<u>0.00</u>
C.	Net Tract Area	C =	<u>36.90</u>

Land Use Category

Input the number "1" under the appropriate land use zoning, and limit to only one entry

ARA	MDR	IDA	HDR	MPD	CIA
0	0	1	0	0	0

D.	Afforestation Threshold (Net Tract Area x 15%)	D =	<u>5.54</u>
E.	Conservation Threshold (Net Tract Area x 20%)	E =	<u>7.38</u>

Existing Forest Cover

F.	Existing Forest Cover within the Net Tract Area	F =	<u>0.00</u>
G.	Area of Forest Above Conservation Threshold	G =	<u>0.00</u>

Break Even Point

H.	Break Even Point	H =	<u>0.00</u>
I.	Forest Clearing Permitted Without Mitigation	I =	<u>0.00</u>

Proposed Forest Clearing

J.	Total Area of Forest to be Cleared	J =	<u>0.00</u>
K.	Total Area of Forest to be Retained	K =	<u>0.00</u>

Planting Requirements

L.	Reforestation for Clearing Above the Conservation Threshold	L =	<u>0.00</u>
M.	Reforestation for Clearing Below the Conservation Threshold	M =	<u>0.00</u>
N.	Credit for Retention above the Conservation Threshold	N =	<u>0.00</u>
P.	Total Reforestation Required	P =	<u>0.00</u>
Q.	Total Afforestation Required	Q =	<u>5.54</u>
R.	Total Planting Requirement	R =	<u>5.54</u>

Sq. Ft. 241,104.60

PIL \$24,110.46

Forest Conservation Worksheet

Runway 28 Deicing Pad Expansion (ALP)

Net Tract Area

A.	Total Tract Area	A =	<u>14.10</u>
B.	Deductions	B =	<u> </u>
C.	Net Tract Area	C =	<u>14.10</u>

Land Use Category

Input the number "1" under the appropriate land use zoning, and limit to only one entry

ARA	MDR	IDA	HDR	MPD	CIA
0	0	1	0	0	0

D.	Afforestation Threshold (Net Tract Area x 15%)	D =	<u>2.12</u>
E.	Conservation Threshold (Net Tract Area x 20%)	E =	<u>2.82</u>

Existing Forest Cover

F.	Existing Forest Cover within the Net Tract Area	F =	<u>0.00</u>
G.	Area of Forest Above Conservation Threshold	G =	<u>0.00</u>

Break Even Point

H.	Break Even Point	H =	<u>0.00</u>
I.	Forest Clearing Permitted Without Mitigation	I =	<u>0.00</u>

Proposed Forest Clearing

J.	Total Area of Forest to be Cleared	J =	<u>0.00</u>
K.	Total Area of Forest to be Retained	K =	<u>0.00</u>

Planting Requirements

L.	Reforestation for Clearing Above the Conservation Threshold	L =	<u>0.00</u>
M.	Reforestation for Clearing Below the Conservation Threshold	M =	<u>0.00</u>
N.	Credit for Retention above the Conservation Threshold	N =	<u>0.00</u>
P.	Total Reforestation Required	P =	<u>0.00</u>
Q.	Total Afforestation Required	Q =	<u>2.12</u>
R.	Total Planting Requirement	R =	<u>2.12</u>

Sq. Ft. 92,129.40

PIL \$9,212.94

Forest Conservation Worksheet

Runway 28 Deicing Pad Expansion (Sponsor's Preferred Alternative)

Net Tract Area

A.	Total Tract Area	A =	<u>16.60</u>
B.	Deductions	B =	<u>0.00</u>
C.	Net Tract Area	C =	<u>16.60</u>

Land Use Category

Input the number "1" under the appropriate land use zoning, and limit to only one entry

ARA	MDR	IDA	HDR	MPD	CIA
0	0	1	0	0	0

D.	Afforestation Threshold (Net Tract Area x 15%)	D =	<u>2.49</u>
E.	Conservation Threshold (Net Tract Area x 20%)	E =	<u>3.32</u>

Existing Forest Cover

F.	Existing Forest Cover within the Net Tract Area	F =	<u>0.00</u>
G.	Area of Forest Above Conservation Threshold	G =	<u>0.00</u>

Break Even Point

H.	Break Even Point	H =	<u>0.00</u>
I.	Forest Clearing Permitted Without Mitigation	I =	<u>0.00</u>

Proposed Forest Clearing

J.	Total Area of Forest to be Cleared	J =	<u>0.00</u>
K.	Total Area of Forest to be Retained	K =	<u>0.00</u>

Planting Requirements

L.	Reforestation for Clearing Above the Conservation Threshold	L =	<u>0.00</u>
M.	Reforestation for Clearing Below the Conservation Threshold	M =	<u>0.00</u>
N.	Credit for Retention above the Conservation Threshold	N =	<u>0.00</u>
P.	Total Reforestation Required	P =	<u>0.00</u>
Q.	Total Afforestation Required	Q =	<u>2.49</u>
R.	Total Planting Requirement	R =	<u>2.49</u>

Sq. Ft. 108,464.40

PIL \$10,846.44

Forest Conservation Worksheet

Taxiway H Relocation (ALP)

Net Tract Area

A.	Total Tract Area	A =	<u>8.80</u>
B.	Deductions	B =	<u>0.00</u>
C.	Net Tract Area	C =	<u>8.80</u>

Land Use Category

Input the number "1" under the appropriate land use zoning, and limit to only one entry

ARA	MDR	IDA	HDR	MPD	CIA
0	0	1	0	0	0

D.	Afforestation Threshold (Net Tract Area x 15%)	D =	<u>1.32</u>
E.	Conservation Threshold (Net Tract Area x 20%)	E =	<u>1.76</u>

Existing Forest Cover

F.	Existing Forest Cover within the Net Tract Area	F =	<u>0.00</u>
G.	Area of Forest Above Conservation Threshold	G =	<u>0.00</u>

Break Even Point

H.	Break Even Point	H =	<u>0.00</u>
I.	Forest Clearing Permitted Without Mitigation	I =	<u>0.00</u>

Proposed Forest Clearing

J.	Total Area of Forest to be Cleared	J =	<u>0.00</u>
K.	Total Area of Forest to be Retained	K =	<u>0.00</u>

Planting Requirements

L.	Reforestation for Clearing Above the Conservation Threshold	L =	<u>0.00</u>
M.	Reforestation for Clearing Below the Conservation Threshold	M =	<u>0.00</u>
N.	Credit for Retention above the Conservation Threshold	N =	<u>0.00</u>
P.	Total Reforestation Required	P =	<u>0.00</u>
Q.	Total Afforestation Required	Q =	<u>1.32</u>
R.	Total Planting Requirement	R =	<u>1.32</u>

Sq. Ft. 57,499.20

PIL \$5,749.92

Forest Conservation Worksheet

Taxiway H Relocation (Sponsor's Preferred Alternative)

Net Tract Area

A.	Total Tract Area	A =	<u>7.10</u>
B.	Deductions	B =	<u>0.00</u>
C.	Net Tract Area	C =	<u>7.10</u>

Land Use Category

Input the number "1" under the appropriate land use zoning, and limit to only one entry

ARA	MDR	IDA	HDR	MPD	CIA
0	0	1	0	0	0

D.	Afforestation Threshold (Net Tract Area x 15%)	D =	<u>1.07</u>
E.	Conservation Threshold (Net Tract Area x 20%)	E =	<u>1.42</u>

Existing Forest Cover

F.	Existing Forest Cover within the Net Tract Area	F =	<u>0.00</u>
G.	Area of Forest Above Conservation Threshold	G =	<u>0.00</u>

Break Even Point

H.	Break Even Point	H =	<u>0.00</u>
I.	Forest Clearing Permitted Without Mitigation	I =	<u>0.00</u>

Proposed Forest Clearing

J.	Total Area of Forest to be Cleared	J =	<u>0.00</u>
K.	Total Area of Forest to be Retained	K =	<u>0.00</u>

Planting Requirements

L.	Reforestation for Clearing Above the Conservation Threshold	L =	<u>0.00</u>
M.	Reforestation for Clearing Below the Conservation Threshold	M =	<u>0.00</u>
N.	Credit for Retention above the Conservation Threshold	N =	<u>0.00</u>
P.	Total Reforestation Required	P =	<u>0.00</u>
Q.	Total Afforestation Required	Q =	<u>1.07</u>
R.	Total Planting Requirement	R =	<u>1.07</u>

Sq. Ft. 46,391.40

PIL \$4,639.14

Forest Conservation Worksheet

Terminal Roadway Widening and Access Improvements (ALP)

Net Tract Area

A.	Total Tract Area	A =	<u>2.00</u>
B.	Deductions	B =	<u>0.00</u>
C.	Net Tract Area	C =	<u>2.00</u>

Land Use Category

Input the number "1" under the appropriate land use zoning, and limit to only one entry

ARA	MDR	IDA	HDR	MPD	CIA
0	0	1	0	0	0

D.	Afforestation Threshold (Net Tract Area x 15%)	D =	<u>0.30</u>
E.	Conservation Threshold (Net Tract Area x 20%)	E =	<u>0.40</u>

Existing Forest Cover

F.	Existing Forest Cover within the Net Tract Area	F =	<u>0.00</u>
G.	Area of Forest Above Conservation Threshold	G =	<u>0.00</u>

Break Even Point

H.	Break Even Point	H =	<u>0.00</u>
I.	Forest Clearing Permitted Without Mitigation	I =	<u>0.00</u>

Proposed Forest Clearing

J.	Total Area of Forest to be Cleared	J =	<u>0.00</u>
K.	Total Area of Forest to be Retained	K =	<u>0.00</u>

Planting Requirements

L.	Reforestation for Clearing Above the Conservation Threshold	L =	<u>0.00</u>
M.	Reforestation for Clearing Below the Conservation Threshold	M =	<u>0.00</u>
N.	Credit for Retention above the Conservation Threshold	N =	<u>0.00</u>
P.	Total Reforestation Required	P =	<u>0.00</u>
Q.	Total Afforestation Required	Q =	<u>0.30</u>
R.	Total Planting Requirement	R =	<u>0.30</u>

Sq. Ft. 13,068.00

PIL \$1,306.80

Forest Conservation Worksheet

Taxiway V Relocation (ALP)

Net Tract Area

A.	Total Tract Area	A =	<u>35.00</u>
B.	Deductions	B =	<u>0.00</u>
C.	Net Tract Area	C =	<u>35.00</u>

Land Use Category

Input the number "1" under the appropriate land use zoning, and limit to only one entry

ARA	MDR	IDA	HDR	MPD	CIA
0	0	1	0	0	0

D.	Afforestation Threshold (Net Tract Area x 15%)	D =	<u>5.25</u>
E.	Conservation Threshold (Net Tract Area x 20%)	E =	<u>7.00</u>

Existing Forest Cover

F.	Existing Forest Cover within the Net Tract Area	F =	<u>0.02</u>
G.	Area of Forest Above Conservation Threshold	G =	<u>0.00</u>

Break Even Point

H.	Break Even Point	H =	<u>0.02</u>
I.	Forest Clearing Permitted Without Mitigation	I =	<u>0.00</u>

Proposed Forest Clearing

J.	Total Area of Forest to be Cleared	J =	<u>0.02</u>
K.	Total Area of Forest to be Retained	K =	<u>0.00</u>

Planting Requirements

L.	Reforestation for Clearing Above the Conservation Threshold	L =	<u>0.00</u>
M.	Reforestation for Clearing Below the Conservation Threshold	M =	<u>0.04</u>
N.	Credit for Retention above the Conservation Threshold	N =	<u>0.00</u>
P.	Total Reforestation Required	P =	<u>0.04</u>
Q.	Total Afforestation Required	Q =	<u>5.23</u>
R.	Total Planting Requirement	R =	<u>5.27</u>

Sq. Ft. 229,561.20

PIL \$22,956.12

Forest Conservation Worksheet

Runway 15 Deicing Pad Expansion (ALP)

Net Tract Area

A.	Total Tract Area	A =	<u>16.30</u>
B.	Deductions	B =	<u>0.00</u>
C.	Net Tract Area	C =	<u>16.30</u>

Land Use Category

Input the number "1" under the appropriate land use zoning, and limit to only one entry

ARA	MDR	IDA	HDR	MPD	CIA
0	0	1	0	0	0

D.	Afforestation Threshold (Net Tract Area x 15%)	D =	<u>2.45</u>
E.	Conservation Threshold (Net Tract Area x 20%)	E =	<u>3.26</u>

Existing Forest Cover

F.	Existing Forest Cover within the Net Tract Area	F =	<u>0.00</u>
G.	Area of Forest Above Conservation Threshold	G =	<u>0.00</u>

Break Even Point

H.	Break Even Point	H =	<u>0.00</u>
I.	Forest Clearing Permitted Without Mitigation	I =	<u>0.00</u>

Proposed Forest Clearing

J.	Total Area of Forest to be Cleared	J =	<u>0.00</u>
K.	Total Area of Forest to be Retained	K =	<u>0.00</u>

Planting Requirements

L.	Reforestation for Clearing Above the Conservation Threshold	L =	<u>0.00</u>
M.	Reforestation for Clearing Below the Conservation Threshold	M =	<u>0.00</u>
N.	Credit for Retention above the Conservation Threshold	N =	<u>0.00</u>
P.	Total Reforestation Required	P =	<u>0.00</u>
Q.	Total Afforestation Required	Q =	<u>2.45</u>
R.	Total Planting Requirement	R =	<u>2.45</u>

Sq. Ft. 106,504.20

PIL \$10,650.42

Forest Conservation Worksheet

Upper Level Roadway Widening at Concourse E (ALP)

Net Tract Area

A.	Total Tract Area	A =	<u>8.10</u>
B.	Deductions	B =	<u>0.00</u>
C.	Net Tract Area	C =	<u>8.10</u>

Land Use Category

Input the number "1" under the appropriate land use zoning, and limit to only one entry

ARA	MDR	IDA	HDR	MPD	CIA
0	0	1	0	0	0

D.	Afforestation Threshold (Net Tract Area x 15%)	D =	<u>1.22</u>
E.	Conservation Threshold (Net Tract Area x 20%)	E =	<u>1.62</u>

Existing Forest Cover

F.	Existing Forest Cover within the Net Tract Area	F =	<u>0.00</u>
G.	Area of Forest Above Conservation Threshold	G =	<u>0.00</u>

Break Even Point

H.	Break Even Point	H =	<u>0.00</u>
I.	Forest Clearing Permitted Without Mitigation	I =	<u>0.00</u>

Proposed Forest Clearing

J.	Total Area of Forest to be Cleared	J =	<u>0.00</u>
K.	Total Area of Forest to be Retained	K =	<u>0.00</u>

Planting Requirements

L.	Reforestation for Clearing Above the Conservation Threshold	L =	<u>0.00</u>
M.	Reforestation for Clearing Below the Conservation Threshold	M =	<u>0.00</u>
N.	Credit for Retention above the Conservation Threshold	N =	<u>0.00</u>
P.	Total Reforestation Required	P =	<u>0.00</u>
Q.	Total Afforestation Required	Q =	<u>1.22</u>
R.	Total Planting Requirement	R =	<u>1.22</u>

Sq. Ft. 52,925.40

PIL \$5,292.54

Forest Conservation Worksheet

Second FBO (ALP)

Net Tract Area

A.	Total Tract Area	A =	<u>13.90</u>
B.	Deductions	B =	<u>0.00</u>
C.	Net Tract Area	C =	<u>13.90</u>

Land Use Category

Input the number "1" under the appropriate land use zoning, and limit to only one entry

ARA	MDR	IDA	HDR	MPD	CIA
0	0	1	0	0	0

D.	Afforestation Threshold (Net Tract Area x 15%)	D =	<u>2.09</u>
E.	Conservation Threshold (Net Tract Area x 20%)	E =	<u>2.78</u>

Existing Forest Cover

F.	Existing Forest Cover within the Net Tract Area	F =	<u>0.00</u>
G.	Area of Forest Above Conservation Threshold	G =	<u>0.00</u>

Break Even Point

H.	Break Even Point	H =	<u>0.00</u>
I.	Forest Clearing Permitted Without Mitigation	I =	<u>0.00</u>

Proposed Forest Clearing

J.	Total Area of Forest to be Cleared	J =	<u>0.00</u>
K.	Total Area of Forest to be Retained	K =	<u>0.00</u>

Planting Requirements

L.	Reforestation for Clearing Above the Conservation Threshold	L =	<u>0.00</u>
M.	Reforestation for Clearing Below the Conservation Threshold	M =	<u>0.00</u>
N.	Credit for Retention above the Conservation Threshold	N =	<u>0.00</u>
P.	Total Reforestation Required	P =	<u>0.00</u>
Q.	Total Afforestation Required	Q =	<u>2.09</u>
R.	Total Planting Requirement	R =	<u>2.09</u>

Sq. Ft. 90,822.60

PIL \$9,082.26

Forest Conservation Worksheet

Northrop Grumman Hanger (ALP)

Net Tract Area

A.	Total Tract Area	A =	<u>11.40</u>
B.	Deductions	B =	<u>0.00</u>
C.	Net Tract Area	C =	<u>11.40</u>

Land Use Category

Input the number "1" under the appropriate land use zoning, and limit to only one entry

ARA	MDR	IDA	HDR	MPD	CIA
0	0	1	0	0	0

D.	Afforestation Threshold (Net Tract Area x 15%)	D =	<u>1.71</u>
E.	Conservation Threshold (Net Tract Area x 20%)	E =	<u>2.28</u>

Existing Forest Cover

F.	Existing Forest Cover within the Net Tract Area	F =	<u>5.43</u>
G.	Area of Forest Above Conservation Threshold	G =	<u>3.15</u>

Break Even Point

H.	Break Even Point	H =	<u>2.91</u>
I.	Forest Clearing Permitted Without Mitigation	I =	<u>2.52</u>

Proposed Forest Clearing

J.	Total Area of Forest to be Cleared	J =	<u>5.43</u>
K.	Total Area of Forest to be Retained	K =	<u>0.00</u>

Planting Requirements

L.	Reforestation for Clearing Above the Conservation Threshold	L =	<u>0.79</u>
M.	Reforestation for Clearing Below the Conservation Threshold	M =	<u>4.56</u>
N.	Credit for Retention above the Conservation Threshold	N =	<u>0.00</u>
P.	Total Reforestation Required	P =	<u>5.35</u>
Q.	Total Afforestation Required	Q =	<u>0.00</u>
R.	Total Planting Requirement	R =	<u>5.35</u>

Sq. Ft. 232,937.10

PIL \$23,293.71

Forest Conservation Worksheet

New Airline Maintenance Facility (ALP)

Net Tract Area

A.	Total Tract Area	A =	<u>76.00</u>
B.	Deductions	B =	<u>0.00</u>
C.	Net Tract Area	C =	<u>76.00</u>

Land Use Category

Input the number "1" under the appropriate land use zoning, and limit to only one entry

ARA	MDR	IDA	HDR	MPD	CIA
0	0	1	0	0	0

D.	Afforestation Threshold (Net Tract Area x 15%)	D =	<u>11.40</u>
E.	Conservation Threshold (Net Tract Area x 20%)	E =	<u>15.20</u>

Existing Forest Cover

F.	Existing Forest Cover within the Net Tract Area	F =	<u>52.93</u>
G.	Area of Forest Above Conservation Threshold	G =	<u>37.73</u>

Break Even Point

H.	Break Even Point	H =	<u>22.75</u>
I.	Forest Clearing Permitted Without Mitigation	I =	<u>30.18</u>

Proposed Forest Clearing

J.	Total Area of Forest to be Cleared	J =	<u>52.93</u>
K.	Total Area of Forest to be Retained	K =	<u>0.00</u>

Planting Requirements

L.	Reforestation for Clearing Above the Conservation Threshold	L =	<u>9.43</u>
M.	Reforestation for Clearing Below the Conservation Threshold	M =	<u>30.40</u>
N.	Credit for Retention above the Conservation Threshold	N =	<u>0.00</u>
P.	Total Reforestation Required	P =	<u>39.83</u>
Q.	Total Afforestation Required	Q =	<u>0.00</u>
R.	Total Planting Requirement	R =	<u>39.83</u>

Sq. Ft. 1,735,103.70

PIL \$173,510.37

Forest Conservation Worksheet

New Airline Maintenance Facility (Sponsor's Preferred Alternative)

Net Tract Area

A.	Total Tract Area	A =	<u>78.00</u>
B.	Deductions	B =	<u>0.00</u>
C.	Net Tract Area	C =	<u>78.00</u>

Land Use Category

Input the number "1" under the appropriate land use zoning, and limit to only one entry

ARA	MDR	IDA	HDR	MPD	CIA
0	0	1	0	0	0

D.	Afforestation Threshold (Net Tract Area x 15%)	D =	<u>11.70</u>
E.	Conservation Threshold (Net Tract Area x 20%)	E =	<u>15.60</u>

Existing Forest Cover

F.	Existing Forest Cover within the Net Tract Area	F =	<u>48.60</u>
G.	Area of Forest Above Conservation Threshold	G =	<u>33.00</u>

Break Even Point

H.	Break Even Point	H =	<u>22.20</u>
I.	Forest Clearing Permitted Without Mitigation	I =	<u>26.40</u>

Proposed Forest Clearing

J.	Total Area of Forest to be Cleared	J =	<u>48.60</u>
K.	Total Area of Forest to be Retained	K =	<u>0.00</u>

Planting Requirements

L.	Reforestation for Clearing Above the Conservation Threshold	L =	<u>8.25</u>
M.	Reforestation for Clearing Below the Conservation Threshold	M =	<u>31.20</u>
N.	Credit for Retention above the Conservation Threshold	N =	<u>0.00</u>
P.	Total Reforestation Required	P =	<u>39.45</u>
Q.	Total Afforestation Required	Q =	<u>0.00</u>
R.	Total Planting Requirement	R =	<u>39.45</u>

Sq. Ft. 1,718,442.00

PIL \$171,844.20

Forest Conservation Worksheet

Airport Maintenance Complex (ALP)

Net Tract Area

A.	Total Tract Area	A =	<u>17.70</u>
B.	Deductions	B =	<u>0.00</u>
C.	Net Tract Area	C =	<u>17.70</u>

Land Use Category

Input the number "1" under the appropriate land use zoning, and limit to only one entry

ARA	MDR	IDA	HDR	MPD	CIA
0	0	1	0	0	0

D.	Afforestation Threshold (Net Tract Area x 15%)	D =	<u>2.66</u>
E.	Conservation Threshold (Net Tract Area x 20%)	E =	<u>3.54</u>

Existing Forest Cover

F.	Existing Forest Cover within the Net Tract Area	F =	<u>0.00</u>
G.	Area of Forest Above Conservation Threshold	G =	<u>0.00</u>

Break Even Point

H.	Break Even Point	H =	<u>0.00</u>
I.	Forest Clearing Permitted Without Mitigation	I =	<u>0.00</u>

Proposed Forest Clearing

J.	Total Area of Forest to be Cleared	J =	<u>0.00</u>
K.	Total Area of Forest to be Retained	K =	<u>0.00</u>

Planting Requirements

L.	Reforestation for Clearing Above the Conservation Threshold	L =	<u>0.00</u>
M.	Reforestation for Clearing Below the Conservation Threshold	M =	<u>0.00</u>
N.	Credit for Retention above the Conservation Threshold	N =	<u>0.00</u>
P.	Total Reforestation Required	P =	<u>0.00</u>
Q.	Total Afforestation Required	Q =	<u>2.66</u>
R.	Total Planting Requirement	R =	<u>2.66</u>

Sq. Ft. 115,651.80

PIL \$11,565.18

Forest Conservation Worksheet

Relocate Fire Training Facility (ALP)

Net Tract Area

A.	Total Tract Area	A =	<u>24.00</u>
B.	Deductions	B =	<u>0.00</u>
C.	Net Tract Area	C =	<u>24.00</u>

Land Use Category

Input the number "1" under the appropriate land use zoning, and limit to only one entry

ARA	MDR	IDA	HDR	MPD	CIA
0	0	1	0	0	0

D.	Afforestation Threshold (Net Tract Area x 15%)	D =	<u>3.60</u>
E.	Conservation Threshold (Net Tract Area x 20%)	E =	<u>4.80</u>

Existing Forest Cover

F.	Existing Forest Cover within the Net Tract Area	F =	<u>17.12</u>
G.	Area of Forest Above Conservation Threshold	G =	<u>12.32</u>

Break Even Point

H.	Break Even Point	H =	<u>7.26</u>
I.	Forest Clearing Permitted Without Mitigation	I =	<u>9.86</u>

Proposed Forest Clearing

J.	Total Area of Forest to be Cleared	J =	<u>17.12</u>
K.	Total Area of Forest to be Retained	K =	<u>0.00</u>

Planting Requirements

L.	Reforestation for Clearing Above the Conservation Threshold	L =	<u>3.08</u>
M.	Reforestation for Clearing Below the Conservation Threshold	M =	<u>9.60</u>
N.	Credit for Retention above the Conservation Threshold	N =	<u>0.00</u>
P.	Total Reforestation Required	P =	<u>12.68</u>
Q.	Total Afforestation Required	Q =	<u>0.00</u>
R.	Total Planting Requirement	R =	<u>12.68</u>

Sq. Ft. 552,340.80

PIL \$55,234.08

Forest Conservation Worksheet

Relocate Fire Training Facility (Sponsor's Preferred Alternative)

Net Tract Area

A.	Total Tract Area	A =	<u>31.00</u>
B.	Deductions	B =	<u>0.00</u>
C.	Net Tract Area	C =	<u>31.00</u>

Land Use Category

Input the number "1" under the appropriate land use zoning, and limit to only one entry

ARA	MDR	IDA	HDR	MPD	CIA
0	0	1	0	0	0

D.	Afforestation Threshold (Net Tract Area x 15%)	D =	<u>4.65</u>
E.	Conservation Threshold (Net Tract Area x 20%)	E =	<u>6.20</u>

Existing Forest Cover

F.	Existing Forest Cover within the Net Tract Area	F =	<u>22.54</u>
G.	Area of Forest Above Conservation Threshold	G =	<u>16.34</u>

Break Even Point

H.	Break Even Point	H =	<u>9.47</u>
I.	Forest Clearing Permitted Without Mitigation	I =	<u>22.54</u>

Proposed Forest Clearing

J.	Total Area of Forest to be Cleared	J =	<u>22.54</u>
K.	Total Area of Forest to be Retained	K =	<u>0.00</u>

Planting Requirements

L.	Reforestation for Clearing Above the Conservation Threshold	L =	<u>4.09</u>
M.	Reforestation for Clearing Below the Conservation Threshold	M =	<u>12.40</u>
N.	Credit for Retention above the Conservation Threshold	N =	<u>0.00</u>
P.	Total Reforestation Required	P =	<u>16.49</u>
Q.	Total Afforestation Required	Q =	<u>0.00</u>
R.	Total Planting Requirement	R =	<u>16.49</u>

Sq. Ft. 718,086.60

PIL \$71,808.66

Forest Conservation Worksheet

VSR Connector (ALP)

Net Tract Area

A.	Total Tract Area	A =	<u>1.90</u>
B.	Deductions	B =	<u>0.00</u>
C.	Net Tract Area	C =	<u>1.90</u>

Land Use Category

Input the number "1" under the appropriate land use zoning, and limit to only one entry

ARA	MDR	IDA	HDR	MPD	CIA
0	0	1	0	0	0

D.	Afforestation Threshold (Net Tract Area x 15%)	D =	<u>0.29</u>
E.	Conservation Threshold (Net Tract Area x 20%)	E =	<u>0.38</u>

Existing Forest Cover

F.	Existing Forest Cover within the Net Tract Area	F =	<u>0.00</u>
G.	Area of Forest Above Conservation Threshold	G =	<u>0.00</u>

Break Even Point

H.	Break Even Point	H =	<u>0.00</u>
I.	Forest Clearing Permitted Without Mitigation	I =	<u>0.00</u>

Proposed Forest Clearing

J.	Total Area of Forest to be Cleared	J =	<u>0.00</u>
K.	Total Area of Forest to be Retained	K =	<u>0.00</u>

Planting Requirements

L.	Reforestation for Clearing Above the Conservation Threshold	L =	<u>0.00</u>
M.	Reforestation for Clearing Below the Conservation Threshold	M =	<u>0.00</u>
N.	Credit for Retention above the Conservation Threshold	N =	<u>0.00</u>
P.	Total Reforestation Required	P =	<u>0.00</u>
Q.	Total Afforestation Required	Q =	<u>0.29</u>
R.	Total Planting Requirement	R =	<u>0.29</u>

Sq. Ft. 12,414.60

PIL \$1,241.46

Forest Conservation Worksheet

Relocate Remote Receiver (ALP Alternative and Sponsor's Preferred Alternative)

Net Tract Area

A.	Total Tract Area	A =	<u>1.30</u>
B.	Deductions	B =	<u> </u>
C.	Net Tract Area	C =	<u>1.30</u>

Land Use Category

Input the number "1" under the appropriate land use zoning, and limit to only one entry

ARA	MDR	IDA	HDR	MPD	CIA
0	0	1	0	0	0

D.	Afforestation Threshold (Net Tract Area x 15%)	D =	<u>0.20</u>
E.	Conservation Threshold (Net Tract Area x 20%)	E =	<u>0.26</u>

Existing Forest Cover

F.	Existing Forest Cover within the Net Tract Area	F =	<u>0.50</u>
G.	Area of Forest Above Conservation Threshold	G =	<u>0.24</u>

Break Even Point

H.	Break Even Point	H =	<u>0.31</u>
I.	Forest Clearing Permitted Without Mitigation	I =	<u>0.19</u>

Proposed Forest Clearing

J.	Total Area of Forest to be Cleared	J =	<u>0.50</u>
K.	Total Area of Forest to be Retained	K =	<u>0.00</u>

Planting Requirements

L.	Reforestation for Clearing Above the Conservation Threshold	L =	<u>0.06</u>
M.	Reforestation for Clearing Below the Conservation Threshold	M =	<u>0.52</u>
N.	Credit for Retention above the Conservation Threshold	N =	<u>0.00</u>
P.	Total Reforestation Required	P =	<u>0.58</u>
Q.	Total Afforestation Required	Q =	<u>0.00</u>
R.	Total Planting Requirement	R =	<u>0.58</u>

Sq. Ft. 25,264.80

PIL \$2,526.48

Forest Conservation Worksheet

VORTAC Critical Area

Net Tract Area

A.	Total Tract Area	A =	<u>6.28</u>
B.	Deductions	B =	<u>0.00</u>
C.	Net Tract Area	C =	<u>6.28</u>

Land Use Category

Input the number "1" under the appropriate land use zoning, and limit to only one entry

ARA	MDR	IDA	HDR	MPD	CIA
0	0	1	0	0	0

D.	Afforestation Threshold (Net Tract Area x 15%)	D =	<u>0.94</u>
E.	Conservation Threshold (Net Tract Area x 20%)	E =	<u>1.26</u>

Existing Forest Cover

F.	Existing Forest Cover within the Net Tract Area	F =	<u>6.28</u>
G.	Area of Forest Above Conservation Threshold	G =	<u>5.02</u>

Break Even Point

H.	Break Even Point	H =	<u>2.26</u>
I.	Forest Clearing Permitted Without Mitigation	I =	<u>4.02</u>

Proposed Forest Clearing

J.	Total Area of Forest to be Cleared	J =	<u>6.28</u>
K.	Total Area of Forest to be Retained	K =	<u>0.00</u>

Planting Requirements

L.	Reforestation for Clearing Above the Conservation Threshold	L =	<u>1.26</u>
M.	Reforestation for Clearing Below the Conservation Threshold	M =	<u>2.51</u>
N.	Credit for Retention above the Conservation Threshold	N =	<u>0.00</u>
P.	Total Reforestation Required	P =	<u>3.77</u>
Q.	Total Afforestation Required	Q =	<u>0.00</u>
R.	Total Planting Requirement	R =	<u>3.77</u>

Sq. Ft. 164,134.08

PIL \$16,413.41

Attachment 7:

MDNR WHS

Coordination on Northern Long-eared Bat in the vicinity of BWI Marshall and MTN

Email, 4/11/2019

From: Lange, Leyla
To: [Lori Byrne -DNR-](#)
Cc: [Robin Bowie](#); [Ryan Lombardi](#); [Kim Hughes](#); [Snyder, Lindsey](#)
Subject: RE: [EXTERNAL] Re: Maryland Aviation Administration Projects in Anne Arundel and Baltimore Counties
Date: Friday, April 12, 2019 10:35:37 AM

Lori,

Thank you very much for your response. We will coordinate through the FAA representative for the project to see if there is any additional coordination that needs to happen at this point. Again, I appreciate your speedy response!

Leyla

Johnson, Mirmiran & Thompson, Inc.
An Employee Owned Company

Leyla E. Lange
Vice President
Natural & Cultural Resources
P. 410-316-2427
M. 301-938-2677

 Please consider the environment before printing this e-mail

From: Lori Byrne -DNR- <lori.byrne@maryland.gov>
Sent: Thursday, April 11, 2019 10:31 AM
To: Lange, Leyla <LLange@jmt.com>
Subject: [EXTERNAL] Re: Maryland Aviation Administration Projects in Anne Arundel and Baltimore Counties

Dear Ms. Lange,

The Wildlife and Heritage Service has no records of hibernacula or maternity sites for the Northern Long-eared Bat in the vicinity of either Baltimore/Washington International Thurgood Marshall Airport (Anne Arundel County) or Martin State Airport (Baltimore County). Thank you for the opportunity to comment.

Lori Byrne

  dnr.maryland.gov	Lori A. Byrne Environmental Review Coordinator Wildlife and Heritage Service Department of Natural Resources 580 Taylor Avenue, E-1 Annapolis, MD 21401 410-260-8573 (office) 410-260-8596 (FAX) lori.byrne@maryland.gov
--	---

On Tue, Apr 9, 2019 at 3:55 PM Lange, Leyla <LLange@jmt.com> wrote:

Hi Lori,

It was good speaking with you earlier today. As discussed, there are two Maryland Aviation Projects I am working on and we have received hits through IPaC for the Northern Long-eared Bat in both Anne Arundel and Baltimore Counties. Could you please confirm that there are no known hibernacula or maternity roost trees within close proximity to either Baltimore/Washington International Thurgood Marshall Airport (Anne Arundel County) or Martin State Airport (Baltimore County)? I have already run the projects through IPaC and we are coming up with a may affect determination for both projects. My experience with other projects means that I have to follow the streamlined process according to the Biological Opinion and the 4(d) rule.

Please let me know if I have

Johnson, Mirmiran & Thompson, Inc.
An Employee Owned Company

Leyla E. Lange
Vice President
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Thank You.

Attachment 8:

**Biological Assessment for Swamp Pink (*Helonias bullata*)
Baltimore/Washington International Thurgood Marshall Airport
ALP Phase I Improvements**

(including November 2019 MDNR WHS survey)

January 2020

BIOLOGICAL ASSESSMENT

For Swamp Pink (*Helonias bullata*)

Baltimore/Washington International Thurgood Marshall Airport
Airport Layout Plan Phase I Improvements

Prepared for:
Federal Aviation Administration
Washington Airports District Office
13783 Park Center Road, Suite 490S
Herndon, VA 20171

Prepared by:
MDOT Maryland Aviation Administration
January 2020

EXECUTIVE SUMMARY

The Endangered Species Act (ESA) requires that federal agencies consult with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NOAA Fisheries) to ensure that actions they fund, authorize, permit, or otherwise carry out will not jeopardize the continued existence of any listed endangered or threatened species or designated critical habitats (collectively, referred to as protected resources).

The Maryland Department of Transportation Maryland Aviation Administration (MDOT MAA) will request funding from the Federal Aviation Administration (FAA) in support of improvements outlined in Phase I of the Baltimore/Washington International Thurgood Marshall (BWI Marshall Airport) Airport Layout Plan (ALP). In coordination with the FAA, MDOT MAA has prepared this Biological Assessment (BA) under Section 7(a)(2) of the ESA to consider potential adverse effects to federally listed species resulting from the proposed improvements.

The ALP Phase I Improvements to BWI Marshall Airport includes several construction and maintenance projects, as well as tree obstruction removal for compliance with Federal Aviation Regulation (FAR) Part 77¹. The proposed projects and obstruction removal will occur on property owned and operated by MDOT MAA, with the exception of utility tie-ins and selective tree clearing on private property north of the Airport.

The purpose and need of the Proposed Action is to meet various FAA design standards, enhance airfield safety and efficiency, accommodate existing and anticipated passenger demand, and improve customer service at BWI Marshall Airport. Additional discussion of the purpose and need of the Proposed Action is provided in *Chapter 2, Purpose and Need*, of the Updated Draft EA and Section 4(f) Determination for ALP Phase I Improvements at BWI Marshall Airport.

Early coordination and pre-consultation with USFWS and Maryland Department of Natural Resources Wildlife and Heritage Service (MDNR WHS) has been completed. Formal consultation with USFWS has been initiated by the FAA with the delivery of this BA. However, due to the absence of NOAA Fisheries protected resources within the action area, no official coordination with NOAA Fisheries was performed. Documentation of consultation with USFWS and MDNR are provided in *Appendix H, Biological Resources* of the Updated Draft EA and Section 4(f) Determination for ALP Phase I Improvements at BWI Marshall Airport.

Based on the initial coordination with USFWS and MDNR, the preparation of a BA for swamp pink (*Helonias bullata*) was required to address potential impacts to this threatened species. Although there is no federally designated Critical Habitat for swamp pink within the area of proposed improvements, the species and supporting habitat have historically been found within the Stony Run Wetlands of Special State Concern (WSSC). Portions of the WSSC may be impacted by tree obstruction removal that is required to comply with FAR Part 77 regulations.

¹ FAR Part 77 governs the safe and efficient use of navigable airspace in the vicinity of airports. Obstruction removal is required for obstructions (vegetative and non-vegetative) which penetrate the Part 77 primary, approach and transitional surfaces.

BIOLOGICAL ASSESSMENT

Based on the evaluation of the anticipated effects from the Proposed Action and the conservation measures to be implemented², it is concluded that the ALP Phase I Improvements, including the Part 77 clearing effort, may affect but are not likely to adversely affect individuals or populations of swamp pink or its supporting habitat within the action area.

² See Section 2.4 Conservation Methods for details on the conservation measures, including use of BMPs and avoidance and minimization techniques.

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Table 1. Outline of Proposed Construction Projects

Table 2. Summary of Impacts to Jurisdictional Wetlands and Streams as of 10/2019

Table 3. Summary of Consultation History for BWI Marshall Airport ALP Phase I Improvements

APPENDIX A –Project Location Maps

APPENDIX B –Agency Coordination

1.0 INTRODUCTION

The Endangered Species Act (ESA) of 1973 (16 U.S.C. 153 *et seq.*), as amended, Section 7(a)(2), directs federal agencies to consult with the U.S. Fish and Wildlife Service (USFWS) and/or National Marine Fisheries Service (NOAA Fisheries) when their proposed actions “may affect” a federally-listed endangered or threatened species, or designated critical habitat. This includes any action that is funded, authorized or permitted by a federal agency.

1.1 Purpose of this Biological Assessment

The Maryland Department of Transportation Maryland Aviation Administration (MDOT MAA) will receive funding from the Federal Aviation Administration (FAA) in support of improvements outlined in Phase I of the Baltimore/Washington International Thurgood Marshall (BWI Marshall Airport) Airport Layout Plan (ALP). In coordination with the FAA, MDOT MAA has prepared this Biological Assessment (BA) under Section 7(a)(2) of the ESA to consider potential adverse effects to federally listed species resulting from the proposed improvements at BWI Marshall Airport.

Based on initial consultation with USFWS and MDNR, the only species of concern identified were swamp pink (*Helonias bullata*) and the northern long-eared bat (*Myotis septentrionalis*), both listed as federally-threatened species. While the northern long-eared bat’s habitat range is within the project area, no known hibernacula or maternity roost trees are known within Anne Arundel County; therefore, no adverse effects are anticipated for this species. Coordination with USFWS and MDNR regarding the northern long-eared bat will continue as project designs progress and is anticipated to occur under the Northern Long-eared Bat Final 4(d) rule. The focus of this BA will remain on individuals and populations of swamp pink and its supporting habitat. Due to the absence of NOAA Fisheries protected resources within the action area, no official coordination with NOAA Fisheries was performed.

The ALP Phase I Improvements at BWI Marshall Airport includes several construction and maintenance projects, as well as tree clearing to comply with Federal Aviation Regulation (FAR) Part 77. The proposed projects and obstruction removal will occur on property owned and operated by MDOT MAA, with the exception of utility tie-ins and selective tree clearing on private property north of the Airport.

Additional state and federal agencies will be involved with the projects through granting of permits and/or authorizations. It is anticipated that the U.S. Army Corps of Engineers (USACE) and Maryland Department of the Environment (MDE) will provide Federal Clean Water Act Section 404 authorization for unavoidable impacts to regulated wetlands and waterways, and MDE will issue a Section 401 Water Quality Certification as part of its authorization.

1.2 Project Purpose and Need

The purpose of the Proposed Action at BWI Marshall Airport is to meet various FAA design standards, enhance airfield safety and efficiency, accommodate existing and anticipated passenger demand, and improve customer service at BWI Marshall Airport. The 2011 *Baltimore /*

Washington International Thurgood Marshall Airport Master Plan developed projections of activity levels for both aircraft operations and passengers that would use the airport and associated those levels with the need for additional facilities to maintain efficient and safe operations while achieving a quality level of service. Within the Master Plan, the timing for commercial (passenger and cargo) and non-commercial (general aviation and military) improvements is tied to specific activity levels. The Proposed Action includes those improvements required to accommodate the projected activity levels through 2022. These activity levels are forecasted based on historical growth at the Airport.

2.0 PROJECT DESCRIPTION

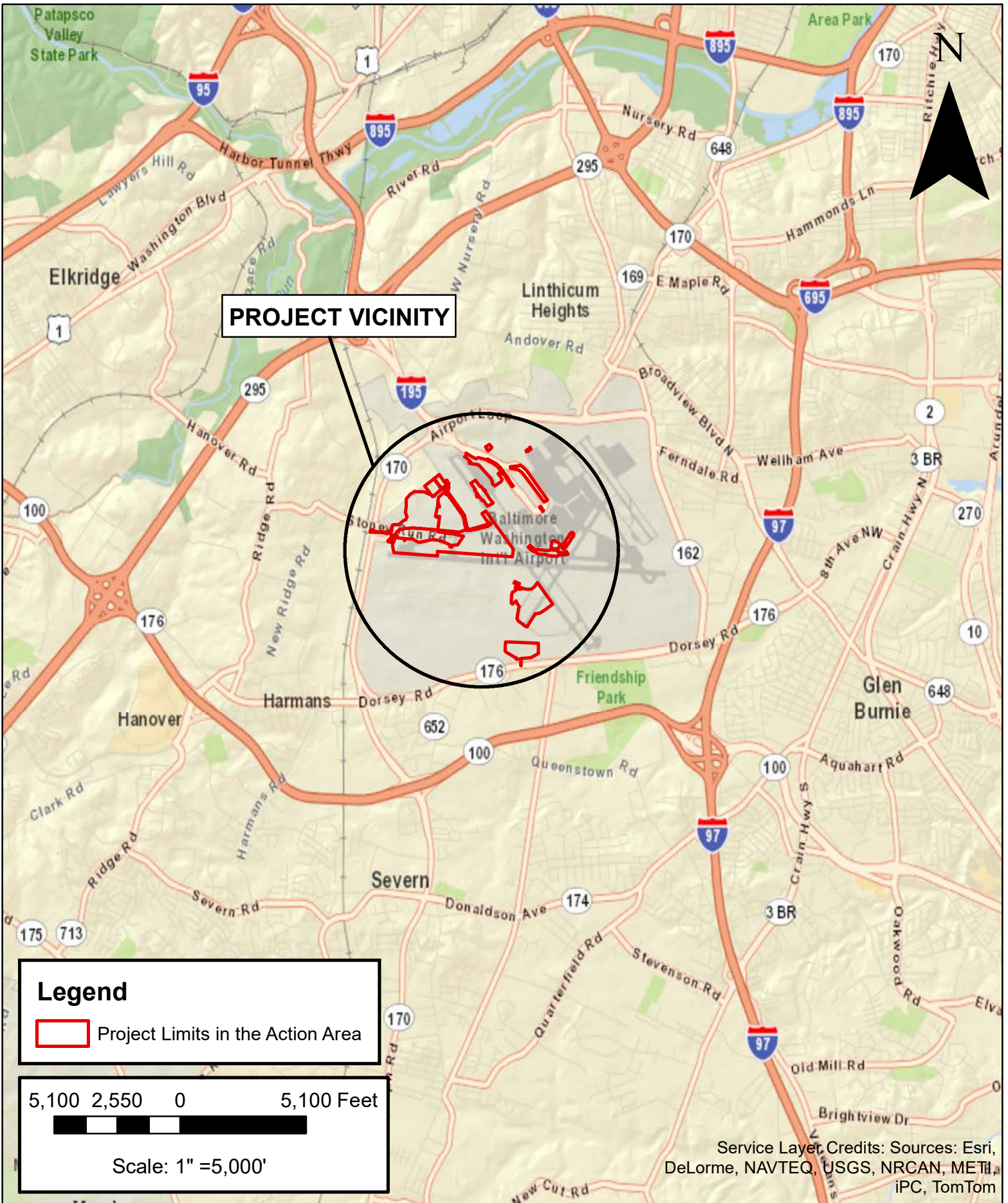
2.1 Project Overview

The Proposed Action will occur at BWI Marshall Airport, located in Anne Arundel County, Maryland. **Figure 1** indicates the individual project limits within the action area, defined as the area nearest to the Stony Run Wetlands of Special State Concern (WSSC), where there is the potential for swamp pink habitat, and further defined in Section 3.0 Action Area.

The combined limit of disturbance (total project footprint) for all construction activities is approximately 439 acres; however, a significant portion of that acreage is underlain by existing facilities and other impervious surfaces. It should be noted that individual tree clearing, which is exclusively meant for compliance with Part 77 obstruction removal, does not currently have designated limits within the total footprint. Discussions with USACE and MDE are currently ongoing to determine how tree clearing impacts will be calculated in wetlands and wetland buffers, including impacts that are proposed in the Stony Run WSSC and potential swamp pink habitat.

2.2 Project Description Summary

The proposed improvements include updates and/or relocation of existing facilities, construction of new facilities, and the clearing of tree obstructions from approach and transitional surfaces in order to comply with FAA safety regulations (FAR Part 77). Construction project limits and individual tree clearing within the action area is shown on **Figure 2**. Proposed construction projects within the defined action area are described in **Table 1** and detailed maps of the projects limits within the action area are available in **Appendix A**. More detailed descriptions of construction efforts and future operations of these facilities is not provided in this document, as individuals and populations of swamp pink and its supporting habitat have not historically been found on the main BWI Marshall Airport campus (on-airport). Impacts to individuals or populations of swamp pink would only be expected to occur within the Stony Run WSSC where supporting habitat is present. **Table 2** outlines the total anticipated wetland and waterway impacts associated with the EA Proposed Action. A determination of permanent and temporary impacts to wetlands and wetland buffers associated with individual tree clearing will be determined prior to the issuance of the Section 404 authorization.

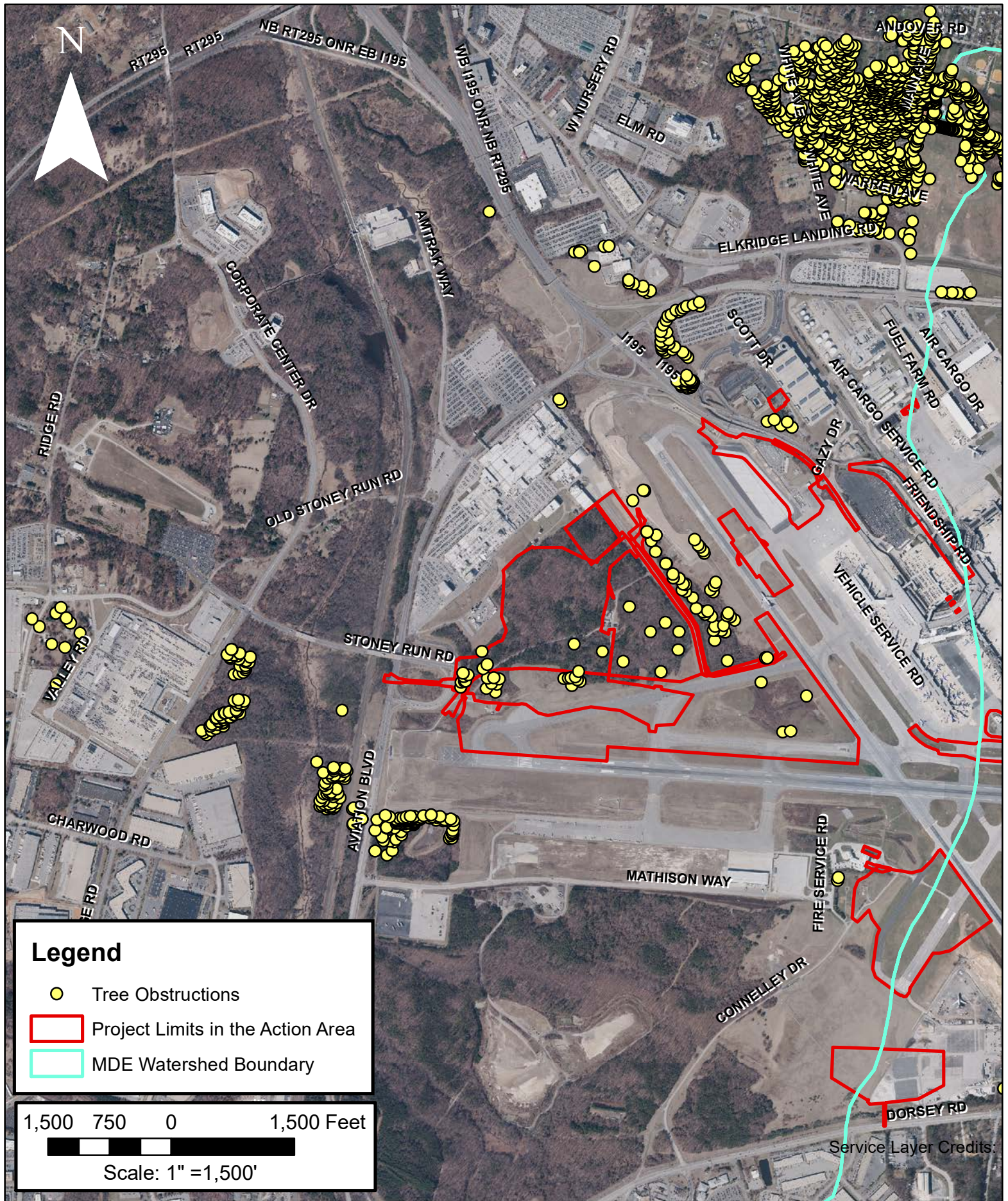


Legend
 [Red Outline] Project Limits in the Action Area

5,100 2,550 0 5,100 Feet
 [Scale Bar]
 Scale: 1" = 5,000'

Service Layer Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, NRCAN, METI, IPC, TomTom

FIGURE 1: PROJECT VICINITY



Legend

- Tree Obstructions
- Project Limits in the Action Area
- MDE Watershed Boundary

1,500 750 0 1,500 Feet



Scale: 1" = 1,500'

Service Layer Credits:

FIGURE 2:PROJECT LIMITS

Table 1. Outline of Proposed Construction Projects within the Action Area

Project Name	Connected Actions
New Airline Maintenance Facility	<ul style="list-style-type: none"> • Provide perimeter roadway in the northwest quadrant of the Airport
Airport Maintenance Complex Relocation and Consolidation	n/a
Relocate Taxiways F & R	<ul style="list-style-type: none"> • Rebuild portions of Taxiways G and R1 to connect Runway 10-28 to the relocated Taxiway R • Build Taxiway R2 to provide additional connection between Runway 10-28 and proposed Taxiway R • Build Taxiway F1 to provide additional connection between new Taxiway R and relocated Taxiway F • Relocated FAA Equipment Shelters for the High Intensity Approach Lighting System with Sequenced Flashing Lights (ALSF-2) outside of the Runway and Taxiway Object Free Areas (ROFA and TOFA)
International Terminal Area Taxiway Fillets / Shoulders	n/a
New Infill Pavement Near Taxiways P, 'Future P', and T	<ul style="list-style-type: none"> • Rebuild Taxiway E 300 feet to the east • Reposition VSR • Demolish and relocate existing Airfield Lighting Vault (ALV) • Demolish and relocate Glycol Pump Control Building • Provide new infrastructure from the Airport Traffic Control Tower (ATCT) for software upgrades
Isolation / RON Apron Construction	<ul style="list-style-type: none"> • Reconfigure ARFF access road around the apron area • Install blast fence
Relocate Taxiway H	<ul style="list-style-type: none"> • Demolish existing Taxiway H exit pavement • Re-designate Taxiway H segment adjacent to Runway 15R deicing pad pavement
Runway 15R Deicing Pad Expansion	<ul style="list-style-type: none"> • Relocate glycol Storage/Truck Staging, including demolition of the existing building • Provide new area for snow dumping • Provide Taxicab Support Building at Former Hotel Site, including taxi / bus staging area • Demolish Hudson General Bus Storage and demolish existing taxi/bus staging area • Relocate Airport Surface Detection System, Model X (ASDE-X) • Relocate Gate A1 • Remove FAA Remote Receiver (RR) facility and demolish existing buildings (RR facility to be relocated to optimize RR signal as part of the Proposed Action) • Demolish deicing control building

**Table 2. Summary of Impacts to Jurisdictional Wetlands and Streams as of 10/2019
(Sponsor’s Preferred Alternative)**

Jurisdictional Wetlands		
<i>Cowardin Class/Activity</i>	<i>Area (SF)</i>	<i>Area (AC)</i>
PFO-Palustrine Forested Wetland (Construction)	26,622	0.17
PFO (Individual Tree Clearing)	Pending	Pending
PFO WSSC (Individual Tree Clearing)	Pending	Pending
PSS-Palustrine Scrub Shrub Wetland (Construction)	1,215	0.03
PEM-Palustrine Emergent Wetland (Construction)	9,418	0.22
PEM/PSS (Construction)	7,062	0.16
Totals	24,944	0.57
Jurisdictional Streams		
<i>Stream Classification</i>	<i>Linear Feet</i>	<i>Area (SF)</i>
Perennial	795	7,357
Intermittent	141	423
Ephemeral	67	614
Totals	1,003	8,394

2.4 Conservation Methods

The flowering species, swamp pink, currently does not have federally designated critical habitat; however, there is an area within the footprint of the ALP Phase I Improvements that has historically supported individuals and state designated habitat for the species. Due to this designation, conservation and avoidance and minimization efforts are required when impacts to the area are anticipated. Specific methods are outlined below and are further analyzed in **Section 5** of this BA.

As previously stated, on-airport construction will not directly impact individuals, populations, or habitat for swamp pink as there are no known populations or supporting habitat for the species. No conservation methods or BMPs directly related to swamp pink habitat are proposed for on-airport facility construction or tree clearing.

The Part 77 obstruction (tree) removal effort, however, includes individual tree removal that occurs within swamp pink habitat in the Stony Run WSSC. Regarding this effort, MDOT MAA developed an avoidance plan that would significantly reduce impacts to the habitat. Trees identified as Part 77 obstructions will be individually removed based on current and estimated tree heights. Current tree heights were measured with aerial photogrammetry; growth rates were estimated based on maximum growth potential (when the species was known) or 2 feet per year (when the species was unknown). Only trees that currently penetrate or are estimated to penetrate, the plane of the Part 77 imaginary surfaces are proposed for removal. Avoidance efforts will include a field measurement for each tree to confirm an absolute need for removal, which will likely reduce the required clearing numbers.

When the confirmed tree obstructions are removed, additional avoidance and minimization of impacts will occur to the maximum extent practicable through the use of effective Best Management Practices (BMPs). The list below is an outline of practices that may be applied, as appropriate, for the specific type of disturbance.

- a) Access paths will be explicitly designed in order to minimize wetland and buffer impacts to the maximum extent practicable, making use of existing infrastructure and access roads in the area;
- b) Each potential tree obstruction will be field measured and marked with flagging to ensure the correct trees have been identified for removal;
- c) Tree removal crew members will be made aware of the habitat designation and will be advised on species characteristics in order to prevent trampling in the event that an individual or population of swamp pink is unexpectedly found within the work area;
- d) Tree obstructions will be cleared by hand, as the use of heavy machinery would significantly increase impacts to vegetation and soils;
- e) Tree stumps will be left in place in order to avoid soil disturbances caused by grubbing; and
- f) The crown of each tree will be removed, but trunks will be left in place, eliminating disturbance that would be caused by full tree removal from the site.

3.0 ACTION AREA

3.1 Action Area Geography

The action area for potential swamp pink impacts is defined as all areas to be affected directly or indirectly by the federal action and not simply the immediate area involved in the action (project footprint). A map of the action area is depicted in **Figure 3**. The boundary of the action area was determined by where the direct impacts occur in relation to key landscape elements such as major roadways and drainage area divides, effectively encompassing both direct and indirect impacts of the action.

The action area is located entirely within the Atlantic Coastal Plain Physiographical Province, which consists of nearly level, gently rolling, and steep topography. Topography within the action area ranges from approximately 68 feet to 218 feet above mean sea level based on the United States Geological Survey (USGS) Relay 7.5' X 7.5' Quadrangle (USGS 2016). The Gunpowder-Patapsco River Watershed (Federal HUC 02060003) drains the entire action area. The Maryland Patapsco River Lower North Branch (02130906) also drains the action area. Overall land use within the action area consists mainly of commercial/industrial development and forest.

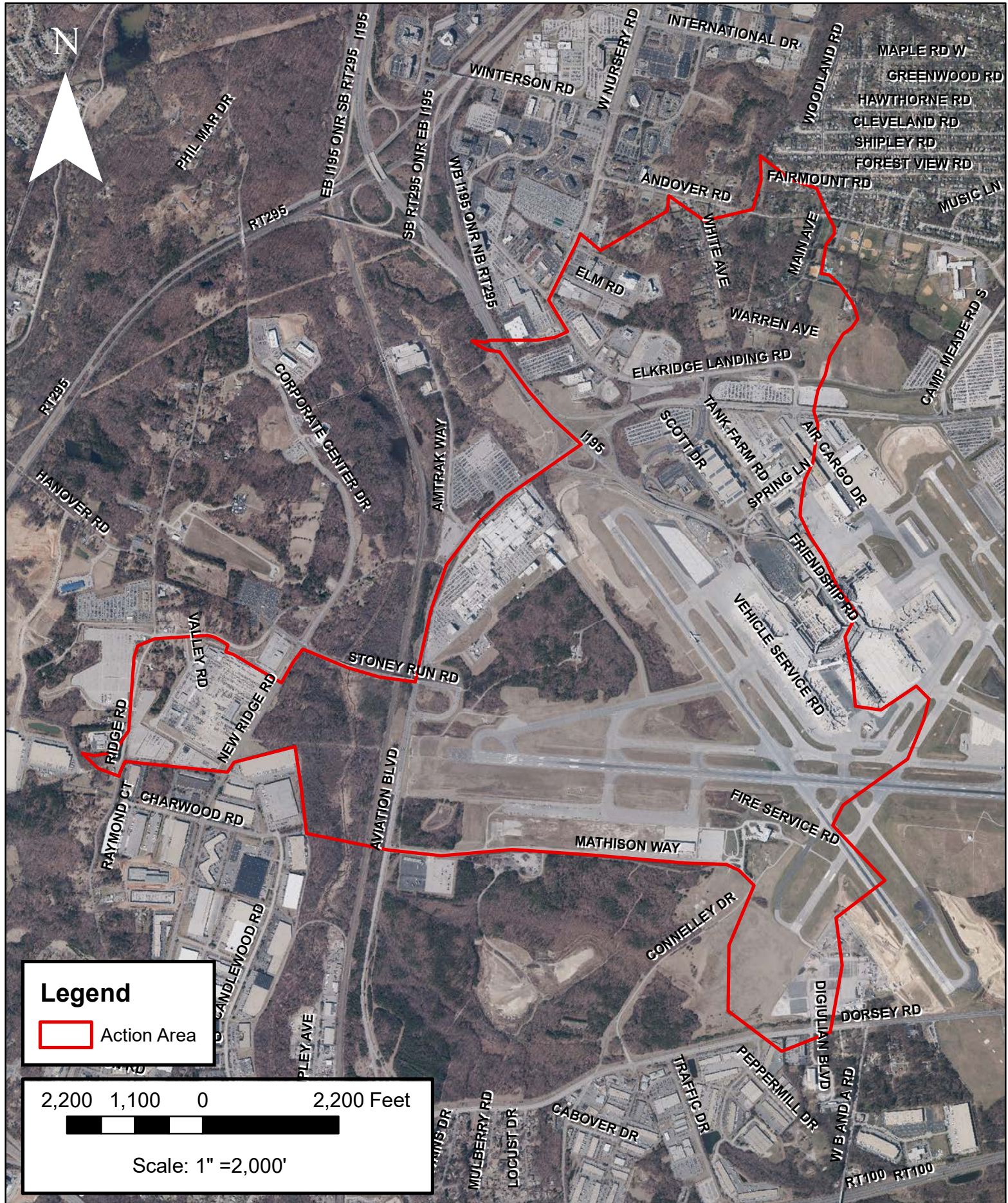
In reference to indirect impacts for the action, the focus is on water quality and habitat loss. Both are associated with the tree clearing that is proposed on- and off-airport. The action area was expanded to the northwest and west to encompass all trees within the watershed that were considered obstructions based on the methodology outlined in the update of the 2014 Forest Management Plan (FMP). Improvements in the watershed were considered due to the fact that trees influence the water table and thus can affect groundwater in the WSSC that are known to historically support individuals and populations of swamp pink.

3.2 Specific Areas of Concern

All construction and maintenance of facilities will occur entirely on the campus of BWI Marshall Airport (on-airport), which is not currently an area of concern for populations or habitat of swamp pink. Activity outside the main Airport campus, but still within MDOT MAA property, includes

BIOLOGICAL ASSESSMENT

individual tree clearing efforts associated with Part 77 obstruction removal. Several obstructions associated with the end of Runway 10 are located within an area of concern which contains both WSSC and an area that has historically supported swamp pink individuals and habitat. **Figure 4** shows the WSSC and the tree clearing proposed there.



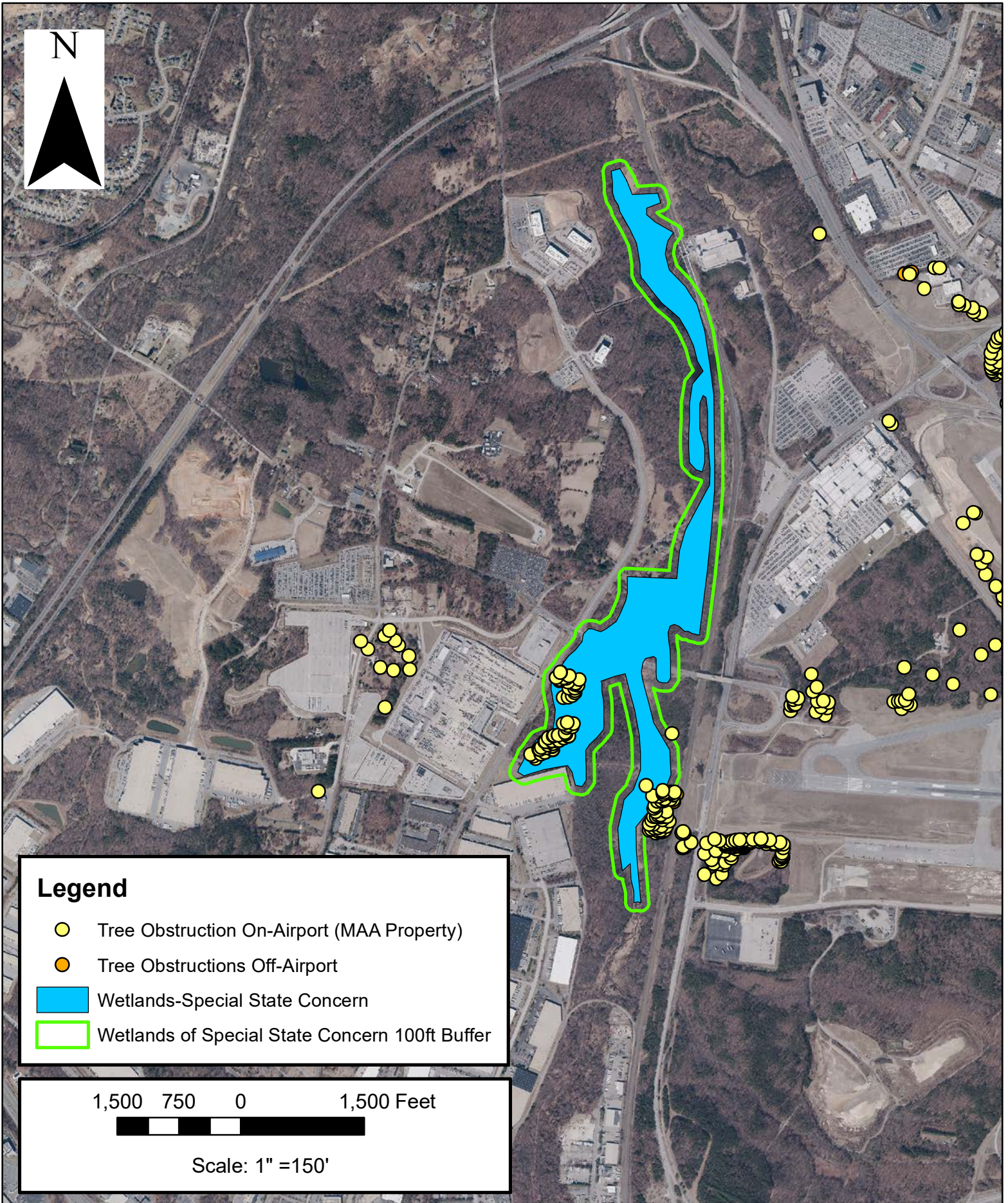
Legend

 Action Area

2,200 1,100 0 2,200 Feet



Scale: 1" = 2,000'



Legend

- Tree Obstruction On-Airport (MAA Property)
- Tree Obstructions Off-Airport
- Wetlands-Special State Concern
- Wetlands of Special State Concern 100ft Buffer

1,500 750 0 1,500 Feet



Scale: 1" = 150'

FIGURE 4: STONY RUN WSSC

3.3 Ongoing Activity

BWI Marshall Airport is located in the central range of swamp pink, which stretches from New Jersey to Georgia. In this portion of the range, groundwater influenced soils help maintain the perennial cool temperature regimes required by this species. Ditching and draining of adjacent lands, suburban development, industrial parks, and groundwater withdrawal for public water supply are all activities that may adversely modify the temperature and moisture level in the plant's habitat (USFWS New Jersey Field Office 2019).

As BWI Marshall Airport is a major transportation hub in the Baltimore/Washington metro area, on-airport operations and adjacent business parks are a continuous source of on-going activity. Although swamp pink habitat is located on MDOT MAA property, these daily activities should not have a direct impact on the quality or condition of the habitat that supports swamp pink. The habitat has been physically isolated in its current state for approximately 17 years. Admittance (by humans) only occurs on existing access roads by approved MDOT MAA personnel. It is assumed that on-going, direct impacts are not occurring in the habitat; however, it is possible that deer browse and foraging by animals may contribute to habitat changes.

In contrast, indirect impacts may be harmful to the habitat quality. The area is surrounded by industrial development, railway lines, and roadways that MDOT MAA does not control or maintain. It is possible that on-going, indirect impacts, due to surrounding land use, may be influencing species success. According to the Environmental Protection Agency (EPA 2003), urban runoff often carries higher water temperatures, which could be harmful to swamp pink over extended periods, as the plant is known to be more successful when groundwater temperatures are cooler. Increased urban runoff would also lead to accumulation of sediment, toxic pollutants, road salts, pesticides, and harmful nutrients.

Historical Activity

Over the last 20 years, large construction projects have occurred in the drainage area to Stony Run, directly or indirectly affecting Signal Branch, Hawkins Branch, Clark Branch, and other contributing tributaries to the Stony Run wetlands.

Following issuance of the Final EA/ Final Finding of No Significant Impact (FONSI) in 2000 for Proposed MAA Development at BWI Airport (2000-2005), the Consolidated Rental Car Facility was constructed within the Stony Run Development Area. The swamp pink habitat was located downstream of the new facility, but impacts were avoided through the use of BMPs and stormwater management design. It was determined that the hydrology that supports the wetlands would remain unchanged.

In 1998, the FAA issued a Final EA/ Final FONSI for the Proposed Expansion of Air Cargo Facilities. The 1998 Final EA/FONSI approved the full build out of the Midfield Cargo Facility which included 49 acres of impervious area in the Signal Branch drainage area, a tributary of Stony Run. Construction of the Midfield Cargo Facility occurred in 2001. While the full build-out of the facility was not completed at this time, stormwater management including grass swales and a large stormwater management pond were constructed to treat the runoff for the full build-out. It was determined in the FONSI that Signal Branch does not provide groundwater recharge to Stony Run, so the proper installation of sediment controls and stormwater management devices would be enough to ensure that the swamp pink habitat downstream would be protected.

During the same time period and approved under the 1998 Final EA/FONSI, a large permanent soil stockpile was constructed in the southwestern portion of the airport property. The 43-acre footprint of the facility was designed to avoid both Clark Branch and Hawkins Branch floodplains and maintain a 200-ft buffer between associated wetlands and the limit of disturbance. According to the FONSI, peak flow from the facility would be managed by conversion of the sediment basins into stormwater management basins, ensuring that impacts downstream would be minimized.

Recent Activity

It is assumed that recent (within 10 years) alterations to the swamp pink habitat would have mainly been caused by indirect sources. Habitat may have been influenced by the addition of impervious surfaces and the construction of stormwater facilities within the drainage area of Stony Run. Alterations not associated with BWI Marshall Airport operations or other anthropogenic sources may include changing climactic conditions and the continued spread of invasive and exotic plant species. The narratives provided below detail federally approved actions that may have had indirect or temporary impacts on the swamp pink habitat discussed in this document.

As included in the 2012 Final EA and Final FONSI/ Record of Decision for Proposed Airport Improvements at Baltimore/Washington International Thurgood Marshall Airport, the removal of 12 tree obstructions from potential swamp pink habitat within the Stony Run WSSC was required. A survey for the species was completed by MDNR WHS prior to the action to ensure that no individuals would be impacted. Based on the location of the tree obstructions within the wetland buffer and the proposed work plan, MDNR WHS concluded via a letter dated January 14, 2011, that no impacts to swamp pink would result from the action. Additionally, in a meeting held on April 25, 2011, MDNR WHS determined that proposed obstruction clearing would not significantly impact potential swamp pink habitat. No other activities approved in the 2012 EA occurred in an area of concern for the species.

In 2017, the FAA approved the Re-Evaluation of the 1998 EA for the Expansion of the Midfield Cargo Facility Ramp at BWI Marshall Airport. The 2017 Re-Evaluation included a six-acre expansion of the Midfield Cargo Facility apron south of Taxiways G and R1 within the footprint of the 1998 EA. Construction of this Midfield Cargo Facility expansion was completed in 2017. In 2018, a Written Re-Evaluation and Record of Decision was issued by the FAA for Midfield Cargo Facility Improvements. The 2018 Re-Evaluation approved 35 acres of additional impervious area within the limit of disturbance of the 1998 EA but including 7.4 acres of impervious area not considered in the 1998 EA. Construction of these Midfield Cargo Facility Improvements began in 2019 and were completed by December of the same year. The stormwater management for the Midfield Cargo Facility was originally designed and constructed in 2001 for the ultimate build-out proposed in the 1998 EA. Therefore, the existing stormwater management within the Signal Branch drainage area was sufficient to treat the additional impervious approved within the 2017 and 2018 Re-Evaluations. The 2017 and 2018 Re-Evaluations concluded, as with the 1998 EA, that there would no impact to threatened and endangered species for completion of the Midfield Cargo Facility.

4.0 EVALUATED SPECIES AND HABITAT CONSIDERED

As previously indicated, this document is evaluating individuals and populations of swamp pink and its supporting habitat, with the understanding that historical habitat is present within an area of proposed disturbance for ALP Phase I Improvements at BWI Marshall Airport.

4.1 Species Status and Biology – Swamp Pink

Swamp Pink Biology

According to USFWS (2019), swamp pink has dark evergreen leaves that are smooth, oblong, and form a rosette shape. These leaves can be seen year-round. Rosettes can produce a flowering stalk in Spring that can grow over three (3) feet tall. The stalk is topped by a 1 to 3-inch-long cluster of 30 to 50 flowers that are small, fragrant, and pink dotted with pale blue anthers. Flowering occurs between March and May. Although a scientific explanation has not been confirmed, it has been observed that only 12-15 percent of individuals in Maryland populations will flower in a given year; some populations may have no inflorescence, while others consistently see growth (USFWS 1991).

Colonies of swamp pink are often found in clumps due to the weight of the seeds. It takes relatively strong winds (20-miles per hour) to disperse the seeds more than 150 cm, which rarely occurs in the forest interior. There is evidence that seeds may also be carried by water, animals, and ants. Unfortunately, once the seeds are dispersed, there seems to be a low survival rate (USFWS 1991).

Swamp Pink Habitat

According to USFWS, swamp pink occurs only in the eastern United States, with historical ranges that include portions of Delaware, Georgia, Maryland, New Jersey, New York, North Carolina, South Carolina, and Virginia. These ranges are designated solely on where the species has historically been located. Anne Arundel County, Baltimore County, and Cecil County, Maryland, all have small pockets of existing or historical populations (USFWS 2019).

Habitat that supports the local growth of swamp pink includes several different types of wetland and lowland forest areas, such as meandering streams and headwater wetlands. Individuals are limited to areas that are perennially saturated, but not inundated, and have a water table near the surface for the entire growing season. The species is shade-tolerant, occurring more often in wetlands that have at least twenty percent canopy closure. Micro-topographic conditions may also be important, as plants are often found in areas of groundwater seepage and on top of hummocks formed by trees, shrubs, and mosses.

According to NatureServe (2019) and MDNR, the habitat within the action area can be classified as an “*Acer rubrum* - *Nyssa sylvatica* - *Magnolia virginiana* / *Viburnum nudum* var. *nudum* / *Osmunda cinnamomea* Swamp Forest”; often characterized as a “groundwater slope wetland”. This type of swamp is acidic, nutrient-poor, and mainly groundwater-saturated. It occurs in the eastern portion of the United States middle latitudes, within saturated stream valleys and other poorly drained depressions. Red maple (*Acer rubrum*) and blackgum (*Nyssa sylvatica*) are the most consonant canopy species in this type of wetland.

4.2 Current Population and Habitat Conditions

On December 12, 2019, via personal communication and email correspondence (see **Appendix B**), MDNR confirmed a field survey was completed on November 14, 2019. MDNR staff surveyed the area of MDOT MAA property near Stony Run that has historically supported swamp pink individuals. The remainder of the action area (on the main Airport campus) was not surveyed, as there is no evidence of the species existing outside of the Stony Run area. During the survey, no individual plants were found. However, there was also no obvious indications that the habitat has been degraded, when compared to surveys in the last five years. It was noted that Japanese stiltgrass (*Microstegium vimineum*) has continued to increase somewhat in coverage, and that the wavyleaf basketgrass (*Oplismenus hirtellus* subsp. *undulatifolius*) is expanding slightly into the habitat. Based on these results, it is assumed that the area surveyed continues to be able to support swamp pink populations, despite the lack of individuals.

4.3 Consultation History

Pre-consultation with USFWS was completed on August 5, 2016 via the ECOS-IPaC system. The Official Species List provided includes one flowering plant (swamp pink) and one mammal, the northern long-eared bat (*Myotis septentrionalis*). Both are considered federally threatened, but neither have designated critical habitat within the project area.

For swamp pink, inclusion on the Official Species List is due to the historical presence of individuals within the Stony Run WSSC. This BA will be submitted as a part of the initiation package for formal consultation with USFWS, which is required for Federal agencies, per 50 CFR 402.14-Formal Consultation.

In reference to the northern long-eared bat (NLEB), correspondence from MDNR WHS was received on April 12, 2019 which states “The Wildlife and Heritage Service has no records of hibernacula or maternity sites for the Northern Long-eared Bat in the vicinity of Baltimore/Washington International Thurgood Marshall Airport (Anne Arundel County)”. FAA will coordinate with USFWS through the NLEB 4(d) Rule streamlined consultation process.

Table 3 provides a summary of the coordination and consultation history for the BWI Marshall Airport ALP Phase I Improvements EA. Documents summarizing coordination and consultation activities for the proposed project are included in **Appendix B** of this BA.

**Table 3. Summary of Consultation History for BWI Marshall Airport
ALP Phase I Improvements**

Dates	Proceedings
August 5, 2016	Preliminary Coordination with USFWS via the ECOS-IPaC system, resulting in the generation of the Official Species List that listed swamp pink and the NLEB.
October 7, 2016	Preliminary coordination with MDNR Environmental Review Program (ERP) via email to determine the presence of Anadromous Fin fish and other fish within the Project Area .
April 6, 2017	Preliminary coordination with MDNR WHS via email to determine the presence of RTE species within the project area, focusing on the Stony Run WSSC and habitat that supports RTE species.
March 28, 2019 (Updated January 14, 2020)	Informal USFWS consultation via ECOS-IPaC to update the Official Species List for the Project Area.
April 11, 2019	Coordination with MDNR WHS via email to determine the presence of NLEB habitat (hibernacula or maternity roosts) near BWI Marshall Airport.
December 12-19, 2019	Coordination with MDNR WHS via email and personal communication to determine the findings of surveys completed by MDNR WHS for swamp pink individuals and habitat conditions in the WSSC area historically known to support the species.

5.0 EFFECTS ANALYSIS

On September 9, 1988, USFWS published the final rule in the Federal Register (FR) for listing swamp pink as a threatened species (Vol. 53 No. 175), with the rule set to become effective on October 11, 1988. As of October 9, 2019, the flowering plant is still federally listed as threatened.

The “effects of the action” refers to the direct and indirect effects of an action on listed species or critical habitat, together with any interrelated and interdependent activities, and including the environmental baseline within the action area. Direct effects are those caused by the action and occur at the same time and place as the action, while indirect effects are those caused by the action and occur at a later time and/or place and are reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend on the larger action for the justification. Interdependent actions are those that have no independent utility apart from the action under consideration.

The following sections provide a summary of potential effects on swamp pink that would result from the Proposed Action. Refer to **Section 2.4** of this BA for a list of species-specific avoidance and minimization measures proposed for the Part 77 Obstruction removal effort.

5.1 Baseline Conditions

As defined under the ESA, the environmental baseline includes past and present impacts of all federal, state, and private actions in the action area; the anticipated impacts of all proposed federal actions in the action area that have already undergone formal or early Section 7 consultation; and the impact of state and private actions which are contemporaneous with the Section 7 consultation process. Future actions and their potential effects are not included in the environmental baseline. This section, in combination with the **Section 4.0**, defines the current status of the species and its habitat in the action area and provides a platform to assess the effects of the Proposed Action under consultation with the USFWS.

At the time of the species' listing, it was decided that no critical habitat would be designated, which is allowable per the Code of Federal Regulations (CFR) Title 50 Section 424.12-criteria for designating critical habitat. As part of this regulation, critical habitat is not considered "prudent" if the designation would not benefit the species. According to the FR, "no benefit of habitat designations would outweigh the potential threat of collection, which might be caused by the publication of a detailed critical habitat description map".

Based on historical and recent activity outlined in **Section 3.3** and the current conditions provided in **Section 4.2**, the baseline conditions of the historical habitat still seem suitable to support populations of swamp pink. Since the last survey in which individuals were found (2011), there have been only minor direct and indirect impacts to the habitat, including individual tree removal in 2012. It is unlikely that these impacts would prevent populations from being reestablished in the area.

5.2 Cumulative Effects

No direct impact to individual plants is expected for this action, as no plants were found within or near the action area during the most recent survey. There is an expectation of impact to the habitat associated with the tree clearing effort; however, these impacts are temporary in nature, as clearing individual trees will not permanently change the dynamics of the system. Therefore, it is unlikely that the action would adversely affect the listed species. Also, due to the lack of a critical habitat designation, it is assumed that negative impacts would be based solely on habitat condition in the target area. An assessment of this type may not deliver findings that are measurable and/or attributable exclusively to MDOT MAA actions.

It is also reasonably certain that no future state or private activities will occur in this portion of the action area. The habitat and adjacent lands are owned by MDOT MAA and are currently set aside as safety zones associated with airport flight operations, meaning that future development is currently prohibited. The adjacent lands also contain the Stony Run WSSC, for which a permanent conservation easement is proposed by MDOT MAA.

5.3 Species Response

As no swamp pink individuals were recently located in the action area, it is assumed that there would be no individual or population response due to the Proposed Action. However, work crews will be advised on how to prevent trampling of individual plants. Despite the lack of swamp pink individuals, habitat that is historically known to support swamp pink may be temporarily affected. The removal of old growth trees from the habitat could increase light infiltration and reduce water

quality until trees naturally regenerate to replace those removed. The additional sun exposure could also encourage growth of invasive and exotic plant species that might out-compete swamp pink seedlings.

5.4 Interrelated and Independent Actions and Their Effects

Interrelated activities are considered part of the Proposed Action in that they depend on the Proposed Action for their justification, and interdependent activities have no independent utility apart from the Proposed Action. At this time, there are no interrelated or interdependent actions associated with the ALP Phase I Improvements at BWI Marshall Airport; therefore, there are no anticipated adverse effects to the species from actions of this type.

Determination for Swamp Pink Habitat

While some unavoidable, temporary impacts to the swamp pink habitat are proposed, BMPs and avoidance and minimization measures, as discussed in Section 2.4, will be implemented in order to reduce effects on the habitat. It is also uncertain how effects of this action would be quantified in a meaningful way. As there are currently no swamp pink individuals found in the action area, effects would be based solely on habitat condition, which may degrade or improve regardless of MDOT MAA action in the area. Therefore, MDOT MAA has concluded that the action **May Affect**, but is **Not Likely to Adversely Affect** swamp pink (*Helonias bullata*) within the action area.

6.0 CONCLUSIONS AND DETERMINATION OF EFFECT

MDOT MAA and FAA have determined that the ALP Phase I Improvements may affect, but is not likely to adversely affect, individuals or populations of swamp pink or its supporting habitat within the action area. Implementation of avoidance and minimization measures will be required during project construction. As the projects progress through final design and permitting, additional avoidance, minimization and conservation measures may be identified as construction methodologies are refined. Coordination with USFWS and MDNR WHS will be continued during the stages of design of the projects (construction specifications, etc.) and re-initiation of consultation will occur if effects that have not previously been considered are revealed. FAA and MDOT MAA have not made, and will not make, any irreversible and irretrievable commitments that would preclude further consideration of reasonable and prudent alternative structure types and/or construction techniques.

Federal Aviation Administration

Printed Name

Date

Washington Airport District Office

7.0 REFERENCES

- American Society of Civil Engineers. 2019. 2019 Outstanding Civil Engineering Achievement Under \$20 Million. <https://www.ascem.org/awards/midfield-cargo-apron-improvements>
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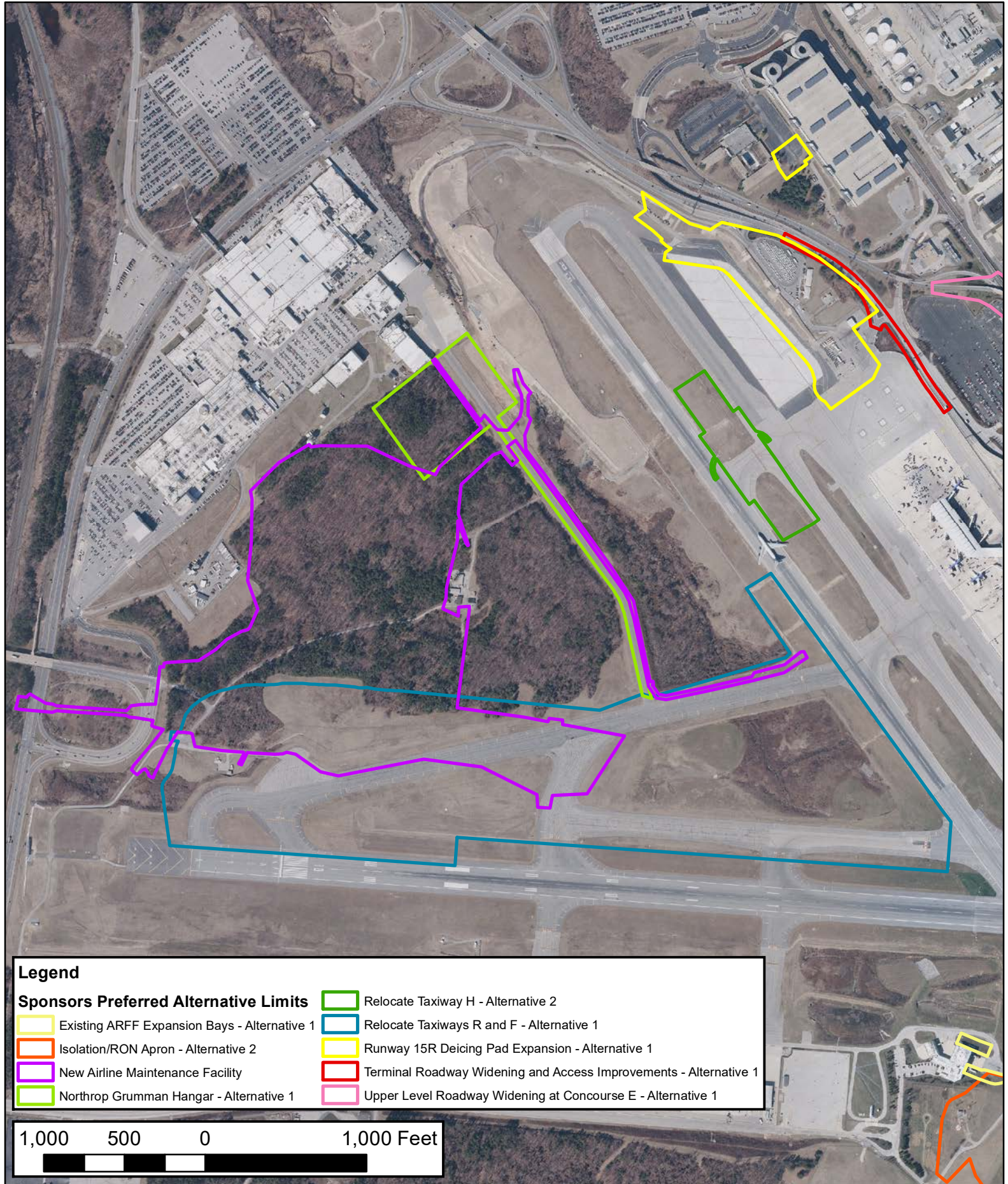
8.0 LIST OF CONTACTS AND PREPARERS

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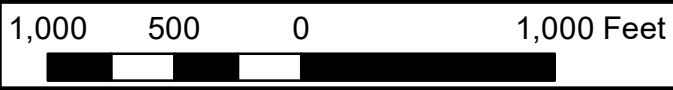
Appendix A
Project Location Maps



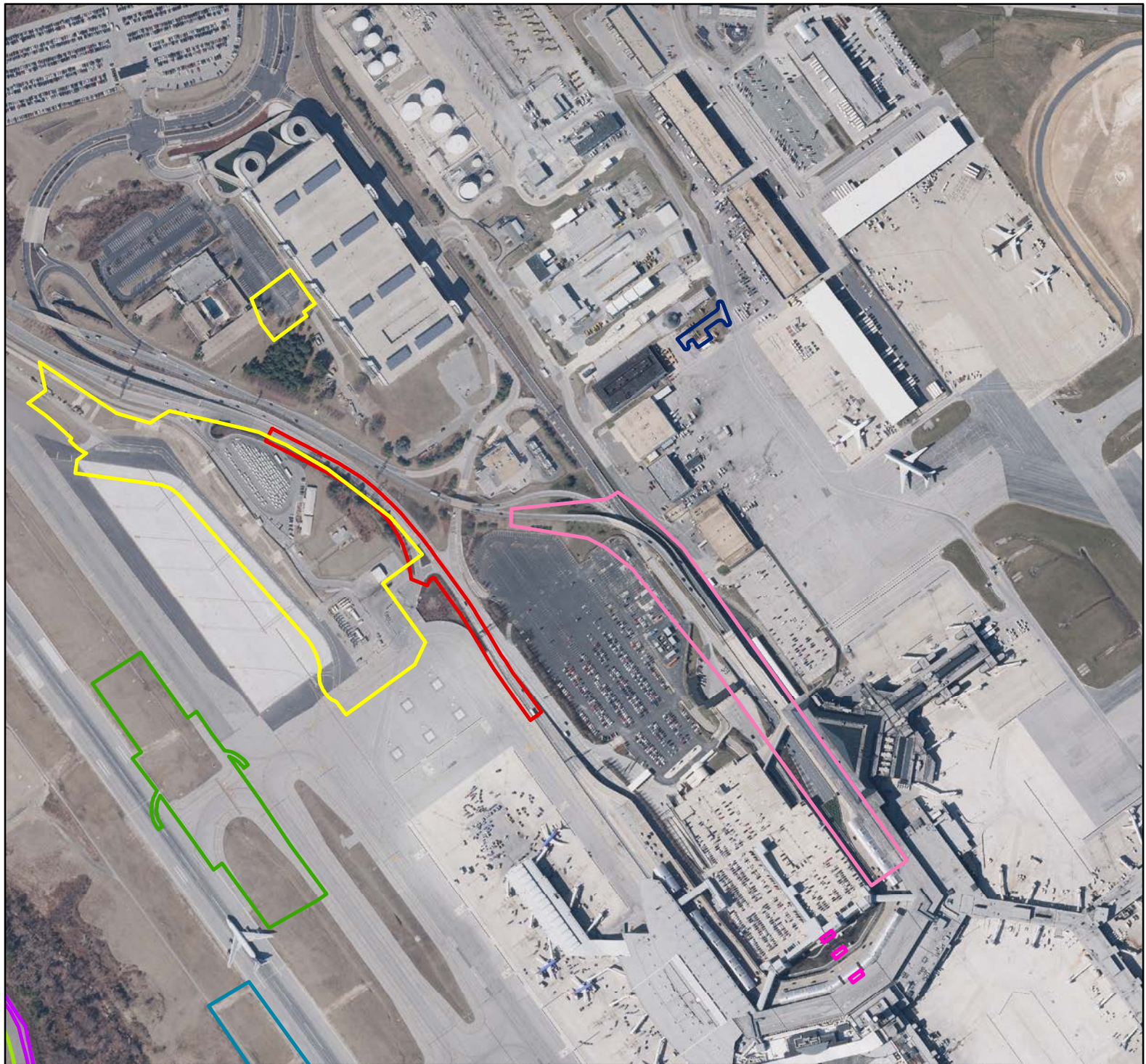
Legend

Sponsors Preferred Alternative Limits

	Existing ARFF Expansion Bays - Alternative 1		Relocate Taxiway H - Alternative 2
	Isolation/RON Apron - Alternative 2		Relocate Taxiways R and F - Alternative 1
	New Airline Maintenance Facility		Runway 15R Deicing Pad Expansion - Alternative 1
	Northrop Grumman Hangar - Alternative 1		Terminal Roadway Widening and Access Improvements - Alternative 1
			Upper Level Roadway Widening at Concourse E - Alternative 1



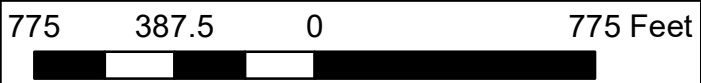
APPENDIX A: PROJECT LIMITS MAP 1



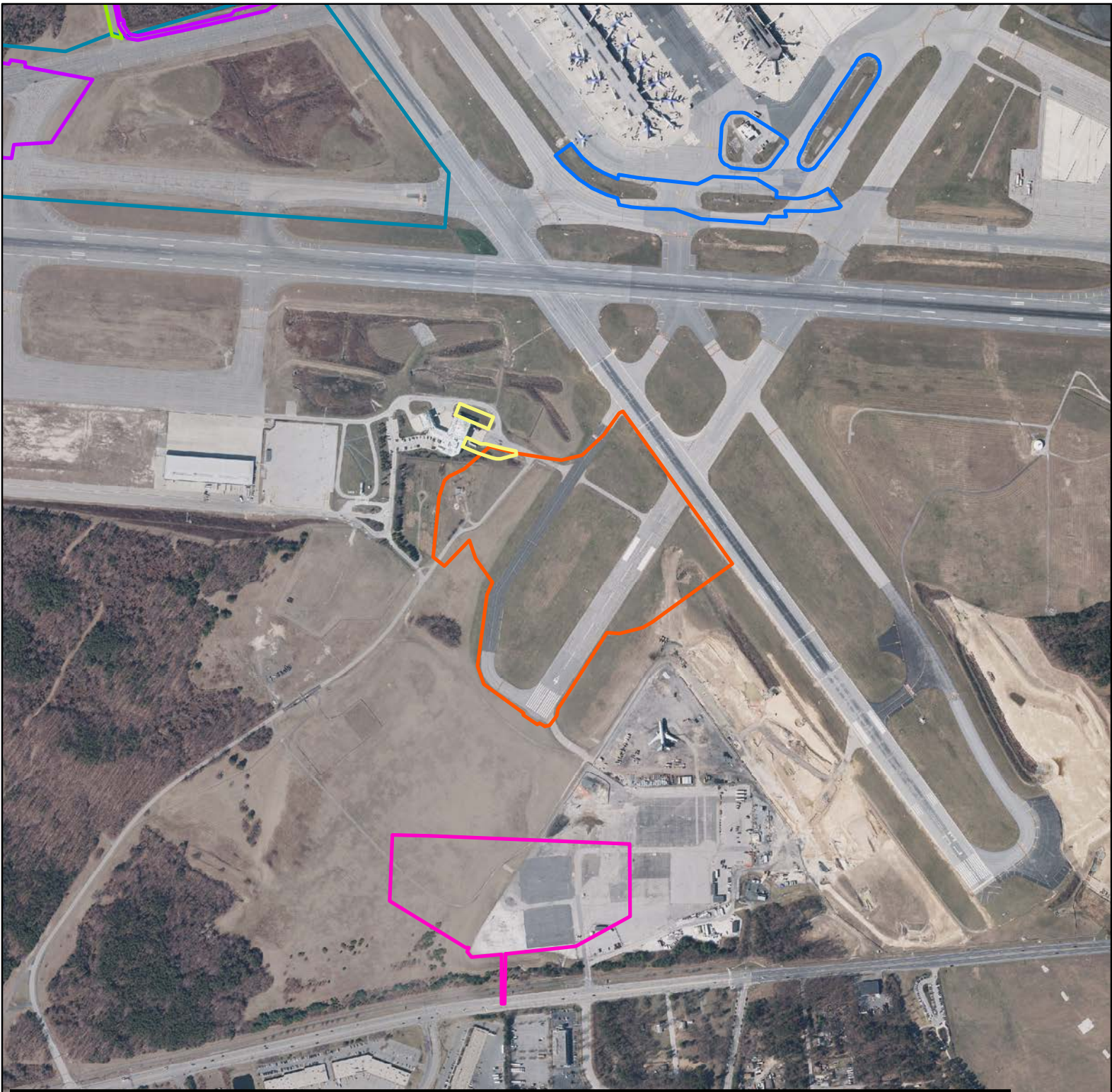
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Sponsors Preferred Alternative Limits

- New Airline Maintenance Facility
- New Infill Pavement Near Taxiways T, P and Future P - Alternative 1
- New Sky Bridge C - Alternative 1
- Northrop Grumman Hangar - Alternative 1
- Relocate Taxiway H - Alternative 2
- Relocate Taxiways R and F - Alternative 1
- Runway 15R Deicing Pad Expansion - Alternative 1
- Runway Deicing Chemical Storage and Access Road - Alternative 1
- Terminal Roadway Widening and Access Improvements - Alternative 1
- Upper Level Roadway Widening at Concourse E - Alternative 1



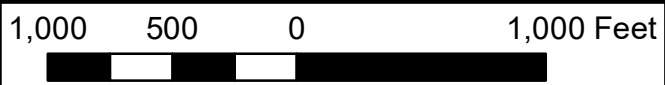
APPENDIX A: PROJECT LIMITS MAP 2



Legend

Sponsors Preferred Alternative Limits

- Airport Maintenance Complex Relocation and Consolidation - Alternative 2
- Existing ARFF Expansion Bays - Alternative 1
- Isolation/RON Apron - Alternative 2
- New Airline Maintenance Facility
- New Infill Pavement Near Taxiways T, P and Future P - Alternative 1
- Northrop Grumman Hangar - Alternative 1
- Relocate Taxiways R and F - Alternative 1



Appendix B
Agency Coordination



United States Department of the Interior



FISH AND WILDLIFE SERVICE
Chesapeake Bay Ecological Services Field Office
177 ADMIRAL COCHRANE DRIVE
ANNAPOLIS, MD 21401

PHONE: (410)573-4599 FAX: (410)266-9127

URL: www.fws.gov/chesapeakebay/;

www.fws.gov/chesapeakebay/endsppweb/ProjectReview/Index.html

Consultation Code: 05E2CB00-2016-SLI-1659

August 05, 2016

Event Code: 05E2CB00-2016-E-01704

Project Name: BWI Marshall Proposed Improvements 2016-2020

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. This species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2) (c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

<http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF>

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (<http://www.fws.gov/windenergy/>) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm>; <http://www.towerkill.com>; and <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html>.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment



United States Department of Interior
Fish and Wildlife Service

Project name: BWI Marshall Proposed Improvements 2016-2020

Official Species List

Provided by:

Chesapeake Bay Ecological Services Field Office

177 ADMIRAL COCHRANE DRIVE

ANNAPOLIS, MD 21401

(410) 573-4599

<http://www.fws.gov/chesapeakebay/>

<http://www.fws.gov/chesapeakebay/endsppweb/ProjectReview/Index.html>

Consultation Code: 05E2CB00-2016-SLI-1659

Event Code: 05E2CB00-2016-E-01704

Project Type: TRANSPORTATION

Project Name: BWI Marshall Proposed Improvements 2016-2020

Project Description: The Maryland Department of Transportation Aviation Administration (MAA) is proposing a number of projects for implementation at Baltimore / Washington International Thurgood Marshall Airport (BWI Marshall Airport). An Environmental Assessment (EA) is being completed to satisfy the requirements of the National Environmental Policy Act of 1969 (NEPA). The EA is being prepared in accordance with FAA policies and procedures for considering environmental impacts: FAA Order 5050.4B, National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions and FAA Order 1050.1F, Environmental Impacts: Policies and Procedures. Improvements to BWI Marshall Airport include realignment of taxiways, construction of new aviation support buildings and the removal of trees and other structures (poles, signs, and obstruction lights) that are considered obstructions to navigable airspace both on- and off-airport. It should be noted that vegetative obstruction removal is expected to be completed with minimal ground disturbance, specifically trees will be cut and the stump will be left in place.

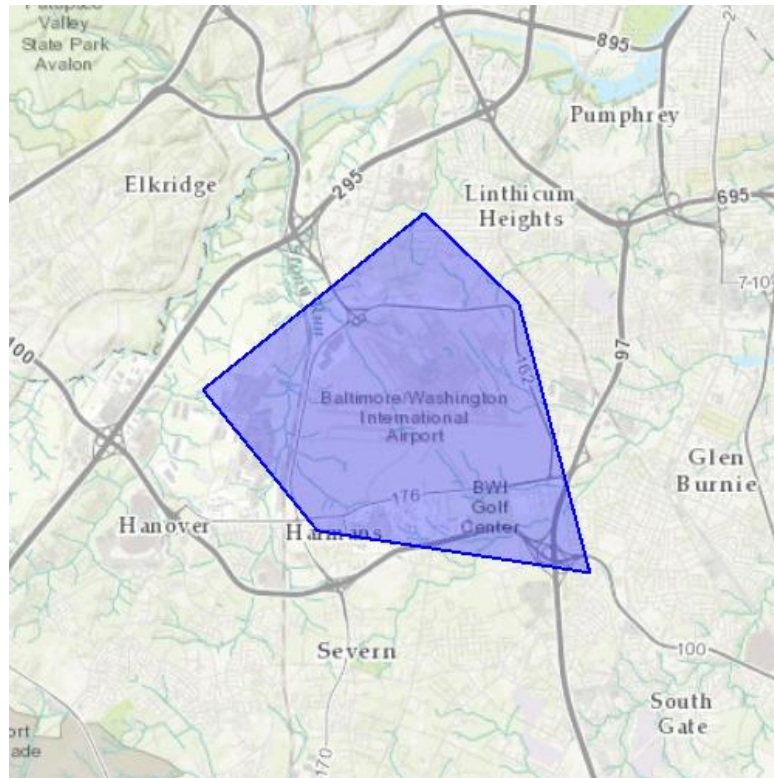
Please Note: The FWS office may have modified the Project Name and/or Project Description, so it may be different from what was submitted in your previous request. If the Consultation Code matches, the FWS considers this to be the same project. Contact the office in the 'Provided by' section of your previous Official Species list if you have any questions or concerns.



United States Department of Interior
Fish and Wildlife Service

Project name: BWI Marshall Proposed Improvements 2016-2020

Project Location Map:



Project Coordinates: MULTIPOLYGON (((-76.65229797363281 39.190622147826424, -76.67049407958984 39.20405848825002, -76.71289443969727 39.17784859094835, -76.69075012207031 39.15682039150626, -76.63873672485352 39.15069707589538, -76.65229797363281 39.190622147826424)))

Project Counties: Anne Arundel, MD



United States Department of Interior
Fish and Wildlife Service

Project name: BWI Marshall Proposed Improvements 2016-2020

Endangered Species Act Species List

There are a total of 1 threatened or endangered species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Critical habitats listed under the **Has Critical Habitat** column may or may not lie within your project area. See the **Critical habitats within your project area** section further below for critical habitat that lies within your project. Please contact the designated FWS office if you have questions.

Flowering Plants	Status	Has Critical Habitat	Condition(s)
Swamp pink (<i>Helonias bullata</i>)	Threatened		



United States Department of Interior
Fish and Wildlife Service

Project name: BWI Marshall Proposed Improvements 2016-2020

Critical habitats that lie within your project area

There are no critical habitats within your project area.



United States Department of Interior
Fish and Wildlife Service

Project name: BWI Marshall Proposed Improvements 2016-2020

Appendix A: FWS National Wildlife Refuges and Fish Hatcheries

There are no refuges or fish hatcheries within your project area.



United States Department of Interior
Fish and Wildlife Service

Project name: BWI Marshall Proposed Improvements 2016-2020

Appendix B: NWI Wetlands

The U.S. Fish and Wildlife Service is the principal Federal agency that provides information on the extent and status of wetlands in the U.S., via the National Wetlands Inventory Program (NWI). In addition to impacts to wetlands within your immediate project area, wetlands outside of your project area may need to be considered in any evaluation of project impacts, due to the hydrologic nature of wetlands (for example, project activities may affect local hydrology within, and outside of, your immediate project area). It may be helpful to refer to the USFWS National Wetland Inventory website. The designated FWS office can also assist you. Impacts to wetlands and other aquatic habitats from your project may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal Statutes. Project Proponents should discuss the relationship of these requirements to their project with the Regulatory Program of the appropriate U.S. Army Corps of Engineers District.

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery and/or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Exclusions - Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tubercid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Precautions - Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of



United States Department of Interior
Fish and Wildlife Service

Project name: BWI Marshall Proposed Improvements 2016-2020

this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

The following NWI Wetland types intersect your project area in one or more locations. To understand the NWI Classification Code, see <https://ecos.fws.gov/ipac/wetlands/decoder>. To view the National Wetlands Inventory on a map go to <http://www.fws.gov/wetlands/Data/Mapper.html>.

Wetland Types	NWI Classification Code
Freshwater Emergent Wetland	PEM1/SS1C
Freshwater Emergent Wetland	PEM1A
Freshwater Emergent Wetland	PEM1Ah
Freshwater Emergent Wetland	PEM1C
Freshwater Emergent Wetland	PEM1Cd
Freshwater Emergent Wetland	PEM1Ch
Freshwater Emergent Wetland	PEM1Cx
Freshwater Emergent Wetland	PEM1F
Freshwater Emergent Wetland	PEM1Fh
Freshwater Emergent Wetland	PEM1Fx
Freshwater Forested/Shrub Wetland	PFO1/4A
Freshwater Forested/Shrub Wetland	PFO1/SS1A
Freshwater Forested/Shrub Wetland	PFO1/SS1C
Freshwater Forested/Shrub Wetland	PFO1/SS1E
Freshwater Forested/Shrub Wetland	PFO1A



United States Department of Interior
Fish and Wildlife Service

Project name: BWI Marshall Proposed Improvements 2016-2020

Freshwater Forested/Shrub Wetland	PFO1C
Freshwater Forested/Shrub Wetland	PFO1Cd
Freshwater Forested/Shrub Wetland	PFO1Ch
Freshwater Forested/Shrub Wetland	PFO1E
Freshwater Forested/Shrub Wetland	PFO1Fh
Freshwater Forested/Shrub Wetland	PSS1/EM1C
Freshwater Forested/Shrub Wetland	PSS1/EM1Ch
Freshwater Forested/Shrub Wetland	PSS1/EM1E
Freshwater Forested/Shrub Wetland	PSS1A
Freshwater Forested/Shrub Wetland	PSS1C
Freshwater Forested/Shrub Wetland	PSS1Ch
Freshwater Forested/Shrub Wetland	PSS1Eh
Freshwater Forested/Shrub Wetland	PSS1/EM1A
Freshwater Pond	PUBFx
Freshwater Pond	PUBH
Freshwater Pond	PUBHh
Freshwater Pond	PUBHx
Riverine	R4SBC
Riverine	R5UBH
Riverine	R2UBH

From: [Robin Bowie](#)
To: [Kim Hughes](#); [Caroline Pinegar](#); [Leyla Lange](#)
Subject: MD DNR comments, response to fisheries resources scoping request, BWI Airport Improvement Projects, 2016-2020, AA County
Date: Friday, October 07, 2016 3:24:44 PM

See below.

Sent via the Samsung GALAXY S® 5, an AT&T 4G LTE smartphone

----- Original message -----

From: Greg Golden -DNR- <greg.golden@maryland.gov>
Date: 10/7/16 2:41 PM (GMT-05:00)
To: Robin Bowie <rbowie@bwiairport.com>
Subject: MD DNR comments, response to fisheries resources scoping request, BWI Airport Improvement Projects, 2016-2020, AA County

MD DNR Environmental Review Program has reviewed your request for fisheries resources scoping (anadromous finfish or other fish) related to the BWI Airport proposed improvement projects, 2016-2020. Please consider this email response as our official comments and response for the request.

As noted in your request information, the subject streams in your project area (Stony Run, Cabin Branch, and Sawmill Creek) are designated as Use I Streams by the State of MD. Typically, instream work is not allowed in Use I streams from March 1 through June 15, inclusive, of any year.

The three streams are similar in nature regarding fisheries resources. Their headwater reaches and tributaries are nearby, adjacent, and/or within the study area and airport boundaries. The perennial reaches of the streams and their tributaries support communities of several warmwater fish species typical of small streams in central Maryland. The spawning periods of these fish species will be protected by the instream work restriction period referenced above.

Migratory anadromous fish, including river herring, white perch, and yellow perch are likely to spawn in the lower reaches of each of these tributaries, closer to tidal waters. These species will also be protected by the referenced restriction period. Yellow perch, typically protected by a slightly earlier restriction period, are found further downstream from your project area so the single restriction period referenced here will apply for your study area for the minor types of activities you have described.

These fish species will also benefit from careful application of sediment and erosion control measures in upland areas for your projects.

If you have any questions on the comments above, please contact me at your convenience.

Greg Golden
Environmental Review Program

MD Department of Natural Resources

[410-260-8331](tel:410-260-8331)

please note my new email address: greg.golden@maryland.gov



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From: [Lori Byrne -DNR-](#)
To: [Lange, Leyla; rbowie@bwiairport.com](#)
Cc: [Katharine McCarthy -DNR-](#)
Subject: BWI Thurgood Marshall Airport Environmental Assessment for Proposed Improvements 2016-2020
Date: Thursday, April 06, 2017 4:11:06 PM

Dear Ms. Lange and Ms. Bowie,

We have reviewed the material sent with this scoping package and only have concerns for the work in the vicinity of Stony Run. Stony Run contains wetlands that are designated in state regulations as Nontidal Wetlands of Special State Concern, and supports several rare, threatened or endangered plant species.

Our concerns for the proposed work in Stony Run focus on one particular area of tree removal, located north of the access road with guidance light towers, west of Stony Run and the sewer easement. There are records for state and federally-listed endangered Swamp Pink (*Helonias bullata*) documented for the immediate area of the proposed tree removal at this site. This occurrence of Swamp Pink could be directly impacted by the work proposed, including impacts from soil compaction and disturbance from equipment in the habitat. Is it possible to confirm that the trees slated for removal at this one area are in fact of the height for necessary removal?

We would also encourage the applicant to take precautions to avoid spreading invasive vegetation into this and the other proposed tree removal locations in Stony Run. Both Japanese Stiltgrass and Wavyleaf Basketgrass have been documented as invasives in this area, and could be further spread by soil disturbance and equipment.

Thank you for the opportunity to review and comment. We look forward to hearing from you.

Lori Byrne

MD Logo.png



dnr.maryland.gov

Lori A. Byrne
Environmental Review Coordinator
Wildlife and Heritage Service
Department of Natural Resources
580 Taylor Avenue, E-1
Annapolis, MD 21401
410-260-8573 (office)
410-260-8596 (FAX)
lori.byrne@maryland.gov

Snyder, Lindsey

From: Lange, Leyla
Sent: Friday, April 12, 2019 10:35 AM
To: Lori Byrne -DNR-
Cc: Robin Bowie; Ryan Lombardi; Kim Hughes; Snyder, Lindsey
Subject: RE: [EXTERNAL] Re: Maryland Aviation Administration Projects in Anne Arundel and Baltimore Counties

Lori,

Thank you very much for your response. We will coordinate through the FAA representative for the project to see if there is any additional coordination that needs to happen at this point. Again, I appreciate your speedy response!

Leyla

Johnson, Mirmiran & Thompson, Inc.
An Employee Owned Company

Leyla E. Lange
Vice President
Natural & Cultural Resources
P. 410-316-2427
M. 301-938-2677

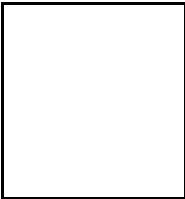
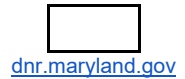
 Please consider the environment before printing this e-mail

From: Lori Byrne -DNR- <lori.byrne@maryland.gov>
Sent: Thursday, April 11, 2019 10:31 AM
To: Lange, Leyla <LLange@jmt.com>
Subject: [EXTERNAL] Re: Maryland Aviation Administration Projects in Anne Arundel and Baltimore Counties

Dear Ms. Lange,

The Wildlife and Heritage Service has no records of hibernacula or maternity sites for the Northern Long-eared Bat in the vicinity of either Baltimore/Washington International Thurgood Marshall Airport (Anne Arundel County) or Martin State Airport (Baltimore County). Thank you for the opportunity to comment.

Lori Byrne

	Lori A. Byrne Environmental Review Coordinator Wildlife and Heritage Service Department of Natural Resources 580 Taylor Avenue, E-1 Annapolis, MD 21401 410-260-8573 (office) 410-260-8596 (FAX) lori.byrne@maryland.gov
 dnr.maryland.gov	

Snyder, Lindsey

From: Katharine McCarthy -DNR- <katharine.mccarthy@maryland.gov>
Sent: Thursday, December 12, 2019 5:09 PM
To: Snyder, Lindsey
Cc: John Hurt; Robin Bowie; Christopher Aadland -DNR-
Subject: [EXTERNAL] Re: FW: Updated Chapters 4, 5 and Matrix

Hi Lindsey,

In response to your request for preparation of the Biological Assessment being completed as part of the NEPA process, below I've pasted in some info on the vegetation in the area that supports Swamp pink (*Helonias bullata*, Federally-listed as Threatened, State-listed as Endangered). This natural community is classified as a Coastal Plain Acidic Seepage Swamp key wildlife habitat (see natural community description for this habitat at NatureServe website. NatureService is a national organization that, among other things, compiles the data of all of the state Natural Heritage Programs in order to provide range-wide status:

http://www.natureserve.org/explorer/servlet/NatureServe?searchCommunityUid=ELEMENT_GLOBAL.2.686944

Acer rubrum - *Nyssa sylvatica* - *Magnolia virginiana* / *Viburnum nudum* var. *nudum* / *Osmunda cinnamomea*
Swamp Forest

Note that this plant community is uncommon rangewide, and is considered Globally Vulnerable (G3 in our ranking. If you have any trouble with this link, please let me know as there is a lot of useful information.

Species associated with Swamp pink at this site in the Acidica Seepage Swamp are *Acer rubrum*, *Pinus rigida*, *Lindera benzoin*, *Leucothoe racemosa*, *Magnolia virginiana*, *Smilax rotundifolia*, *Viburnum nudum*, *Osmunda cinnamomea*, *Sphagnum* spp and *Symplocarpus foetidus*, *Maianthemum canadense*.

We did not find any Swamp pink plants this spring or fall, unfortunately. With the support of staff at BWI airport, we started a small effort to try to promote seed germination of this rare plant at the exact locations where we had observed and flagged plants previously. We will monitor that effort next year.

As I have mentioned previously, please be aware that there are two other rare plant species that inhabit the wetlands in this immediate vicinity, Bog fern (*Thelypteris simulata*, state-listed as Threatened) and Switch cane (*Arundinaria tecta*, state rare). They occur closer to the main stem of Stony Run. In the area where Swamp pink has grown, there is also a population of an uncommon orchid, Southern twayblade (*Listera australis*) which we track on our state Watchlist.

Here is our vegetation data for Bog fern population. Two locations with over 100 plants occur in hummocky seepage wetlands dominated by *Clethra alnifolia*, *Magnolia virginiana*, *Acer rubrum*, *Lyonia lingustrana* and *Smilax rotundifolia*. *Acer rubrum*, *Pinus rigida*, *Nyssa sylvatica* and *Fraxinus pennsylvanica* occur in the canopy while *Leersia*, *Carex* spp, *Polygonum* spp, *Woodwardia areolata* and *Osmunda cinnamomea* dominate herb layer. Occasional sphagnum and liverworts occur on hummocks. Flat, 0-3%, filtered sunlight, ephemeral seep/subsurface water, plain/level/bottom. ZBA- Zekiah and Issue soils.

Vegetation data for Switch cane population. This is a large population with thousands of plants of Switch cane growing on hummocks in the alluvial plain along Stony Run Area S of Stony Run bridge and bordered to E by swamp and mesic forest to W. Several standing dead trees and old beaver sign. Area is a mix of field species

and wetland species. Small sewer trail on W side of area with some old tire ruts. Very open canopy and scattered shrub layer. Woody species included *Platanus occidentalis*, *Cephalanthus occidentalis*, *Acer rubrum*, *Diospyros virginiana*, *Smilax rotundifolia* and *Ilex verticillata*. Herbaceous layer was dense and had *Bidens frondosa*, *Mikania scandens*, *Leersia oryzoides*, *Arundinaria gigantea*, *Solidago rugosa*, *Echinochloa crus-galli*, *Arthraxon hispidus*, *Pilea pumila*, *Eupatorium serotinum*, *Solidago graminifolia*, *Cyperus strigosus*, *Juncus effusus*, *Typha spp*, *Conyza*.

Also, as I've noted before, this is a mature forest, and the trees are not getting much taller at this point. Within the wetlands, the tallest trees seem to be the pitch pines, and eventually they fall over due to the perennially saturated soils. Frequent turbulence from planes flying over may contribute to the tree falls. Note that this is a wetland of special state concern, and vegetation clearing is regulated by the Maryland Dept of the Environment. Given the number of trees proposed for clearing, MDE authorization would likely be necessary.

I ask that a more detailed assessment of canopy heights and clearance requirements be done in order to be absolutely certain that all of these trees need to be cleared for safety purposes. In prior years when more detailed assessments were done it was determined that very few trees, if any, had to be cut. Please feel free to contact me with any questions.

Kathy

Snyder, Lindsey

From: Katharine McCarthy -DNR- <katharine.mccarthy@maryland.gov>
Sent: Thursday, December 19, 2019 11:58 AM
To: Snyder, Lindsey
Subject: Re: [EXTERNAL] Re: FW: Updated Chapters 4, 5 and Matrix

Regarding site condition, the invasive plant, wavy-leaf basketgrass is encroaching, It is not abundant yet, and we pull and bag plants we find during our site visits, but it is a very aggressive species and extremely difficult to control. Japanese stilt grass is now well-established on the roadside and is encroaching in the wetland. It, too, is extremely difficult to control.

Otherwise, there are no evident changes in site conditions over the last five years. -Kathy

On Thu, Dec 19, 2019 at 8:18 AM Snyder, Lindsey <LSnyder@jmt.com> wrote:

Kathy-

Thank you for all the information. The NatureServe website is amazing! I will be using that in the future, for sure.

I do have a question though. During your survey(s), do you remember if there was anything specific to note about the condition of the local habitat? I'm just trying to fill in the blanks for the BA, and the current condition seems to be relevant in a few sections, as compared to previous conditions of the site. Thank you for any help you can offer.

-Lindsey Snyder

Johnson, Mirmiran & Thompson, Inc.

An Employee-Owned Company

Lindsey Snyder, AICP

Associate

P. 443-662-4093

F. 410-472-2200

lsnyder@jmt.com

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United States Department of the Interior



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<http://www.fws.gov/chesapeakebay/>
<http://www.fws.gov/chesapeakebay/endsppweb/ProjectReview/Index.html>

In Reply Refer To:

January 14, 2020

Consultation Code: 05E2CB00-2019-SLI-1151

Event Code: 05E2CB00-2020-E-01094

Project Name: BWI 2016-2020 Improvements

Subject: Updated list of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. This species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

<http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF>

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (<http://www.fws.gov/windenergy/>) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm>; <http://www.towerkill.com>; and <http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html>.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
 - USFWS National Wildlife Refuges and Fish Hatcheries
 - Wetlands
-

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Chesapeake Bay Ecological Services Field Office

177 Admiral Cochrane Drive

Annapolis, MD 21401-7307

(410) 573-4599

Project Summary

Consultation Code: 05E2CB00-2019-SLI-1151

Event Code: 05E2CB00-2020-E-01094

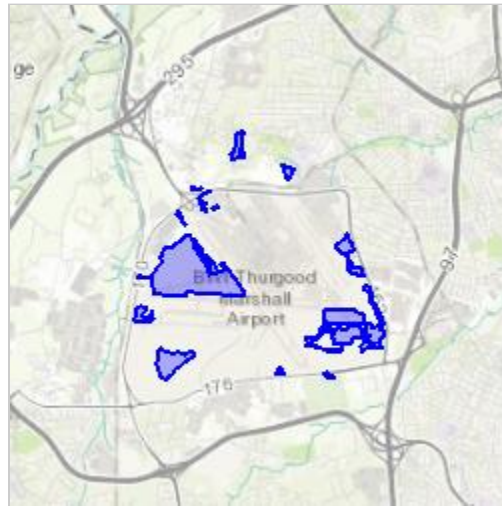
Project Name: BWI 2016-2020 Improvements

Project Type: TRANSPORTATION

Project Description: Maryland Department of Transportation Aviation Administration (MAA) is proposing a number of projects for implementation at Baltimore / Washington International Thurgood Marshall Airport (BWI Marshall Airport).

Project Location:

Approximate location of the project can be viewed in Google Maps: <https://www.google.com/maps/place/39.179080676298355N76.68470208937799W>



Counties: Anne Arundel, MD

Endangered Species Act Species

There is a total of 2 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 1 of these species should be considered only under certain conditions.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries¹, as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

-
1. [NOAA Fisheries](#), also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Northern Long-eared Bat <i>Myotis septentrionalis</i> No critical habitat has been designated for this species. This species only needs to be considered under the following conditions: <ul style="list-style-type: none"> Projects with a federal nexus that have tree clearing = to or > 15 acres: 1. REQUEST A SPECIES LIST 2. NEXT STEP: EVALUATE DETERMINATION KEYS 3. SELECT EVALUATE under the Northern Long-Eared Bat (NLEB) Consultation and 4(d) Rule Consistency key Species profile: https://ecos.fws.gov/ecp/species/9045	Threatened

Flowering Plants

NAME	STATUS
Swamp Pink <i>Helonias bullata</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4333	Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

USFWS National Wildlife Refuge Lands And Fish Hatcheries

Any activity proposed on lands managed by the [National Wildlife Refuge](#) system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

Wetlands

Impacts to [NWI wetlands](#) and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local [U.S. Army Corps of Engineers District](#).

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

FRESHWATER EMERGENT WETLAND

- [PEM1/SS1C](#)
- [PEM1Ch](#)
- [PEM1F](#)

FRESHWATER FORESTED/SHRUB WETLAND

- [PFO1A](#)
- [PSS1/EM1A](#)

FRESHWATER POND

- [PUBHx](#)

RIVERINE

- [R4SBC](#)
 - [R5UBH](#)
-

Attachment 9:

USFWS Determination for Swamp Pink

February 19, 2020



United States Department of the Interior



FISH AND WILDLIFE SERVICE

Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, Maryland 21401
<http://www.fws.gov/chesapeakebay>

February 19, 2020

Genevieve Walker
13873 Park Center Road
Suite 490S
Herndon, VA 20171

RE: "Not Likely to Adversely Affect" determination for swamp pink for BWI Marshall Proposed Improvements 2016-2020 in Anne Arundel County, Maryland

Dear Ms. Walker:

The U.S. Fish and Wildlife Service (Service) has reviewed your project information from the Service's Information for Planning and Consultation (IPaC) online system, as well as from your biological assessment, delivered on January 31, 2020. The comments provided below are in accordance with Section 7 of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*).

The purpose of this proposed project is to make improvements at BWI Marshall Airport; these improvements include realignment of taxiways, construction of new buildings, and removal of obstructions to navigable airspace. The federally threatened swamp pink (*Helonias bullata*) may be present within the project area, specifically within the Stony Run Wetlands of Special State Concern.

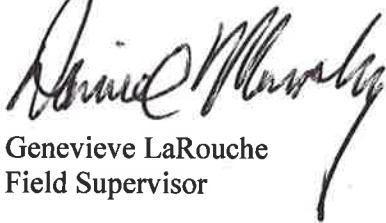
The proposed construction work is not in the vicinity of swamp pink and will not impact swamp pink. However, the proposed tree obstruction removal effort includes removal of trees in Stony Run wetland, where swamp pink has historically occurred and which currently contains suitable habitat. The proposed project includes a number of conservation measures to avoid and minimize impacts to swamp pink and its habitat. As long as the conservation methods described in the biological assessment are followed, the project is "not likely to adversely affect" swamp pink.

Except for occasional transient individuals, no other federally proposed or listed threatened or endangered species are known to exist within the project area. Should project plans change or if additional information on the distribution of listed or proposed species becomes available, this determination may be reconsidered.



We appreciate the opportunity to provide information relative to fish and wildlife issues. Thank you for your interest in these resources. If you have any questions or need further assistance, please contact Kathleen Cullen of my staff at 410/573-4579 or kathleen_cullen@fws.gov.

Sincerely,



Genevieve LaRouche
Field Supervisor

Acting
for

Attachment 10:

**USFWS Determination Letter under the Programmatic Biological Opinion on
Final 4(d) Rule for the Northern Long-eared Bat**

July 16, 2020



United States Department of the Interior



FISH AND WILDLIFE SERVICE
Chesapeake Bay Ecological Services Field Office
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<http://www.fws.gov/chesapeakebay/>
<http://www.fws.gov/chesapeakebay/endsppweb/ProjectReview/Index.html>

In Reply Refer To:

July 16, 2020

Consultation Code: 05E2CB00-2020-TA-0434

Event Code: 05E2CB00-2020-E-04196

Project Name: BWI Marshall Proposed Improvements 2016-2020

Subject: Verification letter for the 'BWI Marshall Proposed Improvements 2016-2020' project under the January 5, 2016, Programmatic Biological Opinion on Final 4(d) Rule for the Northern Long-eared Bat and Activities Excepted from Take Prohibitions.

Dear Genevieve Walker:

The U.S. Fish and Wildlife Service (Service) received on April 14, 2020 your effects determination for the 'BWI Marshall Proposed Improvements 2016-2020' (the Action) using the northern long-eared bat (*Myotis septentrionalis*) key within the Information for Planning and Consultation (IPaC) system. This IPaC key assists users in determining whether a Federal action is consistent with the activities analyzed in the Service's January 5, 2016, Programmatic Biological Opinion (PBO). The PBO addresses activities excepted from "take"^[1] prohibitions applicable to the northern long-eared bat under the Endangered Species Act of 1973 (ESA) (87 Stat.884, as amended; 16 U.S.C. 1531 et seq.).

Based upon your IPaC submission, the Action is consistent with activities analyzed in the PBO. The Action may affect the northern long-eared bat; however, any take that may occur as a result of the Action is not prohibited under the ESA Section 4(d) rule adopted for this species at 50 CFR §17.40(o). Unless the Service advises you within 30 days of the date of this letter that your IPaC-assisted determination was incorrect, this letter verifies that the PBO satisfies and concludes your responsibilities for this Action under ESA Section 7(a)(2) with respect to the northern long-eared bat.

Please report to our office any changes to the information about the Action that you submitted in IPaC, the results of any bat surveys conducted in the Action area, and any dead, injured, or sick northern long-eared bats that are found during Action implementation. If the Action is not completed within one year of the date of this letter, you must update and resubmit the information required in the IPaC key.

This IPaC-assisted determination allows you to rely on the PBO for compliance with ESA Section 7(a)(2) only for the northern long-eared bat. It **does not** apply to the following ESA-protected species that also may occur in the Action area:

- Swamp Pink, *Helonias bullata* (Threatened)

If the Action may affect other federally listed species besides the northern long-eared bat, a proposed species, and/or designated critical habitat, additional consultation between you and this Service office is required. If the Action may disturb bald or golden eagles, additional coordination with the Service under the Bald and Golden Eagle Protection Act is recommended.

[1]Take means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct [ESA Section 3(19)].

Action Description

You provided to IPaC the following name and description for the subject Action.

1. Name

BWI Marshall Proposed Improvements 2016-2020

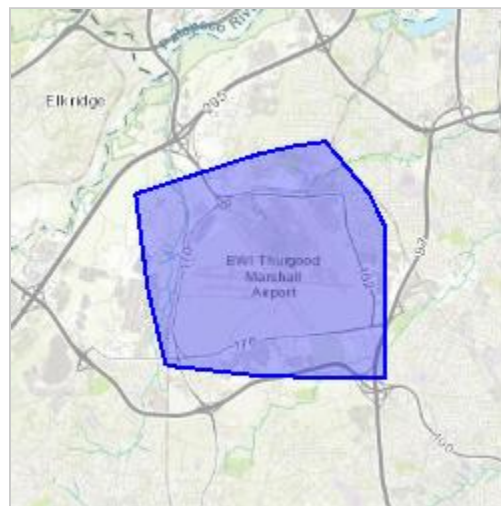
2. Description

The following description was provided for the project 'BWI Marshall Proposed Improvements 2016-2020':

Improvements to BWI Marshall Airport include realignment of taxiways, construction of new aviation support buildings and the removal of trees and other structures (poles, signs, and obstruction lights) that are considered obstructions to navigable airspace both on- and off-airport.

It should be noted that vegetative obstruction removal is expected to be completed with minimal ground disturbance, specifically trees will be cut and the stump will be left in place.

Approximate location of the project can be viewed in Google Maps: <https://www.google.com/maps/place/39.177545468168965N76.67297493858518W>

**Determination Key Result**

This Federal Action may affect the northern long-eared bat in a manner consistent with the description of activities addressed by the Service's PBO dated January 5, 2016. Any taking that may occur incidental to this Action is not prohibited under the final 4(d) rule at 50 CFR

§17.40(o). Therefore, the PBO satisfies your responsibilities for this Action under ESA Section 7(a)(2) relative to the northern long-eared bat.

Determination Key Description: Northern Long-eared Bat 4(d) Rule

This key was last updated in IPaC on May 15, 2017. Keys are subject to periodic revision.

This key is intended for actions that may affect the threatened northern long-eared bat.

The purpose of the key for Federal actions is to assist determinations as to whether proposed actions are consistent with those analyzed in the Service's PBO dated January 5, 2016.

Federal actions that may cause prohibited take of northern long-eared bats, affect ESA-listed species other than the northern long-eared bat, or affect any designated critical habitat, require ESA Section 7(a)(2) consultation in addition to the use of this key. Federal actions that may affect species proposed for listing or critical habitat proposed for designation may require a conference under ESA Section 7(a)(4).

Determination Key Result

This project may affect the threatened Northern long-eared bat; therefore, consultation with the Service pursuant to Section 7(a)(2) of the Endangered Species Act of 1973 (87 Stat.884, as amended; 16 U.S.C. 1531 et seq.) is required. However, based on the information you provided, this project may rely on the Service's January 5, 2016, *Programmatic Biological Opinion on Final 4(d) Rule for the Northern Long-Eared Bat and Activities Excepted from Take Prohibitions* to fulfill its Section 7(a)(2) consultation obligation.

Qualification Interview

1. Is the action authorized, funded, or being carried out by a Federal agency?
Yes
2. Have you determined that the proposed action will have "no effect" on the northern long-eared bat? (If you are unsure select "No")
No
3. Will your activity purposefully **Take** northern long-eared bats?
No
4. Is the project action area located wholly outside the White-nose Syndrome Zone?
Automatically answered
No
5. Have you contacted the appropriate agency to determine if your project is near a known hibernaculum or maternity roost tree?

Location information for northern long-eared bat hibernacula is generally kept in state Natural Heritage Inventory databases – the availability of this data varies state-by-state. Many states provide online access to their data, either directly by providing maps or by providing the opportunity to make a data request. In some cases, to protect those resources, access to the information may be limited. A web page with links to state Natural Heritage Inventory databases and other sources of information on the locations of northern long-eared bat roost trees and hibernacula is available at www.fws.gov/midwest/endangered/mammals/nleb/nhisites.html.

Yes

6. Will the action affect a cave or mine where northern long-eared bats are known to hibernate (i.e., hibernaculum) or could it alter the entrance or the environment (physical or other alteration) of a hibernaculum?

No

7. Will the action involve Tree Removal?

Yes

8. Will the action only remove hazardous trees for the protection of human life or property?

Yes

Project Questionnaire

If the project includes forest conversion, report the appropriate acreages below. Otherwise, type '0' in questions 1-3.

1. Estimated total acres of forest conversion:

19

2. If known, estimated acres of forest conversion from April 1 to October 31

0

3. If known, estimated acres of forest conversion from June 1 to July 31

0

If the project includes timber harvest, report the appropriate acreages below. Otherwise, type '0' in questions 4-6.

4. Estimated total acres of timber harvest

0

5. If known, estimated acres of timber harvest from April 1 to October 31

0

6. If known, estimated acres of timber harvest from June 1 to July 31

0

If the project includes prescribed fire, report the appropriate acreages below. Otherwise, type '0' in questions 7-9.

7. Estimated total acres of prescribed fire

0

8. If known, estimated acres of prescribed fire from April 1 to October 31

0

9. If known, estimated acres of prescribed fire from June 1 to July 31

0

If the project includes new wind turbines, report the megawatts of wind capacity below. Otherwise, type '0' in question 10.

10. What is the estimated wind capacity (in megawatts) of the new turbine(s)?
0