APPENDIX E

Airspace Protection Overview

Airspace Protection Overview

Protecting the navigable airspace around airports is required by the Federal Aviation Administration (FAA) in grant assurances (obligations) that the airport sponsor signs when obtaining grants to fund airport development projects. The grant assurances require the airport sponsor to take appropriate action to ensure that airspace is adequately cleared to protect instrument and visual flight operations by removing, lowering, relocating, marking or lighting, or otherwise mitigating existing airport hazards and preventing the establishment or creation of future airport hazards. There are standard airspace obstacle surfaces around airports that need to be evaluated including the following:

- Federal Aviation Regulations (FAR) Part 77 surfaces contained in Code of Federal Regulations (CFR), Title 14, *Safe, Efficient Use, and Preservation of the Navigable Airspace*,
- Runway End Siting Surfaces (RESS) contained in Advisory Circular (AC) 150/5300-13A, Change 1, *Airport Design*
- Terminal Instrument Procedures (TERPS) surfaces contained in contained in FAA Order 8260.3B, *United States Standard for Terminal Instrument Procedures (TERPS),*
- Obstacle clearance surfaces for visual navigational aids (NAVAIDS) contained in AC 150/5340-30G, *Design and Installation Details for Airport Visual Aids*

Each airspace surface will be discussed in further detail below.

FAR Part 77

The FAA, in the Code of Federal Regulations (CFR), Title 14, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace*, has established standards for determining obstructions to navigable airspace, and their effect on the safe and efficient use of airspace. This regulation defines a system of imaginary surfaces (primary, approach, transitional, horizontal, and conical) designed to protect the critical airspaces around an airport and allow for the safe operation of aircraft to and from the airport. These imaginary surfaces are fixed surfaces that do not move. The applicable Part 77 surface dimensions are based on the type of approaches to each runway end at the airport.

The **primary surface** is longitudinally centered about the runway for a width dependent on the type of runway and extends to a distance of 200 feet beyond each end of a paved runway. The primary surface ends at the end of the runway when the runway has no specially prepared hard surface. The elevation of any point on the primary surface is the same as the elevation of the nearest point on the runway centerline.

The **approach surface** is longitudinally centered on the extended runway centerline and extends outward and upward from each end of the primary surface. The slope and configuration of each runway approach surface varies as a function of runway type and the type of approach available or planned for that runway end.

The **transitional surface** extends outward and upward from the primary and approach surfaces at right angles to each of the runway centerlines at a slope of 7 feet horizontally for each foot vertically. The transitional surface ends where it meets the horizontal surface.

The **horizontal surface** is a horizontal plane 150 feet above the established airport elevation. .The perimeter of the horizontal surface is delineated by constructing tangent lines to a series of arcs with a radius of 10,000 feet from the center point of each end of the primary surface of each of the runway ends.

The **conical surface** extends outward and upward from the periphery of the horizontal surface at a slope of 20 feet horizontally to 1 foot vertically (20:1) for a horizontal distance of 4,000 feet.

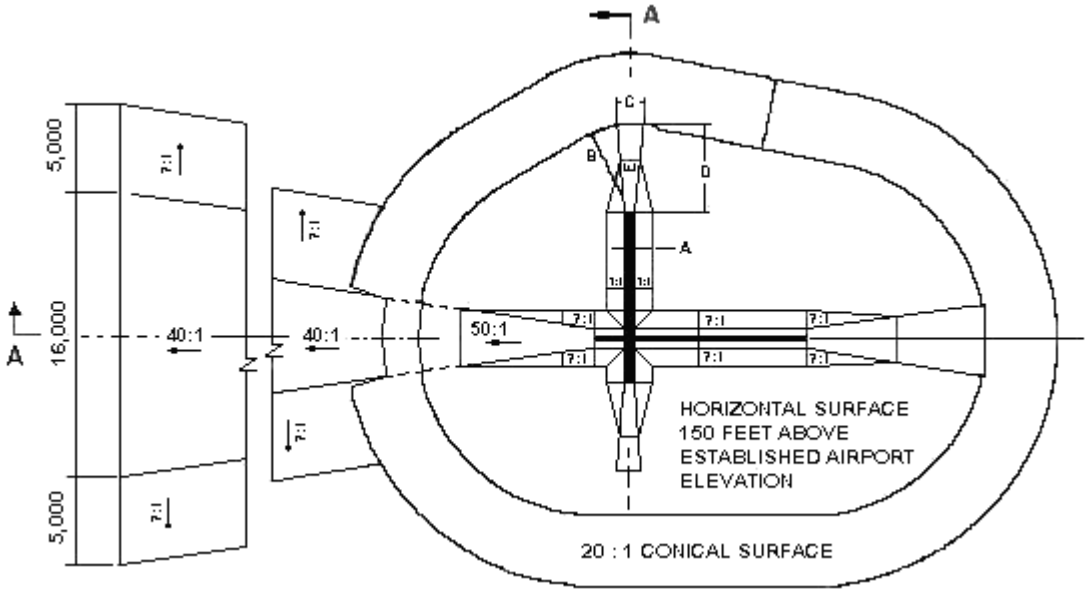
Table 1 shows the dimensional standards associated with each Part 77 surface, and **Figure 1** shows the plan view of the surfaces. A 3D diagram and 3D flythrough of FAR Part 77 surfaces can be viewed at http://www.ngs.noaa.gov/AERO/oisspec.html

Table 1 FAR Part 77 Obstruction Identification Surfaces

DIM	ITEM	DIMENSIONAL STANDARDS (FEET)					
		VISUAL RUNWAY		NON - PRECISION INSTRUMENT RUNWAY			PRECISION INSTRUMENT RUNWAY PIR
		A	B	A	B		
					C	D	
A	WIDTH OF PRIMARY SURFACE AND APPROACH SURFACE WIDTH AT INNER END	250	500	500	500	1,000	1,000
B	RADIUS OF HORIZONTAL SURFACE	5,000	5,000	5,000	10,000	10,000	10,000
		VISUAL APPROACH		NON - PRECISION INSTRUMENT APPROACH			PRECISION INSTRUMENT APPROACH
		A	B	A	B		
					C	D	
C	APPROACH SURFACE WIDTH AT END	1,250	1,500	2,000	3,500	4,000	16,000
D	APPROACH SURFACE LENGTH	5,000	5,000	5,000	10,000	10,000	*
E	APPROACH SLOPE	20:1	20:1	20:1	34:1	34:1	*

Source: National Geodetic Survey (NGS) National Oceanic & Atmospheric Administration (NOAA)

Figure 1 Plan View of FAR Part 77 Surfaces



Source: National Geodetic Survey (NGS) National Oceanic & Atmospheric Administration (NOAA)

The applicable FAR Part 77 surface dimensions used for Griffiss International Airport are based on a non-precision instrument approach procedures to Runway 15 and precision instrument approach procedures for Runway 33.

Table 2—FAR Part 77 Surface Dimensions for Hudson Valley Regional Airport

Item	Runway 15	Runway 33
Primary Surface Width	1,000’	1,000’
Horizontal Surface Radius	10,000’	10,000’
Approach Surface Width at End	3,500’	16,000’
Approach Surface Length	10,000’	50,000*
Approach Procedure	Non-precision	Precision
Approach Slope	34:1	50:1/40:1*

* Horizontal distance = 10,000' at 50:1, Additional 40,000' at 40:1

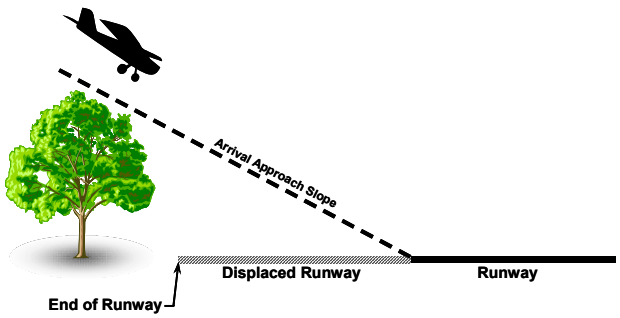
Source: Code of Federal Regulations (CFR), Title 14, Part 77

In December 2013, an aeronautical survey was conducted by Quantum Spatial, from which obstructions were identified and shown on the airspace, inner plan, and profile drawings prepared as part of the Griffiss International Airport Master Plan Update finished in February 2016. This analysis, (hereinafter referred to as *Obstruction Evaluation*) identified obstructions to the Part 77 transitional, horizontal, conical, and approach surfaces. Obstructions identified included tree canopy, individual trees, one tank, one antenna, grain bins/silos, and terrain obstructions (see **Appendix C,** Airspace Drawing and Inner Plan and Profile Drawings).

Runway End Siting Surfaces

Advisory Circular (AC) 150/5300-13A, *Airport Design* contains design standards for runway end siting. According to the AC, the runway threshold is ideally located at the beginning of the runway. The threshold is located to provide proper clearance for landing aircraft over existing obstacles while on approach to landing. When an object beyond the airport owner's power to remove, relocate, or lower obstructs the airspace required for aircraft to land at the beginning of the runway, the threshold may be located farther down the runway. Such a threshold is called a "displaced threshold."

Displacement of a threshold reduces the length of runway available for landings. The portion of the runway behind a displaced threshold may be available for takeoffs and, depending on the reason for displacement, may be available for takeoffs and landings from the opposite direction. Threshold displacement should be undertaken only after a full evaluation reveals that displacement is the best alternative. These standards minimize the loss of operational use of the established runway and reflect the FAA policy of maximum utilization and retention of existing paved areas on airports



In order to protect the runway ends and approach/departure surfaces

- All TERPS approach surfaces and approach surfaces associated with the threshold should be clear of obstacles
- 40:1 instrument departure surface should be clear
- Consider other surfaces associated with electronic and visual NAVAIDs such as precision approach path indicator (PAPI) system, approach lighting system (ALS), and instrument landing system (ILS)

Approach Surfaces

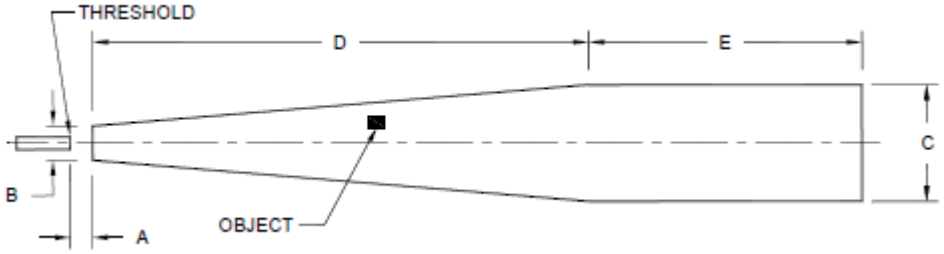
The approach surfaces defined in this section are not the same as the approach surfaces defined in Part 77. The approach surfaces are designed to protect the use of the runway in both visual and instrument meteorological conditions near the airport. The specific size, slope and starting point depends on the visibility minimums and type of procedure (i.e., visual, non-precision, or precision) associated with the runway end. **Table 3** shows the dimensional standards associated with the approach surfaces, and **Figure 2** shows the plan view of the approach surfaces. Obstacles that penetrate the approach surfaces are considered critical obstructions since they can affect the location of the runway threshold, runway length available for landing, and operational use of the runway (i.e., may prohibit current aircraft operating at the airport from being able to land due to the reduced runway length).

Table 3—Approach / Departure Standards

	Runway Type	DIMENSIONAL STANDARDS* Feet (Meters) A	B	C	D	E	Slope/ OCS
1	Approach end of runways expected to serve small airplanes with approach speeds less than 50 knots. (Visual runways only, day/night)	0 (0)	120 (37)	300 (91)	500 (152)	2,500 (762)	15:1
2	Approach end of runways expected to serve small airplanes with approach speeds of 50 knots or more. (Visual runways only, day/night)	0 (0)	250 (76)	700 (213)	2,250 (686)	2,750 (838)	20:1
3	Approach end of runways expected to serve large airplanes (Visual day/night); or instrument minimums ≥ 1 statute mile (1.6 km) (day only).	0 (0)	400 (122)	1000 (305)	1,500 (457)	8,500 (2591)	20:1
4	Approach end of runways expected to support instrument night operations, serving approach Category A and B aircraft only. [1]	200 (61)	400 (122)	3,800 (1158)	10,000 [2] (3048)	0 (0)	20:1
5	Approach end of runways expected to support instrument night operations serving greater than approach Category B aircraft. [1]	200 (61)	800 (244)	3,800 (1158)	10,000 [2] (3048)	0 (0)	20:1
6	Approach end of runways expected to accommodate instrument approaches having visibility minimums ≥ 3/4 but <1 statute mile (≥ 1.2 km but < 1.6 km), day or night.	200 (61)	800 (244)	3,800 (1158)	10,000 [2] (3048)	0 (0)	20:1
7	Approach end of runways expected to accommodate instrument approaches having visibility minimums < 3/4 statute mile (1.2 km).	200 (61)	800 (244)	3,800 (1158)	10,000 [2] (3048)	0 (0)	34:1
8[3,5,6,7]	Approach end of runways expected to accommodate approaches with vertical guidance (Glide Path Qualification Surface [GQS]).	0 (0)	Runway width + 200 (61)	1520 (463)	10,000 [2] (3048)	0 (0)	30:1
9	Departure runway ends for all instrument operations.	0 [4] (0)	See Figure 3-4.				40:1

Source: AC 150/5300-13A, Change 1, *Airport Design*

Figure 2—RESS Approach Surface



Source: AC 150/5300-13A, Change 1, *Airport Design*

The applicable approach surface dimensions used for Griffiss International Airport are as follows:

- Runway 15 End Type "5" with an obstacle clearance surface (OCS) of 20:1
- Runway 33 End Type "7" with an OCS of 34:1
- Runway 15-33 Ends Type "8" with an OCS of 30:1.

The *Obstruction Evaluation* identified RESS approach surface obstructions in the form of tree canopies to the Runway 33 Type "7" approach surface (see **Appendix C,** RW 33 Inner Plan and Profile Drawing). If this tree canopy is not removed or lowered, it would require a displacement of 782 feet

of the Runway 33 threshold. There are no obstacles to the Runway 15 approach surfaces (see **Appendix C**, RW 15 Inner Plan and Profile Drawing).

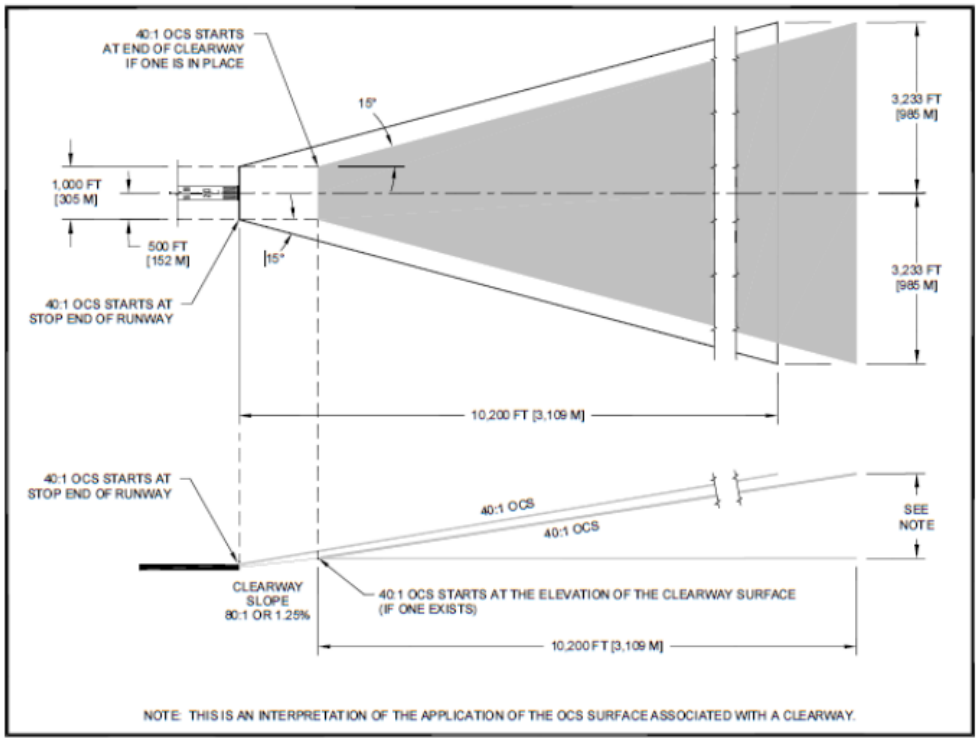
Departure Surfaces

The departure surfaces, when clear, allow pilots to follow standard departure procedures. The departure surface is a trapezoidal shape that begins at the end of the Takeoff Distance Available (TODA) and extends along the extended runway centerline outward and upward at a 40:1 slope (see **Figure 3**). Obstacles that penetrate the departure surface may require the obstacle be published, or may require:

- Non-standard climb rates
- Non-standard (higher) departure minimums. Therefore, it is important for airports to identify and remove these obstacles whenever possible when takeoff procedures can be enhanced, and also to prevent new obstacles.
- Reduction in the length of runway available for takeoff

The *Obstruction Evaluation* identified tree canopy obstructions to the RESS Type "9" departure surfaces for Runway 33 (see **Appendix C**, RW 33 Inner Plan and Profile Drawing). There are no obstacles to the Runway 15 departure surface (see **Appendix C**, RW 15 Inner Plan and Profile Drawing).

Figure 3 Departure Surface for Instrument Runways



Source: AC 150/5300-13A, Change 1, *Airport Design*

Terminal Instrument Procedures (TERPS)

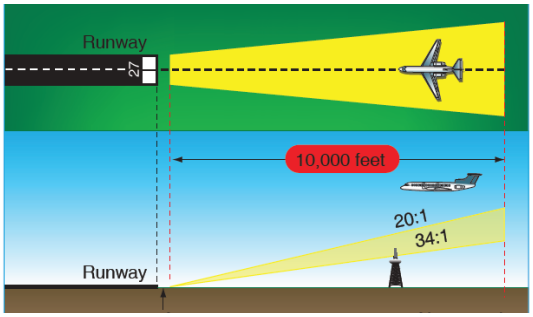
The standards related to TERPS are contained in FAA Order 8260.3D, *United States Standard for Terminal Instrument Procedures (TERPS).* This order is used by the FAA Flight Procedures Branch in

the development of new instrument flight procedures to an airport. FAA Flight Procedures also review existing terminal instrument procedures every two years against current criteria to determine if there are any obstacles that penetrate TERPS surfaces. If obstacles penetrate the TERPS surfaces Flight Procedures will modify the instrument flight procedures to clear all obstacles. Some critical obstruction clearance standards are integrated into the RESS approach/departure surfaces identified in **Table 3** including many final approach segments, the 40:1 departure surface, and the 30:1 glidepath qualification surface.

Visual Portion of Final Approach

The visual portion of the Final Approach segment is centered on the extended runway centerline, begins 200 feet from the runway threshold, has an inner width of 200 feet for Category A and B aircraft or 400 feet for Category C and D aircraft, and extends out for a length of 10,000 feet. Two surfaces are included in this portion of the Final Approach segment one extends upward and outward at a 20:1 slope, the second extends upward and outward at a 34:1 slope (see **Figure 4**).

Figure 4 TERPS Final Approach Segment



Source: FAA Instrument Procedures Handbook

Obstacles that penetrate the 20:1 visual portion (VIS) of the Final Approach segment are considered critical obstructions since they can affect airport operations by restricting night time instrument flight procedures and result in increased visibility minimums (i.e., visibility can be no lower than 1 statute mile). In addition, obstacles that penetrate the 34:1 portion of the Final Approach segment will result in increased visibility minimums (i.e. visibility can be no lower than three-fourths statute mile).

Based on TERPS data received from the FAA FPO, there are no penetrations to the 20:1 visual surface. Individual tree obstructions penetrate the 34:1 visual surface to the Runway 33 end and there are no 34:1 penetrations to the Runway 15 end (see **Appendix D**).

Localizer Performance with Vertical Guidance (LPV) Final Approach Segment

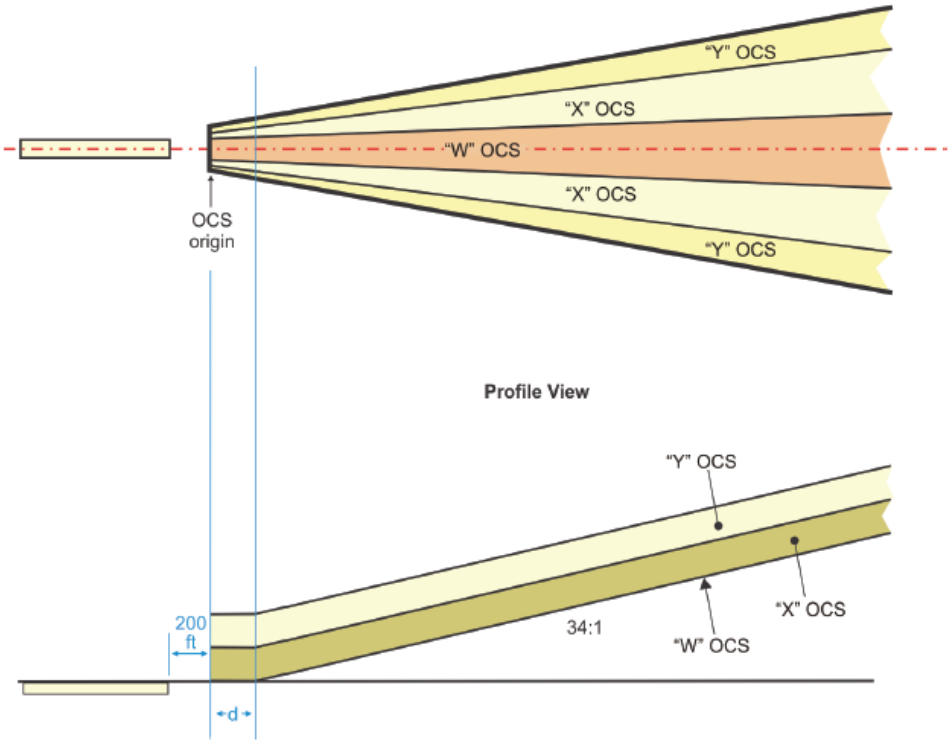
Under the umbrella of the FAA Wide Area Augmentation System (WAAS), an LPV approach offers precision approach capability without the need for any ground based equipment. WAAS is a navigation service using a combination of Global Positioning System (GPS) satellites and the WAAS geostationary satellites to improve the navigational service provided by GPS. The LPV approach is similar to a Category I instrument landing system (ILS) precision instrument approach procedure. Landing minima are usually similar to those of a Type I ILS with a decision height of 200 feet and visibility of 1/2 mile. The final approach segment of the LPV approach consists of W, X, and Y obstacle clearance surfaces (OCS) that begin 200 feet from the runway landing threshold and ends at the precision approach final approach fix (PFAF). When there are penetrations to the OCS, if the obstacle is not removed or the obstruction location and/or height is not adjusted, the instrument approach procedure would need to be modified to eliminate or reduce the amount of penetration.

As a result, LPV Final Approach obstacles are considered critical obstructions. To eliminate or avoid a penetration, one or more of the following actions needs to take place:

- realignment of the final approach course
- displacing the runway landing threshold
- raising the glidepath angle
- adjusting the decision altitude
- increasing the threshold crossing height

Based on TERPS data received from the FAA FPO, trees penetrate the Runway 33 LPV Final Approach Segment (see **Appendix D**).

Figure 5 LPV Final Approach Segment



Source: FAA Order 8260.58A, United States Standard Performance Based Navigation (PBN) Instrument Procedure Design

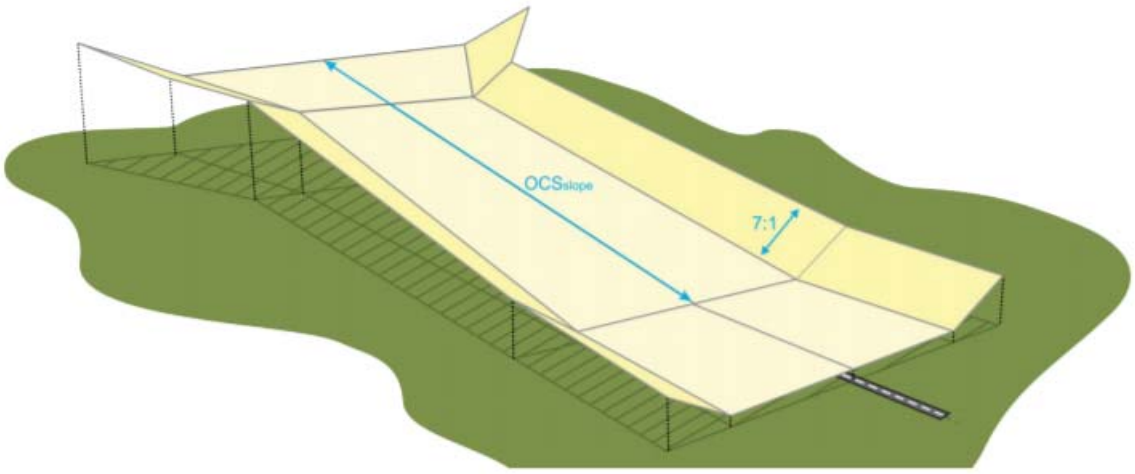
LNAV/VNAV Final Approach Segment

LNAV/VNAV approaches provide both horizontal and approved vertical approach guidance. Vertical Navigation (VNAV) utilizes an internally generated glideslope based on WAAS or baro-VNAV systems. Minimums are published as a DA. In the primary area, the elevation of the OCS at any point is the elevation of the OCS at the course centerline abeam it. The OCS in the secondary area is a 7:1 surface sloping upward from the edge of the primary area OCS perpendicular to the flight track. When there are penetrations to the OCS, if the obstacle is not removed or the obstruction location and/or height is not adjusted, the instrument approach procedure would need to be modified to eliminate or reduce the amount of penetration. To eliminate or avoid a penetration, one or more of the following actions needs to take place:

- raising the glidepath angle
- adjusting the decision altitude
- increasing the threshold crossing height

Based on TERPS data received from the FAA, trees penetrate the Runway 15 and Runway 33 LNAV/VNAV Final Approach Segment (see **Appendix D**).

Figure 6 LNAV/VNAV Final Approach Segment



Source: FAA Order 8260.58A, United States Standard Performance Based Navigation (PBN) Instrument Procedure Design

Glidepath Qualification Surface (GQS)

The GQS extends from the runway threshold along the runway centerline extended to the decision altitude (DA) point. It limits the height of obstructions between the DA and runway threshold. When obstructions exceed the height of the GQS, an approach procedure with positive vertical guidance (ILS, LPV, LNAV/VNAV, etc.) is not authorized. As a result, penetrations to the GQS are considered critical obstructions that need to be addressed as this could affect the airports ability to accommodate existing commercial and business jet aircraft operations.

Based on TERPS data received from the FAA (see **Appendix D**), no obstructions penetrate the Glidepath Qualification Surface.

Visual Navigation Aids

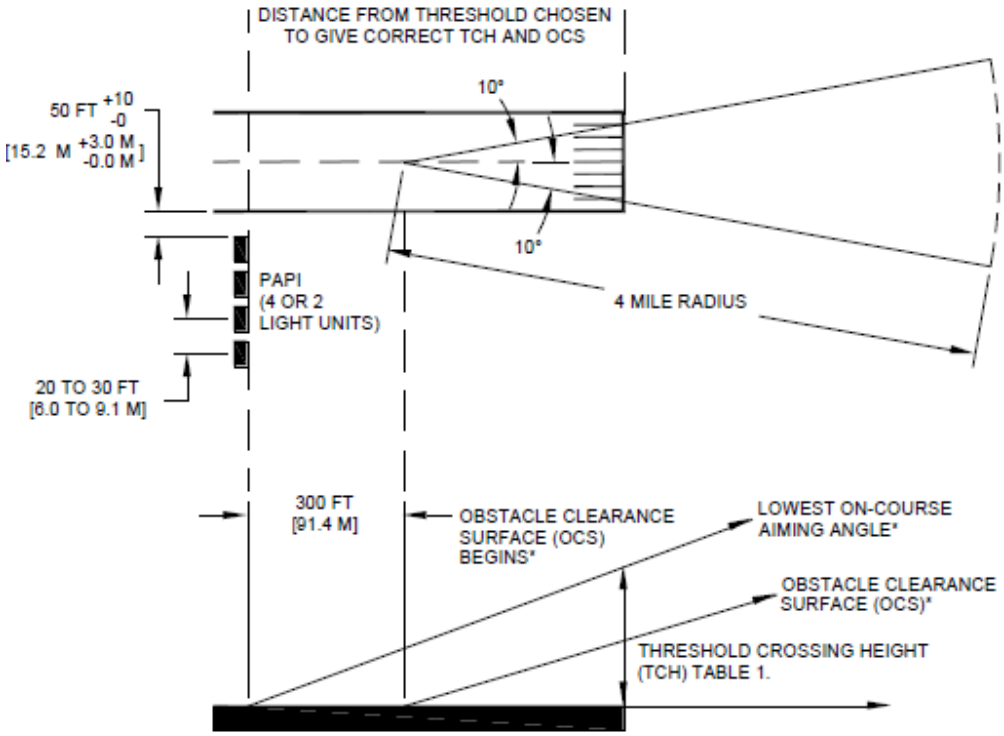
Visual navigational aids (NAVAIDS) at an airport can include approach lighting systems (ALS), runway end identifier lights (REILS) or precision approach path indicator (PAPI) system. These lighting systems are designed and provided to improve the operational safety of aircraft during approach and landing operations. In accordance with AC 150/5300-13A, Change 1, the visual NAVAIDS and associated obstacle clearance surfaces should be considered in order to protect the runway ends and approach/departures. In the case of Griffiss International Airport, the PAPI OCS was evaluated.

Precision Approach Path Indicators (PAPI)

A PAPI is a visual aid that provides the pilot with a safe and accurate descent on final approach to the runway, primarily during visual flight rule weather. The PAPI obstacle clearance surface (OCS) is established to provide the pilot with a minimum clearance over obstacles during approach. The PAPI must be positioned and aimed so that no obstacles penetrate this surface. The surface begins 300 feet in front of the PAPI system (closer to the threshold) and proceeds outward into the approach zone (see **Figure 5**). The visual glide path angle for the PAPI is three degrees and can be raised to four degrees for non-jet runways. When a penetration to the PAPI OCS cannot be removed, the PAPI glideslope angle needs to be increased or the PAPI unit needs to be moved further down the runway. If these options to address PAPI OCS penetrations are not feasible the PAPI would be deactivated and night-time approaches to the runway would be prohibited. As a result, PAPI OCS obstructions are considered critical obstructions.

The *Obstruction Evaluation* did not identify any penetrations to the PAPI OCS (see **Appendix C**, Inner Plan and Profile Drawings).

Figure 7 PAPI OCS Surface



Source: AC 150/5340-30G, Change 1, *Design and Installation Details for Airport Visual Aids*