Environmental Assessment for Houston Optimization of Airspace and Procedures in the Metroplex

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Federal Aviation Administration

Washington D.C.

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1 BACKGROUND

The Federal Aviation Administration (FAA) has prepared this Environmental Assessment (EA) to identify the potential environmental effects associated with the FAA's proposal to improve the management of air traffic by incorporating the newest navigation technology in the Houston, Texas metropolitan area. The Proposed Action includes implementing proposed modifications to Performance Based Navigation (PBN)[1] air traffic control procedures and associated changes to the supporting airspace management structure.[2] Section 4.1 describes the Primary Study Area (PSA) and Supplemental Study Area (SSA) for this EA, as depicted in Figure 1.

[1] Performance-Based Navigation (PBN) is comprised of Area Navigation (RNAV) and Required Navigation Performance (RNP) and describes an aircraft's capability to navigate using performance standards. RNAV enables aircraft to fly on any desired flight path within the coverage of ground- or spaced-based navigation aids, or within the limits of the capability of aircraft self-contained systems, or a combination of both capabilities. RNP is RNAV with the addition of an onboard performance monitoring and alerting capability. The ability of the aircraft navigation system to monitor the navigation performance it achieves and inform the crew if the requirement is unmet during an operation is a defining characteristic of RNP operations. This onboard monitoring and alerting capability enhances the pilot's situation awareness and can enable reduced obstacle clearance. U.S. Federal Aviation Administration (FAA), *FAA Fact Sheet*, "NextGen Goal: Performance-Based Navigation," March 12, 2010.

[2] "Supporting airspace management structure" means the internal administrative procedures the FAA uses to support air traffic operations in the National Airspace System (NAS), including sectorization (lateral and vertical boundaries), as well as the inter- and intra-facility rules (including, but not limited to, FAA directives, Standard Operating Procedures and Letters of Agreement). For the Houston OAPM, the FAA designed the proposed arrival and departure procedures and then examined the supporting airspace management structure for changes necessary to enable the use of the procedures. The proposed action does not include changes to any controlled airspace boundaries (e.g., Class B airspace).

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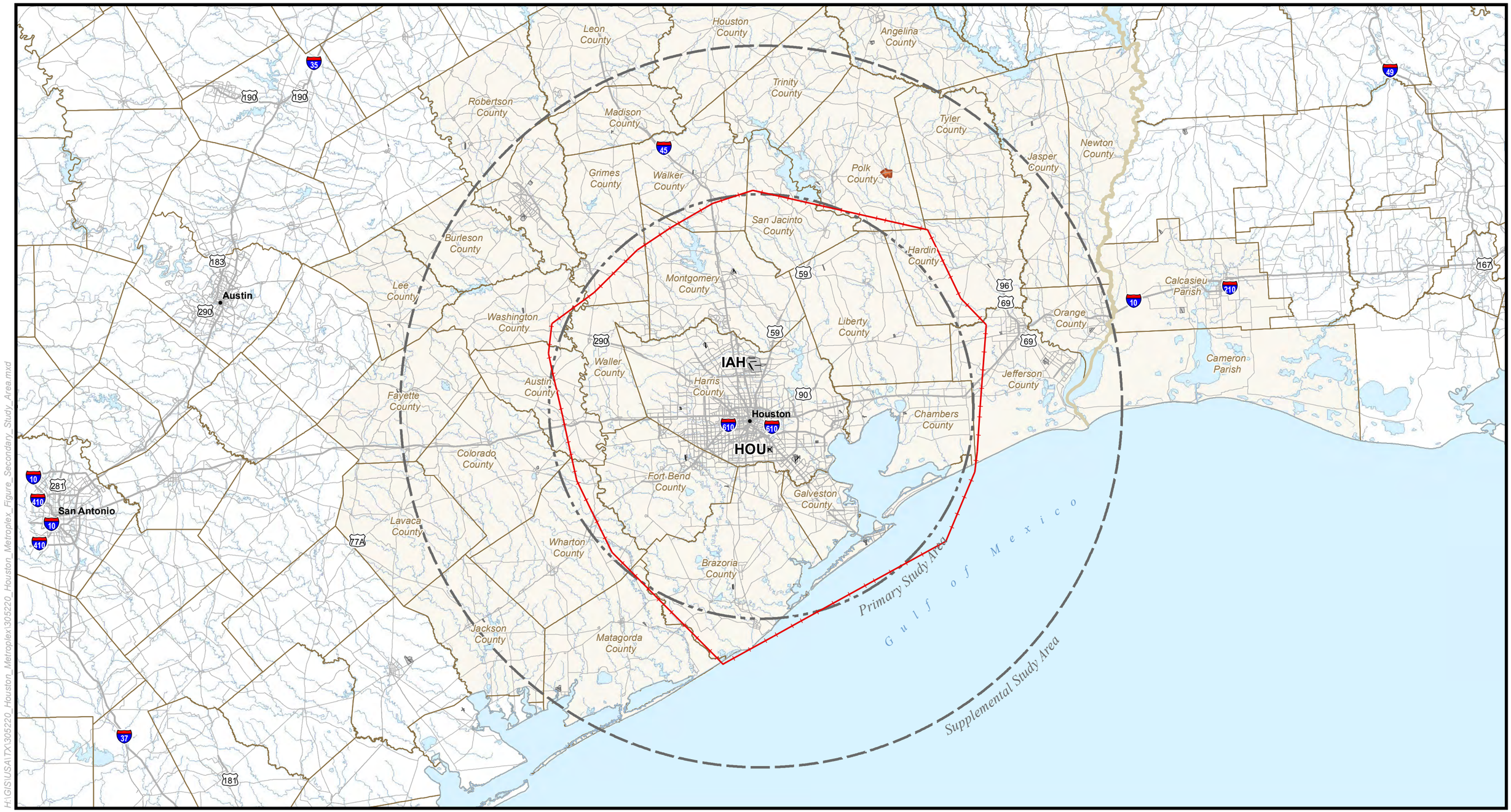

Data Source: Environmental Systems Research Institute, Inc.(ESRI) (Airport/Airport Runways), March 14, 2012; ESRI (State Boundaries/County Boundaries), February 14, 2012; ESRI (Cities), February 8, 2012; ESRI (Roads), March 14, 2012; Houston-Galveston Area Council (Water Features), March 14, 2012; National Atlas (Lakes/Rivers), September 10, 2012 (Updated); National Atlas (Tribal Land/Wilderness Areas), February 08, 2012

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North

0 20 40 Nautical Miles

Primary Study Area
Secondary Study Area
TRACON Boundary

State Boundary
County Boundary

Interstate Highway
Highways
Secondary Roads
Water
River/Stream
Alabama-Coushatta Tribe of Texas Reservation

Primary and Supplemental Study Areas

Figure 1

Houston OAPM EA

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Following recommendations of the aviation community[3], the FAA created an initiative called the Optimization of the Airspace and Procedures in the Metroplex (OAPM). Metroplexes are geographic areas containing several airports serving major metropolitan areas and a diversity of aviation stakeholders. Congestion, airport activity in close geographical proximity, and other limiting factors combine to reduce the efficient management of air traffic in busy Metroplexes. The OAPM initiative involves optimization of airspace and air traffic procedures on a regional scale, rather than focusing on a single airport or set of procedures. This approach takes into account all airports and airspace that support operations in the Metroplex, as well as connectivity with other Metroplexes.[4] The Houston OAPM project is one of many underway or planned across the United States.

One of the major elements of the OAPM program is to optimize and modernize Air Traffic Control (ATC) procedures to take advantage of technological advances in navigation and aircraft surveillance[5] equipment installed on aircraft, also known as equipage, while ensuring continued access to terminal area[6] airspace for aircraft without that level of equipage. These new technologies are the basis of PBN, a primary component of the Next Generation Air Transportation System (NextGen), which involves shifting from fixed, ground-based radio navigation transmitting facilities and radar to satellite, or Global Positioning System (GPS)[7], navigation and onboard surveillance. This transition to NextGen would allow a reduction in costly construction and maintenance of FAA ground-based navigation aids (NAVAIDs)[8], as well as

[3] In September 2009, the FAA received the RTCA's Task Force 5 Final Report on Mid-Term NextGen Implementation, containing recommendations concerning the top priorities for the implementation of NextGen initiatives. A key component of the FAA response to the RTCA recommendations was the formation of teams leveraging FAA and Industry PBN expertise and experience to expedite implementation of optimized airspace and procedures. Optimization of Airspace and Procedures in the Metroplex (OAPM) is a systematic, integrated, and expedited approach to implementing PBN procedures and associated airspace changes. The FAA developed OAPM in direct response to the recommendations from Task Force 5 on the quality, timeliness, and scope of Metroplex solutions.

[4] Michael P. Huerta, Hon., FAA Deputy Administrator, "Statement before the Committee on Transportation and Infrastructure, Subcommittee on Aviation, On the Benefits of the Next Generation Air Transportation System," October 5, 2011: http://republicans.transportation.house.gov/Media/file/TestimonyAviation/2011-10-04%20Huerta.doc.

[5] Surveillance systems are set up to enable the ATC system to know the location of an aircraft and where it is heading. Aircraft positions are displayed for controllers as they actively monitor the traffic to ensure that aircraft do not violate separation criteria. (FAA, *Instrument Procedures Handbook*, 2007.)

[6] Terminal Area: A general term used to describe airspace in which approach control service or airport traffic control service is provided. (FAA, *Pilot-Controller Glossary*, July 26, 2012.)

[7] Global Positioning System (GPS): A U.S.-owned space-based system of 24 satellites that provides users with positioning, navigation, and timing services. The user segment of the system receives signals from the GPS satellites and calculates the user's three-dimensional position and time. The accuracy attained depends on factors such as atmospheric effects and receiver quality, but real-world data collected by the FAA show that high quality GPS receivers currently provide better than 3-meter horizontal accuracy. (U.S. National Coordination Office for Space-Based Position, Navigation, and Timing, "GPS Accuracy": http://www.gps.gov/systems/gps/performance/accuracy.)

[8] Navigational Aid (NAVAID): Any visual or electronic device airborne or on the surface which provides point-to-point guidance information or position data to aircraft in flight. (FAA, *Pilot Controller Glossary*, July 26, 2012.)

improvements in operational efficiency due to more direct routings, without reliance upon fixed locations of NAVAIDs.[9]

Each OAPM project consists of a Study Team phase, which analyzes Metroplex operational challenges and situations and explores the opportunities, followed by a Design and Implementation (D&I) Team phase, which provides very detailed information on expected enhancements and committed improvements in the airspace and procedures areas. In May 2011, the Houston OAPM Study Team began the process of identifying and characterizing operational challenges facing the Houston Metroplex Area. The Study Team determined that a collaborative approach for optimization using PBN procedures would deliver the most efficient and beneficial operations to this Metroplex. The team included subject matter experts from non-local facilities (for an outside perspective), airspace and air traffic procedure design specialists experienced in NextGen PBN, the National Air Traffic Controllers Association (NATCA), and industry representatives (technical pilots from major airlines).[10] The team held three rounds of outreach involving local facilities and other National Airspace System (NAS) users – including Department of Defense (DoD), airlines, business and general aviation (GA), and airport operators – to identify operational issues and propose PBN procedures. In August 2011, the Study Team completed its final report, capturing these issues and proposed solutions, as well as projected benefits of those solutions. See Appendix E, *Houston OAPM Study Team Documents,* for more information.

The Department of Transportation selected the Houston OAPM as a high priority infrastructure project for inclusion on the Federal Infrastructure Projects Dashboard ("Dashboard"). Established pursuant to an August 2011 Presidential Memorandum,[11] the Dashboard is part of an inter-agency initiative, spearheaded by the Office of Management and Budget, to institutionalize best practices to reduce the amount of time required to make permitting and review decisions and improve environmental and community outcomes. The Federal government is enhancing and expanding the Dashboard to serve as a government-wide tool to enable and support collaboration within and among the Federal agencies, as well as to provide increased public transparency regarding the schedules and status of nationally or regionally significant projects, permitting timelines, and overall Federal infrastructure project permitting and review processes.[12] The Houston OAPM is the first aviation project selected for inclusion in the Dashboard; other projects include green infrastructure, surface

[9] For more information on NextGen and PBN, refer to Section 1.3.1 and Appendix D.
[10] Federal Infrastructure Projects Dashboard, "NextGen Infrastructure Initiative – Houston Metroplex (OAPM)": http://permits.performance.gov/permits/study.
[11] White House, "Presidential Memorandum – Speeding Infrastructure Development through More Efficient and Effective Permitting and Environmental Review," August 31, 2011: http://www.whitehouse.gov/the-press-office/2011/08/31/presidential-memorandum-speeding-infrastructure-development-through-more.
[12] Federal Infrastructure Projects Dashboard, "Federal Infrastructure Plan," June 2012: http://permits.performance.gov/sites/default/files/Federal_Infrastructure_Plan.pdf .

transportation, renewable energy, community development, and electricity transmission.[13]

The implementation of these proposed ATC procedures, as with any major Federal action, requires compliance with the National Environmental Policy Act of 1969 (NEPA)[14] and regulations of the Council on Environmental Quality (CEQ) implementing NEPA."[15] FAA actions must also comply with FAA Order 1050.1E, *Environmental Impacts: Policies and Procedures*, which supplements the CEQ regulations for FAA actions. The FAA has prepared this EA in accordance with NEPA, the CEQ regulations, and FAA Order 1050.1E.

1.1 Airport Operations Considered in the EA (Houston OAPM Airports)

The Houston Metroplex consists of airspace under the jurisdiction of the Houston Terminal Radar Approach Control (I90 TRACON)[16], the Houston Air Route Traffic Control Center (ZHU ARTCC)[17], or respective airport Air Traffic Control Towers (ATCTs)[18]. The Metroplex also includes those portions of uncontrolled airspace[19] at satellite airports served by instrument approach[20] and departure[21] procedures.

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[13] Federal Infrastructure Projects Dashboard, "NextGen Infrastructure Initiative – Houston Metroplex (OAPM)": http://permits.performance.gov/projects/nextgen-infrastructure-initiative-houston-Metroplex-oapm

[14] *National Environmental Policy Act (NEPA) of 1969, U.S. Code.* Title 42, sec. 4321-4347 (1970). (Pub. L. 91-190, as amended by Pub. L. 94-52, July 3, 1975, Pub. L. 94-83, August 9, 1975, and Pub. L. 97-258, sec. 4(b), Sept. 13, 1982)

[15] *Code of Federal Regulations*, Title 40, Parts 1500-1508.

[16] Terminal Radar Approach Control Facility (TRACON): A terminal ATC facility that uses radar and non-radar capabilities to provide approach control services to aircraft arriving, departing, or transiting airspace controlled by the facility. For further information, please see Appendix D. (FAA Pilot Controller Glossary, July 26, 2012)

[17] Air Route Traffic Control Center (ARTCC): A facility established to provide air traffic control service to aircraft operating on Instrument Flight Rule (IFR) flight plans within controlled airspace and principally during the en route phase of flight. When equipment capabilities and controller workload permit, certain advisory/assistance services may be provided to Visual Flight Rule (VFR) aircraft. For further information, please see Appendix D. (FAA, *Pilot Controller Glossary*, July 26, 2012.)

[18] Air Traffic Control Tower (ATCT): A terminal facility that uses air/ground communications, visual signaling, and other devices to provide ATC services to aircraft operating in the vicinity of an airport or on the movement area. Authorizes aircraft to land or take off at the airport controlled by the tower or to transit the Class D airspace area regardless of flight plan or weather conditions (IFR or VFR). A tower may also provide approach control services (radar or non-radar). For further information, please see Appendix D. (FAA, *Pilot Controller Glossary*, July 26, 2012.)

[19] Controlled Airspace: An airspace of defined dimensions within which ATC service is provided to IFR flights and to VFR flights in accordance with the airspace classification. Uncontrolled airspace is any space not designated as controlled. (FAA, *Pilot Controller Glossary*, July 26, 2012.)

[20] Instrument Approach Procedure: A series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing or to a point from which a landing may be made visually. It is prescribed and approved for a specific airport by competent authority. (FAA, *Pilot Controller Glossary*, July 26, 2012.)

[21] Instrument Departure Procedure (DP): A preplanned IFR departure procedure published for pilot use, in graphic or textual format, that provides obstruction clearance from the terminal area to the appropriate en route structure. There are two types of DP: 1) an Obstacle Departure Procedure (ODP), printed either textually or graphically, and 2)

The focus of the Houston OAPM effort centers on the area's two busiest airports:[22]

- George Bush Intercontinental/Houston, Houston, TX (IAH)
- William P. Hobby, Houston, TX (HOU)

The Houston OAPM Study Area also includes the following satellite airports:[23]

- David Wayne Hooks Memorial, Houston, TX (DWH)
- Ellington Field, Houston, TX (EFD)
- Lone Star Executive, Houston, TX (CXO)
- Sugar Land Regional, Houston, TX (SGR)
- Scholes International at Galveston, Galveston, TX (GLS)
- West Houston, Houston, TX (IWS)
- Houston Executive, Houston, TX (TME)
- Houston-Southwest, Houston, TX (AXH)
- Texas Gulf Coast Regional, Angleton/Lake Jackson, TX (LBX)[24]
- Pearland Regional, Houston, TX (LVJ)
- Chambers County, Anahuac, TX (T00)
- La Porte Municipal, La Porte, TX (T41)
- RWJ Airpark, Baytown, TX (54T)
- Weiser Air Park, Houston, TX (EYQ)
- Baytown, Baytown, TX (HPY)

This EA refers to the two major and 15 satellite airports collectively as the Houston OAPM Airports. Figure 2 shows the airports' locations within the PSA boundary and various landmarks. Figure 3 and Figure 4 depict the runway layouts of IAH and HOU.

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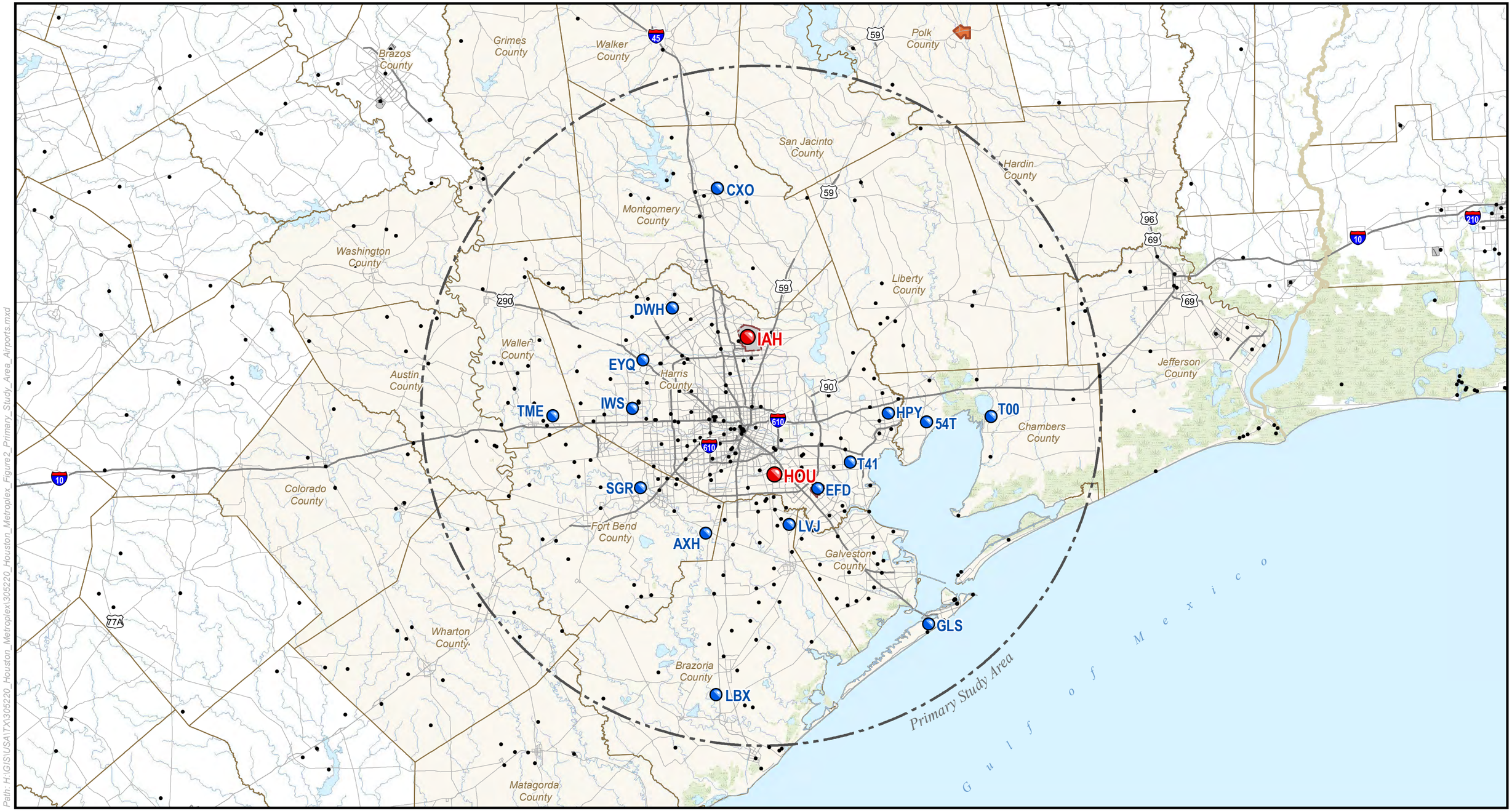
a Standard Instrument Departure (SID), which is always printed graphically. (FAA, *Pilot Controller Glossary*, July 26, 2012.)

[22] FAA, "Airport Data & Contact Information," derived from Forms 5010, "Airport Master Record" data: http://www.faa.gov/airports/airport_safety/airportdata_5010/ (accessed February 2, 2012).

[23] Ibid.

[24] Formerly named Brazoria County Airport.



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Data Source: Environmental Systems Research Institute, Inc.(ESRI) (Airport/Airport Runways), March 14, 2012; ESRI (State Boundaries/County Boundaries), February 14, 2012; ESRI (Cities), February 8, 2012; ESRI (Roads), March 14, 2012; Houston-Galveston Area Council (Water Features), March 14, 2012; National Atlas (Lakes/Rivers), September 10, 2012 (Updated); National Atlas (Tribal Land/Wilderness Areas), February 08, 2012;

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North

0 10 20 Nautical Miles

Primary Study Area
Airport Boundary
State Boundary
County/Parish Boundary
Interstate Highway
Highways
Secondary Roads
Water
River/Stream
Alabama-Coushatta Tribe of Texas Reservation
Major Airports within the Study Area
Satellite Airports within the Study Area
Other Airports and Heliports

Houston OAPM Airports

Figure 2

Houston OAPM EA

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Data Source: Environmental Systems Research Institute, Inc.(ESRI) (Airport/Airport Runways), March 14, 2012; ESRI (State Boundaries/County Boundaries), February 14, 2012; ESRI (Cities), February 8, 2012; ESRI (Roads), March 14, 2012; Aerial Photography, (Bing Maps for ArcGIS Desktop), 2012

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North

0 4,000 8,000 Feet

Approximate Airport Boundary

Airport Runway

Interstate Highway

Highways

Secondary Roads

George Bush Intercontinental Airport (IAH) Layout and Runway Configuration

Figure 3

Houston OAPM EA

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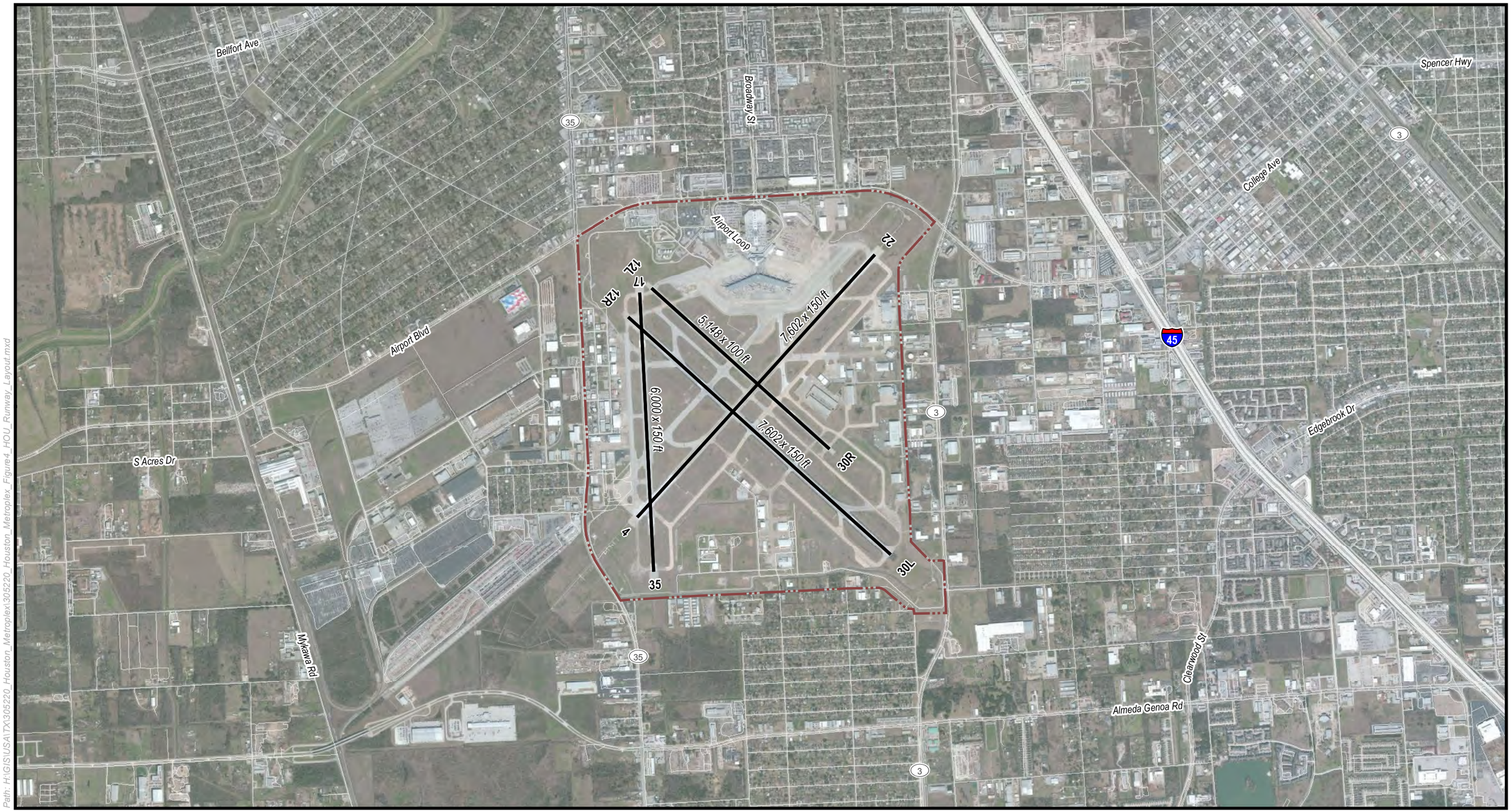

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Data Source: Environmental Systems Research Institute, Inc.(ESRI) (Airport/Airport Runways), March 14, 2012; ESRI (State Boundaries/County Boundaries), February 14, 2012; ESRI (Cities), February 8, 2012; ESRI (Roads), March 14, 2012; Aerial Photography, (Bing Maps for ArcGIS Desktop), 2012

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Approximate Airport Boundary

Airport Runway

Interstate Highway

Highways

Secondary Roads

North

0 2,000 4,000 Feet

William P. Hobby Airport (HOU) Layout and Runway Configuration

Figure 4

Houston OAPM EA

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1.2 NEPA Compliance

The National Environmental Policy Act of 1969 (NEPA) requires Federal agencies to disclose to decision makers and the interested public the potential environmental impacts of proposed Federal actions and alternatives to those actions. Through NEPA, Congress directed Federal agencies to integrate environmental factors into their ongoing planning and decision-making processes. Congress also wished to encourage and facilitate public involvement in decisions that affect the quality of the environment. As part of NEPA, the Council on Environmental Quality (CEQ) was established to develop implementing regulations and monitor ongoing compliance. The CEQ regulations provide specific instruction for Federal agencies on how to comply with NEPA and include procedures for consideration of the purpose and need of proposed actions, alternatives, and environmental impacts.[25] They also call for Federal agencies to adopt their own procedures to supplement the CEQ regulations. FAA Order 1050.1E, "Environmental Impacts: Policies and Procedures" provides the FAA's procedures for NEPA compliance.[26] This EA has been prepared in accordance with the CEQ regulations and FAA Order 1050.1E.

1.3 National Airspace System

The Federal Aviation Act of 1958 delegates to the FAA the responsibility for managing the use of the nation's navigable airspace and for regulating civil and military operations in that airspace, in the interest of the safety and efficiency of both of those operations.[27] The National Airspace System (NAS) is comprised of the navigable airspace itself, along with the communications, navigational, and surveillance (CNS) infrastructure necessary to facilitate operations within the airspace.[28]

Within the NAS, the FAA manages aircraft movements at airports and the flow of aircraft between airports through an integrated system comprised of ATC facilities, people (e.g., air traffic controllers, maintenance and support personnel), technology (e.g., radar and communications equipment), and supporting policies and procedures. The FAA's continuing mission is to provide the safest, most efficient aerospace system in the world.[29]

1.3.1 Relevant NextGen Technologies and Procedural Changes

NextGen is the FAA's plan to modernize the NAS through evolution from a ground-based system of air traffic control to a satellite-based system. As a means of achieving NextGen goals, the FAA is leveraging new technologies and aircraft navigation capabilities that are becoming more readily available by implementing PBN technologies and procedures. PBN is a framework that provides a basis for design and

[25] *Code of Federal Regulations*, Title 40, Parts 1500-1508.
[26] FAA Order 1050.1E, Chg. 1, "Environmental Impacts: Policies and Procedures," March 20, 2006.
[27] *U.S. Code*. Title 49, sec. 40103(b).
[28] For more information, refer to Appendix D.
[29] FAA, "Mission": http://www faa.gov/about/mission/.

implementation of increased automation in the air traffic management (ATM) system. PBN employs Area Navigation (RNAV)[30], as well as aircraft-to-aircraft sensing and data communications technologies, to reduce voice communications requirements and associated CNS infrastructure.[31]

RNAV is a PBN technique that enables aircraft traveling through terminal[32] and en route airspace[33] to follow any desired flight route within the coverage of a network of ground- or spaced-based NAVAIDs rather than flying a point-to-point route over static, ground-based NAVAIDs following a conventional procedure[34]. (For detail, see Appendix D: *National Airspace System Guidebook*.) In contrast, the conventional system defines routes as lines between ground-based navigation transmitters. These routes generally have bends in accordance with the installation locations of these transmitters.

RNAV can provide pilots the ability to choose a direct route for their flight, and air traffic controllers can assign a predictable, flexible, and more accurate set of RNAV procedures to RNAV-equipped aircraft, operated by RNAV-authorized pilots. RNAV procedures facilitate a more efficient design of the air traffic system. These procedures collectively result in maintained or improved safety, and enhanced access, predictability, and operational efficiency, with reduced use of NAS resources. The predictability of routes following RNAV procedures can reduce the need for controllers to employ traffic management tools, such as extensive radar vectoring[35] or holding, and therefore reduces workload.

The FAA OAPM initiative provides a systematic, integrated, and expedited approach to implementing PBN procedures in Metroplexes.

1.4 Document Content and Organization

This EA conforms to the requirements of FAA Order 1050.1E, and the requirements for an EA established in the CEQ regulations. See the list below for a summary of all chapters and appendices:

Chapter 1, *Background & Introduction*: Provides background information related to the Houston OAPM and the scope of this EA, an introduction to NEPA and FAA

[30] See footnote #1 for information on PBN, RNAV, and RNP.
[31] Reducing the need for voice communications results in fewer read and hear-back errors and reduces pilot-controller task complexity, enhancing flight safety.
[32] Terminal (Airspace) Area: A general term used to describe airspace in which approach control service or airport traffic control service is provided. (FAA, *Pilot Controller Glossary,* July 26, 2012.)
[33] En Route Air Traffic Control Services (Airspace): A general term used to describe airspace in which air traffic control service is provided when aircraft are operating between departure and destination terminal areas. (Paraphrased from FAA, *Pilot Controller Glossary,* July 26, 2012.)
[34] A conventional procedure is an instrument flight procedure (IFP) that relies upon ground-based navigation transmitters for course guidance, as contrasted with RNAV procedures.
[35] Radar Vectoring: Provision of navigational guidance to aircraft in the form of specific headings, based on the use of radar. (FAA, *Pilot Controller Glossary,* July 26, 2012.)

compliance responsibilities, a brief overview of the NAS and NextGen PBN technologies, and document content and organization.

Chapter 2, *Purpose & Need*: Provides a discussion of the existing problem (i.e., need), objectives to resolve the need (i.e., purpose), and the proposed timeframe for implementation.

Chapter 3, *Alternatives*: Provides a discussion of the alternatives analyzed by the FAA for the Houston OAPM project, including the Proposed Action and the No Action Alternative.

Chapter 4, *Affected Environment*: Provides a discussion of existing environmental conditions of the potentially affected geographic area, and documents present and reasonably foreseeable Federal and non-Federal actions.

Chapter 5, *Environmental Consequences*: Provides a comparison of the potential environmental impacts, including cumulative impacts, associated with the Proposed Action and the No Action Alternative.

Chapter 6, *Agency and Public Coordination*: Provides a summary of the consultation, coordination, and public involvement opportunities associated with the EA process. This chapter lists all Federal, state, and local agencies, and other interested parties, consulted during the EA process.

Appendices: Contain documentation related to technical information, coordination, and other reference materials.

Appendix A, *Acronyms, Abbreviations, and Glossary of Terms*

Appendix B, *References*

Appendix C, *List of Preparers*

Appendix D, *National Airspace System Guidebook*: Provides a description of the NAS, including legislated responsibilities, ATC fundamentals, advanced navigation technologies, and the concept of airspace efficiency.

Appendix E, *Houston OAPM Study Team Documents*

Appendix F, *Houston OAPM Design and Implementation Team Documents*

Appendix G, *Aircraft Noise Analysis*: Presents the basic concepts of noise analysis, a detailed description of the methodology followed, assumptions used, and the results of aircraft noise analysis for this EA.

Appendix H, *Inventory of Potential Department of Transportation Act, Section 4(f) Resources and Noise Exposure*

Appendix I, *Inventory of Historic Resources and Noise Exposure*

Appendix J, *Coordination and Consultation*

Appendix K, *List of Receiving Parties*

2 PURPOSE AND NEED

The CEQ regulations implementing NEPA require that EAs include a "brief discussion of the need for the proposal."[36] FAA Order 1050.1E expands on this requirement, stating that an EA must include a discussion that "identifies the problem facing the proponent (that is, the need for an action), the purpose of the action (that is, the proposed solution to the problem), and the proposed timeframe for implementing the action."[37] This chapter discusses each of these items separately, as they relate to the Houston OAPM project.

2.1 Need for the Houston OAPM Project

By law, the FAA must "develop plans and policy for the use of the navigable airspace and assign by regulation or order the use of the airspace necessary to ensure the safety of aircraft and the efficient use of airspace."[38] The Houston OAPM Study Team concluded that existing published (i.e., charted) air traffic procedures[39] in the Houston Metroplex are less efficient, less flexible, and more complex than what recent advances in technology would enable (further discussed below).

The Houston OAPM Study Team materials reflected three key factors as causes for the inefficiencies and complexities in the Houston Metroplex (see Appendix E for airspace and route structure analysis by the Study Team):

1. Limitations of the conventional, ground-based navigation system and existing RNAV procedures
2. Limited flight path predictability and flexibility, particularly during adverse weather conditions
3. High occurrence of voice communications among controllers and pilots, leading to excessive workload, and increased hear-back and read-back errors[40]

The following sections discuss each of these factors individually.

2.1.1 Inefficiencies of the Conventional Ground-Based Navigation System and Existing RNAV Procedures

The conventional navigation system, in use since the 1950s, uses conventional point-to-point routes between ground-based NAVAIDs. However, aircraft seldom fly full

[36] *Code of Federal Regulations*, Title 40, sec. 1508.9(b).
[37] FAA Order 1050.1E, Chg. 1, para. 405c.
[38] *U.S. Code*, Title 49, sec. 40103(b)(1).
[39] Charted air traffic procedures include standard instrument departure procedures (SIDS), standard terminal arrival routes (STARs), and standard instrument approach procedures (SIAP), as regulated by *Code of Federal Regulations*, Title 14, Part 97. FAA publishes current procedures at http://aeronav faa.gov/index.asp?xml=aeronav/applications.
[40] "Hear-back and read-back error" is defined as an inadvertent introduction of error caused by a pilot incorrectly repeating controller instructions, and the failure of the controller to recognize the error.

conventional approach procedures as published from an initial approach fix (first point on the approach procedure), except for training purposes or when surveillance radar is unavailable. Instead, controllers typically use radar to vector (i.e., give compass headings to) aircraft to join the final approach course, bypassing much of the published procedure to reduce miles flown. Similar types of shortcuts via radar vectoring also can occur on arrival or departure procedures. These actions reduce distances flown and allow a controller to merge aircraft coming from different directions into a single line. This sometimes results in increased pilot-controller radio transmissions and, when compared to a published procedure, results in a less predictable flight track[41] for the pilot. PBN techniques like RNAV provide a solution to this problem because they enable more direct flight paths similar to the routes offered by radar vectoring, affording controllers greater predictability and flexibility, and reducing the need for pilot-controller interaction.[42] In some locations within the EA study area, the close proximity between arrival and departure corridors causes controllers to more actively monitor aircraft activity along proximate or crossing flight routes (i.e., confliction points) and be prepared to intervene to maintain safe separation.

ATC manages confliction points and ensures safe separation of aircraft using the following techniques:

- Assigning level flight segments where arrival and/or departure flight routes intersect to ensure adequate vertical separation between aircraft
- Radar vectoring (i.e., ATC directed temporary flight path deviations and changes to the previously granted clearance[43] or routings published on navigation charts) to avoid other aircraft on nearby flight routes, a common practice applied to arriving and departing aircraft
- Increasing horizontal spacing between aircraft
- Coordinating with pilots and controllers of neighboring airspace in proximity of aircraft (point-outs)

These ATC actions require verbal communication among controllers and pilots, increasing workload and adding to system complexity. In addition, radar vectoring and “level-offs” reduce flight efficiency. Finally, longer flight routes caused by radar vectoring, and interrupted climbs/descents add distance and time to flights, resulting in unnecessary delays and not taking full advantage of aircraft performance capabilities.

[41] A “flight track” isroute and altitude profile of an aircraft’s flight.
[42] Conventionally equipped aircraft without RNAV capability must continue to have access to the NAS. For this reason, proposed changes to arrival/departure procedures must continue to accommodate varying aircraft operator types and must be redesigned to safely separate aircraft of different equipage levels.
[43] For more information, see Appendix D.

Currently, there are RNAV standard terminal arrival routes (STARs)[44] and standard instrument departures (SIDs)[45] serving IAH, HOU, and other satellite airports in the Houston terminal area. The FAA first introduced these procedures in 2009. As currently designed, however, these procedures do not take full advantage of the capabilities that PBN offers. For example, the existing RNAV STARs often require air traffic controllers to intervene during descent, giving instructions to a pilot to level off and maintain a fixed altitude before clearing the aircraft to begin descent again. These "stair-stepped" approaches are less efficient and increase radio transmissions compared to new optimized profile descents (OPDs),[46] in which an aircraft can descend at reduced power from top-of-descent to final approach with minimal controller interaction. Furthermore, the existing RNAV STARs do not have separate runway transitions[47] that differentiate between airport flow conditions, based primarily on wind direction and speed (i.e., landing to the east versus to the west). The existing RNAV SIDs are not procedurally deconflicted[48] from arrivals, thus requiring intervention by controllers to ensure adequate aircraft separation.

2.1.2 Limited Flight Path Predictability

Due to the limitations of ground-based NAVAIDs, air traffic controllers routinely perform radar vectoring to provide shorter routes to individual aircraft as compared to published procedures. As a result, air traffic control removes aircraft from published procedures, causing less predictable flight paths and increased pilot-controller radio communications.

2.1.3 Frequent Occurrence of Voice Communications

Existing arrival and departure procedures do not include predefined altitude instructions or optimum lateral paths, requiring air traffic controller instructions such as radar vectoring and altitude assignments. Numerous radio voice transmissions between pilots and controllers are necessary to issue and verify these instructions. Frequent radio transmissions increase workload, frequency congestion, and the potential that ATC instructions are misunderstood (e.g., hear-back and read-back errors). When

[44] Standard Terminal Arrival (STAR): A preplanned instrument flight rule (IFR) ATC arrival procedure published for pilot use in graphic and/or textual form. STARs provide transition from the en route structure to an outer fix or an instrument approach fix/arrival waypoint in the terminal area. (FAA, *Pilot-Controller Glossary*, July 26, 2012.)
[45] Standard Instrument Departure (SID): A preplanned instrument flight rule (IFR) air traffic control (ATC) departure procedure printed for pilot/controller use in graphic form to provide obstacle clearance and a transition from the terminal area to the appropriate en route structure. SIDs are primarily designed for system enhancement to expedite traffic flow and to reduce pilot/controller workload. ATC clearance must always be received prior to flying a SID. (FAA, *Pilot-Controller Glossary*, July 26, 2012.)
[46] An OPD is a procedure in which the aircraft's on-board flight computer facilitates a continuous descent from the top of descent to touchdown, without level-off segments. For more information, see Appendix D.
[47] "Runway transition" refers to separate lateral paths to or from specific runways that are depicted on navigation charts.
[48] "Procedural deconfliction" means defining mandatory altitude or lateral restrictions as part of a procedure to keep aircraft from conflicting with others on routes in close proximity.

frequent radio transmissions occupy the attention of controllers, they have less time to devote to other tasks.

2.2 Purpose of the Houston OAPM Project

The purpose of the Houston OAPM project is to address the three components of the need, as described in Section 2.1 . The FAA's primary drivers are improved efficiency of airspace operations, increased flight path predictability and flexibility, and decreased errors in controller/pilot voice communication, along with preserved or improved air traffic safety. In order to address the need, the FAA intends to implement readily available NextGen technologies designed to support these types of improvements. The following sections discuss each element of the purpose.

2.2.1 Improving Operational Efficiency with PBN Technology

The addition of new PBN procedures to provide more precise, predictable lateral and vertical flight path guidance would improve operations through the Houston Metroplex airspace. In many cases, the new PBN procedures would replace existing, less efficient PBN procedures. Optimized climbs and descents and shorter lateral paths reduce inefficient level flight segments and total distance flown. Implementation of new and improved PBN procedures would allow the FAA to accomplish the following:

- Create more efficient vertical flight profiles (i.e., climbs and descents).
- Implement more direct lateral flight paths to reduce flight miles.
- Deconflict arrival and departure procedures to enhance safety and optimize vertical profiles.
- Provide airport-specific arrival and departure routes, reducing complexity through added route separation in certain cases.
- Provide specific transitions that differ depending upon airport flow in use at any given time
- Realign departure routes to the most commonly used destinations.
- Decrease use of current departure procedures that rely on initial radar vectors in favor of more precise RNAV departure routings.

2.2.2 Increase Flight Path Predictability

Implementation of new PBN procedures would improve lateral flight path accuracy (i.e., the extent to which the aircraft flight track matches the published procedure), increasing predictability. More predictable flight paths would support procedural deconfliction and allow pilots to more accurately plan the routing, duration, and fuel requirements for a particular flight.

2.2.3 Decrease Required Controller/Pilot Voice Communication

Implementation of new PBN procedures would reduce the need for numerous radio voice transmissions between pilots and controllers because PBN procedures would include more precise lateral and/or vertical flight path guidance within the published procedure itself and/or readily available in the aircraft's flight computer. Reduced transmissions would result in less frequency congestion, which could potentially reduce listening and repetition errors during verbal instructions (i.e., hear-back and read-back errors). In addition, the consolidation of clearances associated with PBN procedures would reduce pilot workload and provide a more efficient work environment, which would allow more time for the pilot and crew to focus on tasks during high-workload situations (e.g., departures and arrivals).

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3 ALTERNATIVES

The purpose of the Proposed Action, as described in Chapter 2, *Purpose and Need*, is the implementation of optimized standard arrival and departure instrument procedures, serving air traffic flows into and out of airports in the Houston Metroplex. Implementation of the Proposed Action would (1) improve operational efficiency through use of PBN procedures, (2) increase flight path predictability, and (3) decrease required pilot-controller voice communication.

This chapter describes the alternatives analyzed by the FAA for the Houston OAPM project. The FAA conducted the analysis in accordance with the CEQ regulations and FAA Order 1050.1E.

3.1 Identification and Evaluation of Potential Alternatives

The Houston OAPM Study Team and Design & Implementation (D&I) Team each identified and evaluated potential alternatives to individual procedures. Collectively, the final set of proposed changes to instrument flight procedures (IFPs),[49] as detailed in Section 3.1.2, became the Proposed Action. The following sections summarize this process.

3.1.1 Houston OAPM Study Team

Chapter 1, *Background*, includes a brief description of the Houston OAPM Study Team. The Study Team convened in May 2011 to define operational issues in the Houston Metroplex and identify potential corresponding solutions. Work by the Study Team served to guide later detailed design efforts and inform FAA decision-making processes related to these efforts. During three sets of outreach meetings, the Study Team obtained input from ATC experts, airspace users, and industry representatives. These meetings helped identify existing operational challenges, enhancement opportunities, and evaluation metrics. Initially, 105 issues were identified, after which similar issues were grouped to determine potential solution sets.

The Study Team identified several potential modifications to the arrival/departure procedures that addressed issues identified in the outreach meetings. The team recommended new or changed arrival and departure procedures that meet the need for the project, as described in Section 2.1 .

The Study Team rejected or modified several of the initial proposals because they would not address the need for the project or would adversely affect existing operations. The team also worked closely with environmental specialists to consider whether any of the proposed solutions might create an environmental impact and to develop mitigation alternatives as necessary. Considerations included reviewing level flight segments and flight profiles. During a descent or climb profile, level flight segments are less efficient.

[49] IFPs include conventional ground-based and PBN procedures, through all phases of flight (i.e., departures, arrivals, and approaches).

Therefore, the team emphasized optimization of aircraft climb and descent profiles for the various procedures. When proposing PBN procedures or airspace modifications, the Study Team also considered the Alabama-Coushatta Tribe of Texas Reservation, as well as resources protected under Section 4(f) of the Department of Transportation (DOT) Act[50] (including the Big Thicket National Preserve, the Sam Houston National Forest, and the Anahuac and Trinity River National Wildlife Refuges). The result of the initial screening by the Study Team indicated minimal potential for significant environmental impacts on these lands.

The Study Team recommendations became the basis for the initial set of alternatives evaluated by the D&I Team. (See Appendix E for the record of this process.)

3.1.2 Houston OAPM Design and Implementation Team

The Houston OAPM Design and Implementation (D&I) Team, comprised of FAA and industry personnel, convened in January 2012 to review the procedures recommended by the Study Team. The D&I Team adopted, refined, rejected, and added to the proposal elements recommended by the Study Team. The D&I Team engaged airspace users and environmental specialists regularly for feedback throughout their deliberations.

The D&I Team carefully considered the Study Team recommendations. In some instances, design concerns or other issues precluded the development of procedures as originally envisioned by the Study Team. As the D&I Team analyzed changes to individual procedures, and their associated interactions between procedures, it elected not to carry some changes forward because they did not meet FAA design or safety criteria, and/or the purpose and need of this project. This evaluation was an iterative process, as modifying one procedure had potential to affect one or more other procedures.

Also during this iterative process, the D&I Team considered various environmental factors based on use and location of routes. The following are some examples of consideration of environmental factors by the D&I Team during the development process:

- Modification of initial Study Team recommendations that would have increased runway use on IAH Runway 26R. With the modification, arrival use of Runways 26L, 26R, and 27 would not be expected to change
- Change of the initial design of a proposed airway to direct aircraft away from Big Thicket National Preserve

[50] Section 4(f) of the DOT Act, codified at *United States Code*, Title 49, sec. 303(c), provides protection for "publicly owned land of a public park, recreation area, or wildlife and waterfowl refuge of national, State, or local significance, or land of an historic site of national, State, or local significance (as determined by the Federal, State, or local officials having jurisdiction over the park, area, refuge, or site)."

- Revision of proposed departure procedures for IAH Runways 15L/R to minimize changes in noise exposure

The Study Team recommended use of procedural deconfliction[51] where practical. The D&I Team looked at each procedure individually and considered the benefits both gained and lost due to the use of procedural deconfliction in developing PBN procedures. When an operational advantage seemed likely, the D&I team employed procedural deconfliction. In some cases, though, burdens imposed on airspace users would have outweighed the operational advantage of procedural deconfliction. For example, where two routes intersect at the same altitude, procedural deconfliction would require one aircraft to take a less efficient routing or altitude in order to maintain adequate separation. Existing and anticipated air traffic levels, however, may not warrant imposing these burdens upon users. In these cases, the D&I Team determined that tactical separation[52] of aircraft on an as-needed basis was a more effective option.

In addition to standard design considerations (e.g., aircraft performance capabilities, airfield layout and runway geometry, and locations of satellite airports), other factors specific to the Houston Metroplex also influenced the design (see Appendix F, *Houston OAPM Design and Implementation Team Documents*). Two such considerations included the proximity of the two primary airports in the region, IAH and HOU, and the presence and location of Special Use Airspace (SUA) for military operations. The D&I Team also accounted for additional operational factors, including preferred runways during fluctuating wind conditions.[53]

Throughout the course of its deliberations, the D&I Team made numerous modifications and improvements to the Study Team's recommendations. For discussions of each proposed procedure, specific functional issues, comparisons to existing procedures, and various constraints identified during analysis, see Appendix F.

3.2 Alternatives Considered

This section provides descriptions of the alternatives analyzed in detail in this EA – the No Action Alternative and the Proposed Action.

3.2.1 No Action Alternative

There are currently 34 published SIDs and STARs in the Houston Metroplex, serving the Houston OAPM Airports.

- Four (4) RNAV SIDs
- Eleven (11) RNAV STARs
- Twelve (12) conventional (i.e., non-RNAV) SIDs[54]

[51] The Study Team referred to "procedural deconfliction" as "procedural separation."
[52] "Tactical separation" is the separation of aircraft by ATC instruction via radio-voice communication.
[53] Aircraft generally land and take-off into the wind. This allows an aircraft to operate at a slower speed relative to the ground.
[54] The terms "non-RNAV" and "conventional" are used interchangeably in this document.

- Seven (7) conventional STARs

Under the No Action Alternative, the FAA would maintain the existing arrival and departure procedures in the Houston Metroplex. However, it would include expected future actions that are independent of the Houston OAPM process. The existing conventional and RNAV arrival and departure procedures would remain as is, subject to minor, periodic reviews and revisions in response to changes in the operational environment. The No Action Alternative would not implement the specific procedures designed as part of the Houston OAPM (as detailed in Appendix F).

3.2.2 Proposed Action

The Study Team recommended 22 new or changed SIDs and STARs. The D&I Team reviewed the Study Team recommendations and developed the Proposed Action, which consists of the following:

- Establish twenty (20) new RNAV SIDs and twenty (20) new RNAV STARs;
- Establish five (5) new conventional STARs and modify four (4) existing conventional STARs;
- Establish four (4) new RNP Authorization Required (AR)[55] approaches and modify two (2) RNP AR approaches for IAH (two [2] new and one [1] modified per each flow);
- Modify six (6) existing Instrument Landing System (ILS)[56] approaches by adding RNAV ILS transitions;[57]
- Cancel nineteen (19) existing procedures.

The Proposed Action would not affect eleven (11) of the existing SIDs, which would be retained. The Proposed Action would (1) improve operational efficiency through use of new PBN procedures, (2) increase flight path predictability, and (3) decrease required pilot-controller voice communication. Table 11, in Section 3.4 , lists the individual procedures and their relationship to the purpose and need. In some cases, PBN routes that mirror the existing flight paths over the ground would replace standard routings achieved currently through radar vectoring.[58] This would typically result in shorter and more predictable routes as compared to current published routes. The new PBN

[55] Required Navigation Performance (RNP) is a method of aircraft navigation that utilizes modern flight computers, GPS, and innovative new procedures to fly precisely predetermined paths loaded into aircraft computers. A RNP "Authorization Required" (AR) procedure is a type of Standard Instrument Approach Procedure (SIAP) that offers the most benefit to users by allowing for predetermined, precise, curved flight paths that can reduce flight distances, conserve fuel, and preserve the environment. These procedures require specific aircraft functionality and pilot crew training. For more information, see Appendix D.
[56] An Instrument Landing System (ILS) is a ground-based navigation system that provides lateral and vertical course guidance, to facilitate landings during adverse weather conditions. (FAA, *Pilot/Controller Glossary*, July 26, 2012.)
[57] An "RNAV ILS Transition" connects the end of the RNAV STAR procedure to an ILS final approach course, from where the aircraft completes a normal ILS approach procedure to the landing runway.
[58] For more information, see Appendix D.

procedures would also provide vertical navigation, allowing the aircraft to descend from cruise altitude into the airport area with reduced pilot-controller communications and fewer inefficient level flight segments. Additionally, modifications to routes that interact with the adjacent Fort Worth ARTCC (ZFW) would improve integration with ZFW procedures. Finally, certain procedures would change in order to better align routes and profiles for international flights to Mexico and South America. Appendix F provides detail on the proposed alterations, deletions, or additions to each procedure associated with the Proposed Action. The target date for publication of the Houston Metroplex optimized procedures is December 12, 2013.[59]

Implementation of the Proposed Action would not require any ground disturbance or development of facilities, nor would it require local or state action. The Proposed Action consists only of procedural changes intended to improve operational efficiency, increase flight path predictability, and reduce required controller-pilot voice communication. Therefore, it would not increase the number of aircraft operations within southeast Texas airspace when compared to the No Action Alternative.

3.3 Comparison of the No Action Alternative and the Proposed Action

This section describes the similarities and differences between the Proposed Action and the No Action Alternative, as shown in Table 1 through Table 10 in the discussion of the Houston OAPM Airports. Figure 5 depicts the air traffic flows into and out of the Houston metropolitan area. Figure 6 through Figure 13 present generalized depictions of the current instrument procedures and an annualized representation of flight activity (on the left), and proposed new or modified procedures (on the right), in the discussion of each airport.[60] Appendix F provides additional details on the existing and proposed procedures.

3.3.1 Similarities

Arrivals in both the Proposed Action and No Action Alternative would transfer from ZHU ARTCC airspace to I90 TRACON airspace over the following "corner-posts,"[61] illustrated in Figure 5:

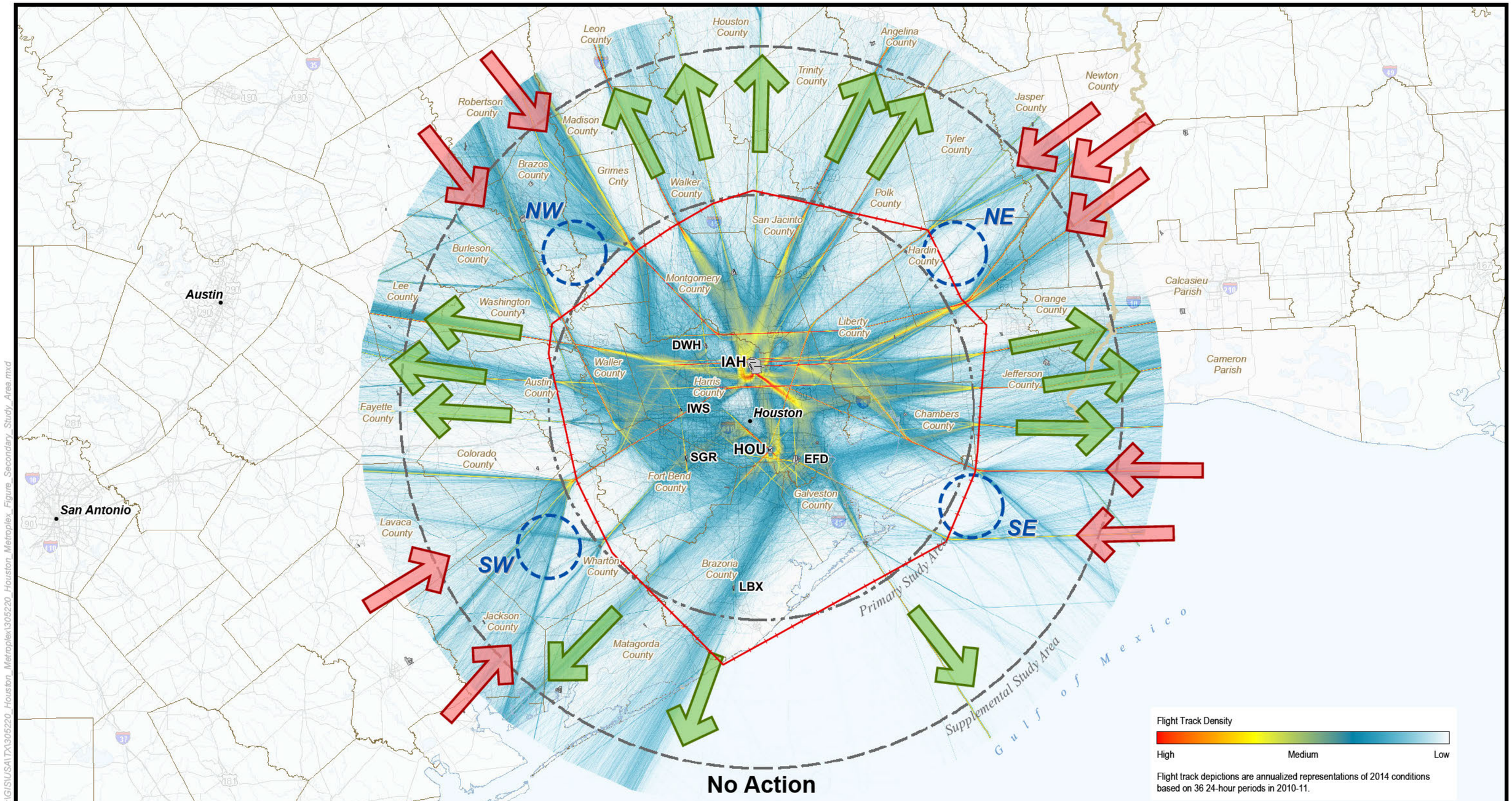
- Northeast approximately over Hardin County
- Southeast over the Gulf of Mexico, south of Chambers County
- Southwest over Wharton County
- Northwest in an area over Brazos, Grimes and Washington Counties

[59] Federal Infrastructure Projects Dashboard, "NextGen Infrastructure Initiative – Houston Metroplex (OAPM)": http://permits.performance.gov/permits/implementation.
[60] For additional information on the representation of flight activity, see Section 4.1.1 and Appendix G.2, Section 4.9.
[61] Corner-post configuration refers to an arrangement of air traffic pathways in a terminal area that brings incoming flights over points (i.e., fixes) at four corners of the traffic area, while outbound flights depart between the fixes, thus minimizing conflicts between arriving and departing air traffic.

Departures in both alternatives would continue to transfer from I90 TRACON airspace to ZHU ARTCC airspace between the “corner-posts” or to the north, east, south, or west over the following locations:

- North in an area over Walker, San Jacinto and Polk Counties
- East over Jefferson County
- South over Brazoria, Galveston and Matagorda Counties
- West over Austin County and the southern portion of Washington County

The Proposed Action would not affect how many aircraft land on each runway.



Data Source: Environmental Systems Research Institute, Inc.(ESRI) (Airport/Airport Runways), March 14, 2012; ESRI (State Boundaries/County Boundaries), February 14, 2012; ESRI (Cities), February 8, 2012; ESRI (Mountain Peaks), February 28, 2012; ESRI (Roads), March 14, 2012; Houston-Galveston Area Council (Water Features), March 14, 2012; National Atlas (Lakes/Rivers), September 10, 2012 (Updated)

Prepared By: Harris Miller Miller & Hanson Inc., January, 2013

Primary Study Area
Secondary Study Area
TRACON Boundary
State Boundary
County Boundary
Interstate Highway
Highways
Secondary Roads
Water
River/Stream
Arrival Corridor
Departure Corridor
Corner Post

North

0 20 40 Nautical Miles

Corner Posts and Arrival and Departure Flight Routes

Figure 5
Sheet 1 of 2

Houston OAPM EA

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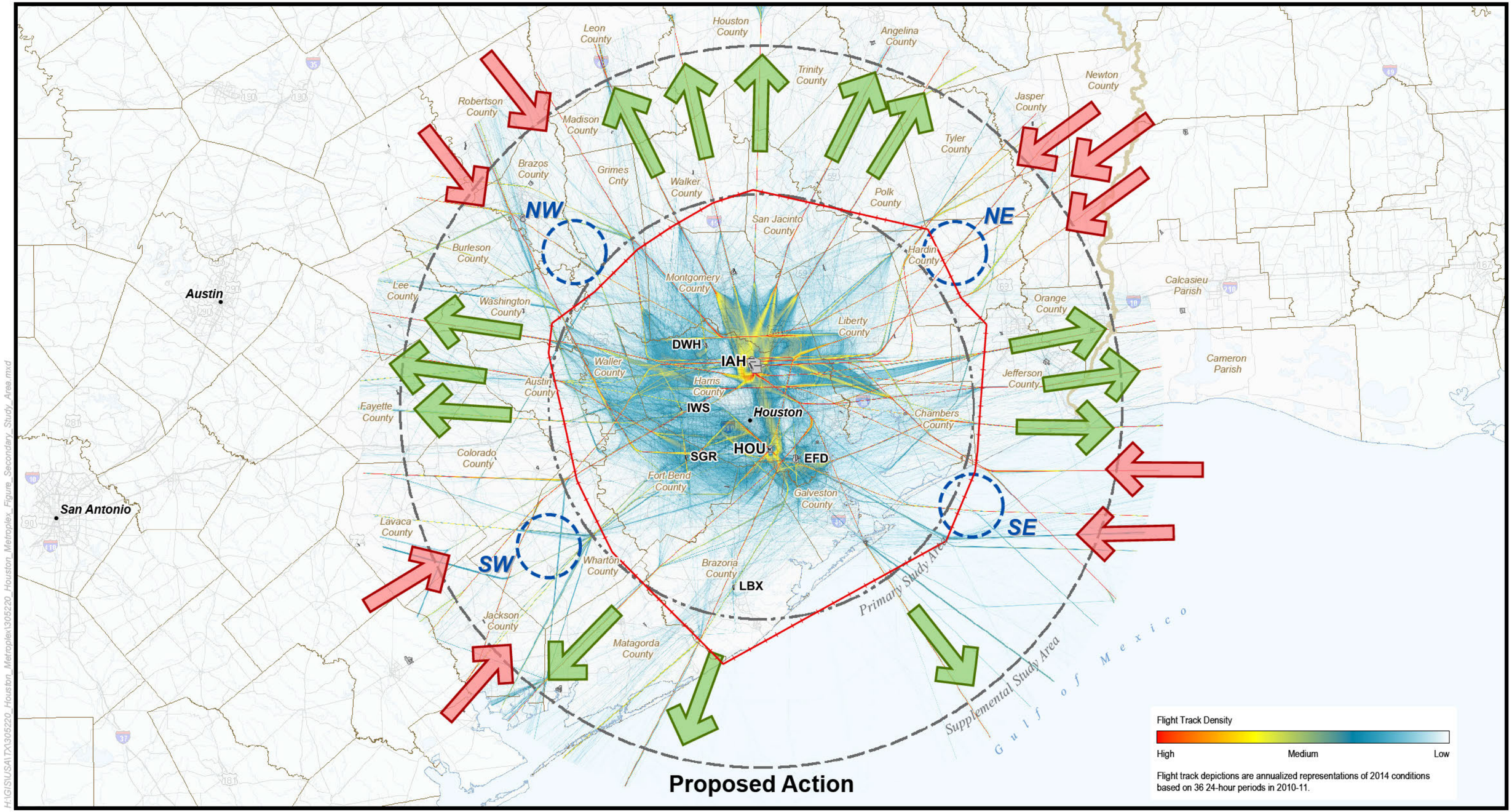

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Data Source: Environmental Systems Research Institute, Inc.(ESRI) (Airport/Airport Runways), March 14, 2012; ESRI (State Boundaries/County Boundaries), February 14, 2012; ESRI (Cities), February 8, 2012; ESRI (Mountain Peaks), February 28, 2012; ESRI (Roads), March 14, 2012; Houston-Galveston Area Council (Water Features), March 14, 2012; National Atlas (Lakes/Rivers), September 10, 2012 (Updated)

Prepared By: Harris Miller Miller & Hanson Inc., January, 2013

Primary Study Area
Secondary Study Area
TRACON Boundary
State Boundary
County Boundary

Interstate Highway
Highways
Secondary Roads
Water
River/Stream

Arrival Corridor
Departure Corridor
Corner Post

North

0 20 40 Nautical Miles

Corner Posts and Arrival and Departure Flight Routes

Figure 5
Sheet 2 of 2

Houston OAPM EA

3.3.2 Differences

In ZHU ARTCC airspace, the Proposed Action procedures would align better with current flight paths of aircraft that are radar vectored onto more direct routes into and out of IAH and HOU. Under the Proposed Action, this would allow aircraft operators to plan for a more direct route, increasing flight path predictability and reducing pilot-controller voice communications. In contrast to the Proposed Action, the existing published procedures (i.e., No Action Alternative) are less direct and/or require a more frequent occurrence of pilot-controller radio communication to radar vector the aircraft along a more efficient flight path when conditions permit. The Proposed Action arrival procedures include OPDs, as opposed to current flight profiles that sometimes employ a stair-stepped, alternating sequence of level-offs and descending flight segments.

The current STARs are not flow-specific[62] and do not include OPDs. Therefore, they result in level flight segments when control of aircraft transfers from ZHU ARTCC to I90 TRACON. Current procedures include inefficiently designed and under-utilized dual STARs[63] on some corner-posts that are seldom utilized due to inefficient design. The Proposed Action would implement flow-specific STARs that incorporate OPDs, thereby minimizing level flight segments during transfer of control from ZHU ARTCC to I90 TRACON. The Proposed Action would also redesign dual STARs to improve efficiency and utilization.

The current SIDs are not optimized for unrestricted climbs and are not procedurally deconflicted from STARs. Therefore, they result in level flight segments and inefficient vertical profiles. Additionally, current SIDs restrict aircraft to a longer departure path than necessary before transitioning to requested routes. Under the Proposed Action, the FAA would implement new or modified SIDs for maximum efficiency, allowing unrestricted climbs when possible, thereby minimizing level flight segments. The proposed SIDs would also be shorter, thereby allowing earlier transitions to requested routes. Additionally, while existing RNAV SIDs currently rely upon manual instructions from air traffic control after take-off (e.g., radar vectoring), the Proposed Action would implement some RNAV SIDs that would provide pre-defined and automated guidance immediately after take-off (i.e., RNAV off-the-ground).[64]

Currently there are two RNP AR approach procedures in the Metroplex, serving IAH Runways 8R and 27. As mentioned in Section 3.1.2, under the Proposed Action, the two existing RNP AR approaches would be modified and four additional RNP AR approaches serving the balance of the east/west runways at IAH would be developed (Runways 8L/26R, 26L, and 9). In addition, RNAV transitions to ILS approaches (i.e., RNAV ILS transitions) would occur at IAH (6) and HOU (1). Implementation of these

[62] "Flow" refers to the direction in which aircraft take-off and land at a particular airport. Aircraft generally take-off and land into the wind. However, other factors (e.g., nearby airports, construction) can also affect flow.
[63] "Dual STARs" refers to the presence of a second, generally parallel, STAR over a corner-post to the same airport.
[64] "RNAV off-the-ground" refers to procedures developed for specific runways that allow aircraft immediately after take-off to use navigational course guidance from the onboard Flight Management System (FMS) rather than conventional ground-based navigation aids or radar vectors by ATC.

procedures would improve lateral flight path accuracy (i.e., the extent to which the aircraft flight track matches the published procedure), increasing predictability.

The following sections provide tabular and graphical comparisons of the existing No Action procedures and the Proposed Action procedures for the Houston OAPM Airports. Table 1 through Table 10 show the various procedures for the Proposed Action and No Action Alternative. Figure 6 through Figure 13 present generalized depictions of the current instrument procedures and an annualized representation of flight activity (on the left), and proposed new or modified procedures (on the right) in the discussion of each airport.[65] Note that many of the figures consist of multiple pages labeled as "Sheet 1 of 2" and "Sheet 2 of 2." Appendix F provides additional details on the existing and proposed procedures.

3.3.2.1 IAH Arrivals

Table 1 lists the Proposed Action IAH arrival procedure(s) that would replace or supplement the respective No Action procedures. In addition, it identifies the associated corner-post, applicable aircraft types, and any specific noteworthy comments.

Table 1 IAH Arrival Procedures Modifications

Flow	Existing Procedure	New Procedure	Corner Post	Aircraft Types[66]	Comments
West	WOLDE	GILLL	SE	Jets/All Turbo-Props	Applicable to Runways 26L, 26R and 27[67]
East	WOLDE	BRSKT	SE	Jets/All Turbo-Props	Applicable to Runways 8L, 8R and 9
All	KABOY	BOOZZ	SE	Jets/All Turbo-Props	Applicable to all Runways; Severe Weather Avoidance Procedure (SWAP)[68] route when assigned by Air Traffic Control
All	GILCO		SE	Jets/Turbo-Props	Retained/Modified conventional STAR for non-RNAV equipped arrivals
West	HAMMU	TEJAS	SW	Jets/High-Performance Turbo-Props	Applicable to Runways 26L, 26R and 27
East	HAMMU	HTOWN	SW	Jets/High-Performance Turbo-Props	Applicable to Runways 8L, 8R and 9
All	CARNE	CARNE	SW	Jets/Turbo-Props/Pistons	Revised CARNE conventional STAR to align with proposed TEJAS RNAV STAR; for non-RNAV equipped arrivals
West	BAZBL	DRLLR	NW	Jets/All Turbo-Props	Applicable to Runways 26L, 26R and 27

[65] Flight track depictions on Figures 6 through 13 are annualized representations of 2014 conditions, based on 36 24-hour periods in 2010-11.
[66] These procedures would apply to various classifications of aircraft, including jet, high-performance turbo-prop (capable of greater than 280 knots), and other propeller aircraft.
[67] Runways are identified based on their magnetic direction. For example, a runway oriented on an east-west axis, having a magnetic heading of 090° and 270° would be identified as Runway 9/27. This single runway would be identified as Runway 9 when taking off or landing eastbound, and Runway 27 when taking off or landing westbound. Parallel runways have a letter appended to the number indicating "left" or "right" or "center" (e.g., 26R). The runways at IAH and HOU are depicted in Figures 3 and 4 in Section 1.1.
[68] Severe Weather Avoidance Plan (SWAP) – A route only assigned by ATC during adverse weather conditions.

Flow	Existing Procedure	New Procedure	Corner Post	Aircraft Types[66]	Comments
East	BAZBL	GUSHR	NW	Jets/All Turbo-Props	Applicable to Runways 8L, 8R and 9
West	AGGEE	MSCOT	NW	Jets/High-Performance Turbo-Props	Applicable to Runways 26L, 26R and 27 Generally traffic from El Paso, Llano, and Austin
East	AGGEE	TTORO	NW	Jets/High-Performance Turbo-Props	Applicable to Runways 8L, 8R and 9 Generally traffic from El Paso, Llano, and Austin
All	RIICE		NW	Jets/Turbo-Props/Pistons	Retained/Modified conventional STAR for non-RNAV equipped arrivals
West	TXMEX	DOOBI	NE	Jets/High-Performance Turbo-Props	Primary Runway 26L
East	TXMEX	SKNRD	NE	Jets/High-Performance Turbo-Props	Primary Runway 8L
West	DAS	WHACK	NE	Jets/High-Performance Turbo-Props	Primary Runway 26R with options for Runways 26L and 27
East	DAS	TWSTD	NE	Jets/High-Performance Turbo-Props	Primary Runway 8L
All		OHIIO	NE	Jets/Turbo-Props/Pistons	New conventional STAR for non-RNAV equipped arrivals
Source: Houston OAPM D&I Team (see Appendix F)					

Figure 6 presents IAH arrivals during west flow and Figure 7 presents IAH arrivals during east flow. Both figures provide a comparison of the No Action and the Proposed Action IAH arrival procedures within the SSA for the respective operations.

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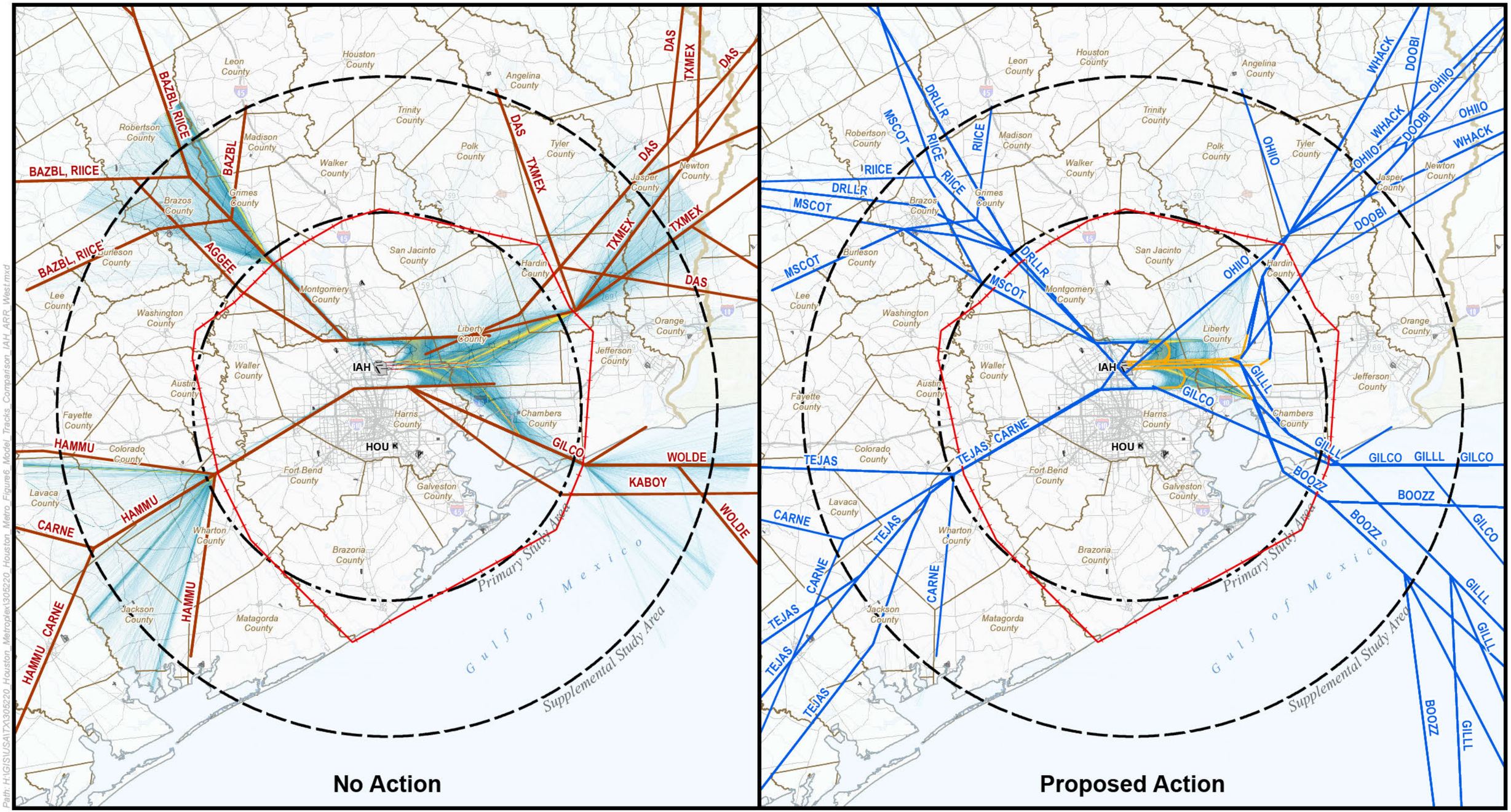

Data Source: Environmental Systems Research Institute, Inc.(ESRI) (Airport/Airport Runways), March 14, 2012; ESRI (State Boundaries/County Boundaries), February 14, 2012; ESRI (Cities), February 8, 2012; ESRI (Mountain Peaks), February 28, 2012; ESRI (Roads), March 14, 2012; Houston-Galveston Area Council (Water Features), March 14, 2012; National Atlas (Lakes/Rivers), September 10, 2012 (Updated);

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North

0 20 40 Nautical Miles

Primary Study Area

Supplemental Study Area

Core I90 TRACON Boundary

County/Parish Boundary

Alabama-Coushatta Tribe of Texas Reservation

Proposed Procedure

No Action Procedure

Proposed RNP AR Approaches and RNAV Transitions (RNP AR and ILS)

Flight Track Density

Low Medium High

Flight track depictions are annualized representations of 2014 conditions based on 36 24-hour periods in 2010-11.

IAH Arrivals during West Flow (Comparison of Proposed Action and No Action Alternatives)

Figure 6
Sheet 1 of 2

Houston OAPM EA

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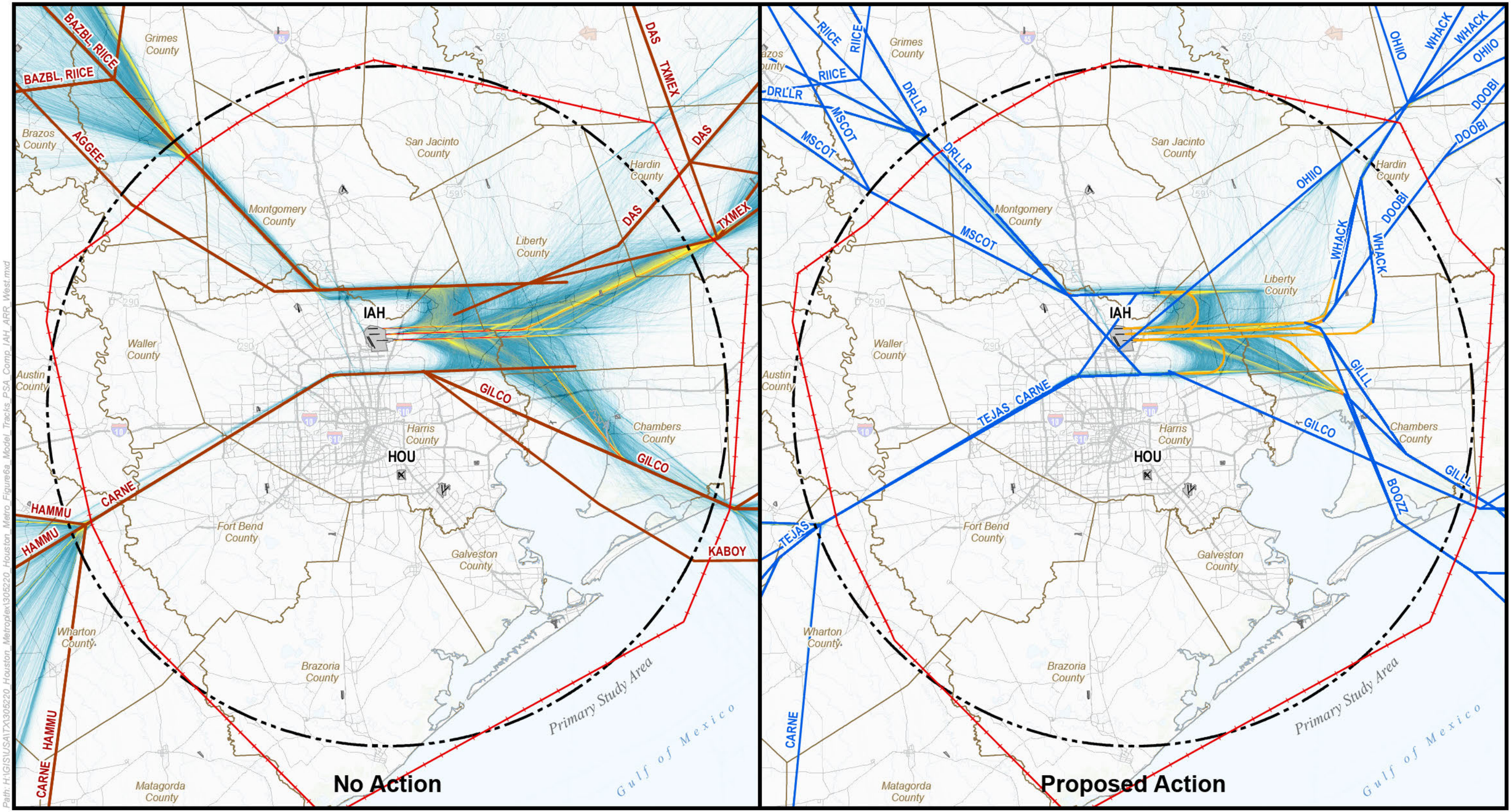

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Data Source: Environmental Systems Research Institute, Inc.(ESRI) (Airport/Airport Runways), March 14, 2012; ESRI (State Boundaries/County Boundaries), February 14, 2012; ESRI (Cities), February 8, 2012; ESRI (Mountain Peaks), February 28, 2012; ESRI (Roads), March 14, 2012; Houston-Galveston Area Council (Water Features), March 14, 2012; National Atlas (Lakes/Rivers), September 10, 2012 (Updated);

Prepared By: Harris Miller Miller & Hanson Inc., January, 2013

Primary Study Area

Core I90 TRACON Boundary

County/Parish Boundary

Alabama-Coushatta Tribe of Texas Reservation

Proposed Procedure

No Action Procedure

Proposed RNP AR Approaches and RNAV Transitions (RNP AR and ILS)

Flight Track Density

Low — Medium — High

Flight track depictions are annualized representations of 2014 conditions based on 36 24-hour periods in 2010-11.

North

0 10 20 Nautical Miles

IAH Arrivals during West Flow (Comparison of Proposed Action and No Action Alternatives)

Figure 6
Sheet 2 of 2

Houston OAPM EA

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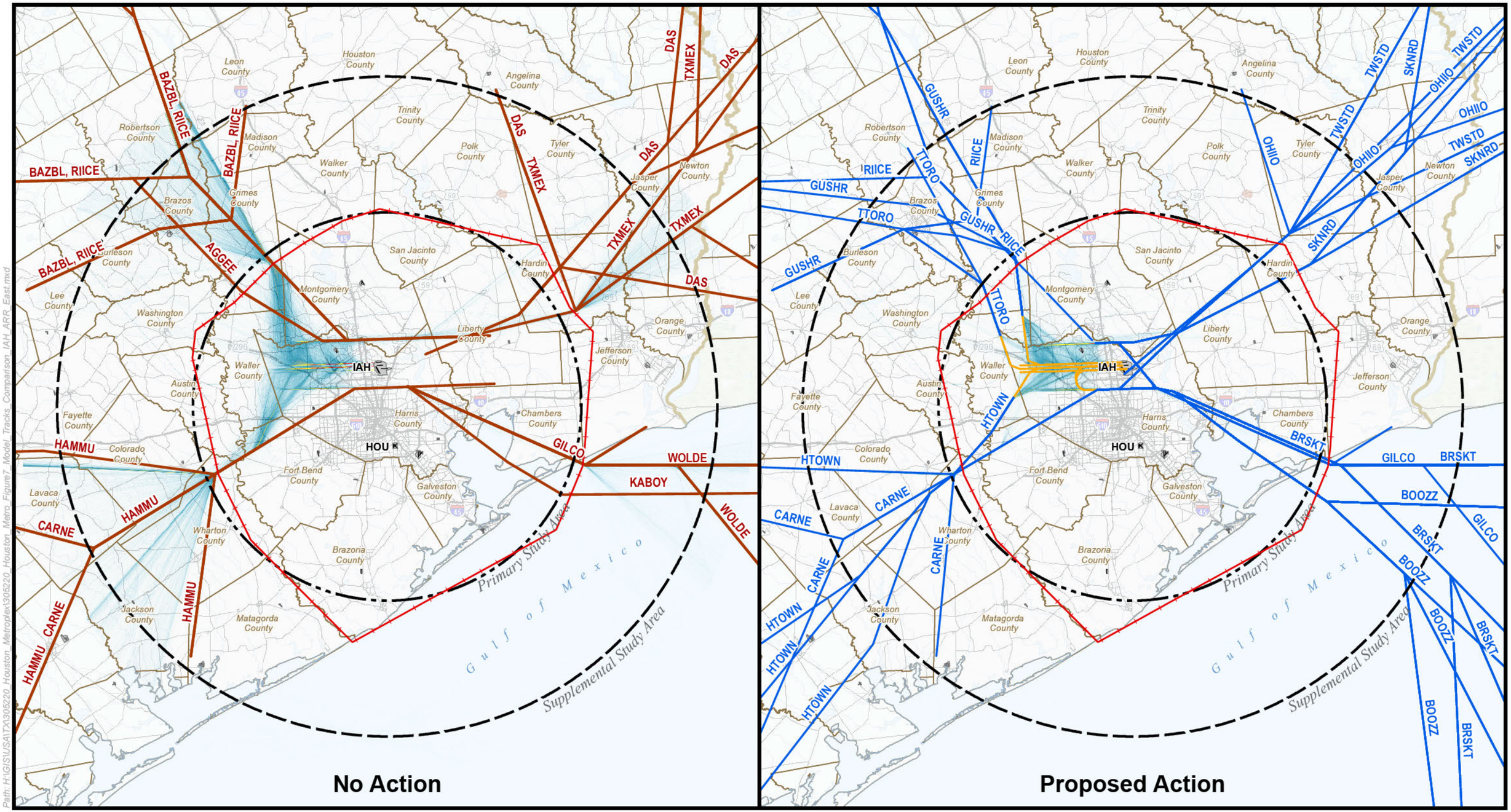

Data Source: Environmental Systems Research Institute, Inc.(ESRI) (Airport/Airport Runways), March 14, 2012; ESRI (State Boundaries/County Boundaries), February 14, 2012; ESRI (Cities), February 8, 2012; ESRI (Mountain Peaks), February 28, 2012; ESRI (Roads), March 14, 2012; Houston-Galveston Area Council (Water Features), March 14, 2012; National Atlas (Lakes/Rivers), September 10, 2012 (Updated);

Prepared By: Harris Miller Miller & Hanson Inc., January, 2013

Primary Study Area
Supplemental Study Area
Core I90 TRACON Boundary
County/Parish Boundary
Alabama-Coushatta Tribe of Texas Reservation

Proposed Procedure
No Action Procedure
Proposed RNP AR Approaches and RNAV Transitions (RNP AR and ILS)

Flight Track Density
Low Medium High

Flight track depictions are annualized representations of 2014 conditions based on 36 24-hour periods in 2010-11.

North
0 20 40 Nautical Miles

IAH Arrivals during East Flow (Comparison of Proposed Action and No Action Alternatives)

Figure 7
Sheet 1 of 2

Houston OAPM EA

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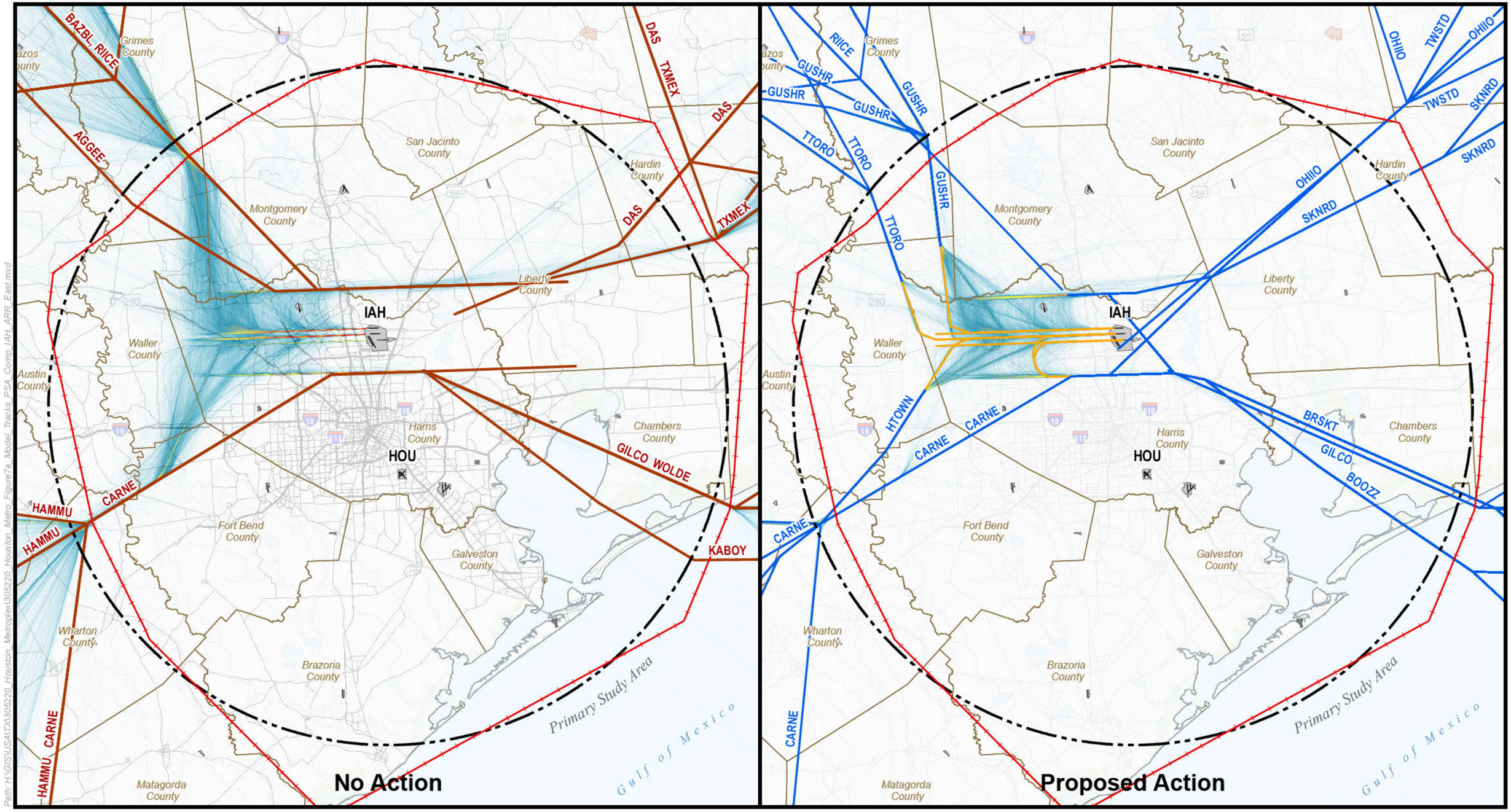

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Data Source: Environmental Systems Research Institute, Inc.(ESRI) (Airport/Airport Runways), March 14, 2012; ESRI (State Boundaries/County Boundaries), February 14, 2012; ESRI (Cities), February 8, 2012; ESRI (Mountain Peaks), February 28, 2012; ESRI (Roads), March 14, 2012; Houston-Galveston Area Council (Water Features), March 14, 2012; National Atlas (Lakes/Rivers), September 10, 2012 (Updated);

Prepared By: Harris Miller Miller & Hanson Inc., January, 2013

Primary Study Area

Core I90 TRACON Boundary

County/Parish Boundary

Alabama-Coushatta Tribe of Texas Reservation

Proposed Procedure

No Action Procedure

Proposed RNP AR Approaches and RNAV Transitions (RNP AR and ILS)

Flight Track Density

Low — Medium — High

Flight track depictions are annualized representations of 2014 conditions based on 36 24-hour periods in 2010-11.

North

0 10 20 Nautical Miles

IAH Arrivals during East Flow (Comparison of Proposed Action and No Action Alternatives)

Figure 7
Sheet 2 of 2

Houston OAPM EA

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3.3.2.2 IAH RNAV ILS Transitions

Table 2 lists the proposed RNAV transitions to the respective ILS for IAH, also illustrated in Figure 6 and Figure 7. ATC would issue these transitions to aircraft based on direction of flow and the landing runway assigned, as shown in the table.

Table 2 IAH Proposed RNAV ILS Transitions

Flow	Runway	RNAV STAR	Corner Post	Aircraft Types[69]	Comments*
East	8L	GUSHR	NW	Jets/Turbo-Props	RNAV-equipped aircraft
East	8R	TTORO	NW	Jets/Turbo-Props	RNAV-equipped aircraft
East	8R	HTOWN	SW	Jets/Turbo-Props	RNAV-equipped aircraft
West	26L/27	GILLL/BOOZZ	SE	Jets/Turbo-Props	RNAV-equipped aircraft
West	26L	DOOBI	NE	Jets/Turbo-Props	RNAV-equipped aircraft
West	26L/26R/27	WHACK	NE	Jets/Turbo-Props	RNAV-equipped aircraft

*Note: .All RNAV ILS transitions would be ATC-assigned only In other words, the use of an RNAV ILS Transition is solely at the discretion of ATC.
Source: Houston OAPM D&I Team (see Appendix F)

3.3.2.3 IAH Required Navigation Performance (RNP) Authorization Required (AR) Approaches

Table 3 lists the proposed RNP AR approaches to the three parallel runways – 8L/26R, 8R/26L, and 9/27. Only properly equipped jets and turbo-props with authorized aircrews would fly these approaches. For each runway, the RNP AR final approach course[70] would coincide with the ILS final approach course. The table identifies the specific flow and runway, the proposed RNAV STAR feeding the procedure, and the arrival direction. Figure 6 and Figure 7 show the RNP AR approaches as they connect to the appropriate RNAV STARs.

Table 3 IAH RNP AR Approaches

Flow	Runway	RNAV STAR	Corner Post	Arrival Direction
East	8L	GUSHR	NW	Short-side[1]
East	8R	TTORO	NW	Short-side
		HTOWN	SW	Short-side
		BRSKT, BOOZZ	SE	Long-side[2]
East	9	BRSKT, BOOZZ	SE	Long-side
		TWSTD, SKNRD	NE	Long-side
West	26L	DRLLR, MSCOT	NW	Long-side
		DOOBI, WHACK	NE	Short-side
		GILLL, BOOZZ	SE	Short-side

[69] These procedures would apply to various classifications of aircraft, include jet, high-performance turbo-prop (capable of greater than 280 knots), and other propeller aircraft.
[70] The final approach course is the segment of the procedure that begins when the procedure track aligns with the runway (i.e., the extended runway centerline), continuing to the runway.

Flow	Runway	RNAV STAR	Corner Post	Arrival Direction
West	26R	DRLLR, MSCOT	NW	Long-side
		WHACK	NE	Short-side
		TEJAS	SW	Long-side
West	27	DRLLR, MSCOT	NW	Long-side
		WHACK	NE	Short-side
		GILLL, BOOZZ	SE	Short-side
		TEJAS	SW	Long-side

Notes:

1. "Short-side" refers to a circumstance when a STAR ties into the final approach course of a SIAP, continuing directly to the landing runway without requiring a course reversal (e.g., aircraft arriving on a STAR from the northwest or southwest side of the Metroplex, with west to east landing operations at IAH on Runways 8L/R or 9).
2. "Long-side" refers to a circumstance when a STAR ties into the final approach course of a SIAP after a course reversal to a landing runway on the opposite side of the airfield (e.g., aircraft arriving on a STAR from the northwest or southwest, with east to west landing operations at IAH on Runways 26L/R or 27).
3. All proposed RNP AR approaches would be ATC-assigned only. In other words, the use of an RNAV ILS Transition is solely at the discretion of ATC.

Source: Houston OAPM D&I Team (see Appendix F)

3.3.2.4 IAH Departures

Table 4 lists the Proposed Action IAH departure procedure(s) that would replace or supplement the respective No Action procedures.

Table 4 IAH Departure Procedures Modifications

Flow	Existing Procedure	New Procedure	Boundary Side	Comments
West	LAKE CHARLES /GUSTI/SABINE PASS	MMUGS	E	Includes RNAV off-the-ground for Runways 15L/15R; departures for all other runways would be issued a heading to fly; LAKE CHARLES retained as a conventional, non-RNAV route
East	LAKE CHARLES /GUSTI/SABINE PASS	GUMBY	E	Includes RNAV off-the-ground for Runways 15L/15R; departures for all other runways would be issued a heading to fly; LAKE CHARLES retained as a conventional, non-RNAV route
All	SCHOLES	FLYZA	S	Includes RNAV off-the-ground for Runways 15L/15R; departures for all other runways would be issued a heading to fly
All	TRUAX/PALACIOS	RITAA	S	Includes RNAV off-the-ground for Runways 15L/15R; departures for all other runways would be radar vectored to a fix on the RNAV SID; based on proposed procedural changes with Mexico. TRUAX and PALACIOS retained as conventional, non-RNAV routes
All	BOWFN		S	RNAV-equipped aircraft; retained for use during weather events
West	INDUSTRY/JUNCTION /WAILN	BNDTO	W	Includes RNAV off-the-ground for Runways 15L/15R; departures for all other runways would be radar vectored to a fix on the RNAV SID; INDUSTRY and JUNCTION retained as conventional, non-RNAV routes
East	INDUSTRY/JUNCTION /WAILN	PITZZ	W	Includes RNAV off-the-ground for Runways 15L/15R; departures for all other runways would be radar vectored to a fix on the RNAV SID. INDUSTRY and JUNCTION retained as conventional, non-RNAV routes

Flow	Existing Procedure	New Procedure	Boundary Side	Comments
All	LEONA	STYCK	N	RNAV-equipped aircraft; departures from all runways would be radar vectored a fix on the RNAV SID. LEONA retained as a conventional, non-RNAV route
All	CRIED	DREMR	N	RNAV-equipped aircraft; departures from all runways would be radar vectored to a fix on the RNAV SID; prior to North Texas OAPM[1] implementation, aircraft would fly DREMR to DAL; after expected North Texas implementation, they would fly DREMR to DFW, with CRIED retained as a conventional, non-RNAV route
All	GIFFA	WYLSN	N	RNAV-equipped aircraft; departures from all runways to radar vectored to a fix on the RNAV SID; prior to North Texas OAPM implementation, aircraft would fly GIFFA transition to DFW; after expected North Texas implementation, they would fly MAJKK transition to DAL, with GIFFA retained as a conventional, non-RNAV route
All	LUFKIN	INDIE	N	RNAV-equipped aircraft; departures from all runways to radar vectored to a fix on the RNAV SID; LUFKIN retained as a conventional, non-RNAV route
All	ALEXANDRIA	STRYA	N	RNAV-equipped aircraft; departures from all runways to radar vectored to a fix on the RNAV SID
All	EL DORADO	LURIC	N	RNAV-equipped aircraft; departures from all runways to radar vectored to a fix on the RNAV SID; EL DORADO retained as a conventional, non-RNAV route

Source: Houston OAPM D&I Team (see Appendix F)
Note:
1. Similar to the Houston OAPM, the North Texas OAPM project would optimize air traffic operations in the Dallas – Fort Worth area.

Figure 8 presents IAH departures during west flow and Figure 9 presents IAH departures during west flow. Both figures provide a comparison of the No Action and the Proposed Action IAH departure procedures within the SSA for the respective operations.

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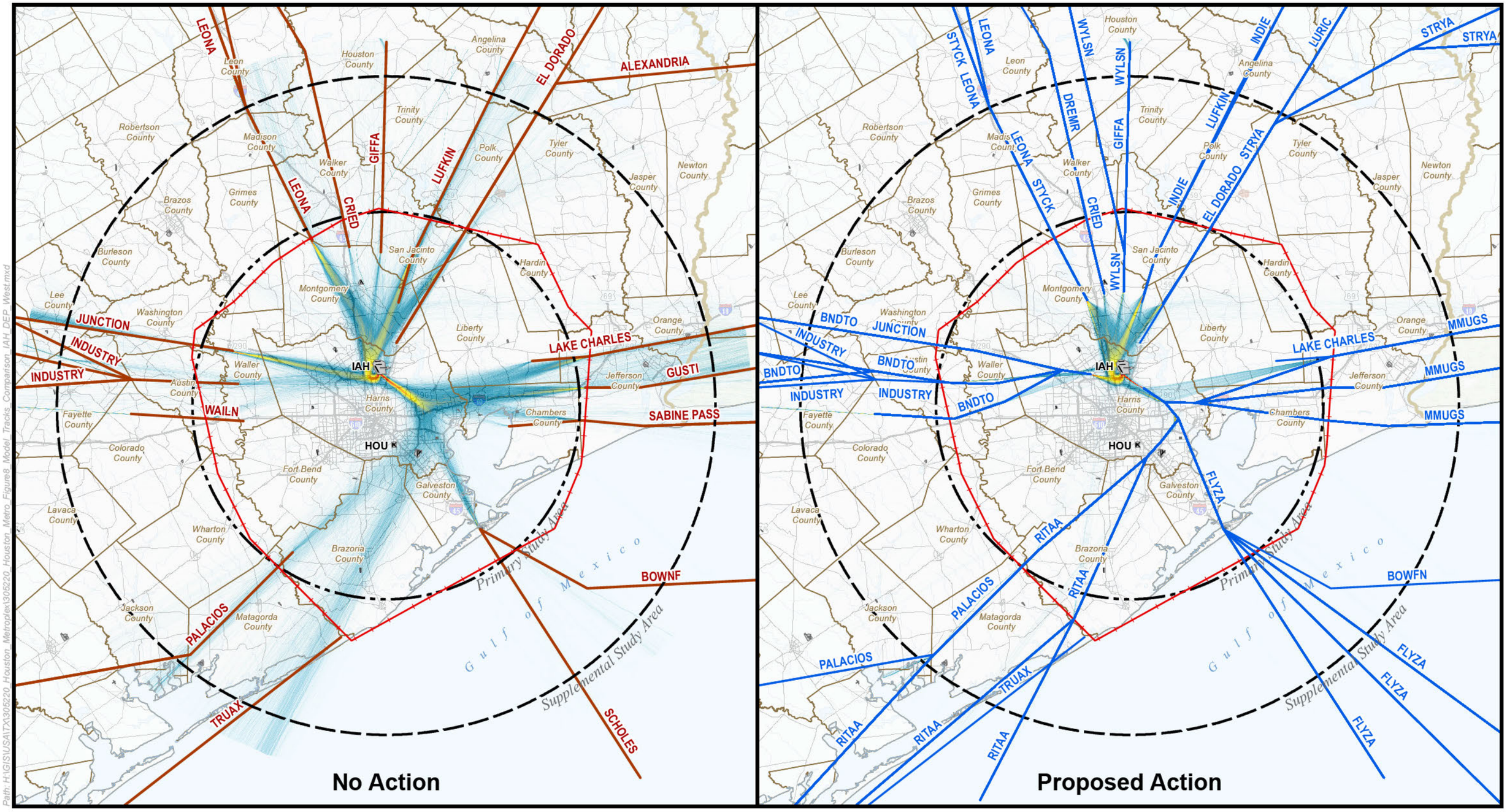

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Data Source: Environmental Systems Research Institute, Inc.(ESRI) (Airport/Airport Runways), March 14, 2012; ESRI (State Boundaries/County Boundaries), February 14, 2012; ESRI (Cities), February 8, 2012; ESRI (Mountain Peaks), February 28, 2012; ESRI (Roads), March 14, 2012; Houston-Galveston Area Council (Water Features), March 14, 2012; National Atlas (Lakes/Rivers), September 10, 2012 (Updated)

Prepared By: Harris Miller Miller & Hanson Inc., January, 2013

North

0 20 40 Nautical Miles

Primary Study Area

Supplemental Study Area

Core I90 TRACON Boundary

County/Parish Boundary

Alabama-Coushatta Tribe of Texas Reservation

Proposed Procedure

No Action Procedure

Flight Track Density

Low Medium High

Flight track depictions are annualized representations of 2014 conditions based on 36 24-hour periods in 2010-11.

IAH Departures during West (Comparison of Proposed Action and No Action Alternatives)

Figure 8
Sheet 1 of 2

Houston OAPM EA

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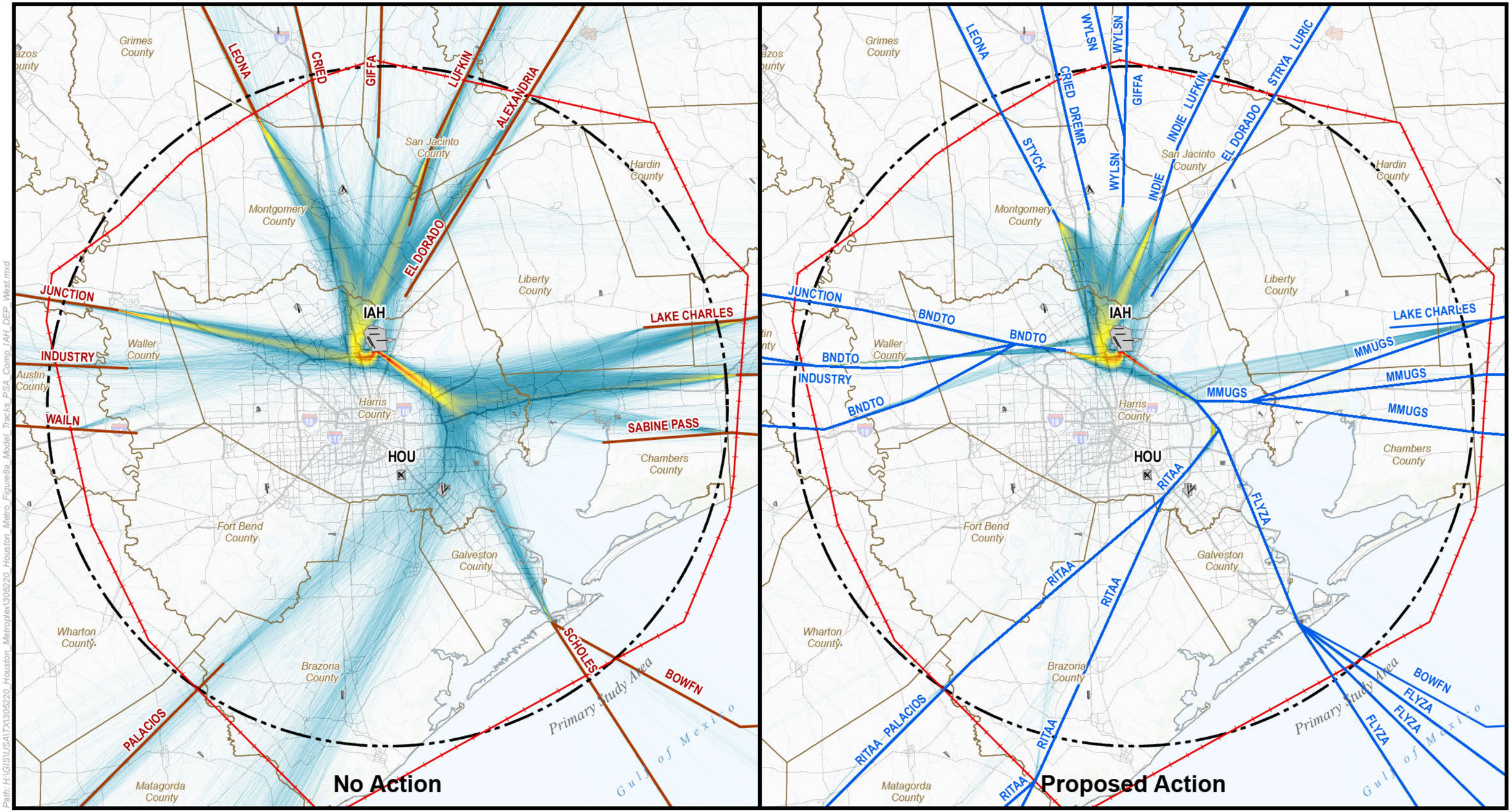

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Prepared By: Harris Miller Miller & Hanson Inc., January, 2013

Primary Study Area
Core I90 TRACON Boundary
County/Parish Boundary
Alabama-Coushatta Tribe of Texas Reservation

Proposed Procedure
No Action Procedure

Flight Track Density
Low Medium High

Flight track depictions are annualized representations of 2014 conditions based on 36 24-hour periods in 2010-11.

North
0 10 20 Nautical Miles

IAH Departures during West (Comparison of Proposed Action and No Action Alternatives)

Figure 8
Sheet 2 of 2

Houston OAPM EA

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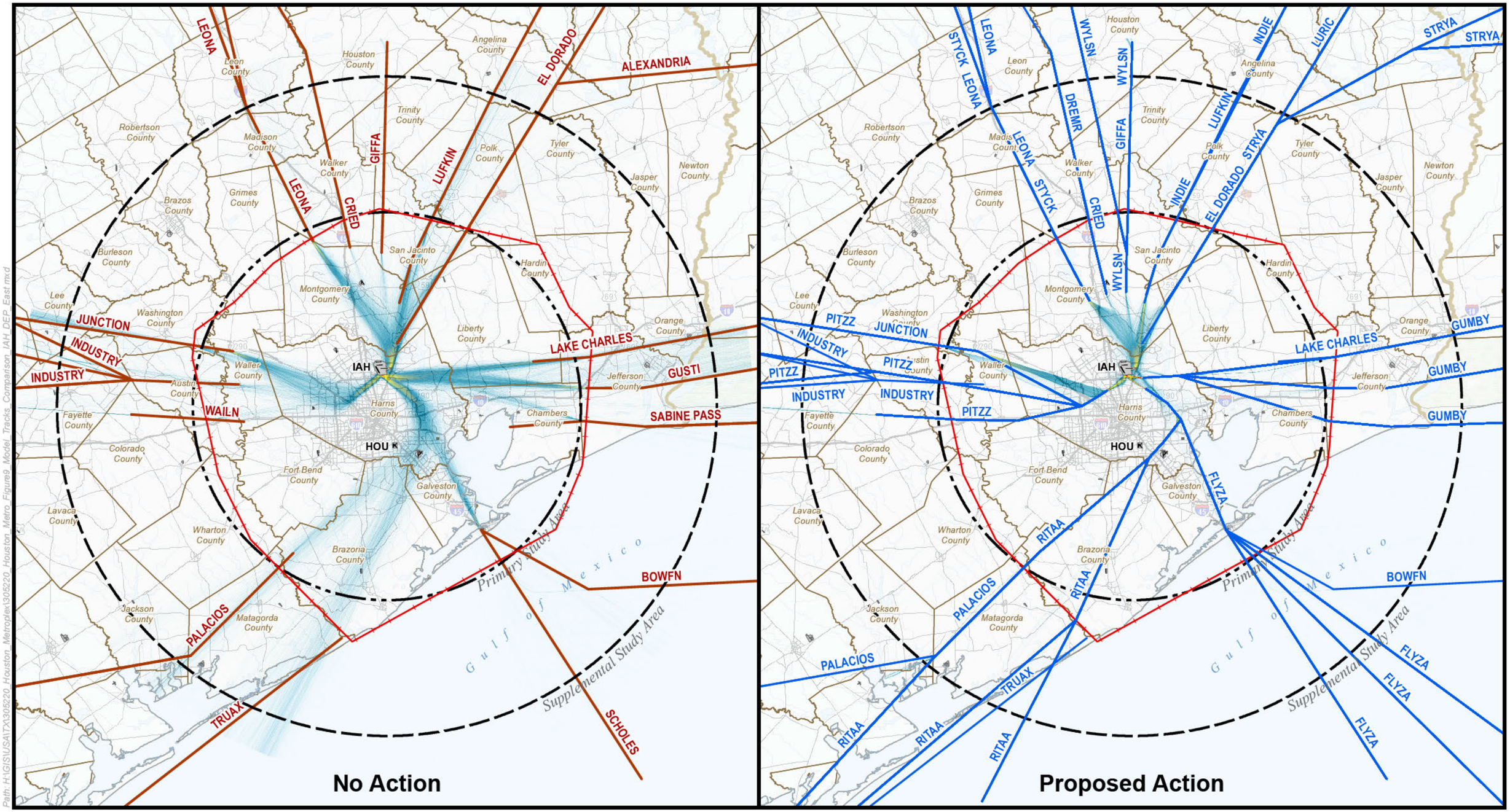

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Prepared By: Harris Miller Miller & Hanson Inc., January, 2013

North

0 20 40 Nautical Miles

Primary Study Area

Supplemental Study Area

Core I90 TRACON Boundary

County/Parish Boundary

Alabama-Coushatta Tribe of Texas Reservation

Proposed Procedure

No Action Procedure

Flight Track Density

Low Medium High

Flight track depictions are annualized representations of 2014 conditions based on 36 24-hour periods in 2010-11.

IAH Departures during East Flow (Comparison of Proposed Action and No Action Alternatives)

Figure 9
Sheet 1 of 2

Houston OAPM EA

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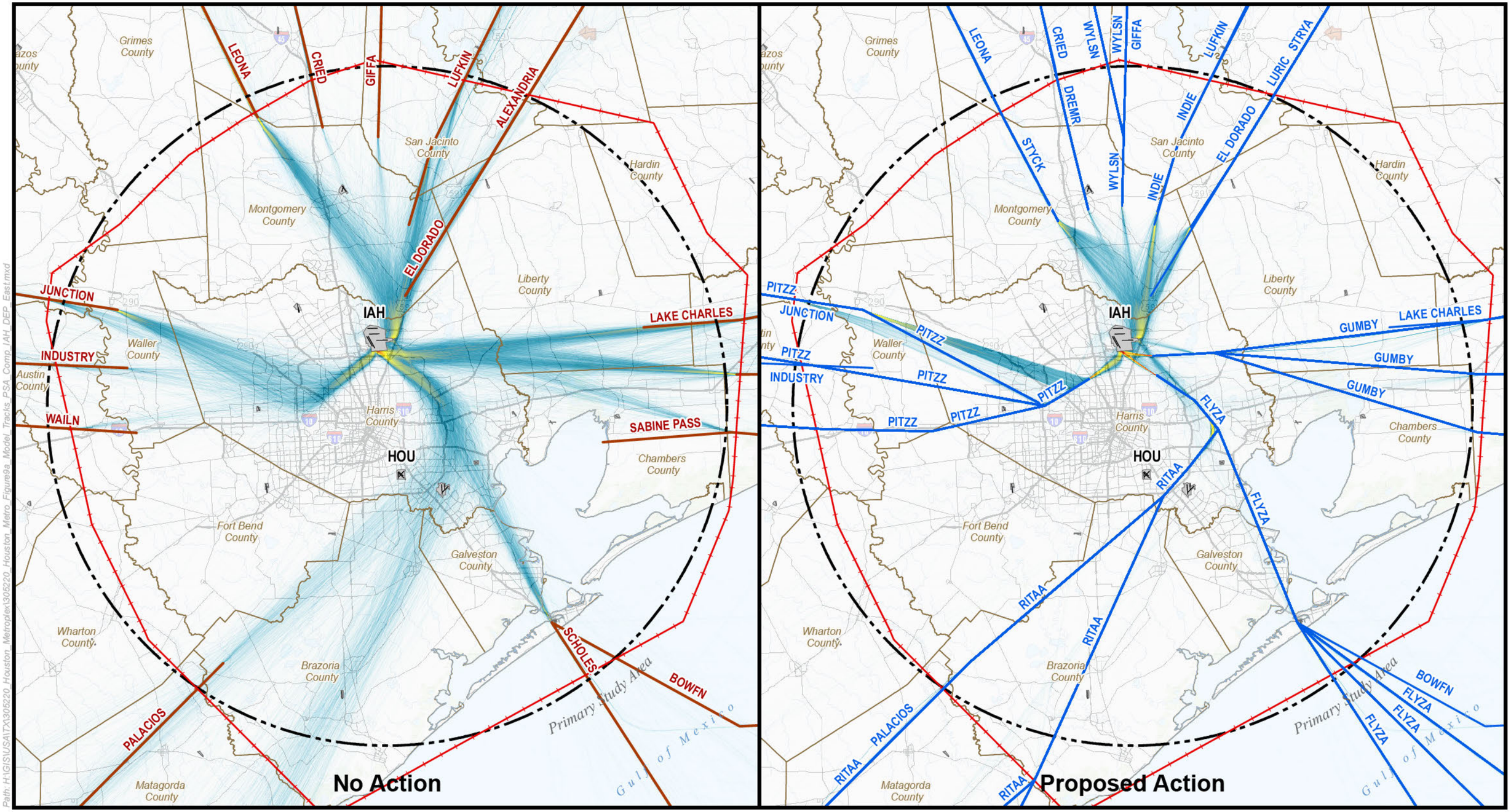

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Prepared By: Harris Miller Miller & Hanson Inc., January, 2013

Primary Study Area
Core I90 TRACON Boundary
County/Parish Boundary
Alabama-Coushatta Tribe of Texas Reservation

Proposed Procedure
No Action Procedure

Flight Track Density
Low Medium High

Flight track depictions are annualized representations of 2014 conditions based on 36 24-hour periods in 2010-11.

North

0 10 20 Nautical Miles

IAH Departures during East Flow (Comparison of Proposed Action and No Action Alternatives)

Figure 9
Sheet 2 of 2

Houston OAPM EA

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3.3.2.5 HOU Arrivals

Table 5 lists the Proposed Action HOU arrival procedure(s) that would replace or supplement the respective No Action procedures.

Table 5 HOU Arrival Procedures Modifications

Flow	Existing Procedure	New Procedure	Corner-Post	Aircraft Types	Comments
All	COLUMBIA	TKNIQ	SE	Turbo-Props	RNAV-equipped aircraft; primary route for turboprop aircraft landing at HOU; used by jets landing at HOU when Severe Weather Avoidance Procedures initiated for BOOZZ to IAH
Runway 4 or 12L/R	COLUMBIA	BAYYY	SE	Jets	RNAV-equipped aircraft; BAYYY closely follows path of BOOZZ; jets redirected to TKNIQ when BOOZZ used by IAH
Runway 22 or 30L/R	COLUMBIA	PUCKS	SE	Jets	RNAV-equipped aircraft; PUCKS closely follows path of BOOZZ; jets redirected to TQNIK when BOOZZ used by IAH
All	STROS	BELLR	SW	Jets/High-Performance Turbo-Props	RNAV-equipped aircraft
All	ROYOH	TCHDN	SW	Jets/Turbo-Props/Pistons	Revised conventional STAR to align with BELLR RNAV STAR; for non-RNAV-equipped aircraft
All	COACH	KIDDZ	NW	Jets	RNAV-equipped aircraft
All	BLUBL		NW	Turbo-Props/Pistons	Retained/Modified conventional STAR for non-RNAV-equipped aircraft
All		TAKKL	NW	Jets	Conventional STAR for non-RNAV-equipped aircraft
All	ROKIT	WAPPL	NE	Jets/High-Performance Turbo-Props	RNAV-equipped aircraft
All		CESAN	NE	Turbo-Props/Pistons	RNAV-equipped aircraft
All		HUDZY	NE	Jets/Turbo-Props	Conventional STAR for non-RNAV-equipped aircraft
Source: Houston OAPM D&I Team (see Appendix F)					

Figure 10 compares the No Action and the Proposed Action HOU arrival procedures within the SSA.

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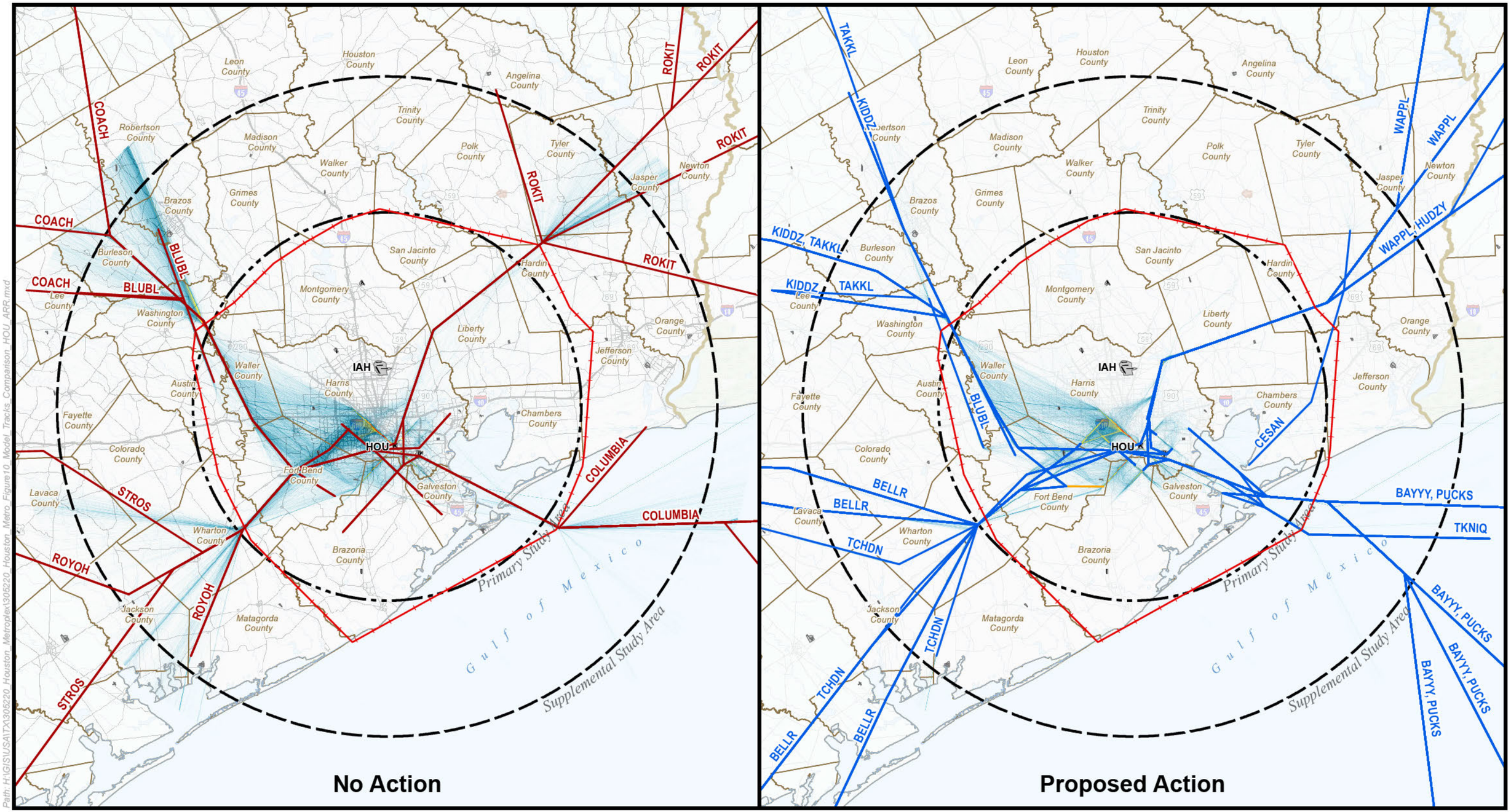

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Prepared By: Harris Miller Miller & Hanson Inc., January, 2013

North

0 20 40 Nautical Miles

Primary Study Area

Supplemental Study Area

Core I90 TRACON Boundary

County/Parish Boundary

Alabama-Coushatta Tribe of Texas Reservation

Proposed Procedure

No Action Procedure

Proposed RNP AR Approaches and RNAV Transitions (RNP AR and ILS)

Flight Track Density

Low Medium High

Flight track depictions are annualized representations of 2014 conditions based on 36 24-hour periods in 2010-11.

HOU Arrivals (Comparison of Proposed Action and No Action Alternatives)

Figure 10
Sheet 1 of 2

Houston OAPM EA

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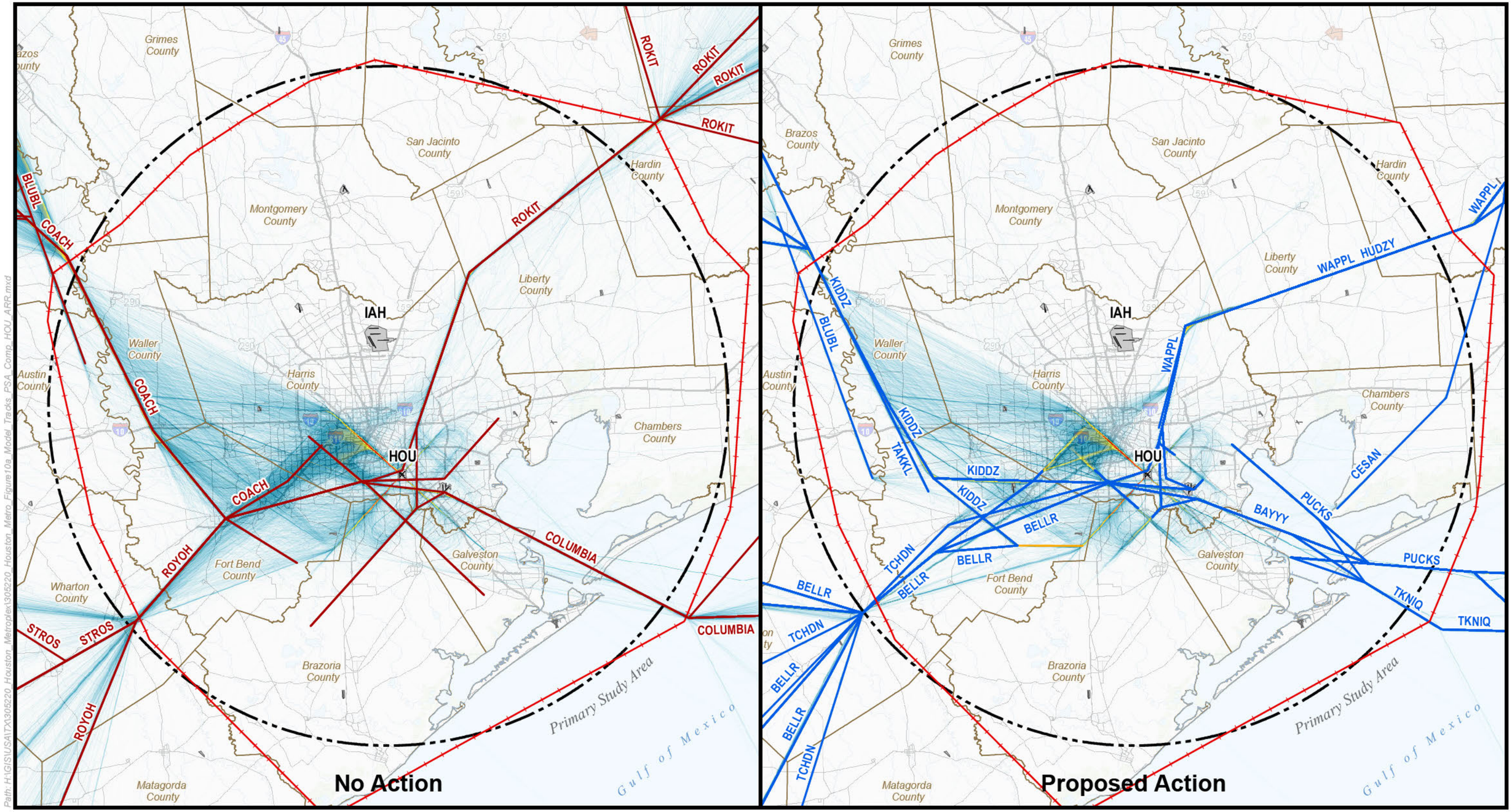

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Data Source: Environmental Systems Research Institute, Inc.(ESRI) (Airport/Airport Runways), March 14, 2012; ESRI (State Boundaries/County Boundaries), February 14, 2012; ESRI (Cities), February 8, 2012; ESRI (Mountain Peaks), February 28, 2012; ESRI (Roads), March 14, 2012; Houston-Galveston Area Council (Water Features), March 14, 2012; National Atlas (Lakes/Rivers), September 10, 2012 (Updated)

Prepared By: Harris Miller Miller & Hanson Inc., January, 2013

Primary Study Area

Core I90 TRACON Boundary

County/Parish Boundary

Alabama-Coushatta Tribe of Texas Reservation

Proposed Procedure

No Action Procedure

Proposed RNP AR Approaches and RNAV Transitions (RNP AR and ILS)

Flight Track Density

Low — Medium — High

Flight track depictions are annualized representations of 2014 conditions based on 36 24-hour periods in 2010-11.

North

0 10 20 Nautical Miles

HOU Arrivals (Comparison of Proposed Action and No Action Alternatives)

Figure 10
Sheet 2 of 2

Houston OAPM EA

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3.3.2.6 HOU RNAV ILS Transition

Table 6 lists and Figure 10 illustrates the proposed RNAV transition to the ILS for HOU. This transition is only applicable to Runway 4, as shown in the table.

Table 6 HOU Proposed RNAV ILS Transitions

Runway	RNAV STAR	Corner-Post	Aircraft Types[71]	Comments*
4	KIDDZ	NW	Jets/Turbo-Props	RNAV-equipped aircraft
	BELLR	SW		
*Note: The use of an RNAV ILS Transition is solely at the discretion of ATC. In other words, the use of an RNAV ILS Transition is solely at the discretion of ATC. Source: Houston OAPM D&I Team (see Appendix F)				

3.3.2.7 HOU Departures

Table 7 lists the Proposed Action HOU departure procedures that would replace or supplement the respective No Action procedure(s).

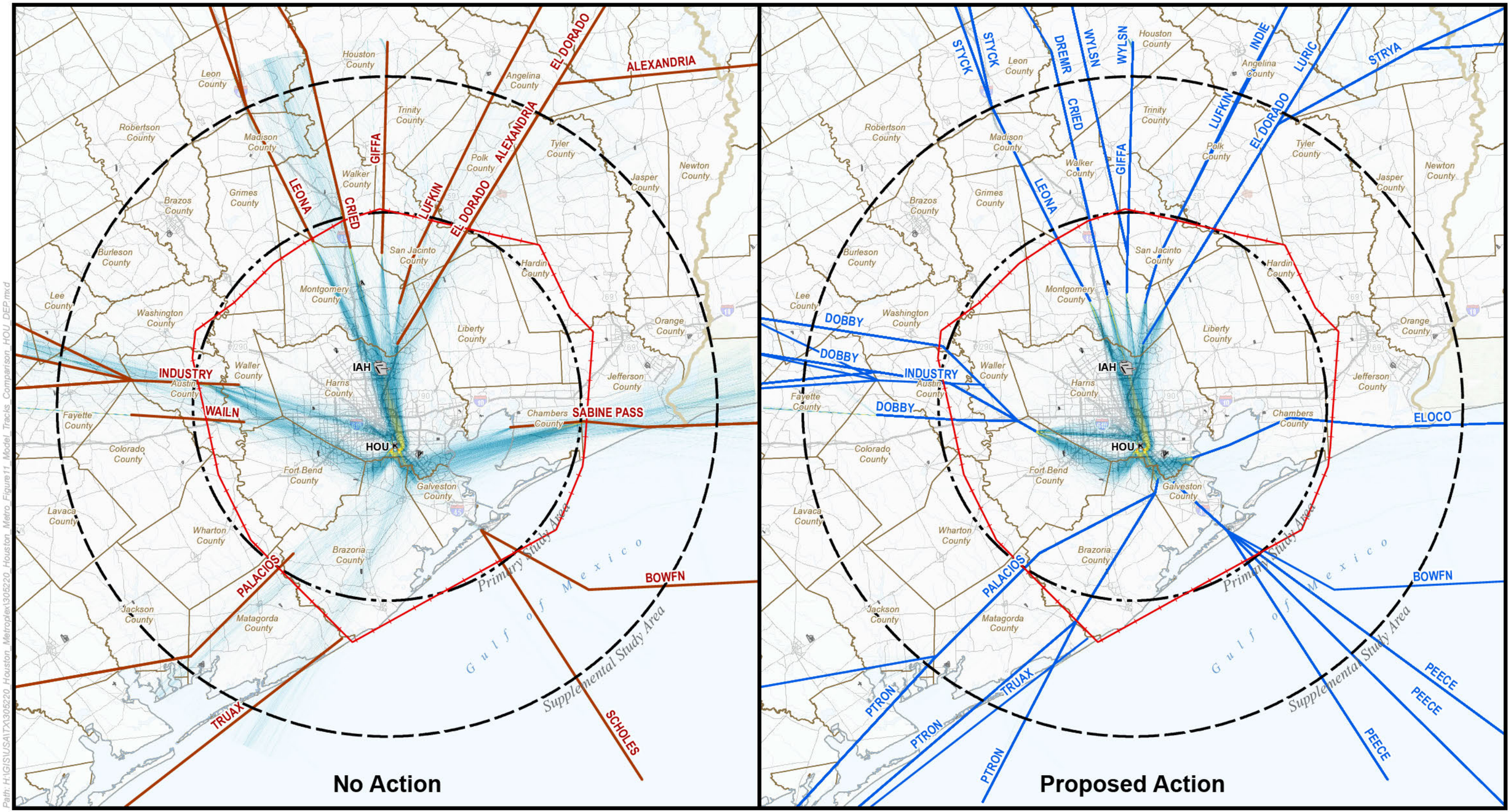
Table 7 HOU Departure Procedures Modifications

Flow	Existing Procedure	New Procedure	Boundary Side	Comments
All	SABINE PASS	ELOCO	E	RNAV aircraft issued radar vectors to ELOCO
All	SCHOLES	PEECE	S	RNAV aircraft issued radar vectors to PEECE; aligned with proposed Gulf of Mexico Required Navigation Performance routes
All	TRUAX/PALACIOS	PTRON	S	RNAV aircraft issued radar vectors; en route transitions based on proposed procedural changes with Mexico; TRUAX and PALACIOS retained as conventional, non-RNAV routes
All	BOWFN		S	RNAV-equipped aircraft; retained for use during weather events
All	INDUSTRY /WAILN	DOBBY	W	RNAV aircraft issued radar vectors; INDUSTRY retained as conventional, non-RNAV route
All	LEONA	STYCK	N	RNAV-equipped aircraft; departures from all runways would be radar vectored to a point; LEONA retained as conventional, non-RNAV route
All	CRIED	DREMR	N	RNAV-equipped aircraft; departures from all runways would be radar vectored to a point; prior to North Texas OAPM implementation, aircraft would fly DREMR to DAL; after expected North Texas implementation, they would fly DREMR to DFW, with CRIED retained as conventional, non-RNAV route
All	GIFFA	WYLSN	N	RNAV-equipped aircraft; departures from all runways would be radar vectored to a point; prior to North Texas OAPM implementation, aircraft would fly GIFFA transition to DFW; after expected North Texas implementation would fly MAJKK transition to DAL; GIFFA retained as conventional, non-RNAV route
All	LUFKIN	INDIE	N	RNAV-equipped aircraft; departures from all runways would be radar vectored to a point; LUFKIN retained as conventional, non-RNAV route
All	ALEXANDRIA	STRYA	N	RNAV-equipped aircraft; departures from all runways would be radar

[71] These procedures would apply to various classifications of aircraft, include jet, high-performance turbo-prop (capable of greater than 280 knots), and other propeller aircraft.

Flow	Existing Procedure	New Procedure	Boundary Side	Comments
				vectored to a point
All	EL DORADO	LURIC	N	RNAV-equipped aircraft; departures from all runways would be radar vectored to a point; EL DORADO retained as conventional, non-RNAV route
Source: Houston OAPM D&I Team (see Appendix F)				

Figure 11 compares the No Action and the Proposed Action HOU departure procedures within the SSA.



Path: H:\GIS\US\ALTX\305220_Houston_Metroplex\305220_Houston_Metro_Figure11_Model_Tracks_Comparison_HOU_DEP.mxd

Data Source: Environmental Systems Research Institute, Inc.(ESRI) (Airport/Airport Runways), March 14, 2012; ESRI (State Boundaries/County Boundaries), February 14, 2012; ESRI (Cities), February 8, 2012; ESRI (Mountain Peaks), February 28, 2012; ESRI (Roads), March 14, 2012; Houston-Galveston Area Council (Water Features), March 14, 2012; National Atlas (Lakes/Rivers), September 10, 2012 (Updated)

Prepared By: Harris Miller Miller & Hanson Inc., January, 2013

Primary Study Area
Supplemental Study Area
Core I90 TRACON Boundary
County/Parish Boundary
Alabama-Coushatta Tribe of Texas Reservation

Proposed Procedure
No Action Procedure

Flight Track Density
Low Medium High

Flight track depictions are annualized representations of 2014 conditions based on 36 24-hour periods in 2010-11.

North
0 20 40 Nautical Miles

HOU Departures (Comparison of Proposed Action and No Action Alternatives)

Figure 11
Sheet 1 of 2

Houston OAPM EA

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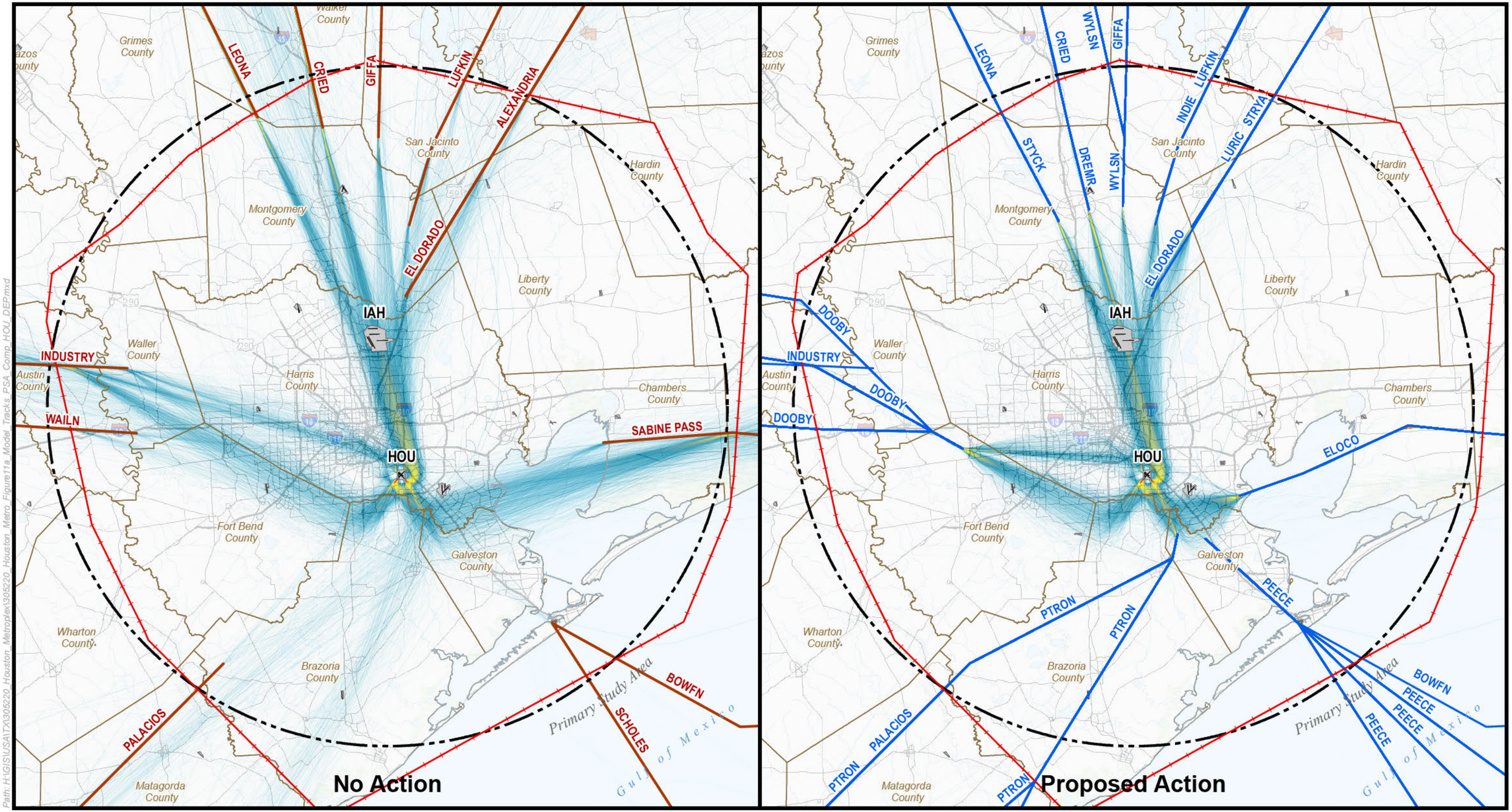

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Data Source: Environmental Systems Research Institute, Inc.(ESRI) (Airport/Airport Runways), March 14, 2012; ESRI (State Boundaries/County Boundaries), February 14, 2012; ESRI (Cities), February 8, 2012; ESRI (Mountain Peaks), February 28, 2012; ESRI (Roads), March 14, 2012; Houston-Galveston Area Council (Water Features), March 14, 2012; National Atlas (Lakes/Rivers), September 10, 2012 (Updated)

Prepared By: Harris Miller Miller & Hanson Inc., January, 2013

Primary Study Area
Supplemental Study Area
Core I90 TRACON Boundary
County/Parish Boundary
Alabama-Coushatta Tribe of Texas Reservation

Proposed Procedure
No Action Procedure

Flight Track Density
Low Medium High

Flight track depictions are annualized representations of 2014 conditions based on 36 24-hour periods in 2010-11.

North

0 10 20 Nautical Miles

HOU Departures (Comparison of Proposed Action and No Action Alternatives)

Figure 11
Sheet 2 of 2

Houston OAPM EA

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3.3.2.8 Satellite Airport Operations

Chapter 1 identified 15 satellite airports within the PSA where the Proposed Action would change SIDs and/or STARs. The D&I Team grouped these airports geographically as either North or South in reference to Jet Route J2, which approximates Interstate Highway 10 (I-10) in the PSA. Table 8 lists the satellite airports by this grouping, followed by Table 9 and Table 10, which list the existing and proposed new arrivals and departures, respectively. Figure 12 and Figure 13 show representations of the satellite airport arrivals and departures, respectively.

Table 8 Satellite Geographical Location in Reference to I-10

Airport ID	South of I-10 Airport Name	Airport ID	North of I-10 Airport Name
AXH	Houston Southwest	CXO	Lone Star Executive
EFD	Ellington Field	DWH	David Wayne Hooks Memorial
GLS	Scholes International at Galveston	EYQ	Weiser Air Park
HPY	Baytown		
IWS	West Houston		
LBX	Texas Gulf Coast Regional		
LVJ	Pearland Regional		
SGR	Sugar Land Regional		
TME	Houston Executive		
T00	Chambers County		
T41	La Porte Municipal		
54T	RWJ Airpark		
Source: Houston OAPM D&I Team (see Appendix F)			

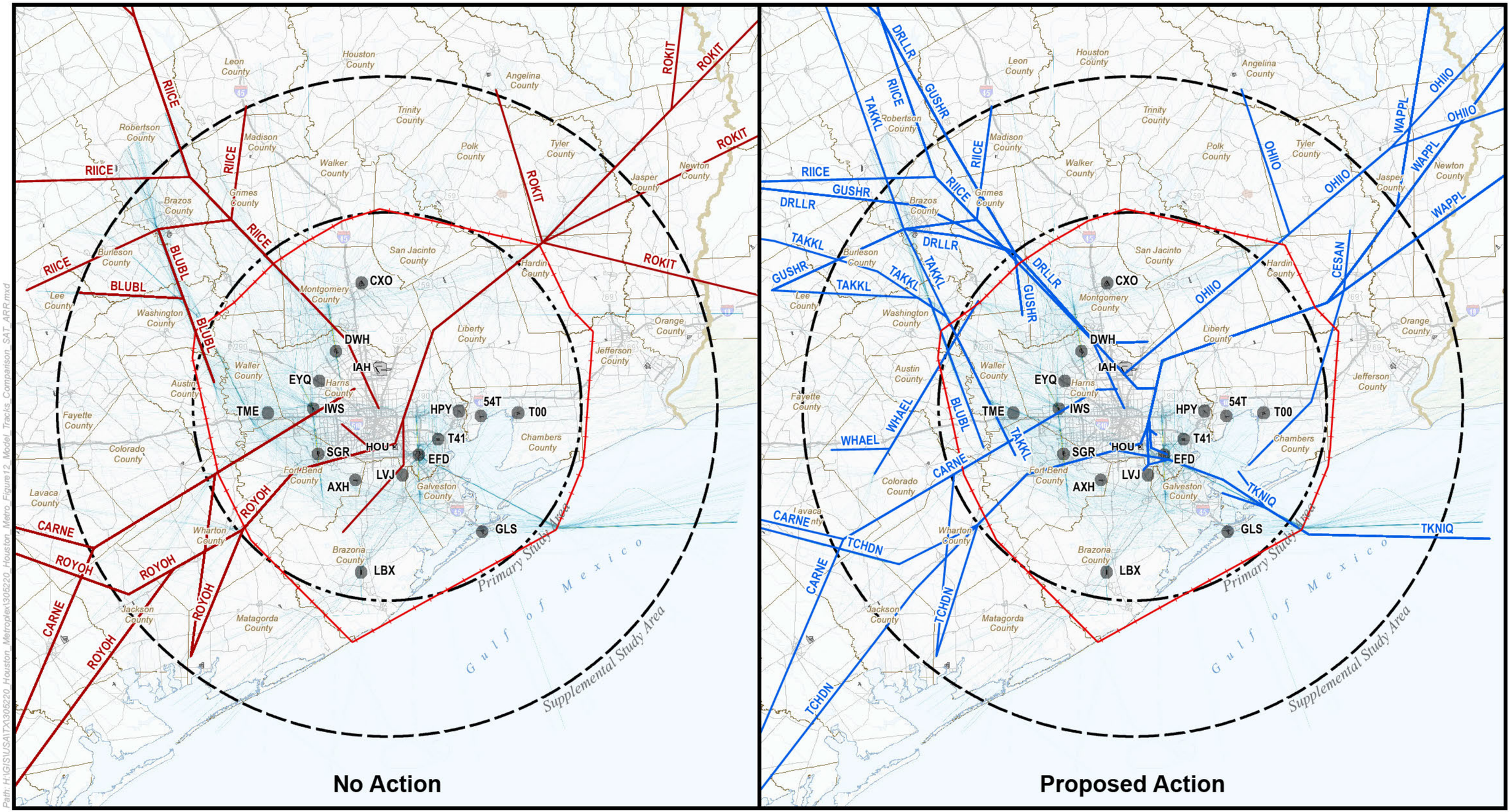
Table 9 Satellite Arrival Procedures Modifications

Flow	Existing Procedure	New Procedure	Satellite Airports	Aircraft Types	Comments
All	CARNE		CXO, DWH	Jets/Turbo-Props/Pistons	Retained/Modified for non-RNAV-equipped aircraft; IAH west flow only
All	RIICE		North	Jets/Turbo-Props/Pistons	Retained/Modified conventional STAR for non-RNAV equipped aircraft
All		WHAEL	CXO, DWH	Jets/Turbo-Props/Pistons	Non-RNAV-equipped aircraft
All		OHIIO	North	Jets/Turbo-Props/Pistons	Non-RNAV-equipped aircraft
East		GUSHR	North	Jets/Turbo-Props/Pistons	RNAV-equipped aircraft
West		DRLLR	North	Jets/Turbo-Props/Pistons	RNAV-equipped aircraft
All	BLUBL		AXH, HPY, IWS, LVJ, SGR, TME, T00, T41, 54T	Turbo-Props/Pistons	Retained/Modified for RNAV and non-RNAV-equipped aircraft

Flow	Existing Procedure	New Procedure	Satellite Airports	Aircraft Types	Comments
All	ROYOH	TCHDN	South	Jets/Turbo-Props/Pistons	Revised conventional STAR to align with BELLR RNAV STAR; for non-RNAV-equipped aircraft
All	ROKIT	WAPPL	South	Jets/High Performance Turbo-Props	RNAV-equipped aircraft
All		CESAN	South	Turbo-Props/Pistons	RNAV-equipped aircraft
All		TAKKL	EFD, GLS, and LBX	Jets/Turbo-Props/Pistons	Non-RNAV-equipped aircraft
All		TKNIQ	EFD,GLS, HPY, IWS, LVJ, LBX, SGR, TME, T00, T41, 54T	Jets/Turbo-Props/Pistons	RNAV-equipped aircraft
Source: Houston OAPM D&I Team (see Appendix F)					

Table 10 Satellite Airport Departure Procedures Modifications

Flow	Existing Procedure	New Procedure	North or South satellite	Comments
All	CRIED	DREMR	Both	RNAV-equipped aircraft; CRIED retained for Non-RNAV-equipped aircraft
All	EL DORADO	LURIC	Both	RNAV-equipped aircraft; EL DORADO retained for Non-RNAV-equipped aircraft
All	GIFFA	WYLSN	Both	RNAV-equipped aircraft; GIFFA retained for Non-RNAV-equipped aircraft
All	LEONA	STYCK	Both	RNAV-equipped aircraft; LEONA retained for Non-RNAV-equipped aircraft
All	LUFKIN	INDIE	Both	RNAV-equipped aircraft; LUFKIN retained for Non-RNAV-equipped aircraft
All	ALEXANDRIA	STRYA	Both	RNAV-equipped aircraft
All	INDUSTRY/JUNCTION/WAILN	BORRN	Both	RNAV-equipped aircraft; INDUSTRY and JUNCTION retained for Non-RNAV-equipped aircraft
All	TRUAX/PALACIOS	KARRR	Both	RNAV-equipped aircraft; TRUAX and PALACIOS retained for Non-RNAV-equipped aircraft
All	LAKE CHARLES/GUSTI/ SABINE PASS	MMALT	Both	RNAV-equipped aircraft; LAKE CHARLES retained for Non-RNAV-equipped aircraft
All	BOWFN		Both	RNAV-equipped aircraft; retained for use during weather events.
All		WATFO	Both	RNAV-equipped aircraft
Source: Houston OAPM D&I Team (see Appendix F)				



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Data Source: Environmental Systems Research Institute, Inc.(ESRI) (Airport/Airport Runways), March 14, 2012; ESRI (State Boundaries/County Boundaries), February 14, 2012; ESRI (Cities), February 8, 2012; ESRI (Mountain Peaks), February 28, 2012; ESRI (Roads), March 14, 2012; Houston-Galveston Area Council (Water Features), March 14, 2012; National Atlas (Lakes/Rivers), September 10, 2012 (Updated)

Prepared By: Harris Miller Miller & Hanson Inc., January, 2013

Primary Study Area
Supplemental Study Area
Core I90 TRACON Boundary
County/Parish Boundary
Alabama-Coushatta Tribe of Texas Reservation

Proposed Procedure
No Action Procedure
Satellite Airports

Flight Track Density
Low Medium High

Flight track depictions are annualized representations of 2014 conditions based on 36 24-hour periods in 2010-11.

North

0 20 40 Nautical Miles

Satellite Airport Arrivals (Comparison of Proposed Action and No Action Alternatives)

Figure 12

Houston OAPM EA

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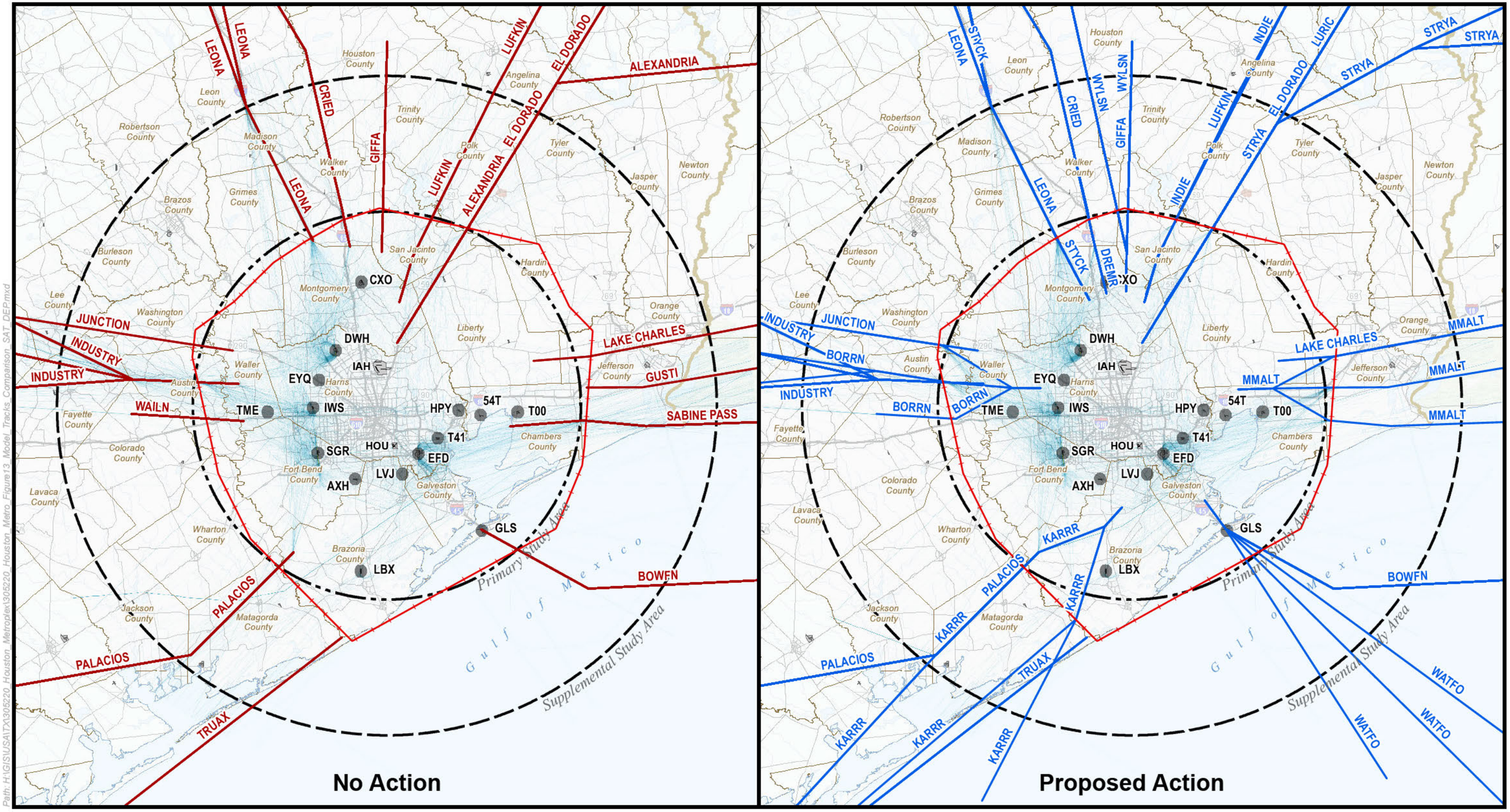

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Prepared By: Harris Miller Miller & Hanson Inc., January, 2013

Primary Study Area
Supplemental Study Area
Core I90 TRACON Boundary
County/Parish Boundary
Alabama-Coushatta Tribe of Texas Reservation

Proposed Procedure
No Action Procedure
Satellite Airports

Flight Track Density
Low Medium High

Flight track depictions are annualized representations of 2014 conditions based on 36 24-hour periods in 2010-11.

North
0 20 40 Nautical Miles

Satellite Airport Departures (Comparison of Proposed Action and No Action Alternatives)

Figure 13

Houston OAPM EA

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3.4 Identification of the Preferred Alternative

Of the two alternatives carried forward for detailed analysis, only the Proposed Action would meet the Purpose and Need, as stated in Chapter 2. Therefore, the Proposed Action is the Preferred Alternative.

The No Action Alternative does not meet the Purpose and Need and, therefore, existing air traffic inefficiencies would remain and the Houston Metroplex would not fully realize the benefits of PBN procedures. Although the No Action Alternative would not meet the Purpose and Need, this EA carries it forward, as required by CEQ regulations, to establish a benchmark against which decision makers can compare the magnitude of the environmental effects of undertaking the Proposed Action.

Table 11 relates the Proposed Action to the Purpose and Need by presenting all individual procedures that would comprise the Proposed Action, including procedures that would be retained, modified, or cancelled from the No Action Alternative.

Table 11 Relation of All Proposed Changes in Instrument Procedures to Purpose & Need Criteria

Procedure Name	Action	Boundary Side	Improves Efficiency	Flight Path Predictability & Flexibility	Reduces Pilot-Controller Communication
RNAV SIDs					
ELOCO	New	E	Y	Y	Y
GUMBY	New	E	Y	Y	Y
MMALT	New	E	Y	Y	Y
MMUGS	New	E	Y	Y	Y
WATFO	New	E	Y	Y	Y
GUSTI	Cancel	E	-	-	-
SABINE PASS	Cancel	E	-	-	-
DREMR	New	N	Y	Y	No Change
INDIE	New	N	Y	Y	No Change
LURIC	New	N	Y	Y	No Change
STRYA	New	N	Y	Y	Y
STYCK	New	N	Y	Y	No Change
WYLSN	New	N	Y	Y	No Change
BOWFN	Retain	S	No Change	No Change	No Change
FLYZA	New	S	Y	Y	Y
KARRR	New	S	Y	Y	Y
PEECE	New	S	Y	Y	Y
PTRON	New	S	Y	Y	Y
RITAA	New	S	Y	Y	Y
BNDTO	New	W	Y	Y	Y
BORRN	New	W	Y	Y	Y
DOBBY	New	W	Y	Y	Y
PITZZ	New	W	Y	Y	Y

Procedure Name	Action	Boundary Side	Improves Efficiency	Flight Path Predictability & Flexibility	Reduces Pilot-Controller Communication
WAILN	Cancel	W	-	-	-
Conventional (non-RNAV) SIDs					
LAKE CHARLES	Retain	E	No Change	No Change	No Change
CRIED	Retain	N	No Change	No Change	No Change
EL DORADO	Retain	N	No Change	No Change	No Change
GIFFA	Retain	N	No Change	No Change	No Change
LEONA	Retain	N	No Change	No Change	No Change
LUFKIN	Retain	N	No Change	No Change	No Change
ALEXANDRIA	Cancel	N	-	-	-
PALACIOS	Retain	S	No Change	No Change	No Change
TRUAX	Retain	S	No Change	No Change	No Change
SCHOLES	Cancel	S	-	-	-
INDUSTRY	Retain	W	No Change	No Change	No Change
JUNCTION	Retain	W	No Change	No Change	No Change
RNAV STARs					
CESAN	New	NE	Y	Y	No Change
DOOBI	New	NE	Y	Y	Y
SKNRD	New	NE	Y	Y	Y
TWSTD	New	NE	Y	Y	Y
WAPPL	New	NE	Y	Y	Y
WHACK	New	NE	Y	Y	Y
ROKIT	Cancel	NE	-	-	-
TXMEX	Cancel	NE	-	-	-
DRLLR	New	NW	Y	Y	Y
GUSHR	New	NW	Y	Y	Y
KIDDZ	New	NW	Y	Y	Y
MSCOT	New	NW	Y	Y	Y
TTORO	New	NW	Y	Y	Y
AGEEE	Cancel	NW	-	-	-
BAZBL	Cancel	NW	-	-	-
COACH	Cancel	NW	-	-	-
BAYYY	New	SE	Y	Y	Y
BOOZZ	New	SE	Y	Y	Y
BRSKT	New	SE	Y	Y	Y
GILLL	New	SE	Y	Y	Y
PUCKS	New	SE	Y	Y	Y
TQNIK	New	SE	Y	Y	Y
CLMBA	Cancel	SE	-	-	-
KABOY	Cancel	SE	-	-	-
WOLDE	Cancel	SE	-	-	-
BELLR	New	SW	Y	Y	Y

Procedure Name	Action	Boundary Side	Improves Efficiency	Flight Path Predictability & Flexibility	Reduces Pilot-Controller Communication
HTOWN	New	SW	Y	Y	Y
TEJAS	New	SW	Y	Y	Y
DYNMO	Cancel	SW	-	-	-
HAMMU	Cancel	SW	-	-	-
STROS	Cancel	SW	-	-	-
Conventional (non-RNAV) STARs					
HUDZY	New	NE	Y	Y	No Change
OHIIO	New	NE	Y	Y	No Change
DAS	Cancel	NE	-	-	-
TAKKL	New	NW	Y	Y	No Change
BLUBL	Modify	NW	No Change	No Change	No Change
RIICE	Modify	NW	No Change	No Change	No Change
TEXNN	Cancel	NW	-	-	-
GILCO	Modify	SE	No Change	No Change	No Change
TCHDN	New	SW	Y	Y	No Change
WHAEL	New	SW	Y	Y	No Change
CARNE	Modify	SW	No Change	No Change	No Change
ROYOH	Cancel	SW	-	-	-
RNP AR Approaches					
IAH 8L[1]	New	E	Y	Y	Y
IAH 8R	Modify	E	Y	Y	Y
IAH 9	New	E	Y	Y	Y
IAH 26L	New	W	Y	Y	Y
IAH 26R	New	W	Y	Y	Y
IAH 27	Modify	W	Y	Y	Y
RNAV ILS Transitions[2]					
IAH 8L[1]	Modify	E	Y	Y	Y
IAH 8R	Modify	E	Y	Y	Y
IAH 26L	Modify	W	Y	Y	Y
IAH 26R	Modify	W	Y	Y	Y
IAH 27	Modify	W	Y	Y	Y
HOU 4	Modify	All	Y	Y	Y

Notes:
1. For RNP AR Approaches and RNAV ILS Transitions, the "Procedure Name" is replaced with the associated airport and runway.
2. The proposed RNAV ILS Transitions would be published as modification or amendment to the respective existing ILS approaches.

Source: Houston OAPM D&I Team (see Appendix F)

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4 AFFECTED ENVIRONMENT

This chapter of the EA describes the existing environmental conditions within the geographic area that could potentially be affected by the Proposed Action. A description of the Study Area is provided first, followed by descriptions of each environmental impact category.[72] Section 4.2 presents those environmental impact categories that the Proposed Action could have potential to affect. Section 4.3 lists those categories that the Proposed Action would not have potential to affect. Since neither the No Action Alternative nor the Proposed Action would involve construction or land-disturbing activities, the potential environmental consequences are limited, and several impact categories would have no potential effects.

The description of the Affected Environment provides the context to assess the environmental impacts of the Proposed Action, which are presented in Chapter 5 *"Environmental Consequences."* Section 4.4 presents relevant past, present, or reasonably foreseeable future actions that are not part of the Proposed Action to allow for assessment of potential cumulative effects in conjunction with implementation of the Proposed Action. The cumulative effects analysis itself is presented in Chapter 5.

4.1 Environmental Assessment Study Area

A "study area" is the geographic area within which environmental impacts could potentially occur as a result of implementation of a Proposed Action. The altitude ceiling for environmental consideration regarding "air traffic airspace actions" is generally 10,000 feet (ft.) above ground level (AGL).[73] However, analysis between 10,000 ft. and 18,000 ft. AGL may be considered when the proposed changes are over a National Park or Wildlife Refuge.[74] Using methodology described further below, the FAA developed two study areas for this EA (see Figure 14):

1. A **Primary Study Area (PSA)**, consisting of the area within a 50 nautical mile (NM) radius of a point midway between IAH and HOU was identified to evaluate potential impacts of changes in aircraft routings that are proposed to occur below 10,000 ft. AGL[75]

2. A **Supplemental Study Area (SSA)**, which includes the PSA, consisting of the area within an 85 NM radius of a point midway between IAH and HOU was identified to evaluate potential effects of changes in aircraft routing up to 18,000 ft. AGL over National Parks and Wildlife Refuges

Both study areas are large enough to allow evaluation of the potential effects of the Proposed Action on all environmental impact categories.

[72] FAA Order 1050.1E, Chg. 1, App. A (and related guidance memoranda) identifies and defines the Environmental Impact Categories.
[73] Ibid., sec. 14.5e.
[74] FAA Order JO 7400.2J, "Procedures for Handling Airspace Matters," February 9, 2012, sec. 32-2-1.b.
[75] The following coordinates were used to represent the mid-point between IAH and HOU: Latitude 29.815485 N, Longitude 95.310150 W.

Figure 14 Primary and Supplemental Study Areas

The geographic area for each impact category can vary, sometimes coinciding with the study area but more often constituting a smaller area within the study area. The relevant geographic area can, and often does, differ from one impact category to another (e.g., Compatible Land Use area can be different from Air Quality area). The effects on some environmental impact categories are highly localized and confined, whereas others cover a broader geographic area. Given the vast size and geographical diversity of the Study Area, focusing on specific geographic areas for each environmental impact category allows a more complete analysis of the potential effects of the Proposed Action.

4.1.1 Data Acquisition

To determine the study area boundaries for this EA, the FAA considered the geographic areas where new or revised aircraft routings under the Proposed Action would differ from the No Action Alternative. The FAA evaluated the existing flight paths in the southeast Texas region as a basis to determine where Proposed Action changes are likely to occur. Initially, the FAA collected radar data for arrival and departure operations from airports in the southeast Texas region during 2010-2011, focusing on aircraft traffic controlled by the ZHU ARTCC and the I90 TRACON. The ZHU ARTCC is

located at IAH and controls airspace in southern Texas, Louisiana, southern Mississippi, southwestern Alabama, and areas in the Gulf of Mexico. The I90 TRACON provides approach control for airports within the Houston Metroplex. This analysis gathered representative radar data, specific to the region, from the National Offload Program (NOP) for thirty-six (36) 24-hour periods between October 3, 2010 and September 26, 2011, providing an accurate representation of overall annual conditions.

4.1.2 Methodology to Determine the Study Area

The FAA analyzed the collected radar data for approaching and departing Houston Metroplex jet aircraft operating under Instrument Flight Rules (IFR).[76] A review of radar data showed that approximately 95 percent of Houston Metroplex jet aircraft operations below 10,000 ft. AGL occur within 50 nm of a point midway between IAH and HOU. This became the PSA. Development of the SSA applied the same methodology as was used for the PSA. Approximately 95 percent of IFR Houston Metroplex jet aircraft operations below 18,000 ft. AGL occur within 85 nm of a point midway between IAH and HOU.

4.1.3 Setting and Location

The PSA encompasses approximately 7,850 square nautical miles (NM^2) and 19 counties in part or whole (all within Texas). The SSA, including the PSA, encompasses approximately 22,700 NM^2, spanning 16 additional counties and two Louisiana parishes, in part or whole. Table 12 lists all counties in the PSA and SSA.

Table 12 Study Area Counties and Parishes

Primary Study Area (PSA)	Supplemental Study Area (SSA)[1]
Austin	Angelina
Brazoria	Brazos
Chambers	Burleson
Colorado	Fayette
Fort Bend	Houston
Galveston	Jackson
Grimes	Jasper
Hardin	Lavaca
Harris	Lee
Jefferson	Leon
Liberty	Madison
Matagorda	Newton
Montgomery	Orange
Polk	Robertson
San Jacinto	Trinity
Walker	Tyler

[76] Instrument Flight Rules (IFR): Rules governing the procedures for conducting instrument flight. Also a term used by pilots and controllers to indicate type of flight plan. For further information, please see Appendix D. (FAA, *Pilot-Controller Glossary,* July 26, 2012)

Primary Study Area (PSA)	Supplemental Study Area (SSA)[1]
Waller	Calcasieu (Louisiana)
Washington	Cameron (Louisiana)
Wharton	
Note: 1. SSA also includes all counties in the PSA	

4.1.4 Airport Facilities

There are 411 public and private airports and heliports in the PSA and SSA.[77] This EA focuses on those airports with existing, published aircraft procedures that the Proposed Action may potentially affect, including the Houston OAPM Airports (see Section 1.1), as depicted in Figure 15.[78] Five of the 15 satellite airports warranted noise analysis in this EA. The remaining satellite airports were determined to have too few operations to warrant noise analysis.[79] Table 13 identifies the airports subject to detailed noise modeling in this EA, referred to throughout this EA as "Analyzed Airports."

[77] FAA, Forms 5010, "Airport Master Records": http://www.faa.gov/airports/airport_safety/airportdata_5010/ (current as of May 31, 2012).
[78] Houston OAPM Design and Implementation (D&I) Team, "Optimization of Airspace and Procedures in the Metroplex (OAPM) Design Submission, Executive Summary, Houston Metroplex" (see Appendix F).
[79] Harris Miller Miller and Hanson Inc., "Recommended Satellite Airports for Noise Analysis," *Memorandum to Roger McGrath, Environmental & Airspace Specialist, FAA, ATO Central Service Center*, July 31, 2012 (see Appendix G.2, *Noise Modeling Technical Report*).

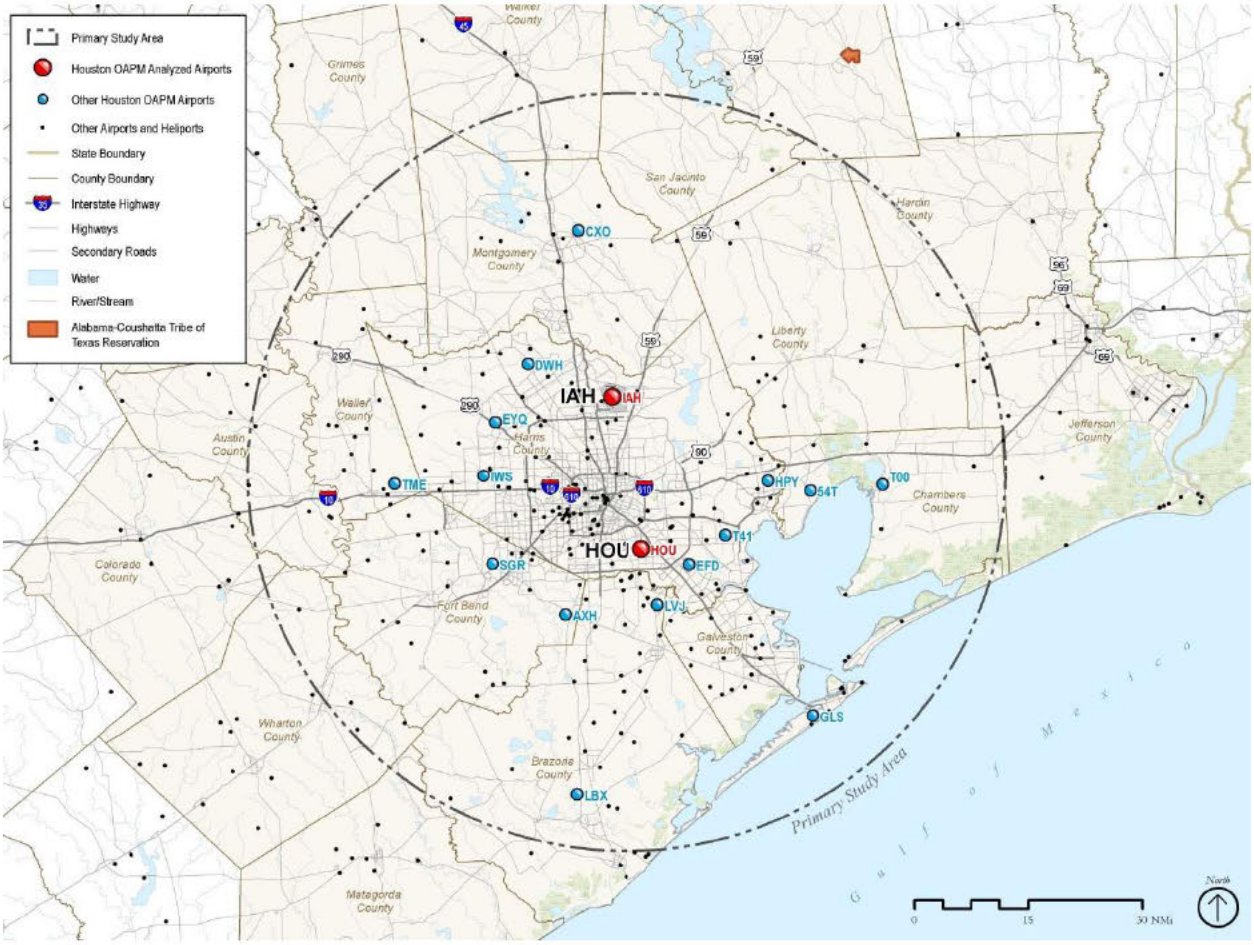


Figure 15 Houston OAPM Airports

Table 13 Analyzed Airports

Primary Airports	Satellite Airports
George Bush Intercontinental/Houston (IAH) William P Hobby (HOU)	Ellington Field (EFD) David Wayne Hooks Memorial (DWH) West Houston (IWS) Texas Gulf Coast Regional (LBX) Sugar Land Regional (SGR)

4.2 Potentially Affected Environmental Impact Categories

This section provides information on the existing conditions within the PSA and SSA for the following environmental impact categories, which the Proposed Action could potentially affect:

- Noise
- Compatible Land Use
- Department of Transportation Act, Section 4(f)
- Historical, Architectural, Archeological, and Cultural Resources

- Air Quality
- Natural Resources and Energy Supply (Aircraft Fuel)[80]
- Climate
- Fish, Wildlife, and Plants
- Light Emissions and Visual Impacts
- Environmental Justice

4.2.1 Noise

Aircraft noise is often the most noticeable environmental effect associated with aviation projects. FAA Order 1050.1E, Appendix A, Section 14 provides specific policy and procedures for the assessment of aircraft noise for compliance with NEPA, as well as other laws and statutes.

For the Houston OAPM EA, the FAA conducted aircraft noise exposure modeling within the Study Area. The following sections include a description of the aircraft noise modeling methodology used for this EA and a discussion of the existing aircraft noise exposure level within the PSA. Appendix G, *Aircraft Noise Analysis* provides background information on the physics of sound, the effects of noise on people, noise metrics, and greater detail about noise modeling for this EA.

4.2.1.1 Definition of Impact Category

Day-Night Average Sound Level (DNL) Metric

The FAA has determined that the exposure of individuals to noise resulting from aviation activities must be analyzed in terms of the yearly Day-Night Average Sound Level (DNL).[81] DNL is a single value of sound exposure for a complete 24-hour period, including all of the time-varying sound energy within the period, computed for the Average Annual Day (AAD) of aircraft operations for specified years of interest.[82] To emphasize the greater annoyance factor of noise events that occur at nighttime, when people typically sleep and ambient noise levels are lower, DNL includes an added 10 decibel (dB) weighting for noise events occurring between 10:00 P.M. and 7:00 A.M. The 10 dB weighting essentially equates one nighttime aircraft operation to ten daytime operations. Appendix G provides further information on the DNL metric.

[80] Aircraft fuel is the only aspect of the Natural Resources and Energy Supply impact category that is potentially affected by the Proposed Action. Otherwise, the Proposed Action would not affect this impact category (see Section 4.3).
[81] FAA Order 1050.1E, Chg. 1, App. A, sec. 14.
[82] "Average Annual Day (AAD)" is a noise modeling metric used to normalize day-to-day variations in aviation operations over a one year period, calculated as the total number of annual operations divided by 365 (i.e., the number of days in a year).

Noise Modeling Methodology

In addition to requiring the use of the DNL metric, the FAA also requires that aircraft noise be evaluated using authorized computer noise models. Specifically, for air traffic actions such as Houston OAPM, where the study area is larger than the immediate vicinity of an airport, incorporates more than one airport, or includes actions above 3,000 ft. AGL, the FAA mandates that noise modeling be conducted using the Noise Integrated Routing System (NIRS).[83]

For this EA, the FAA conducted a detailed analysis of IFR aircraft for the 2012 Base Year.[84] The FAA developed detailed operations from calendar year (CY) 2011 flight plan data, as described in Appendix G. Although the noise environment around major airports comes almost entirely from jet aircraft operations, the DNL calculations reflect noise from many types of jet and propeller aircraft operations on IFR flight plans that the Proposed Action could affect. Most aircraft around major airports operate IFR to obtain ATC separation services in these busy areas. Aircraft operating under Visual Flight Rules (VFR) are not included in the analysis. Such aircraft are unaffected by the Proposed Action. Further, VFR aircraft operating outside certain categories of controlled airspace are not required to be in contact with ATC. Since these aircraft operate at the discretion of the pilot on the "see and be seen" principle and are not required to file flight plans, the FAA has very limited information for these operations. There is no known source for comprehensive route, altitude, aircraft type, and frequency information for VFR operations for the entire study area. Even if complete information were available for VFR operations, the Proposed Action evaluated in the EA would not require a change to the route or altitude of these operations. Therefore, if modeling were possible, both the No Action and Proposed Action scenarios would show the same flight route and altitude. Forecast conditions in 2014 (the first full year of implementation) and 2019 (five years after implementation) for both the No Action Alternative and Proposed Action are described in Chapter 5.[85]

NIRS requires a variety of inputs, including local environmental data (e.g., temperature and relative humidity), runway layout, aircraft operations, runway use, and flight tracks. The FAA assembled detailed information on aircraft operations within the PSA for input into NIRS. This includes specific aircraft fleet mix information such as aircraft type, arrival and departure times, and origin/destination airport. Table 14 provides a summary of the number of aircraft operations for each primary and satellite airport listed in Table 13.

[83] FAA Order 1050.1E, Chg. 1, App. A, sec. 14.5e.
[84] The "2012 Base Year" refers to the projected baseline level of annual operations for 2012. It is not the actual number of 2012 annual operations, as the 2012 annual period was not yet complete when analysis for this assessment began. It is used to estimate or represent year 2012 existing conditions for comparison with 2014 and 2019 forecast operations. For further information, please see Appendix G.2, *Noise Modeling Technical Report*.
[85] The target date for publication of the Houston Metroplex optimized procedures is December 12, 2013.

Table 14 2012 Base Year and Forecast Annual Operations by Airport

Airport	2012			2014			2019		
	Total[1]	IFR[2]	VFR[2]	Total[1]	IFR[2]	VFR[2]	Total[1,3]	IFR[2,3]	VFR[2]
IAH	559,910	557,474	2,436	609,095	606,581	2,514	720,217	717,523	2,694
HOU	205,815	180,871	24,944	209,643	184,172	25,471	253,191	225,971	27,220
EFD	144,702	21,571	123,131	144,702	21,571	123,131	144,702	21,571	123,131
DWH	181,172	22,460	158,712	183,106	22,837	160,269	188,078	23,808	164,270
IWS	105,957	14,041	91,916	109,007	14,222	94,785	117,020	15,260	101,760
LBX	81,456	5,279	76,177	85,091	5,373	79,718	94,948	5,976	88,972
SGR	68,519	25,343	43,176	69,570	25,887	43,683	72,305	27,305	45,000

Sources:
1. FAA Terminal Area Forecast (TAF), January 2012, http://aspm.faa.gov/main/taf.asp
2. HMMH – Calculated values assuming ratios of IFR to VFR remain the same as they were in calendar year 2011 as reported by FAA Air Traffic Activity Data System, Calendar Year 2011 or FAA TAF for 2011 https://aspm.faa.gov/opsnet/sys/Main.asp?force=atads
3. HMMH – Includes an estimated increase in operations associated with the proposed Houston Hobby (HOU) Terminal Building and other Facilities Expansion for Planned International Operations (construction of five additional gates for international flights and construction of a Federal Inspection Services facility at HOU). Information provided on Houston Airport System (HAS) website http://www.fly2houston.com/HobbyInternational , in particular "The Economic Impact of International Commercial Air Service at William P. Hobby Airport"., a report dated May 9, 2012 and prepared by GRA, Incorporated and InterVISTAS Consulting LLC for the HAS.

While the fleet mix defines the number and type of aircraft operations that produce noise, runway use and flight track location and usage data provide additional information about where aircraft travel in the study area. To obtain this information, the FAA used thirty-six (36) 24-hour period samples of radar data, which provided flight route geometry (i.e., flight tracks), track usage by aircraft type and time of day, and flight profiles (i.e., altitudes). The FAA then applied this information, including more than 72,000 actual flight tracks, to create modeled flight tracks. To supplement this radar data, the Houston Airport System (HAS) – which manages the operations at IAH, HOU, and EFD – provided CY 2011 runway use data for IAH and HOU. Comparison of both data sets indicated that runway use in the 36 radar data samples was representative of annual conditions. While the HAS data were used for IAH and HOU runway use, the radar data and CY 2011 flight plan data were used to develop operations for all Analyzed airports and runway use for all other Analyzed Airports.[86] Additional details on NIRS and development and summary of the noise modeling inputs are available in Appendix G.

[86] The Houston Airport System (HAS) provided the FAA data regarding CY 2011 IAH and HOU operations. HAS had provided the same data to the Texas Commission on Environmental Quality (TCEQ) at an earlier date. The HAS data were used for IAH and HOU because they represented a complete calendar year and for consistency with HAS and TCEQ analysis and reports. Appendix G presents additional details regarding the use of data are presented.

4.2.1.2 Existing Conditions

The FAA calculated noise exposure from aircraft operations at more than 120,000 locations throughout the PSA and SSA, including:

1. Population centroids in the PSA only (i.e., centers of census blocks, described below)[87]
2. Certain specific cultural resources (see Section4.2.4) and areas potentially protected under the Department of Transportation Act, Section 4(f) (see Section 4.2.3)
3. Evenly-spaced grids over the PSA and SSA to document aircraft noise levels at potential noise sensitive locations that were not otherwise identified

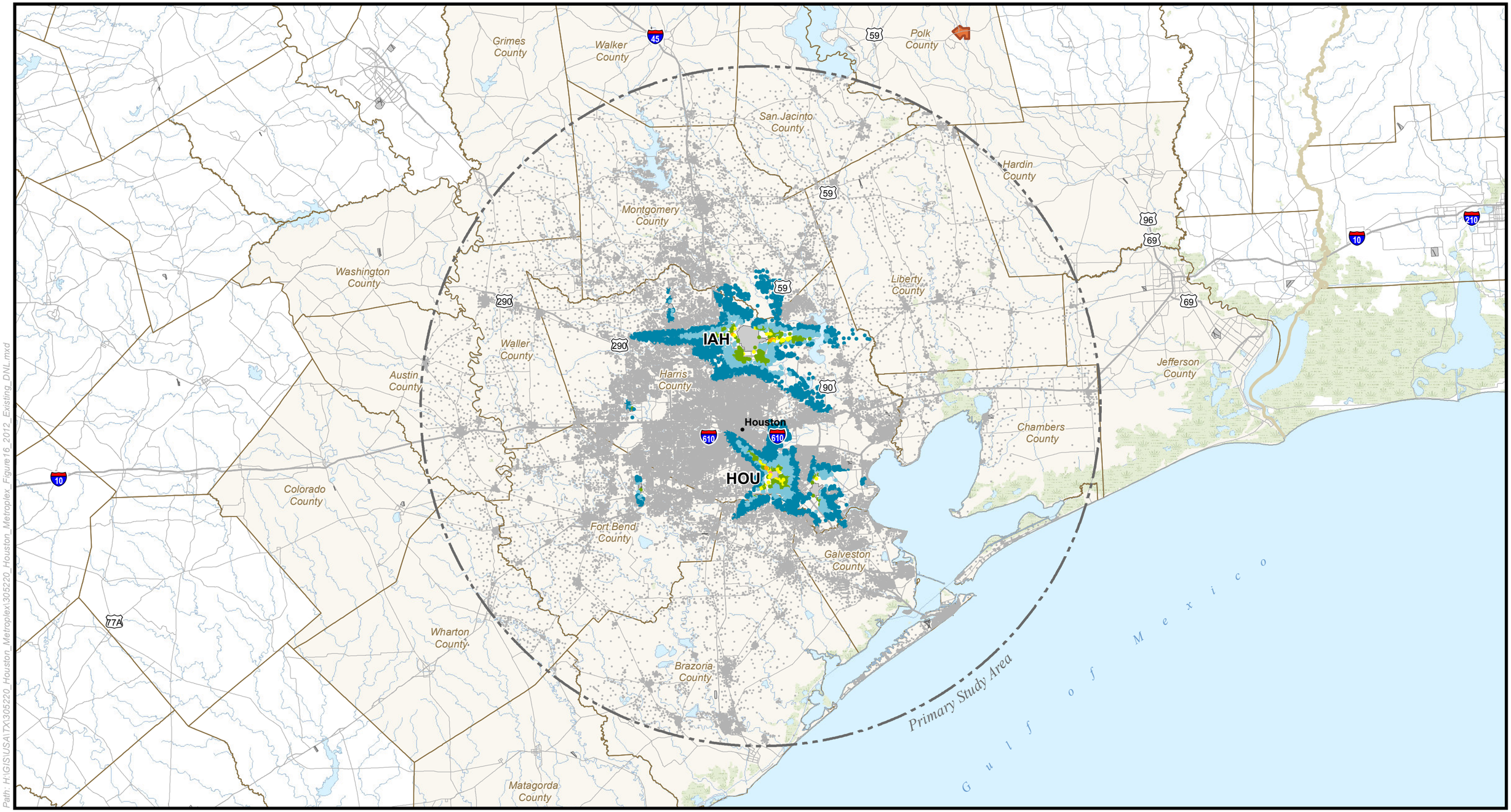
Census blocks are the smallest geographic unit for which the U.S. Census Bureau tabulates data. Streets, legal boundaries and other features generally bound census blocks. For this noise analysis, the FAA estimated the exposure to various noise levels of all census block centroids[88] in the Study Area , categorized in ranges of DNL (e.g., less than 45 dB, 45-50 dB, etc.). The FAA then estimated the population exposed to those noise levels as the number of people residing in each census block. As noise levels may vary throughout a census block, the actual number of people affected at a given noise level may be more or less than the total population of that census block. For the Houston OAPM, the FAA analyzed 67,184 census blocks in the study areas.

To describe the Affected Environment, the FAA established existing conditions noise exposure data to provide the public an opportunity to relate current personal experience with the degree of noise exposure reported. In addition, the 2012 noise analysis is the foundation upon which the noise modeling for the future conditions (i.e., 2014, first full calendar year of implementation and 2019, five years beyond implementation) is developed. The information provided refers to noise exposure levels only within the PSA. Table 15 provides the population exposed to Average Annual Day (AAD) DNL in ranges of 5 dB increments from DNL 45 dB to 75 dB, and the population exposed to DNL less than 45 dB and greater than 75 dB. Figure 16 provides a graphical representation of existing exposure levels to aircraft noise for all population centroid locations within the entire PSA for the 2012 Base Year. For each population centroid, the DNL ranges defined in Table 15 correspond with a color in Figure 16.

[87] The FAA analyzed population centroids only for the PSA because the purpose of the SSA is to evaluate potential effects of changes in aircraft routing up to 18,000 ft. AGL over national parks and wildlife refuges.
[88] The centroid is a single point that is the geographical center of the census block.

Table 15 Population Exposed to Aircraft Noise

2012 Estimated Population Exposed to Aircraft Noise			
DNL Range (dB)	Population	Percent of Total Population	Color on Figure 16
Less than 45	4,773,339	80.40%	Gray
45 to less than 50	765,173	12.89%	Dark Blue
50 to less than 55	300,687	5.06%	Light Blue
55 to less than 60	85,215	1.44%	Green
60 to less than 65	11,682	0.20%	Yellow
65 to less than 70	792	0.01%	Orange
70 to less than 75	10	<0.01%	Pink
Greater than or equal to 75	-	0.00%	Red
Total	5,936,898	100.00%	



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Data Source: Environmental Systems Research Institute, Inc.(ESRI) (Airport/Airport Runways), March 14, 2012; ESRI (State Boundaries/County Boundaries), February 14, 2012; ESRI (Cities), February 8, 2012; ESRI (Roads), March 14, 2012; Houston-Galveston Area Council (Water Features), March 14, 2012; National Atlas (Lakes/Rivers), September 10, 2012 (Updated); National Atlas (Tribal Land/Wilderness Areas), February 08, 2012;

Prepared By: Harris Miller Miller & Hanson Inc., December, 2012

North

0 10 20 Miles

Primary Study Area
Airport Boundary
State Boundary
County/Parish Boundary
Interstate Highway
Highways
Secondary Roads
Water
River/Stream
Alabama-Coushatta Tribe of Texas Reservation

2012 Existing DNL Levels

- DNL < 45.0 dB
- DNL 45.0 - 50.0 dB
- DNL 50.0 - 55.0 dB
- DNL 55.0 - 60.0 dB
- DNL 60.0 - 65.0 dB
- DNL 65.0 - 70.0 dB
- DNL 70.0 - 75.0 dB
- DNL > 75.0 dB

2012 Base Year Aircraft Noise Exposure at Population Centroids

Figure 16

Houston OAPM EA

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Areas closer to airports are exposed to higher aircraft noise exposure levels than areas farther from airports. Additionally, as Figure 16 illustrates, areas with higher noise levels generally align with primary runways and flight patterns. The majority of the PSA population (80 percent) is exposed to aircraft DNL of less than 45 dB and the smallest population group (less than one-hundredth of a percent) is exposed to aircraft DNL of 70 dB and greater.

4.2.2 Compatible Land Use

This section describes land cover classification located within the PSA. The FAA obtained land coverage data from the USGS National Land Cover Database 2006 (NLCD 2006) to document the entire study area with either land use or land cover. Land cover classifications include Developed (low, medium, high, and open space), Pasture/Cultivated Crops, Shrub/Scrub/Grassland, Wetlands, and Barren and Forests (deciduous, evergreen, and mixed). Developed land use occurs primarily within and adjacent to the City of Houston, and Planted/Cultivated and Shrub/Scrub/Grassland land uses occur in rural areas. Figure 17 illustrates general land cover classification within the PSA.

The PSA includes numerous large parks, recreational areas, and wildlife refuges, and other types of resources managed by the U.S. Forest Service (USFS), the National Park Service (NPS), and the U.S. Fish and Wildlife Service (USFWS). Sections 4.2.3 and 4.2.4 provide further information on these resources.

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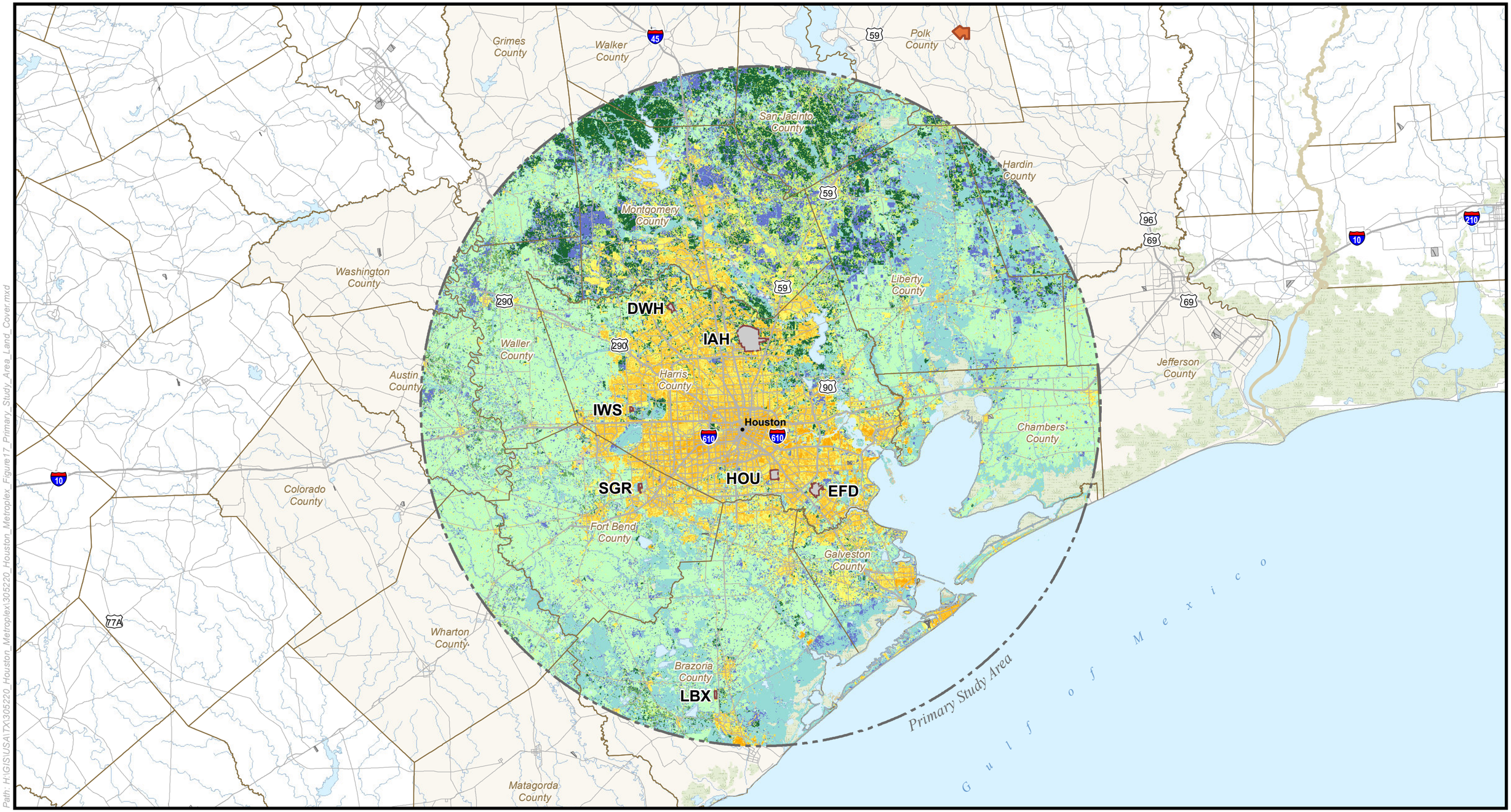

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Data Source: Environmental Systems Research Institute, Inc.(ESRI) (Airport/Airport Runways), March 14, 2012; ESRI (State Boundaries/County Boundaries), February 14, 2012; ESRI (Cities), February 8, 2012; ESRI (Roads), March 14, 2012; Houston-Galveston Area Council (Water Features), March 14, 2012; National Atlas (Lakes/Rivers), September 10, 2012 (Updated); National Atlas (Tribal Land/Wilderness Areas), February 08, 2012; Research Institute (ESRI), USGS via Houston-Galveston Area Council (USGS National Land Cover Database 2006 (NLCD 2006)), March 8, 2012;

Prepared By: Harris Miller Miller & Hanson Inc., January, 2013

North

0 10 20 Miles

Primary Study Area
Airport Boundary
State Boundary
County/Parish Boundary
Interstate Highway
Highways
Secondary Roads
Water
River/Stream
Alabama-Coushatta Tribe of Texas Reservation

National Land Cover Classification

Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Developed, High Intensity
Barren Land
Deciduous Forest
Evergreen Forest
Mixed Forest
Shrub/Scrub/Grassland/Herbaceous
Pasture Hay / Cultivated Crops
Wetlands
Water

Primary Study Area Land Cover

Figure 17

Houston OAPM EA

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4.2.3 Department of Transportation Act, Section 4(f) Resources

This section includes a brief synopsis of the protections afforded to publicly owned parks, recreation areas, wildlife and waterfowl refuges, and public or private historic sites under Section 4(f) of the Department of Transportation (DOT) Act of 1966.[89] As with compatible land use (see Section 4.2.2), the FAA assesses this impact category in terms of the effects that aircraft noise may have on these properties, since the Proposed Action does not include construction or land-disturbing activities that could affect properties protected under Section 4(f).

4.2.3.1 Definition of Impact Category

Section 4(f) of the Department of Transportation (DOT) Act states that the "Secretary of Transportation will not approve a project that requires the use of any publicly-owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance or land from a historic site of national, state, or local significance as determined by the officials having jurisdiction thereof, unless there is no feasible and prudent alternative to the use of such land and the project includes all possible planning to minimize harm resulting from the use." The term "use" encompasses both direct physical taking of Section 4(f) lands (i.e., permanent or temporary incorporation or occupancy of land as part of a transportation project) as well as "constructive" use of such lands. Constructive use occurs when the proximity impacts (e.g., noise) of a proposed project adjacent to, or near, a Section 4(f) property result in substantial impairment of the property. Substantial impairment occurs only when the activities, features, or attributes of the Section 4(f) property that contribute to its significance or enjoyment are substantially diminished. Substantial impairment would occur when impacts to Section 4(f) lands are sufficiently serious that the value of the site in terms of its prior significance and enjoyment are substantially reduced or lost. With respect to aircraft noise, for example, the noise must be at levels high enough to have negative consequences of a substantial nature that amount to a taking of a park or portion of a park for transportation purposes. Privately-owned parks, recreation areas and wildlife refuges are not subject to Section 4(f). If the FAA determines there would not be substantial impairment of a Section 4(f) resource, the action would not constitute a constructive use and would not therefore invoke Section 4(f).

In determining whether a constructive use would occur because of aircraft noise, the FAA uses the guidelines for land use compatibility in *Code of Federal Regulations (CFR)*, Title 14, Part 150 to the extent those guidelines are relevant to the value, significance, and enjoyment of the Section 4(f) lands in question.[90] When assessing use of Section 4(f) properties located in a quiet setting, where the setting is a generally recognized feature or attribute of the site's significance, the FAA carefully evaluates reliance on the Part 150 guidelines. Additional factors are weighed in determining

[89] *U.S. Code*. Title 49, sec. 303(c) (commonly referred to as "Section 4(f)")
[90] *Code of Federal Regulations*, Land Use Compatibility with Yearly Day-Night Average Sound Levels, Title 14, sec. 150, App. A, Table 1.

whether to apply the thresholds listed in Part 150 guidelines to determine the significance of noise impacts on noise-sensitive areas within national parks, national wildlife refuges, and historic sites including traditional cultural properties. The FAA consults appropriate Federal, state, and local officials having jurisdiction over the affected Section 4(f) resources when determining whether project-related noise impacts would substantially impair the resource.

Some Section 4(f) properties are also subject to Section 6(f) of the Land and Water Conservation Fund (LWCF) Act.[91] Section 6(f) states that no public outdoor recreation areas acquired or developed with any LWCF assistance can be converted to non-recreation uses without the approval of the Secretary of the Interior. The Secretary of the Interior may only approve conversions if they are in accordance with the comprehensive statewide outdoor recreation plan and if other recreation lands of reasonably equivalent usefulness and location will replace the converted areas.

4.2.3.2 Existing Conditions

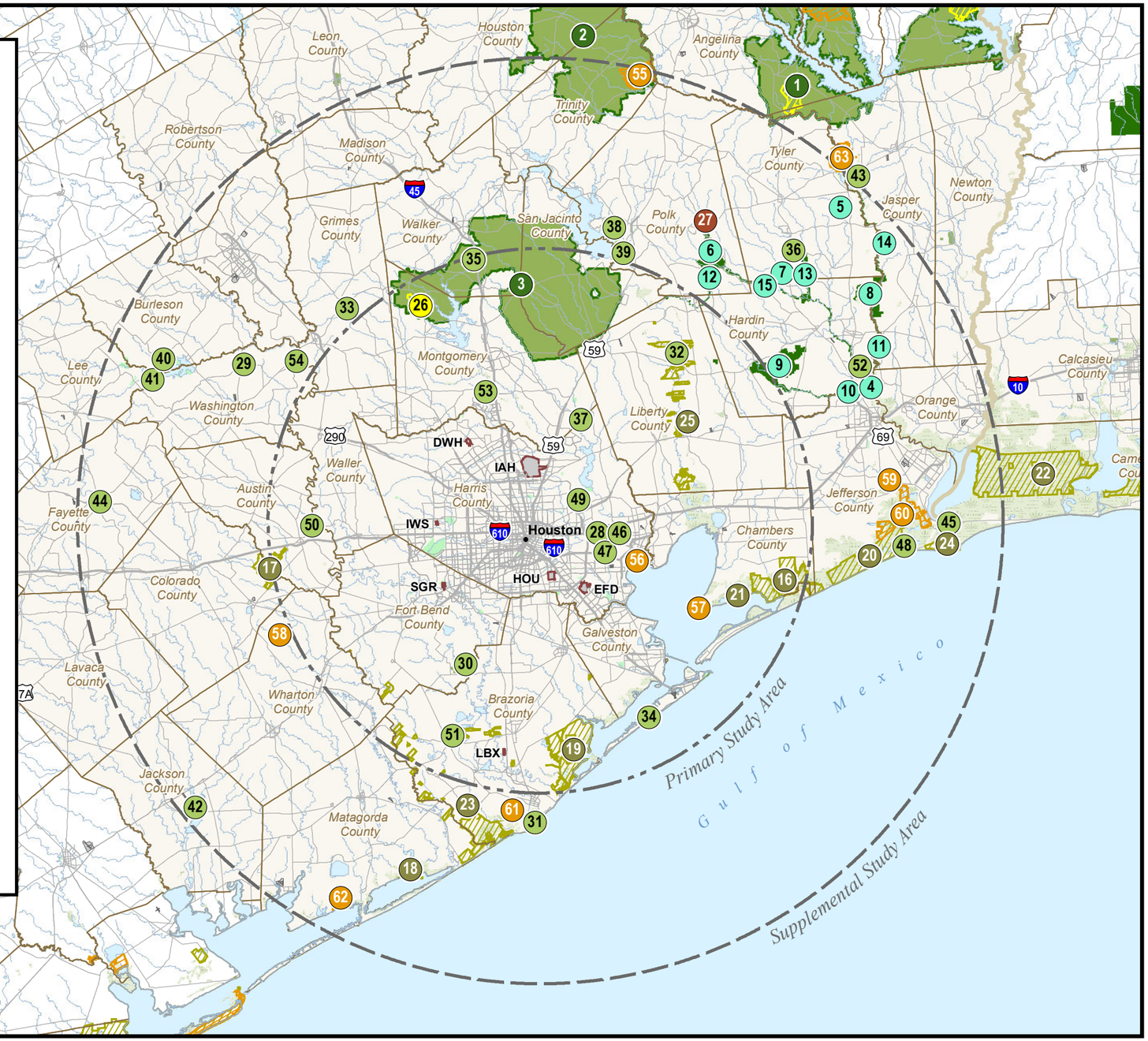
The PSA and SSA include numerous Federal, state, county, and city parks, as well as other potential Section 4(f) resources.[92] Figure 18 identifies the Federal and state resources. The FAA identified over 520 county and municipal parks in the PSA. A list of these is included in Appendix H, *Inventory of Potential Department of Transportation, Section 4(f) Resources and Noise Exposure*. The FAA developed the SSA to identify national parks and wildlife refuges that underlie proposed changes to air traffic procedures up to 18,000 ft. AGL. Although not required by FAA policy, this analysis also includes state parks and state wildlife management areas. The FAA identified potential national and state Section 4(f) resources within the PSA and SSA. The FAA identified these resources to assist in characterizing conditions in the existing environment.

The FAA sent letters to the appropriate Federal and state agencies responsible for management of potential Section 4(f) properties in the PSA and the SSA. These letters are included in Appendix J, *Coordination and Consultation*.

[91] *U.S. Code*. Title 16, sec. 450.
[92] The FAA collected data on publicly owned parks, refuges, National Atlas, Texas Natural Resource Information System (TNRIS), US Fish & Wildlife Service, United States Department of Agriculture, National Park Service, and the Environmental Systems Research Institute (ESRI).

National Forest	
1	Angelina National Forest
2	Davy Crockett National Forest
3	Sam Houston National Forest
National Parks	
4	BTNP - Beaumont Unit
5	BTNP - Beech Creek Unit
6	BTNP - Big Sandy Unit
7	BTNP - Hickory Creek Unit
8	BTNP - Jack Gore Baygall Unit
9	BTNP - Lance Rosier Unit
10	BTNP - Little Pine Island Bayou Unit
11	BTNP - Lower Neches Unit
12	BTNP - Menard Creek Unit
13	BTNP - Turkey Creek Unit
14	BTNP - Upper Neches Unit
15	BTNP - Village Creek
	BTNP: Big Thicket National Preserve
National Wildlife Refuge	
16	Anahuac National Wildlife Refuge
17	Attwater Prairie Chicken National Wildlife Refuge
18	Big Boggy National Wildlife Refuge
19	Brazoria National Wildlife Refuge
20	Mcfaddin National Wildlife Refuge
21	Moody National Wildlife Refuge
22	Sabine National Wildlife Refuge
23	San Bernard National Wildlife Refuge
24	Texas Point National Wildlife Refuge
25	Trinity River National Wildlife Refuge
National Wilderness Area	
26	Little Lake Creek Wilderness
Tribal Land	
27	Alabama-Coushatta Indian Reservation

State Parks	
28	Battleship Texas (BB-35)
29	Baylor University State Park
30	Brazos Bend State Park
31	Bryan Beach State Recreation Area
32	Davis Hill State Park
33	Fanthorp Inn State Historic Site
34	Galveston Island State Park
35	Huntsville State Park
36	John H Kirby State Forest
37	Lake Houston State Park
38	Lake Livingston State Park
39	Lake Livingston State Recreation Area
40	Lake Somerville State Park - Birch Creek
41	Lake Somerville State Park - Nails Creek
42	Lake Texana State Park
43	Martin Dies Jr. State Park
44	Monument Hill / Kreische Brewery State Historic Site
45	Sabine Pass Battleground - State Historical Park
46	San Jacinto Battleground State Historic Site
47	San Jacinto Battleground State Historic Site
48	Sea Rim State Park
49	Sheldon Lake State Park
50	Stephen F. Austin State Park
51	Varner-Hogg Plantation State Historical Park
52	Village Creek State Park
53	W G Jones State Forest
54	Washington-On-The-Brazos State Historic Site
State Wildlife Management Area	
55	Alabama Creek Wildlife Management Area
56	Atkinson Island WMA
57	Candy Abshier WMA
58	D R Wintermann WMA
59	J D Murphee State Wildlife Management Area
60	J D Murphee Wildlife Management Area
61	Justin Hurst/Peach Point WMA
62	Mad Island Wildlife Management Area
63	State Wildlife Scientific Area



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Data Source: Environmental Systems Research Institute, Inc.(ESRI) (Airport/Airport Runways), March 14, 2012; ESRI (State Boundaries/County Boundaries), February 14, 2012; ESRI (Cities), February 8, 2012; ESRI (Mountain Peaks), February 28, 2012; ESRI (Roads), March 14, 2012; National Atlas (Tribal Land/Wilderness Areas), February 08, 2012; Texas Natural Resource Information System (TNRIS) (Wildlife Management Areas), February 08, 2012; US Fish & Wildlife Service (National Wildlife Refuge), June 13, 2012; United States Dept of Agriculture (National Forest), May 07, 2012; National Park Service (National Park), February 07, 2012; TNRIS (State Parks or Forest/Local Parks), May 03, 2012; ESRI (Local Parks), May 03, 2012; TNRIS (Department of Defense), February 08, 2012

Prepared By: Harris Miller Miller & Hanson Inc., January, 2013

North

0 20 40 Miles

Primary Study Area
Secondary Study Area
Study Airports
Other Airports
County/Parish Boundary
National Forest
National Park
State Park or Forest
Local Park or Recreation Area
Alabama-Coushatta Tribe of Texas Reservation
National Wilderness Area
National Wildlife Refuge
State Wildlife Management Area
Water

Potential Department of Transportation Act, Section 4(f) Resources

Figure 18

Houston OAPM EA

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Land and Water Conservation Fund Act, Section 6(f) Resources

According to the U.S. Department of Interior (National Park Service)[94] since 1965 there have been 190 Land and Water Conservation Fund (LWCF) grants, totaling over $45.4 million, approved for a variety of state and local agencies within the 19 PSA counties. The grant funds have been provided to develop or improve regional parks and trails, state parks, and historic sites within the PSA counties.[95]

Existing Noise Exposure

For each resource, the FAA modeled the existing conditions (CY 2012) aircraft noise levels for potential Section 4(f) locations within the PSA at one or more grid points. The modeled aircraft noise levels for these locations varied depending on the property's proximity to a nearby airport. DNL values for the 3,246 grid points ranged from DNL 16 dB to 66 dB. Similarly, the FAA computed the 2012 aircraft noise levels in the SSA. As previously mentioned, noise modeling for these points was extended up to an altitude of 18,000 ft. AGL. The noise levels for the 152 grid points representing the Big Thicket National Preserve (all units) range from DNL 22 dB to 34 dB. Appendix H includes additional information, including a summary of the modeled noise exposure values at the grid points.

4.2.4 Historical, Architectural, Archeological, and Cultural Resources

This section presents information on the presence of known historical, architectural, archaeological, and cultural resources that the Proposed Action could affect. Similar to the manner in which aircraft noise influences the analysis of compatible land use and DOT Section 4(f) properties (see Sections 4.2.2 and 4.2.3), an assessment of the effects that the Proposed Action may have on historical, architectural, archaeological, and cultural uses occurs primarily in the context of the effects that aircraft noise could have on these resources.

4.2.4.1 Definition of Impact Category

The National Historic Preservation Act of 1966 (NHPA) requires the FAA to consider the effects of its undertakings on properties in or eligible for listing in the National Register of Historic Places (NRHP).[96] The NHPA requires the Secretary of the Interior to establish standards by which individual resources (both archaeological and architectural) are evaluated to determine their eligibility for listing on the NHRP.[97] Resources may include buildings, sites, objects, and structures. They are placed on the NRHP in reference to their (1) association with events that have made a significant contribution to the broad patterns of American history, (2) association with the lives of

[94] U.S. National Park Service (NPS), "Land & Water Conservation Fund (LWCF), Detailed Listing of Grants Grouped by County": http://waso-lwcf.ncrc nps.gov/public/index.cfm (accessed August 22, 2012).
[95] This review summary is at the county level and includes grants and projects outside the PSA, but within the 19 PSA counties.
[96] *Code of Federal Regulations*, Protection of Historic Properties, Title 36, Part 800.
[97] Ibid.

persons significant in our past, (3) architectural or archaeological significance, and/or (4) ability to yield information important in prehistory or history.[98]

Compliance with Section 106 of the NHPA may require consultation with the Tribal Historic Preservation Officer (THPO), the Advisory Council on Historic Preservation (ACHP), and/or the State Historic Preservation Officer (SHPO) if a Federal undertaking has a potential for an adverse effect to historic properties on or eligible for listing on the NRHP. The Proposed Action (changes to instrument flight procedures), is an undertaking under the meaning of *Code of Federal Regulations,* Title 36, sec. 800.16(y). The FAA provided notice to the Alabama-Coushatta Tribe of Texas and the SHPO in July 2012 that it was preparing this EA, soliciting information on potential historic and cultural resources and inviting comment on those already identified by the FAA (see Appendix J, *Coordination and Consultation*).

4.2.4.2 Existing Conditions

The Proposed Action would only involve changes in aircraft routing and would not involve land acquisition or construction that could cause physical destruction of, alterations to, or relocations to any properties or resources listed or eligible for listing in the NRHP, or listed by the Texas Historical Commission (THC) on its register of Recorded Texas Historic Landmarks. The THC serves the role of the SHPO in Texas. Under the NHPA, the Federal government, specifically the Department of the Interior (DOI), and the SHPO both have duties for this impact category.[99] Due to the lack of any physical ground disturbance, this EA does not consider effects on potential archaeological resources, as there is no potential for adverse effect of that impact category. To assess potential noise impacts to historic sites, architecture, landmarks, and traditional cultural properties, the FAA identified the historic districts and historic sites within the PSA, listed by either NHRP or THC.[100] The FAA sent this inventory to the ACHP, the Department of the Interior, the National Park Service (which maintains the NRHP), and the THC for review. These letters are included in Appendix J.

The Alabama-Coushatta Indian Reservation lies within the SSA, located east of Livingston, Texas and north of Big Thicket National Preserve, covering approximately 4,600 acres of timberland. Ninety percent of the Reservation is classified as commercial forestry. The Tribe's Forestry Department oversees all forestry-related activities on the Reservation, including protection and development of timber stands, wildfire protection and prevention, endangered species protection management (e.g., Red-Cockaded Woodpecker), and the protection of cultural and historical sites.[101] The Alabama-Coushatta Indian Reservation also includes the Lake Tombigbee

[98] *Code of Federal Regulations*, National Register of Historic Places, Title 36, sec. 60.
[99] Ibid., sec. 800.2(c).
[100] NPS, "National Register of Historic Places, Download Center": http://nrhp.focus.nps.gov/natreg/docs/Download html (accessed July 3, 2012).
Texas Historical Commission: ftp://ftp.thc.state.tx.us/ (accessed March 07, 2012).
[101] Alabama-Coushatta Tribe of Texas, "Tribal Departments, Natural Resources, Forestry": http://www.alabama-coushatta.com/TribalDepartments/NaturalResources/Forestry.aspx (accessed August 1, 2012).

Campgrounds. Located adjacent to the 26-acre Lake Tombigbee, camping facilities include a pavilion, picnic tables, fire rings, and swimming areas.[102] The FAA has notified the Alabama-Coushatta Tribe of Texas of this project, and a copy of that correspondence is included in Appendix J.

Figure 19 identifies the Alabama-Coushatta Tribe of Texas Reservation and other historic and cultural resources in the PSA.[103] A list of these resources, their designation status (Federal, state, or both), and modeled noise values is included in Appendix I, *Inventory of Historic Places and Noise Exposure*.

[102] Alabama-Coushatta Tribe of Texas, "Services, Campground": http://www.alabama-coushatta.com/Services/Campground.aspx (accessed August 1, 2012).
[103] This figure does not show the SSA boundary.

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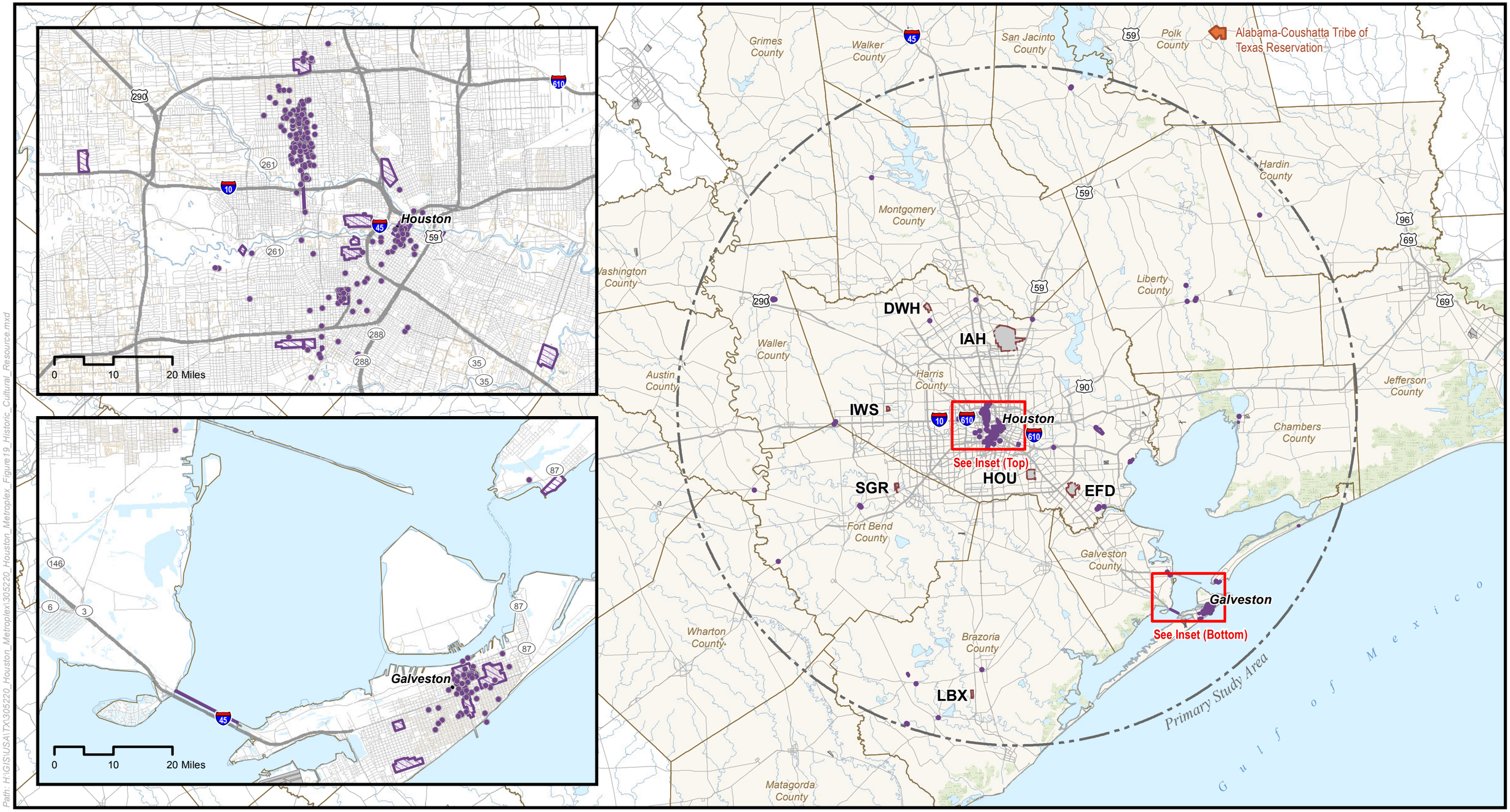

Path: H:\GIS\USA\TX\305220_Houston_Metroplex\305220_Houston_Metroplex_Figure19_Historic_Cultural_Resource.mxd

Data Source: Environmental Systems Research Institute, Inc.(ESRI) (Airport/Airport Runways), March 14, 2012; ESRI (State Boundaries/County Boundaries), February 14, 2012; ESRI (Cities), February 8, 2012; ESRI (Roads), March 14, 2012; Houston-Galveston Area Council (Water Features), March 14, 2012; National Atlas (Lakes/Rivers), September 10, 2012 (Updated); National Atlas (Tribal Land/Wilderness Areas), February 08, 2012; National Park Service (National Register of Historic Places), July 3, 2012; National Park Service (National Register of Historic Districts), July 3, 2012; Texas Historical Commission (Historic Properties), March 7, 2012;

Prepared By: Harris Miller Miller & Hanson Inc., January, 2013

North

0 10 20 Nautical Miles

Primary Study Area
Airport Boundary
Other Airports
State Boundary
County/Parish Boundary
Interstate Highway
Highways
Secondary Roads
Water
River/Stream
Alabama-Coushatta Tribe of Texas Reservation
National and/or State Listed Historic Place
National and/or State Listed Historic District

Primary Study Area Historical and Cultural Resources

Figure 19

Houston OAPM EA

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4.2.5 Air Quality

This section describes the legislative and regulatory directives that protect air quality. It also addresses the framework for assessing the effects that the Proposed Action may have on air quality, and the presence of existing pollutants in the 19 counties within the PSA. The section also includes a description of the current EPA attainment status designations (i.e., areas meeting or not meeting national air quality standards, as discussed below), and a summary of the local air monitoring data.

4.2.5.1 Definition of Impact Category

Pursuant to the Federal Clean Air Act of 1970 (CAA)[104], the U.S. Environmental Protection Agency (EPA) established National Ambient Air Quality Standards (NAAQS) for major pollutants, called "criteria pollutants." Currently there are six criteria pollutants: ozone (O3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM), and lead (Pb). PM includes particles with a diameter less than 10 micrometers (PM_{10}) and with a diameter of less than 2.5 micrometers ($PM_{2.5}$).

Table 16 shows the primary and secondary NAAQS for the criteria pollutants.[105] The NAAQS are two-tiered. The first tier (i.e., primary) is intended to protect public health; the second tier (i.e., secondary) is intended to prevent further degradation of the environment.

[104] *U.S. Code*. Title 42, sec. 7401 – 7676.
[105] *Code of Federal Regulations*, Title 40, Part 50.

Table 16 National Ambient Air Quality Standards

Pollutant	Averaging Time	Primary Standards [1,2]	Secondary Standards [1,3]
CO	8- hour	9 ppm	None
	1- hour	35 ppm	None
Pb [4]	Rolling 3-Month Average	0.15 µg/m³	Same as Primary
NO_2	Annual Arithmetic Mean	0.053 ppm	Same as Primary
	1-hour	0.100 ppm[5]	None
PM_{10}	Annual Arithmetic Mean	None	None
	24-hour	150 µg/m³	Same as Primary
$PM_{2.5}$	Annual Arithmetic Mean	15 µg/m³	Same as Primary
	24-hour	35 µg/m³	Same as Primary
O_3	8-hour (2008 standard)	0.075 ppm[8]	Same as Primary
	8-hour (1997 standard)	0.08 ppm[9]	Same as Primary
	1-hour	0.12 ppm[6]	Same as Primary
SO_2	1-hour	75 ppb[7]	None
	3-hour		0.5 ppm

ppm – parts per million
ppb – parts per billion
µg/m³ – micrograms per cubic meter

Notes:
National standards (other than ozone, particulate matter, and those based on annual averages) are not to be exceeded more than once per year. The ozone standard is attained when the fourth highest eight-hour concentration in a year, averaged over three years, is equal to or is less than the standard. For PM_{10}, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 ug/m³ is equal to or is less than one. For $PM_{2.5}$, the 24-hour standard is attained when 98% of the daily concentrations, averaged over three years, are equal to or are less than the standard.

1. Primary Standards: Levels necessary to protect public health with an adequate margin of safety.
2. Secondary Standards: Levels necessary to protect the public from any known or anticipated adverse effects.
3. Lead is categorized as a "toxic air contaminant" with no threshold exposure level for adverse health effects determined.
4. To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 0.100 ppm.
5. EPA has revoked the 1-hour ozone standard in all areas within the PSA.
6. To attain this standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 75 ppb.
7. To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm. (effective May 27, 2008)
8. To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.

The standards in Table 16 apply to the concentration of a pollutant in outdoor ambient air. If the air quality in a geographic area meets or exceeds the national standard, it is designated an attainment area. Areas that do not meet the national standard are designated non-attainment areas. If there is insufficient information to classify an area as attainment or non-attainment for a particular air pollutant, the area is designated unclassifiable for that pollutant. Once a non-attainment area meets the standards, the EPA will designate the area as a "maintenance area."

Each state is required to draft a State Implementation Plan (SIP) to improve further the air quality in non-attainment areas and to maintain the air quality in attainment and maintenance areas. The SIP outlines the measures that the state will take in order to improve air quality.

4.2.5.2 Existing Conditions

Table 17 presents the EPA-designated attainment status for the counties, in part or in whole, within the PSA. The EPA has designated parts of the area as non-attainment for the 8-hour ozone NAAQS. There are also counties previously designated as non-attainment for the old 1-hour ozone standard.[106] The counties in the PSA are in attainment of the NAAQSs for the remaining criteria pollutants (i.e., CO, SO_2, NO_2, PM_{10}/$PM_{2.5}$, and Pb).

[106] EPA revoked the 1-hour standard as of June 15, 2005.

Table 17 EPA Designated Attainment Status for PSA

County	Pollutant[1]	Designated Attainment Status[4,5,6]
Austin	Ozone 8-hour (1997)[2] Ozone 8-hour (2008)[3]	Attainment Attainment
Brazoria	Ozone 8-hour (1997)[2] Ozone 8-hour (2008)[3]	Severe-15 Marginal
Colorado	Ozone 8-hour (1997)[2] Ozone 8-hour (2008)[3]	Attainment Attainment
Chambers	Ozone 8-hour (1997)[2] Ozone 8-hour (2008)[3]	Severe-15 Marginal
Fort Bend	Ozone 8-hour (1997)[2] Ozone 8-hour (2008)[3]	Severe-15 Marginal
Galveston	Ozone 8-hour (1997)[2] Ozone 8-hour (2008)[3]	Severe-15 Marginal
Grimes	Ozone 8-hour (1997)[2] Ozone 8-hour (2008)[3]	Attainment Attainment
Hardin	Ozone 8-hour (1997)[2] Ozone 8-hour (2008)[3]	Maintenance Attainment
Harris	Ozone 8-hour (1997)[2] Ozone 8-hour (2008)[3]	Severe-15 Marginal
Jefferson	Ozone 8-hour (1997)[2] Ozone 8-hour (2008)[3]	Maintenance Attainment
Liberty	Ozone 8-hour (1997)[2] Ozone 8-hour (2008)[3]	Severe-15 Marginal
Montgomery	Ozone 8-hour (1997)[2] Ozone 8-hour (2008)[3]	Severe-15 Marginal
Polk	Ozone 8-hour (1997)[2] Ozone 8-hour (2008)[3]	Attainment Attainment
San Jacinto	Ozone 8-hour (1997)[2] Ozone 8-hour (2008)[3]	Attainment Attainment
Matagorda	Ozone 8-hour (1997)[2] Ozone 8-hour (2008)[3]	Attainment Attainment
Waller	Ozone 8-hour (1997)[2] Ozone 8-hour (2008)[3]	Severe-15 Marginal
Walker	Ozone 8-hour (1997)[2] Ozone 8-hour (2008)[3]	Attainment Attainment
Washington	Ozone 8-hour (1997)[2] Ozone 8-hour (2008)[3]	Attainment Attainment
Wharton	Ozone 8-hour (1997)[2] Ozone 8-hour (2008)[3]	Attainment Attainment

Notes:
1. There are also counties previously designated as non-attainment for the old 1-hour ozone standard. EPA has since revoked the 1-hour standard as of June 15, 2005.
2. Ozone 8-hour (1998) denotes attainment status with the 1997 standard.
3. Ozone 8-hour (2008) denotes attainment status with the 2008 standard.
4. Severe 17 Area has a design value of 0.190 up to 0.280 ppm and has 17 years to attain.
5. Severe 15 Area has a design value of 0.120 up to but not including 0.127 ppm
6. Marginal Area has a design value of 0.076 up to but not including 0.086 ppm.

EPA and local state agencies operate ambient monitoring stations that are used to assess air quality in each state. To characterize the existing conditions of the counties in the PSA, the FAA reviewed the most recent data from the Texas Commission on

Environmental Quality (TCEQ) and the EPA AirData database. The TCEQ operates these monitoring stations to measure ambient air quality and ensure compliance of the NAAQS. Since IAH and HOU are located in Harris County, the FAA chose the highest monitored values recorded within Harris County for 2011. This is conservative since the highest values were chosen regardless of location or representativeness to IAH or HOU. The analysis consisted of the criteria pollutants regulated by the NAAQS. Table 18 presents a summary of the ambient background air quality concentrations.

The review showed that there were no violations of the NAAQS at any of the Harris County monitoring locations, except for the 8-hour ozone standard. TCEQ operated 17 ozone-monitoring locations within Harris County for 2011, measuring 139 exceedences against the 8-hour ozone standard for 2011. TCEQ measured the maximum 8-hour ozone concentration of 0.101 ppm at the Croquet location for 2011. The EPA revoked the 1-hour ozone standard on June 15, 2005 for all affected counties within the PSA and, therefore, was not included in this analysis.

Table 18 Ambient Background Air Quality Concentrations

County	Carbon Monoxide (CO)		Nitrogen Dioxide (NO_2)		Sulfur Dioxide (SO_2)		Ozone	$PM_{2.5}$		PM_{10}	Lead
	1-Hour	8-Hour	1-Hour	Annual	1-Hour	3-Hour	8-Hour	24-Hour	Annual	24-Hour	Quarterly
Harris	3.0	2.0	60	No Data	41	No data Available	0.101	24	13.3	92	0.015
NAAQS	35 ppm	9 ppm	100ppb	0.053 ppm	75 ppb	0.14 ppm	0.075 ppm	35 ug/m³	15 ug/m³	150 ug/m³	0.15 ug/m³

Notes:
1. CO monitor located at 4401 ½ Lang Road, Houston, TX.
2. NO_2 monitor located at 2311 Texas Ave, Houston, TX.
3. SO_2, PM_{10}, $PM_{2.5}$ monitor located at 9525 Clinton Dr., Houston, TX.
4. Ozone monitor located at 13826 ½ Croquet, Houston, TX.
5. Lead monitor located at 1262 ½ Mae Dr., Houston, TX.

Source: http://www.epa.gov/airdata/

4.2.6 Natural Resources and Energy Supply (Aircraft Fuel)

The natural resource and energy supply environmental impact category covers a wide range of activities. However, for the purposes of this EA and the Proposed Action only aircraft fuel consumption is relevant. This section describes fuel consumption related to the existing movement of aircraft within the SSA (and 10 NM outside the SSA[107]), using the same operational inputs as discussed in Section 4.2.1.

[107] The tracks developed for NIRS go 10 NM beyond the SSA. This extra 10 NM allows modeling of noise values up to the edge of the SSA.

4.2.6.1 Definition of Impact

Executive Order 13123, "Greening the Government through Efficient Energy Management," requires agencies to reduce petroleum use, air quality emissions, and water consumption.[108] According to FAA Order 1050.1E and consistent with NEPA and CEQ regulations, it is also the policy of the FAA that all elements of the transportation system should be "designed with a view to their aesthetic impact, conservation of resources such as energy, pollution prevention, harmonization with community environment, and sensitivity to the concerns of the traveling public."[109]

In addition, *Code of Federal Regulations,* Title 40, sec. 1502.16(e-f) require Federal agencies to assess each alternative's energy requirements, energy conservation, and the use of natural or consumable resources.

In determining the significance of impacts, FAA Order 1050.1E, Appendix A, section 13 states the following:

> "For most actions, changes in energy demands or other natural resource consumption will not result in significant impacts. If an EA identifies problems such as demands exceeding supplies, additional analysis may be required in an EIS. Otherwise, it may be assumed that impacts are not significant."

In assessing the potential for significant impacts, this analysis considers the following factors in assessing the potential to cause demands that would exceed available or future (project year) natural resource or energy supplies:

- The action would cause a substantial demand on available energy or natural resource supplies.
- When compared with future no action conditions, changes in aircraft movements would cause a statistically significant increase in fuel consumption.

4.2.6.2 Existing Conditions

The FAA calculated aircraft fuel burn to estimate aircraft fuel consumption associated with air traffic flows in existing conditions (i.e., 2012 Base Year) using NIRS, which calculates fuel burn using the same input used for calculating aircraft noise. According to the NIRS calculation, approximately 524,701 Metric Tons (MT) of fuel are forecasted to be burned in the 2012 Base Year by IFR aircraft arriving at and departing from the Analyzed Airports, while in flight through the SSA (and 10 NM outside the SSA).[110]

[108] U.S. Department of Energy (DOE), Executive Order 13123, "Greening the Government through Efficient Energy Management: Guidance Documents for Federal Agencies," December 2000.
[109] FAA Order 1050.1E, App. A, sec. 13.1b, p. A-58.
[110] One metric ton (MT) = 1,000 kilograms (kg)

4.2.7 Climate

This section presents a discussion of global climate change as it relates to aircraft emissions of greenhouse gases (GHGs). It also provides the calculated GHG emissions based on estimated aircraft fuel burn for existing conditions, as derived in Section 4.2.6.

4.2.7.1 Definition of Impact Category

The Council on Environmental Quality (CEQ) has recently affirmed the need to describe GHG emissions and their effect on climate as part of the NEPA analysis.[111] Executive Order 13514, "Federal Leadership in Environmental, Energy, and Economic Performance," defines GHG emissions as carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydro fluorocarbons (HFCs), and sulfur hexafluoride (SF_6). In accordance with the CEQ document *Federal Greenhouse Gas Accounting and Reporting Guidance* (October 6, 2010),[112] and to provide a single metric that embodies all GHGs, emissions should be reported in metric tons of carbon dioxide equivalent (MT CO_2e). It is important to note that for aircraft, CO_2 emissions are equivalent to CO_2e emissions because CO_2 is the only combustion product of the six GHGs in the CEQ document.

Research has shown there is a direct correlation between fuel combustion and GHG emissions. In terms of U.S. contributions, the General Accounting Office (GAO) reports that according to EPA data, "domestic aviation contributes about 3 percent of the total carbon dioxide emissions" compared with other industrial sources including the remainder of the transportation section (20 percent) and power generation (41 percent)[113]. The International Civil Aviation Organization (ICAO) estimates that GHG emissions from aircraft account for roughly 3 percent of all anthropogenic[114] GHG emissions globally.[115] Climate change due to GHG emissions is a global phenomenon, so the affected environment is the global environment.[116]

The scientific community is continuing efforts to better understand the impact of aviation emissions on the global atmosphere. The FAA is leading and participating in a number of initiatives intended to clarify the role that commercial aviation plays in GHG emissions and climate. The FAA, with support from the U.S. Global Change Research Program

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[111] FAA Order 1050.1E, Chg. 1, Guidance Memo#3, "Considering Greenhouse Gases and Climate under the National Environmental Policy Act (NEPA): Interim Guidance," January 12, 2012.
[112] Council on Environmental Quality (CEQ), *Federal GHG Accounting and Reporting*, and *Technical Support Document* (corresponding): http://www.whitehouse.gov/administration/eop/ceq/sustainability/fed-ghg.
[113] Government Accountability Office (GAO), "Aircraft Emissions Expected to Grow, but Technological and Operational Improvements and Government Policies Can Help Control Emissions," GAO-09-554, 2009.
[114] Anthropogenic emissions are those produced by human activities.
[115] Alan Melrose, "European ATM and Climate Adaptation: A Scoping Study", *ICAO Environmental Report*, 2010.
[116] "[Greenhouse] gases, once emitted, become well mixed in the atmosphere, meaning U.S. emissions can affect not only the U.S. population and environment but other regions of the world as well; likewise, emissions in other countries can affect the United States." U.S. Environmental Protection Agency, *Technical Support Document for Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act 2-3*, 2009: http://epa.gov/climatechange/endangerment.html

and its participating Federal agencies,[117] has developed the Aviation Climate Change Research Initiative (ACCRI) in an effort to advance scientific understanding of regional and global climate impacts of aircraft emissions. The FAA also funds the Partnership for Air Transportation Noise & Emissions Reduction (PARTNER) Center of Excellence research initiative to quantify the effects of aircraft exhaust and contrails on global and U.S. climate and atmospheric composition. ICAO is examining similar research topics at the international level.[118]

4.2.7.2 Existing Conditions

An analysis of 2012 Base Year IFR operations, using the same operational inputs as discussed in Section 4.2.1.1, indicates that approximately 524,701 MT of fuel will be burned in 2012 by aircraft arriving at and departing from the Analyzed Airports.[119] Aircraft in flight through the SSA would account for emissions of 1,655,432 MT of CO_2e.

4.2.8 Fish, Wildlife, and Plants

This section describes the legislative and regulatory directives concerning protection of certain species of fish, wildlife, and plants. It also describes the relevant baseline conditions for species that the Proposed Action could potentially affect. The Proposed Action, comprised of changes to aircraft flight procedures, would not involve construction or land disturbing activities with the potential to alter habitat for fish, wildlife, and plants on the ground. Therefore, the discussion and analysis of this impact category is limited to avian and bat species that occupy the airspace, subject to evaluation in the PSA and the 19 associated counties.

4.2.8.1 Definition of Impact Category

Endangered Species Protection Laws

The U.S. *Endangered Species Act (ESA) of 1973* protects threatened and endangered species of fish, wildlife, and plants. Endangered species are defined as those in danger of extinction throughout all or a significant portion of its range. Threatened species are defined as any species that are likely to become an endangered species, within the foreseeable future, throughout all or a significant portion of its range. Section 7 of the ESA applies to Federal agency actions and sets forth requirements for consultation to determine if the proposed action "may affect" an endangered or threatened species. If an agency determines that an action authorized, funded, or carried out by the agency "may affect" a threatened or endangered species, then Section 7(a)(2) requires

[117] Including the National Aeronautics and Space Administration (NASA), the National Oceanic and Atmospheric Administration (NOAA), the Department of Energy (DOE), and the EPA.
[118] Lourdes Q. Maurice and David S. Lee, "Chapter 5: Aviation Impacts on Climate," in *Final Report of the International Civil Aviation Organization (ICAO) Committee on Aviation and Environmental Protection (CAEP) Workshop, October 29th – November 2nd 2007, Montreal*: http://www.icao.int/icaonet/cnfrst/CAEP_SG_20082/docs/Caep8_SG2_WP10.pdf
[119] Fuel burn and CO_2 emissions are generated in NIRS. The formula to convert fuel burn to CO_2 emissions is Fuel (kilograms)*3.155 = CO_2.

consultation with the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS), as appropriate. This consultation is intended to ensure that the action is not likely to jeopardize the continued existence of the species or result in the destruction or adverse modification of critical habitat. For avian and bat species, Section 7 Consultation is conducted with the USFWS.

The Texas legislature enacted legislation in 1973 to protect endangered animal populations in the state.[120] The legislation authorized the Executive Director of the Texas Parks and Wildlife Department (TPWD) to designate as "endangered" plants and animals threatened with statewide extinction, and the TPWD Commission to designate species with the potential to become endangered in the future as "threatened." The TPWD maintains a list of species receiving Federal and state protection on its website and references the NatureServe Explorer[121] database for specific information. The TPWD also maintains the Texas Natural Diversity Database (TXNDD)[122] as the most comprehensive source for information on rare, threatened, and endangered plants, animals, invertebrates, exemplary natural communities, and other significant features.

Migratory Birds

The *Migratory Bird Treaty Act of 1918* (MBTA), as amended, prohibits the pursuit, hunting, taking, and killing, or attempts to do the same of any migratory bird, or part of a bird including egg or nest, unless permitted by regulation.[123] It authorizes the Secretary of the Interior to enforce the law and establish regulations as necessary. Executive Order 13186, "Responsibilities of Federal Agencies To Protect Migratory Birds," signed in January 2001, required all Federal agencies to enact and implement Memoranda of Understanding (MOUs) with the USFWS to enhance programs to protect migratory birds and, in particular, species of concern.[124] The MBTA and Executive Order together require that Federal agencies ensure that their actions do not impact migratory bird species populations and that the effects of those actions on migratory birds be evaluated through the NEPA process.

Code of Federal Regulations, Title 50, sec. 10.13 lists the species defined as migratory birds and included for protection under the MBTA and Executive Order 13186.[125]

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[120] Texas Parks and Wildlife Department (TPWD), "Nongame and Rare Species Program: Texas Threatened/Endangered Species Regulations": http://www.tpwd.state.tx.us/huntwild/wild/wildlife_diversity/texas_rare_species/txendangered/ (accessed June 13, 2012).
[121] NatureServe, *Explorer*: http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Buteo+nitidus (accessed June 13, 2012).
[122] Texas Parks and Wildlife Department (TPWD), "The Texas Natural Diversity Database (TNDD)": http://www.tpwd.state.tx.us/huntwild/wild/wildlife_diversity/txndd/ (accessed October 30, 2012).
[123] *U.S. Code.* Title 16, sec. 590z.
[124] USFWS, "Digest of Federal Resource Laws": http://www.fws.gov/laws/lawsdigest/EO htm#eo13186 (accessed June 13, 2012).
[125] John L. Trapp, "Bird Species of the United States and its Territories and Their Protection under the Migratory Bird Treaty Act," USFWS:

There are 1,007 species for protection under the MBTA.[126] Texas has recorded 333 species of migratory birds, more than any other state.[127] The MBTA and Executive Order 13186 protect nearly all bird species that occur in the PSA, with the exception of those that do not migrate.

Migration routes or "flyways" refer to the broad geographic corridors utilized by birds traveling from breeding to wintering grounds. The actual routes followed by a given migratory bird species differ by variables such as distance traveled, time of starting, flight speed, and geographic position and latitude of the breeding and wintering grounds.

4.2.8.2 Existing Conditions

Threatened and Endangered Species

The two animal groups described in this section are birds and bats. Table 19 includes avian and bat species identified as occurring in the 19 counties of the PSA and the status of Federal and state endangered species listing. It includes 16 bird species and one bat species. The ESA lists seven of the 17 species for protection, while Texas state endangered species law lists all 17 for protection.

Table 19 Listed Endangered Avian and Bat Species Potentially Occurring in the Study Area

Common Name	Scientific Name	Counties	Federal Listing Status[128]	State Listing Status[129]
BIRDS				
Attwater's Greater Prairie-Chicken	*Tympanuchus cupido attwateri*	Austin, Colorado, Fort Bend, Galveston, Waller, Wharton	E	E
Bachman's Sparrow	*Aimophila aestivalis*	Hardin, Liberty, Polk, San Jacinto, Walker	NL	T
Bald Eagle	*Haliaeetus*	Austin, Brazoria, Chambers, Colorado, Fort Bend,	NL	T

http://www.fws.gov/migratorybirds/RegulationsPolicies/mbta/MBTAProtectedNonprotected.html (accessed August 29, 2012).

[126] USFWS, "Official Number of Protected Migratory Bird Species Climbs to More than 1,000": http://www.fws.gov/news/NewsReleases/showNews.cfm?newsId=1A6C3012-D22E-4F75-ABD98CD33992DD42 (accessed June 14, 2012).

[127] TPWD, "Frequently Asked Questions": http://www.tpwd.state.tx.us/huntwild/wild/birding/migration/faq/ (accessed June 14, 2012).

[128] USFWS, "Endangered Species Program": http://www.fws.gov/southwest/es/EndangeredSpecies/EndangeredSpecies_Lists/EndangeredSpecies_ListSpecies.cfm (accessed June 13, 2012).

[129] TPWD: http://www.tpwd.state.tx.us/gis/ris/endangered_species/ (accessed June 13 and October 15, 2012); http://www.tpwd.state.tx.us/landwater/land/maps/gis/ris/endangered_species/ (accessed October 15, 2012).

Common Name	Scientific Name	Counties	Federal Listing Status[128]	State Listing Status[129]
	leucocephalus	Galveston, Grimes, Hardin, Harris, Jefferson, Liberty, Matagorda, Montgomery, Polk, San Jacinto, Walker, Waller, Washington, Wharton		
Eskimo Curlew	*Numenius borealis*	Brazoria, Galveston, Matagorda	E	E
Interior Least Tern	*Sterna antillarum athalassos*	Austin, Colorado, Fort Bend, Grimes, Waller, Washington, Wharton	E	E
Northern Aplomado Falcon	*Falco femoralis septentrionalis*	Matagorda	E	E
Peregrine Falcon	*Falco peregrines*	Austin, Brazoria, Chambers, Colorado, Fort Bend, Galveston, Grimes, Hardin, Harris, Jefferson, Liberty, Matagorda, Montgomery, Polk, San Jacinto, Walker, Waller, Washington, Wharton	NL	T
Piping Plover	*Charadrius melodus*	Brazoria, Chambers, Galveston, Hardin, Jefferson, Liberty, Matagorda, Montgomery, Polk, San Jacinto, Walker	T	T
Red-cockaded Woodpecker[1]	*Picoides borealis*	Grimes, Hardin, Harris, Liberty, Montgomery, Polk, San Jacinto, Walker	E	E
Reddish Egret	*Egretta rufescens*	Brazoria, Chambers, Galveston, Jefferson, Matagorda	NL	T
Sooty Tern	*Sterna fuscata*	Chambers, Hardin, Jefferson, Liberty, Polk, San Jacinto	NL	T
Swallow-tailed Kite	*Elanoides forficatus*	Chambers, Hardin, Jefferson, Liberty, Polk, San Jacinto	NL	T
White-tailed Hawk	*Buteo albicaudatus*	Austin, Brazoria, Colorado, Fort Bend, Galveston, Harris, Matagorda, Waller, Wharton	NL	T
White-faced Ibis	*Plegadis chihi*	Austin, Brazoria, Chambers, Colorado, Fort Bend, Galveston, Grimes, Hardin, Harris, Jefferson, Liberty, Matagorda, Montgomery, Waller, Washington, Wharton	NL	T
Wood Stork	*Mycteria americana*	Austin, Brazoria, Chambers, Colorado, Fort Bend, Galveston, Grimes, Hardin, Harris, Jefferson, Liberty, Matagorda, Montgomery, Polk, San Jacinto, Walker, Waller, Washington, Wharton	NL	T
Whooping Crane	*Grus americana*	Austin, Brazoria, Colorado, Fort Bend, Galveston, Grimes, Harris, Matagorda, Montgomery, Walker, Waller, Washington, Wharton	E	E
BATS				
Rafinesque's Big-Eared Bat	*Corynorhinus rafinesquii*	Hardin, Harris, Jefferson, Liberty, Montgomery, Polk, San Jacinto, Walker	NL	T

E – Endangered
T – Threatened
NL – Not Listed
Note:
1. The Red-cockaded Woodpecker was identified by the National Forests and Grasslands in Texas (NFGT) in a comment letter dated July 31, 2012 (see Appendix J.3)

The species listed above could occur in the study area when transiting to and from areas necessary to satisfy species basic life requirements of food, shelter, and breeding.

Bats

The Texas Bat Protection Law protects all bats from hunting or possession and sale.[130] While 31 species of bats occur in Texas, only two are relevant to the Proposed Action: (1) Rafinesque's big-eared bat and (2) the Mexican free-tailed bat.[131]

The Rafinesque's big-eared bat is the only bat species in Texas protected as an endangered species, listed as a "threatened" species under state law, as noted in Table 19. The USFWS considers both its identified subspecies – *C. r. macrotis* and *C. r. rafinesquii* – as rare and as a species of special concern. Rafinesque's big-eared bats occur in the Study Area as single individuals in small colonies. For more information, see the TPWD website.[132]

The Mexican free-tailed bat occurs in large colonies in Central Texas, including a colony of about 250,000 individuals that roost year-round under the Waugh Drive Bridge in Houston.[133] Figure 20 shows the location of the colony. Detailed radar studies conducted on a colony north of San Antonio recorded Mexican free-tailed bats flying at a maximum altitude of 10,000 ft. AGL, with the densest occurrence between 600 and 3,200 ft. AGL.[134] This EA accounts for the Mexican free-tailed bat in relation to the Proposed Action due to its concentrated population in specific areas of the PSA. None of the other 29 bat species known to inhabit Texas either are listed as endangered or occur in large colonies in the Study Area.

[130] Texas Bat Protection Law. *Texas Statues, 2001*. Title 5 § 63.101.
[131] U.S. Geological Survey (USGS), "House Bat Management: Discussion and Recommendations": http://www.npwrc.usgs.gov/resource/mammals/housebat/discuss.htm (accessed June 22, 2012)
[132] TPWD, "Rafinesque's Big-eared Bat (Corynorhinus rafinesquii)": http://www.tpwd.state.tx.us/huntwild/wild/species/rafinesque/ (accessed August 29, 2012)
[133] Bat Conservation International, "BCI Species Profiles: Tadarida brasiliensis": http://www.batcon.org/index.php/all-about-bats/species-profiles html?task=detail&species=1738&country=43&state=all&family=all&start=25 (accessed June 22, 2012)
[134] G.F. McCracken, "Bats Aloft: A Study of High-Altitude Feeding," *BATS* 14(3): p.7-10 (1996).

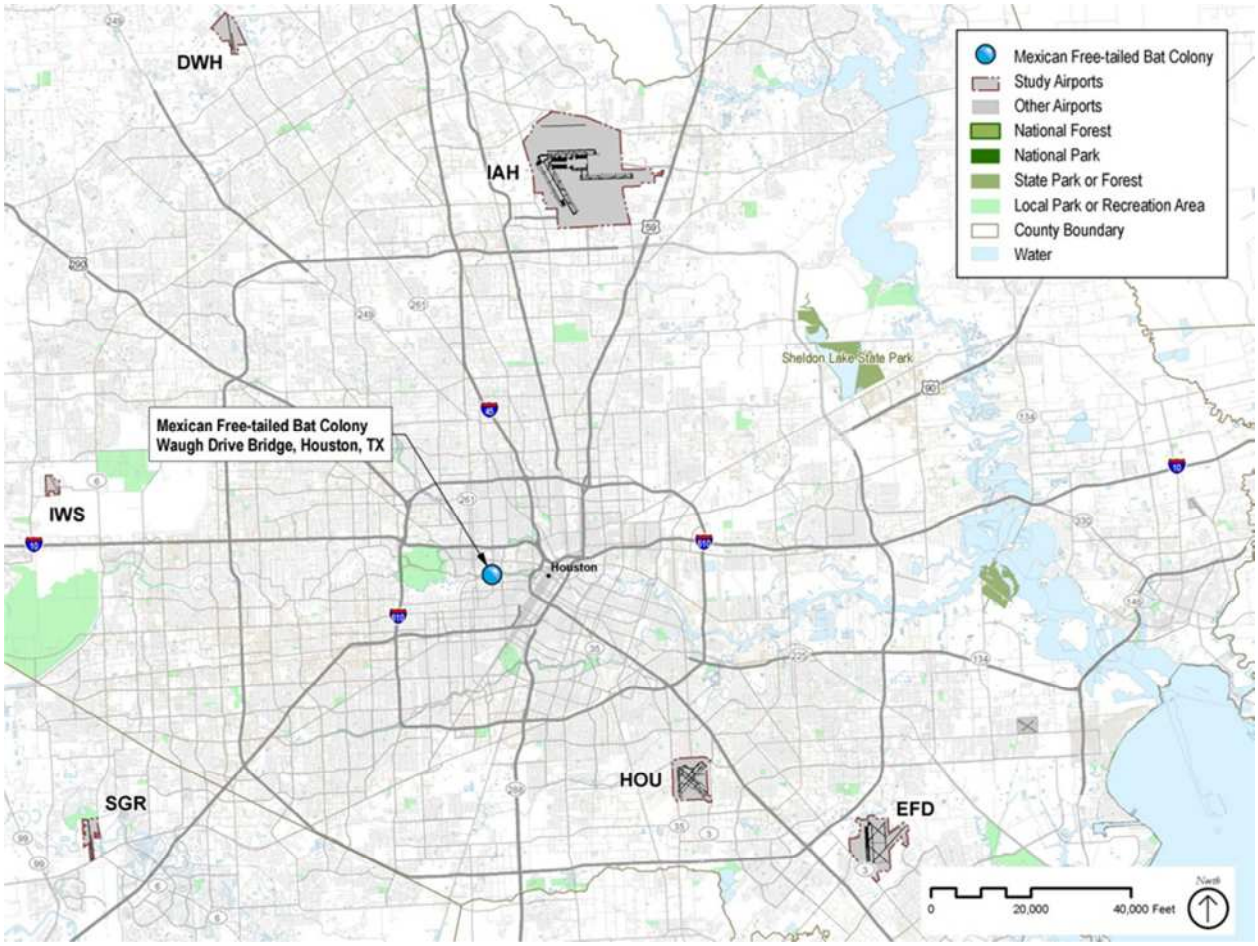

Figure 20 Mexican Free-Tailed Bat Colony

Migratory Bird Treaty Act Species

The USFWS and its partner agencies manage for migratory birds based on specific migratory route paths within North America (Atlantic, Mississippi, Central, and Pacific). Based on those route paths, state and Federal agencies developed the four administrative Flyways that administer migratory bird resources.[135] These flyways are not specific lines the birds follow but broad areas through which the birds migrate. The most frequently traveled migration routes conform very closely to major topographical features that lie in the general north-south movement of migratory bird flyways.

Texas is in the middle of the Central Flyway, which is the primary migratory route for birds that travel from Central America through the middle of North America. As a group, migratory birds generally fly from south to north in spring and return south in the fall. Some species transit through Texas to breeding locations further north while others

[135] USFWS, "Migratory Bird Flyways": http://www.fws.gov/migratorybirds/Flyways.html (accessed June 22, 2012).

breed and nest during the summer months in Texas. Species are grouped into zoogeographic regions based on how far south they winter and how far north they breed. The Central Flyway does not include any known subsets of specific migratory routes and, therefore, the USFWS does not classify any particular area of Texas as more important to migration than another area.

Habitat for Avian Species of Concern

In response to a request for information, the U.S. Department of Agriculture (USDA) and the TXNDD submitted information on the habitat of two avian species of particular concern: Red-cockaded Woodpecker and Piping Plover. While the Proposed Action is confined to changes in aircraft flight procedures and would not involve construction or land disturbing activities with the potential to alter habitat for fish, wildlife, and plants on the ground, these comments are briefly summarized.

The USDA National Forests and Grasslands in Texas (NFGT) identified the Red-cockaded Woodpecker and its habitat in a comment letter dated July 31, 2012 (see Appendix J). The letter identifies the importance of three national forest properties (Sam Houston, Davy Crockett, and Angelina) in the study area and the concern of changes in flight patterns and altitudes over the Sam Houston National Forest, which has the largest population of Red-cockaded Woodpecker. The Wildlife Strike Database (discussed in Section 5.9) does not identify any specific strikes associated with Houston OAPM Airports of the Red-cockaded Woodpecker, or any other woodpecker species. According to BirdLife International, the Red-cockaded Woodpecker ranges in altitude from ground level to approximately 500 meters (m), or approximately 1,640 ft.[136]

The TPWD identified critical habitat for the Piping Plover on October 24, 2012 in response to a request for information through the TXNDD (see Appendix J). The USFWS has identified habitat for wintering Piping Plover on barrier beaches and mudflats along the Gulf Coast.[137] The Wildlife Strike Database does not identify any specific strikes associated with Houston OAPM Airports of the Piping Plover. However, there are two reports of plover strikes: one of an American golden plover and another of an unidentified plover struck at ground level. Research on flight altitude is limited primarily because of its strong fidelity to wintering and breeding habitats and limited movement during non-migratory periods.[138] However, flight during migration when populations are moving between breeding grounds in the Great Lakes and wintering areas along the Gulf Coast should be considered.

[136] BirdLife International, "Species Factsheet: Picoides borealis": http://www.birdlife.org (accessed August 8, 2012).
[137] USFWS, "Recovery Plan for the Great Lakes Piping Plover," USFWS Region 3, Fort Snelling, MN, September 2003.
[138] J. Thompson, K. Drake, and C. Zonick, "Movements, Habitat Use and Survival of Non-breeding Piping Plovers," *The Condor*, 103:259-267 (2001).

4.2.9 Light Emissions and Visual Impacts

This section defines the light emissions and visual impacts category and describes relevant conditions in the study area.

4.2.9.1 Definition of Impact Category

For light emissions, the FAA considers the extent to which any lighting associated with an action would create an annoyance among people in the vicinity or interfere with their normal activities. The FAA does not consider the visual sight of aircraft, aircraft contrails, or aircraft lights at night, particularly at a distance that is not normally intrusive, as constituting an adverse impact absent unusual circumstances.

4.2.9.2 Existing Conditions

The City of Houston is a highly urbanized area at the center of the PSA surrounded by suburban and rural communities. Sources of light and the visual landscape are typical of cities, suburbs, and rural areas throughout the United States.

A large number of aircraft operations currently occur and numerous aircraft are visible within the PSA airspace, flying at various altitudes. Aircraft operations consist of aircraft arrivals, departures, and overflights. According to Federal Aviation Regulations (FAR), Section 91.209, all aircraft are required to operate with position lights. These position lights are intended for the safe movement of aircraft and do not emit a significant amount of light; however, these lights are often visible from the ground.

4.2.10 Environmental Justice

The U.S. EPA defines Environmental Justice (EJ) as the "fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies."[139]

4.2.10.1 Definition of Impact Category

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority and Low-Income Populations," the accompanying Presidential Memorandum, and DOT Order 5610.2(a), "Department of Transportation Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," provide guidance for the Federal government, including the FAA, with regard to Environmental Justice compliance. The FAA must provide (1) meaningful public involvement by minority and low-income populations and (2) analysis, including demographic analysis, which identifies and addresses potential impacts on those populations that may be disproportionately high and adverse. The Presidential Memorandum encourages the consideration of EJ impacts in EAs, especially to determine whether a disproportionately high and adverse impact may occur. Although such an analysis is

[139] EPA, "Environmental Justice": http://www.epa.gov/environmentaljustice/ (accessed August 21, 2012).

not required in an EA, it may be helpful in determining whether there is a potentially significant impact.[140]

4.2.10.2 Existing Conditions

The FAA used data from the 2010 U.S. Census[141] and 2006-2010 American Community Survey (ACS 5 year dataset)[142] (the most recent available) to identify minority populations and low-income populations in the PSA. DOT Order 5610.2(a) defines "low-income" as "a person whose median household income is at or below the Department of Health and Human Services (HHS) poverty guidelines."[143] The order defines "minority" as one of the following categories:

- Black – a person having origins in any of the black racial groups of Africa
- Hispanic or Latino – a person of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race
- Asian American – a person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent
- American Indian and Alaskan Native – a person having origins in any of the original people of North America, South America (including Central America), and who maintains cultural identification through tribal affiliation or community recognition
- Native Hawaiian and Other Pacific Islander – persons having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands

This EA performed analysis at the U.S. Census block group level,[144] defining and identifying census blocks for minority and low-income population as follows:

- A *minority population census block group* is a group having a minority population percentage greater than the average minority population percentage in the PSA. Based on the 2010 data, the average percentage of minority population residing in the PSA was 60.1 percent. Therefore, the FAA identified every census block group with a percentage of minority population greater than 60.1 percent as a census block group of environmental justice concern.

[140] FAA Order 1050.1E, Chg. 1, App. A, sec. 16.2a.
[141] U.S. Census Bureau, "2010 U.S. Census data," released June 2011, http://www2.census.gov/census_2010/04-Summary_File_1/Texas/ (accessed August 14, 2012).
[142] U.S. Census Bureau, "2006-2010 American Community Survey, November 2011," http://www2.census.gov/acs2010_5yr/summaryfile/ (accessed August 14, 2012 and August 15, 2012).
[143] U.S. Department of Transportation (DOT), Order 5610.2(a), "Department of Transportation Actions to Address Environmental Justice in Minority and Low-Income Populations," May 2, 2012.
[144] A U.S. Census block group is one of several geographical units by which the U.S. Census Bureau organizes data and is the smallest such unit available for this analysis throughout the PSA. There are 3,057 individual census block groups in, or intersecting (i.e. extending beyond), the PSA. This EJ analysis used all 3,057 individual census block groups and therefore the population totals differ compared to other analyses in this EA.

- A *low-income population census block group* is a group having a low-income population percentage greater than the average low-income population percentage in the PSA. Based on the 2010 Poverty Guidelines identified by the HHS,[145] and accounting for the average household size within each census block group, the average poverty threshold in the PSA was $17,572 per household. In order to equate this to the low-income household counts available in $5,000 intervals through the ACS 5-year dataset, the FAA used a threshold of $20,000 for identifying low-income census block groups. Based on 2010 data, the average percentage of low-income population residing in the PSA was 16.3 percent. Therefore, the FAA identified every census block group with a percentage of low-income population greater than 16.3 percent as a census block group of environmental justice concern.

As a result, the FAA defined census blocks of environmental justice concern as those in which either the concentration of minority population and/or the concentration of low-income population are higher than their respective averages of the PSA. Table 20 presents the analysis results of minority and low-income population for the purposes of this environmental justice analysis.

Figure 21 depicts the areas of environmental justice concern located within the PSA, derived from census block groups. In examining Figure 21, it is important to note that population distribution is not necessarily uniform across a census block group. For that reason, the actual number of minority or low-income persons impacted can be more or less than the total population represented by a single census block group because impacts may vary throughout the census block group.

[145] U.S. National Archives and Records Administration, "Delayed Update of the HHS Poverty Guidelines for the Remainder of 2010," *Federal Register* 75, no. 148 (August 2010): 45628–45629. http://www.gpo.gov/fdsys/pkg/FR-2010-08-03/html/2010-19129 htm

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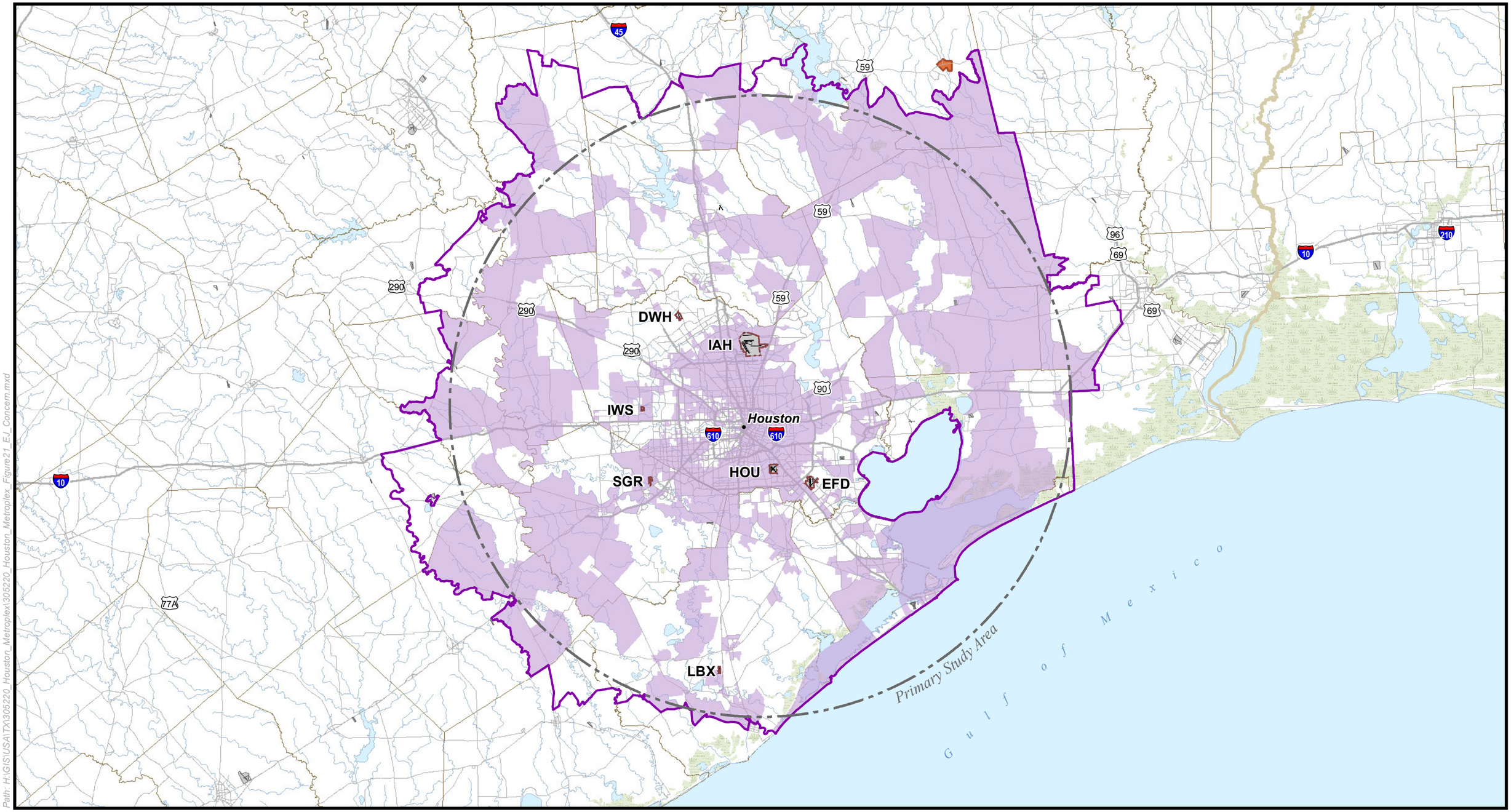

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Environmental Systems Research Institute, Inc.(ESRI) (Airport/Airport Runways), March 14, 2012; ESRI (State Boundaries/County Boundaries), February 14, 2012; ESRI (Cities), February 8, 2012; ESRI (Mountain Peaks), February 28, 2012; ESRI (Roads), March 14, 2012; Houston-Galveston Area Council (Water Features), March 14, 2012; National Atlas (Lakes/Rivers), September 10, 2012 (Updated); National Atlas (Tribal Land/ Wilderness Areas), February 08, 2012; US Census Bureau (Census Block Boundaries), March 09, 2012;

Prepared By: Harris Miller Miller & Hanson Inc., January, 2013

Primary Study Area
Airport Boundary
State Boundary
County/Parish Boundary
Interstate Highway
Highways
Secondary Roads
Water
River/Stream
Alabama-Coushatta Tribe of Texas Reservation
Areas of Environmental Justice Concern
Extent of Environmental Justice Concern Analysis

North

0 15 30 Nautical Miles

Areas of Environmental Justice Concern

Figure 21

Houston OAPM EA

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Table 20 Statistics on Low-Income and Minority Populations within the PSA

Demographic	Population	Percentage of Total
Total Population	5,988,197	100.0%
Minority Population[1]		
Hispanic or Latino	2,103,458	35.1%
Black or African American	1,005,329	16.8%
American Indian and Alaska Native	14,059	0.2%
Asian	384,853	6.4%
Native Hawaiian and Other Pacific Islander	2,931	<0.1%
Other or Two or More Races	86,917	1.5%
Total Minority Population	3,597,547	60.1%
Demographic	**Population**	**Percentage of Total**
Low-Income Households		
Total Number of Households	1,980,325	100.0%
Number of Households with Annual Income Below $20,000	322,797	16.3%
Census Block Groups	**No. Census Blocks**	**Percentage of Total**
Total Census Block Groups Intersecting PSA	3,057	100.0%
Minority Population (only) Census Block Groups[2]	495	16.2%
Low-Income Households (only) Census Block Groups[3]	390	12.8%
Minority Population and Low Income Census Block Groups	1,048	34.3%
Environmental Justice Census Blocks[4]	1,933	63.2%

Notes:
1 Names as they appear in U.S. Census 2010 data
2 For environmental justice purposes, the FAA defined a minority population census block as a census block having a percentage of minority population greater than 60.1 percent (the minority population percentage of the PSA).
3 For environmental justice purposes, the FAA defined a low-income population census block as a census block having a percentage of low-income population greater than 16.3 percent (the low-income population percentage of the PSA).
4 An environmental justice census block is defined as a census block in which either the concentration of minority population or the concentration of low-income population is higher than their respective percentages of the PSA.

4.3 Environmental Impact Categories Not Affected by the Proposed Action

The FAA considered the following environmental impact categories for purposes of potential environmental impacts but determined that further detailed analysis would not be required. There would be no potential for the Proposed Action to affect the following resource categories for reasons noted below:

- Coastal Resources – Without construction or land-disturbing activities, there is no potential for the Proposed Action to affect coastal resources or barrier islands.
- Construction Impacts – The Proposed Action does not involve any construction activities.
- Farmlands – The Proposed Action would not have potential to convert existing prime farmland to a non-agricultural use and would not affect the agricultural economy of the area.
- Floodplains – Without construction or land-disturbing activities, there is no potential for the Proposed Action to affect floodplains.

- Hazardous Materials, Pollution Prevention, and Solid Waste – The Proposed Action would not generate, disturb, transport, or treat hazardous materials.
- Natural Resources and Energy Supply (other than aircraft fuel)—The Proposed Action would not require unusual natural resources or materials, or those in short supply.
- Socioeconomic impacts and children's' environmental health and safety risks:
  - Socioeconomic impacts – The Proposed Action would not involve acquisition of real estate, relocation of residents or community businesses, disruption of local traffic patterns, loss in community tax base, or changes to the fabric of the community.
  - Children's Environmental Health - The Proposed Action would not affect products or substances that a child is likely to come into contact with, ingest, use, or be exposed to, and would not result in environmental health and safety risks that could disproportionately affect children.
- Secondary (Induced) Impacts – The Proposed Action would not have the potential for induced or secondary impacts on surrounding communities. It would not cause changes in patterns of population movement or growth, public service demands, or business and economic activity. Furthermore, the Proposed Action does not involve construction activities, so it would not involve the relocation of people or businesses.
- Water Quality – Without construction or land-disturbing activities, there is no potential for the Proposed Action to increase impervious surfaces or affect water quality or ground water.
- Wetlands – Absent construction or land-disturbing activities, there is no potential for the Proposed Action to affect wetlands.
- Wild and Scenic Rivers – The Proposed Action would not foreclose or downgrade Wild, Scenic, or Recreational river status of a river or river segment included in the Wild and Scenic River System.[146]

As stated in Chapter 2, the Proposed Action would reroute existing air traffic without generating additional aircraft operations. The same number of aircraft operations and passenger enplanements at the Houston OAPM Airports would occur with either the No Action Alternative or the Proposed Action. Therefore, the Proposed Action would not:

[146] No Wild and Scenic River segments are located within the PSA or SSA. The location of Wild and Scenic rivers is available at the National Wild and Scenic Rivers System website (http://www.rivers.gov/rivers/). The closest Wild and Scenic River is the Saline Bayou National Scenic River, which is approximately 4 mi. outside of the SSA in Saline, LA. The nearest section of the Rio Grande designated as a Wild and Scenic River is located over 100 miles outside the SSA.

- Increase the disposal of municipal solid waste (i.e., trash) or affect the capacity of local landfills
- Increase the use of potable water or disposal and treatment of wastewater
- Increase the use of energy (i.e. electricity), when compared to the No Action Alternative

In order to focus analysis on impact categories with potential for significant environmental impact, or on uncertainties that may require evaluation, the EA does not provide any detailed description of the affected environment associated with these impact categories listed in this section. Accordingly, there is no detailed discussion of these resources in Chapter 5.

4.4 Past, Present, and Reasonably Foreseeable Actions

In accordance with the CEQ regulations, this EA must consider past, present, and reasonably foreseeable future actions in the evaluation of potential cumulative effects of the Proposed Action.[147] Table 21 provides a summary of projects that have been completed, are currently ongoing, or are anticipated to be completed in the foreseeable future that could potentially affect similar resources as those affected by the Proposed Action.

Due to the nature of the Proposed Action (i.e., lack of land disturbing or construction activities), the only projects considered were those with anticipated direct or indirect effects on the following:

- The noise setting, with its corresponding implications to compatible land use, potential DOT Section 4(f) properties, historical and cultural resources, and environmental justice concerns
- Ambient air quality within the Study Area

Reasonably foreseeable actions were defined as those expected to begin within five years of the Proposed Action.

The Proposed Action is primarily anticipated to affect the noise environment. In particular, this potential effect would primarily occur when the action would involve changes to existing flight paths up to 3,000 ft. Above Ground Level (AGL). However, the search for relevant projects extended to 10,000 ft. AGL. Such changes to flight procedures would normally occur near the 17 Houston OAPM Airports for which changes to instrument flight procedures are proposed. However, only five of these airports presently have or would in the future have a sufficient number of operations to warrant detailed operational analysis and noise modeling per FAA Order 1050.1E. This EA refers to the airports for which detailed operational analysis and noise modeling occurred as the Analyzed Airports.

[147] *Code of Federal Regulations*, Title 40, sec. 1508.7.

Project Types Evaluated

- Airports Airside Improvements
- Airspace and Navigation Enhancements
- Roadway Construction and Major Improvements in vicinity of main airports
- Light Rail Construction

Project Sources

- Federal Aviation Administration
- Environmental Protection Agency
- Houston Metrorail
- Texas Department of Transportation

Table 21 Summary of Past, Present, and Reasonably Foreseeable Future Actions

Project	Description	Current Status
Projects at Houston OAPM		
Houston Intercontinental (IAH) Terminal B Improvements	Phase one of this project – scheduled for completion in 2013 – will create a new Terminal B concourse dedicated to domestic regional jet operations. Plans for the entire three-phase redevelopment project are over seven to 10 years, based on demand.	Construction began in 2012 and is expected to be ongoing after phase one in 2013.[i]
Revision to IAH SIAPs serving Runways 26L /26R / 27	Revised altitudes on approaches	Implemented Feb. 2012
Revision to IAH SIAPs serving Runways 8L/8R/9	Revised altitudes on Runway 9 approaches (no change for the 8L/8R approaches that would affect aircraft altitudes)	Implemented May 2012
Houston Hobby (HOU) Terminal Building and other Facilities Expansion for Planned International Operations	Construction of five additional gates for international flights and construction of a Federal Inspection Services facility at HOU.[ii]	Project planning documents indicate completion late 2015.
IAH Potential New Cross-field Taxiway and Terminal Improvements	Houston Airport System (HAS) is taking steps to upgrade terminal D to accommodate Airbus A-380 and Boeing B748 aircraft between 2012 and 2018. HAS is also discussing a cross-field taxiway.	A timeline for planning and construction has not been identified.
Runway Extension at Lonestar Executive Airport (CXO)	Texas DOT is considering extending Runway 14/32.	The project is currently in the planning phase. Schedule for completion is unknown.
Potential Improvements to Facilities at Ellington Field (EFD)	Various GA facility development plans are slated for EFD.[iii]	A timeline for planning and construction has not been identified.

Project	Description	Current Status
Regional Airspace Projects		
Gulf of Mexico Lateral Separation Reduction / RNAV Routes	Publication and implementation of new RNAV routes across the Gulf of Mexico	Categorical exclusion from NEPA review approved September 2012; procedures to be implemented[iv]
BAZBL STAR STROS STAR ROYOH STAR COACH STAR	Changes to HOU arrival procedures, west of the airport	Procedure changes were published effective May 2012.
North Texas OAPM	The North Texas OAPM project would optimize air traffic operations in the Dallas – Fort Worth area.	Expected implementation is after Houston OAPM.
Surface Transportation Projects		
US 290 Corridor	Construction of Roadway Improvements from Farm-to-Market (FM) 2920 to Interstate Highway 610 (IH-610), Harris County, TX	Harris County and TxDOT executed a Memorandum of Understanding for interim improvements. US 290 from IH 610 to SH 99 to bo constructed by 2017.[v]
Grand Parkway (State Highway 99 [SH-99]) Segment B	Construction from SH-288 to IH-45, Brazoria and Galveston Counties, TX	TXDOT hosted public hearings in August 2012 to discuss proposed improvements in the SH99 corridor from SH 288 to IH 45 (S).[vi]
Grand Parkway (SH-99) Segment E	Improvement Project, IH-10 to US-290, Harris County, TX	FHWA issued Revised Record of Decision (ROD) and approved the Final Environmental Impact Statement (FEIS). Re-evaluation was approved by the Federal Highway Administration on June 9, 2009.[vii]
Grand Parkway (SH-99) Segment F-1	Highway Construction, US-290 to SH-249, Harris, Montgomery, Fort Bend, Liberty, Brazoria, Galveston and Chambers Counties, TX	The Second Segment F-1 Final Environmental Impact Statement (FEIS) Re-evaluation was approved by the Federal Highway Administration on May 22, 2012.[viii]
Grand Parkway (SH-99) Segment F-2	From SH-249 to IH-45, a new four-lane, controlled access divided highway. This segment borders David Wayne Hooks Airport (DWH).	The Segment F-2 Final Environmental Impact Statement (FEIS) Re-evaluation was approved by the Federal Highway Administration on May 22, 2012.[ix]
Grand Parkway (SH-99) Segment G	From IH-45 to U.S. Highway 59 (US-59), Harris and Montgomery Counties, TX	The Segment G Final Environmental Impact Statement (FEIS) Re-evaluation was approved by the Federal Highway Administration on May 22, 2012.[x]
Grand Parkway (SH-99) Segments H and I-1	From US-59 (N) to IH-10 (E), Transportation Improvement , Montgomery, Harris, Liberty and Chambers Counties, TX	Public Hearings were held on August 9, 2011 and August 11, 2011 to inform the public and stakeholders of the proposed roadway improvements for SH 99 Grand Parkway Segments H & I-1.[xi]
Light Rail – North Corridor Fixed Guideway Project	Proposed Transit Improvements from University of Houston (UH)-Downtown Station to Northline Mall, Harris County, TX	Expected Completion in 2014[xii]
Light Rail – Southwest Corridor Project	Proposed Fixed-Guideway Transit System, Harris County, Houston, Harris County, TX	Public meetings concluded on June 12, 2012. Next steps include: Conduct detailed analysis of alternatives in Deraft Environmental Impact Statement (DEIS); Submit draft of the DEIS to the Federal Transit Administration for approval in Fall 2012; Publish DEIS and conduct public hearing in Winter 2013; Prepare final EIS in

Project	Description	Current Status
		2013[xiii]

Sources:

i. Houston Airport System, http://www.fly2houston.com/business-current-projects/?modpage=HASProjects2-2&projectid=1129807 (accessed September 23, 2012).
ii. Houston Airport System, http://www.fly2houston.com/HobbyInternational (accessed September 23, 2012).
iii. Janelia Moreno, "More Growth Appears on Ellington's Horizon," *Houston Chronicle*, http://www.chron.com/business/article/More-growth-appears-on-Ellington-s-horizon-2160026.php (accessed August 21, 2012).
iv. FAA, En Route & Oceanic Services, http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/enroute/oceanic/gomex/ (accessed August 21, 2012).
v. US290 Environmental Project, http://www.my290.com/environmental/ (accessed August 6, 2012).
vi. Grand Parkway Segment B, "Notice of Public Hearing," http://www.grandpky.com/downloads/segmentb/GP%20B%20Hearing%20Mailer%20English-Spanish%207.18.12.pdf (accessed August 6, 2012).
vii. Grand Parkway Segment E, http://www.grandpky.com/news/default.asp (accessed August 6, 2012).
viii. Grand Parkway Segment F-1, http://www.grandpky.com/news/default.asp (accessed August 6, 2012).
ix. Grand Parkway Segment F-2, http://www.grandpky.com/segments/f-2/ (accessed August 6, 2012).
x. Grand Parkway Segment G, http://www.grandpky.com/segments/g/ (accessed August 6, 2012).
xi. Grand Parkway Segment H, http://www.grandpky.com/segments/h/ (accessed August 6, 2012).
xii. Ride Metro Current Projects List, http://www.ridemetro.org/CurrentProjects/METRORailExpansion.aspx (accessed August 6, 2012).
xiii. Ride Metro Current Projects List, http://www.ridemetro.org/CurrentProjects/90A-Southwest_RailCorridor.aspx (accessed August 6, 2012).

5 ENVIRONMENTAL CONSEQUENCES

This chapter discusses the potential environmental impacts that could result from implementation of the Proposed Action and the No Action Alternative in all relevant environmental impact categories specified in FAA Order 1050.1E. The FAA evaluated both alternatives for conditions in 2014, the first full year aircraft would use the optimized air traffic routes under the Proposed Action, and 2019, five years after expected implementation of the Proposed Action.

5.1 Assessment of Impacts

Neither the Proposed Action nor the No Action Alternative would involve land acquisition, physical disturbance, or construction activities and therefore they would not affect certain environmental impact categories (see Section 4.3). Accordingly, this chapter does not include assessment of those impact categories. Table 22 provides a summary of the environmental impact categories with potential to be affected by the Proposed Action and the findings of the impact assessment. The remainder of this chapter discusses these summary findings in detail, along with consideration of cumulative impacts.

Each subsection of this chapter begins with a brief overview of impacts, followed by a description of the methodology used to determine impacts, and then a more detailed discussion of the potential impacts. However, in summary, there are no significant impacts for any environmental impact category.

Table 22 Summary of Potential Environmental Impacts of Implementing the Proposed Action (2014 and 2019)

Environmental Impact Category	2014	2019
Noise	Proposed Action would not result in a DNL 1.5 dB increase in areas exposed to aircraft noise at or above DNL 65 dB. No significant impact.	Same as 2014
Compatible Land Use	Proposed Action would result in one population centroid being added to the area exposed to DNL 65 dB and higher, but it would experience a significant noise increase (DNL 1.5 dB or greater). No significant impact.	Same as 2014
Department of Transportation Act, Section 4(f)	Proposed Action would not use any resources protected under Section 4(f). No significant impact.	Same as 2014
Historical, Architectural, Archaeological, and Cultural Resources	Proposed Action would not adversely affect the historical or cultural characteristics of Tribal Lands or historic resources. No significant impact.	Same as 2014
Air Quality	The Proposed Action would result in slightly more fuel burned compared to the No Action. However, the Proposed Action is presumed to conform with the State Implementation Plan (SIP). Accordingly, implementation would not cause or contribute to a new violation of the National Ambient Air Quality Standards (NAAQS). Therefore, implementation would not have a significant impact on air quality and a conformity determination is not required.	Same as 2014
Natural Resources and Energy Supply (Aircraft Fuel)	Proposed Action would not have a measurable effect on local supplies of energy. No significant impact.	Same as 2014
Climate	Although fuel burn would increase slightly with the Proposed Action compared to the No Action Alternative, no significant project-related effects on climate are expected.	Same as 2014
Fish, Wildlife, and Plants	Proposed Action would not increase the probability of aircraft strikes to migratory birds, nor would it result in an increase in noise that would have the potential to adversely affect the long-term survival of any species. No significant impact.	Same as 2014
Light Emissions and Visual Impacts	Proposed Action would not cause aircraft to be more visually intrusive to normal activities on the ground surface. No significant impact.	Same as 2014
Environmental Justice	Proposed Action would not affect low income or minority populations at a disproportionately higher level than other population segments, nor would it disproportionately affect children. No significant impact.	Same as 2014

5.2 Noise

This section provides a summary of the NIRS calculations of future noise exposure in 2014 and 2019 resulting from the Proposed Action and the No Action Alternative, as required by FAA Order 1050.1E. The section also identifies the differences in noise exposure between the two alternatives to determine if implementing the Proposed Action would result in significant noise impacts. Appendix G provides additional information on this analysis. Section 4.2.1 presents a discussion of existing aircraft noise exposure in the PSA.

5.2.1 Overview of Impacts

Implementation of the Proposed Action would not result in a DNL increase of 1.5 dB or more in noise sensitive areas exposed to aircraft noise at or above DNL 65 dB. Therefore, there would be no significant impacts.

5.2.2 Methodology

As presented in Section 4.2.1.1, the FAA has developed specific guidance and requirements for the assessment of potential aircraft noise impacts on people. This guidance, described in FAA Order 1050.1E, requires analysis of aircraft noise in terms of the DNL metric. Additionally, the order defines the threshold levels above which the FAA considers a change in aircraft noise causes a significant impact on people. The order defines a significant noise impact as a noise sensitive area (e.g., residences, schools, etc.) experiencing an increase in DNL of 1.5 dB or more at or above DNL 65 dB when compared to the No Action Alternative for the same timeframe.[148]

In accordance with FAA Order 1050.1E, the FAA analyzed community exposure to aircraft noise within the PSA generated by IFR aircraft flights projected to be operating between the surface and 10,000 ft. AGL. The FAA based the number of IFR aircraft flights on a forecast of aircraft activity for the years 2014 and 2019 and modeled them for conditions under both the No Action Alternative and Proposed Action. Appendix G.2, *Noise Modeling Technical Report*, provides detailed technical information regarding the determination of the Study Area, the Analyzed Airports, the modeling process, and the results of the analysis.

In 1990, the FAA issued a noise screening procedure to evaluate whether certain airspace actions above 3,000 ft. AGL might increase DNL levels by 5 dB or more. The procedure served as a response to the FAA's experience that increases in DNL of 5 dB or more at cumulative levels well below DNL 65 dB could be disturbing to people and become a source of public concern. In 1992, the Federal Interagency Committee on Noise (FICON) recommended that in instances where there are DNL increases of 1.5 dB or more at noise sensitive locations at or above DNL 65 dB, that DNL increases of 3 dB or more between DNL 60 dB and 65 dB should also be evaluated. DNL increases of 3 dB below DNL 65 dB are not "significant impacts" but are to receive consideration in the environmental documentation. The FAA has adopted FICON's recommendation in FAA Order 1050.1E.[149] The Order also provides that increases in DNL of 5 dB or greater between DNL 45 dB and 60 dB should be considered for airspace actions.[150] For clarity, this EA uses the term "reportable increase" in referring to DNL increases of 3 dB or more between DNL 60 and 65 dB and DNL increases of 5 dB or more between DNL 45 and 60 dB.

[148] FAA Order 1050.1E, Chg. 1, App. A, sec.14.3.
[149] Ibid., sec. 14.4c.
[150] Ibid., sec. 14.5e.

Table 23 summarizes the criteria used to assess the impact of change in noise exposure attributable to the Proposed Action compared with the No Action Alternative. This section reports noise levels on population, as represented by the 67,184 census block centroids defined in the PSA. Section 5.4 and Section 5.5 discuss potential noise impacts to Section 4(f) resources and historic resources, respectively.

Table 23 Criteria for Determining Impact of Changes in Aircraft Noise

DNL Noise Exposure under Proposed Action	Increase in DNL with Proposed Action	Aircraft Noise Exposure Change Consideration
DNL 65 dB and higher	DNL 1.5 dB or greater[1]	Significant Impact
DNL 60 dB to 65 dB	DNL 3.0 dB or greater[2]	Reportable Increase
DNL 45 dB to 60 dB	DNL 5.0 dB or greater[2]	Reportable Increase

Sources:
1. FAA, Order 1050.1E, App. A, sec. 14.3
2. FAA Order 1050.1E, App. A, sec. 14.5e

Prepared by: Harris Miller Miller & Hanson Inc., October 2012

Following the noise modeling methodology defined by FAA guidance and requirements for compliance with NEPA requirements, the FAA assembled detailed information on IFR aircraft operations for the Analyzed Airports for input into the FAA's noise model, NIRS. The information assembled included:

- Average Annual Day (AAD) IFR operations for 2014 and 2019
- Flight tracks (i.e., the route and altitude profile of an aircraft's flight)
- Runway use

In each forecast year, the Proposed Action and the No Action Alternative have the same number and type of aircraft operations. Therefore, the noise analysis reflects the change in noise exposure due to the proposed changes in aircraft routings (i.e., flight tracks) by the Proposed Action, as compared to the No Action Alternative.[151]

Appendix G provides a detailed discussion of the development of the 2014 and 2019 average annual day operations. The FAA based future year IFR operations on the 2012 Terminal Area Forecast (TAF)[152] for the forecast years, modified with additional detail using previously identified arrival and departure times, aircraft types and origins/destinations.

The FAA based the No Action modeled flight tracks on collaboration with ATC personnel and radar data collected for the existing conditions (i.e., 2012 Base Year) analysis. For the Proposed Action, the FAA developed flight tracks from the new and modified procedures proposed by the Houston OAPM D&I Team. Figure 6 through

[151] For greater detail, see Chapter 3, Appendix F, and Appendix G.2.
[152] The Terminal Area Forecast (TAF) system is the official forecast of aviation activity at FAA facilities. For more information, please see http://aspm.faa.gov/main/taf.asp.

Figure 13 in Chapter 3, *Alternatives*, provide graphic depictions of the procedures and flight tracks under the No Action Alternative and the Proposed Action.

The NIRS model computed DNL values for 2014 and 2019 conditions at three sets of data points throughout the PSA, as discussed in Section 4.2.1:

1. Population census block centroids
2. Points representing certain specific cultural resources and areas potentially protected under Section 4(f) of the Department of Transportation Act
3. A uniform grid throughout the PSA (using 3,000 ft. spacing) and the SSA (using 6,000 ft. spacing) to document aircraft noise levels at potential noise sensitive locations that were not otherwise identified

Section 5.2.3 discusses potential noise impacts to census block centroids for each future year and alternative. Section 5.4 and Section 5.5 discuss potential noise impacts to Section 4(f) resources and historic and other cultural resources, respectively.

5.2.3 Potential Impacts

The noise analysis presented in this section confirms that the Proposed Action would not result in a DNL increase of 1.5 dB in noise-sensitive areas exposed to aircraft noise at or above DNL 65 dB.

Figures 22 and 23 shows the calculated average daily noise exposure levels for 2014 at census block centroids under the No Action Alternative and the Proposed Action, respectively. Table 24 summarizes the estimated affected population from less than DNL 45 dB to greater than DNL 75 dB in 5 dB increments and the percent change from the No Action Alternative to the Proposed Action.

Figure 24 illustrates the increase or decrease in noise exposure levels at each grid point for year 2014 when comparing the Proposed Action to the No Action Alternative and the criteria described in Table 23. Additionally, it illustrates areas where noise levels would increase by less than DNL 1.5 dB but move above or below DNL 65 dB.

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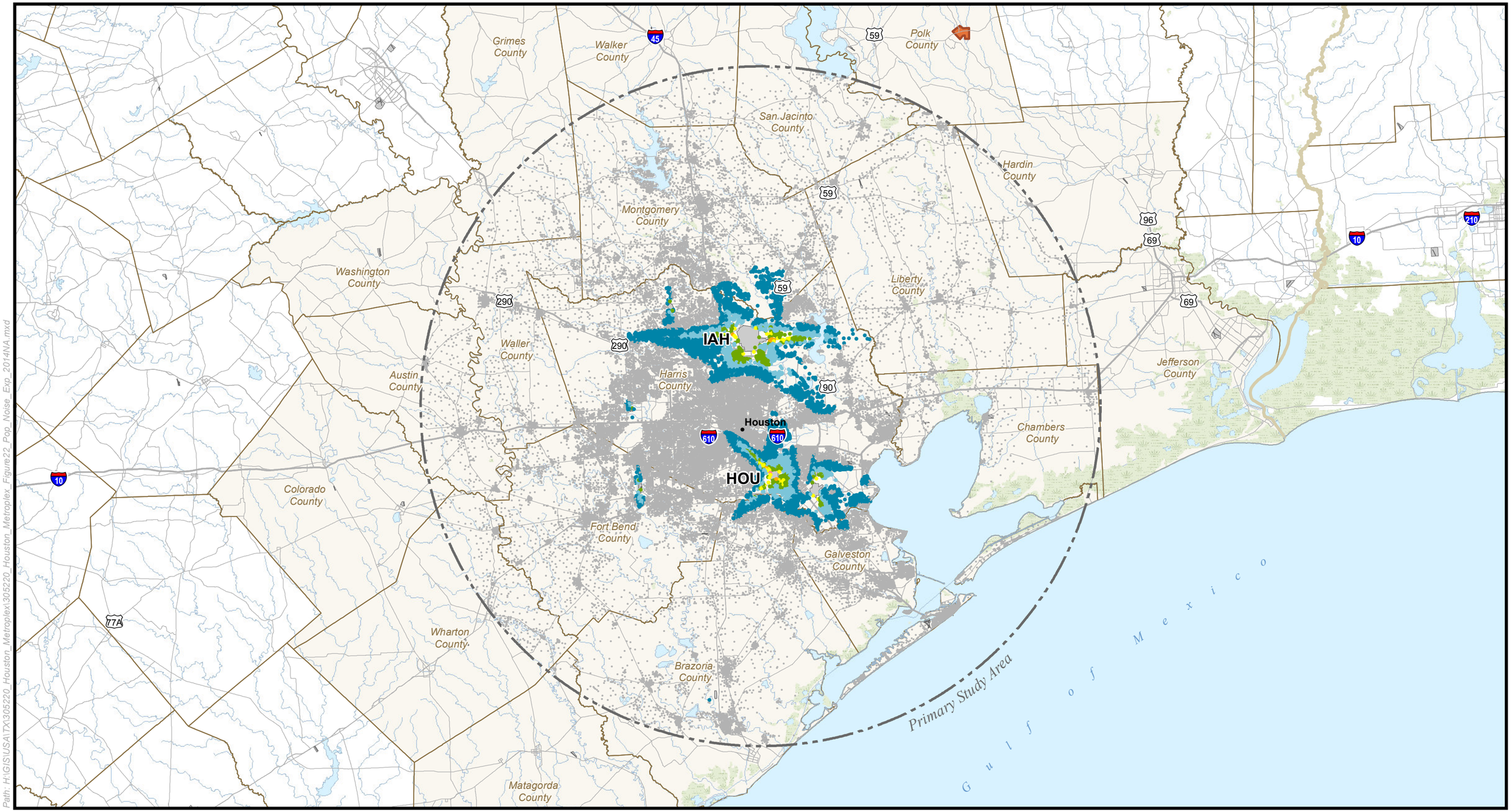

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Data Source: Environmental Systems Research Institute, Inc.(ESRI) (Airport/Airport Runways), March 14, 2012; ESRI (State Boundaries/County Boundaries), February 14, 2012; ESRI (Cities), February 8, 2012; ESRI (Roads), March 14, 2012; Houston-Galveston Area Council (Water Features), March 14, 2012; National Atlas (Lakes/Rivers), September 10, 2012 (Updated); National Atlas (Tribal Land/Wilderness Areas), February 08, 2012;

Prepared By: Harris Miller Miller & Hanson Inc., January, 2013

North

0 10 20 Nautical Miles

Primary Study Area
Airport Boundary
State Boundary
County/Parish Boundary

Interstate Highway
Highways
Secondary Roads
Water
River/Stream
Alabama-Coushatta Tribe of Texas Reservation

2014 No Action DNL Levels

- DNL < 45.0 dB
- DNL 45.0 - 50.0 dB
- DNL 50.0 - 55.0 dB
- DNL 55.0 - 60.0 dB
- DNL 60.0 - 65.0 dB
- DNL 65.0 - 70.0 dB
- DNL 70.0 - 75.0 dB
- DNL > 75.0 dB

Population Exposed to Aircraft Noise - No Action, 2014

Figure 22

Houston OAPM EA

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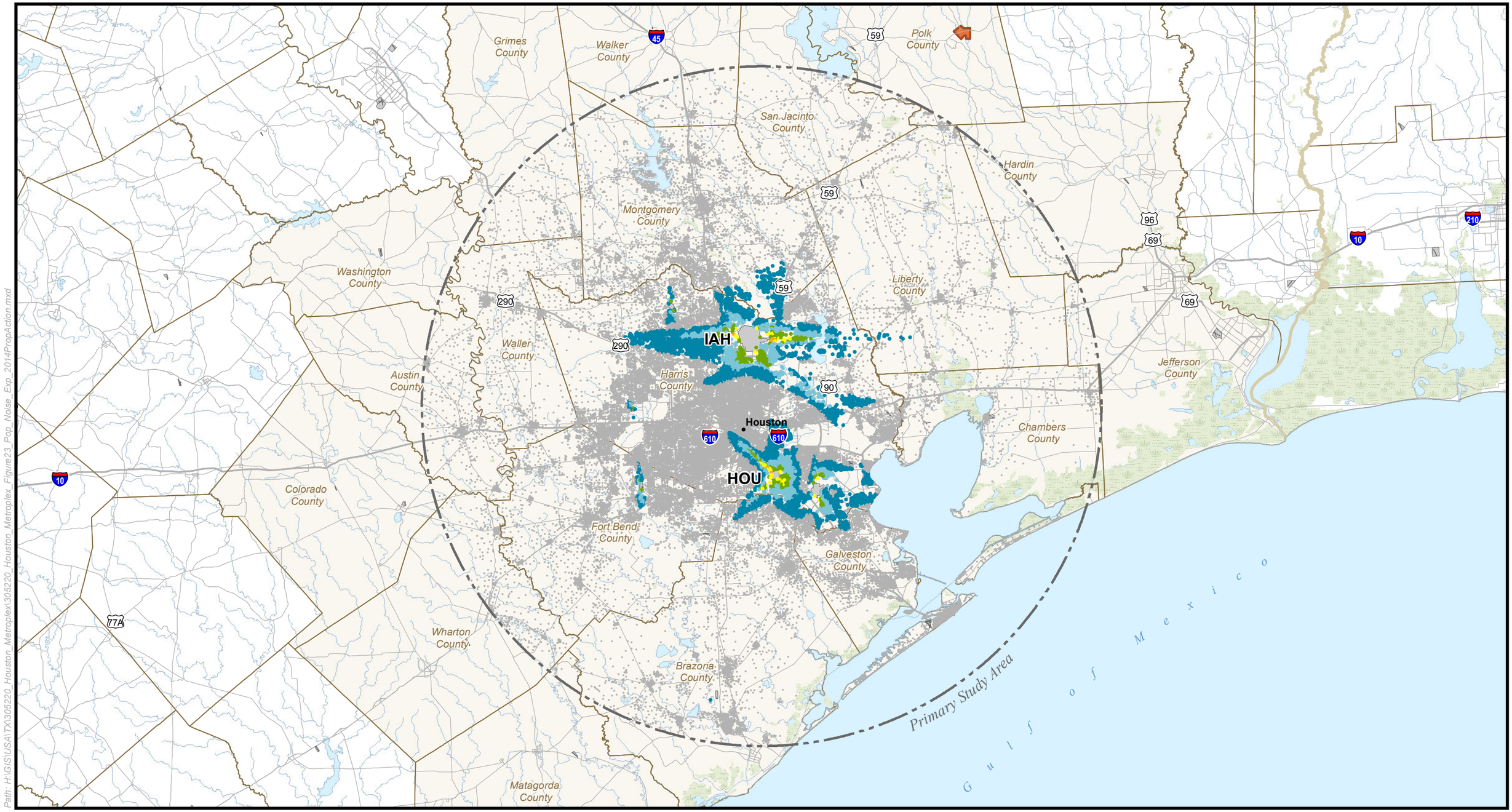

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Data Source: Environmental Systems Research Institute, Inc.(ESRI) (Airport/Airport Runways), March 14, 2012; ESRI (State Boundaries/County Boundaries), February 14, 2012; ESRI (Cities), February 8, 2012; ESRI (Roads), March 14, 2012; Houston-Galveston Area Council (Water Features), March 14, 2012; National Atlas (Lakes/Rivers), September 10, 2012 (Updated); National Atlas (Tribal Land/Wilderness Areas), February 08, 2012;

Prepared By: Harris Miller Miller & Hanson Inc., January, 2013

North

0 10 20 Nautical Miles

Primary Study Area
Airport Boundary
State Boundary
County/Parish Boundary
Interstate Highway
Highways
Secondary Roads
Water
River/Stream
Alabama-Coushatta Tribe of Texas Reservation

2014 Proposed Action DNL Levels

- DNL < 45.0 dB
- DNL 45.0 - 50.0 dB
- DNL 50.0 - 55.0 dB
- DNL 55.0 - 60.0 dB
- DNL 60.0 - 65.0 dB
- DNL 65.0 - 70.0 dB
- DNL 70.0 - 75.0 dB
- DNL > 75.0 dB

Population Exposed to Aircraft Noise - Proposed Action, 2014

Figure 23

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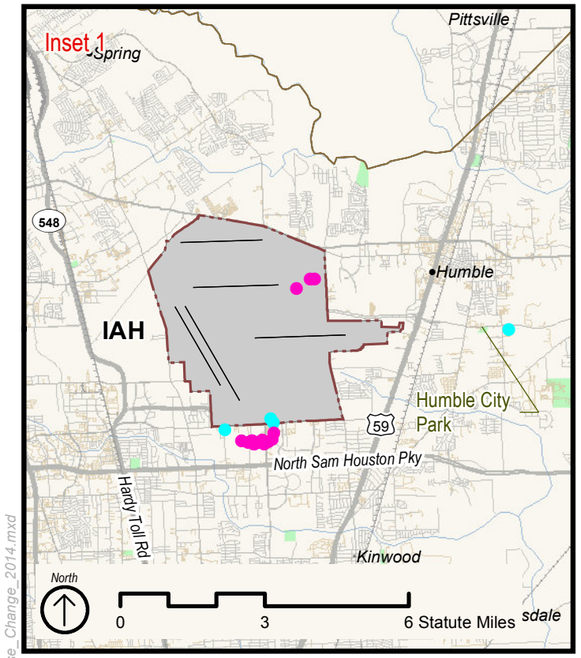

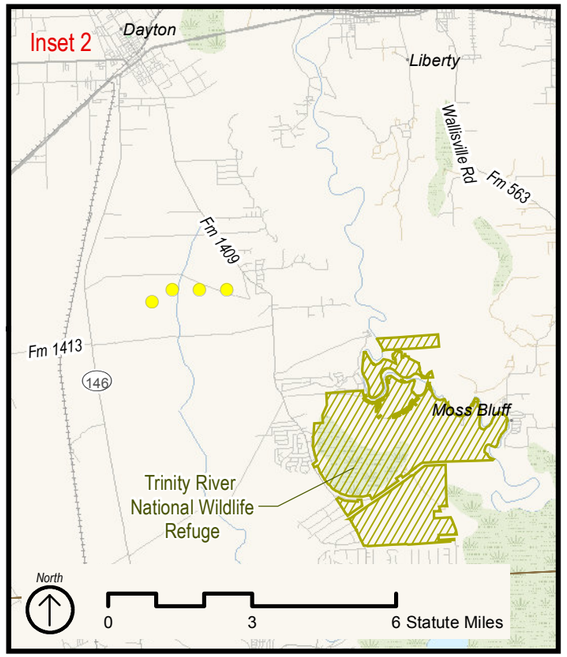

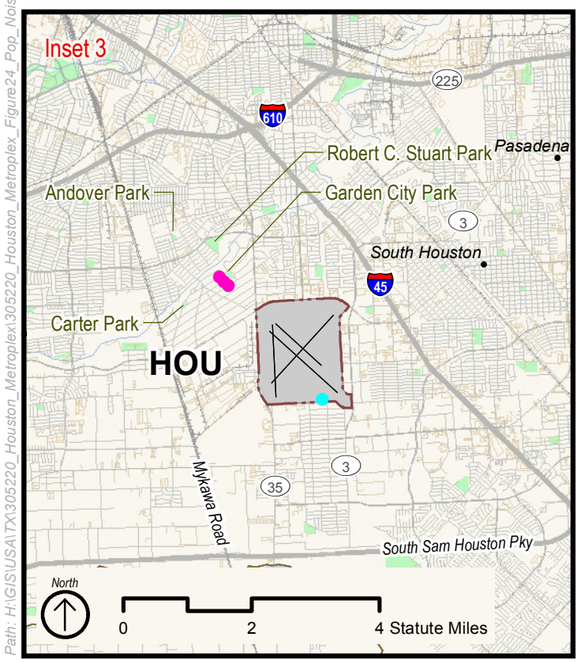

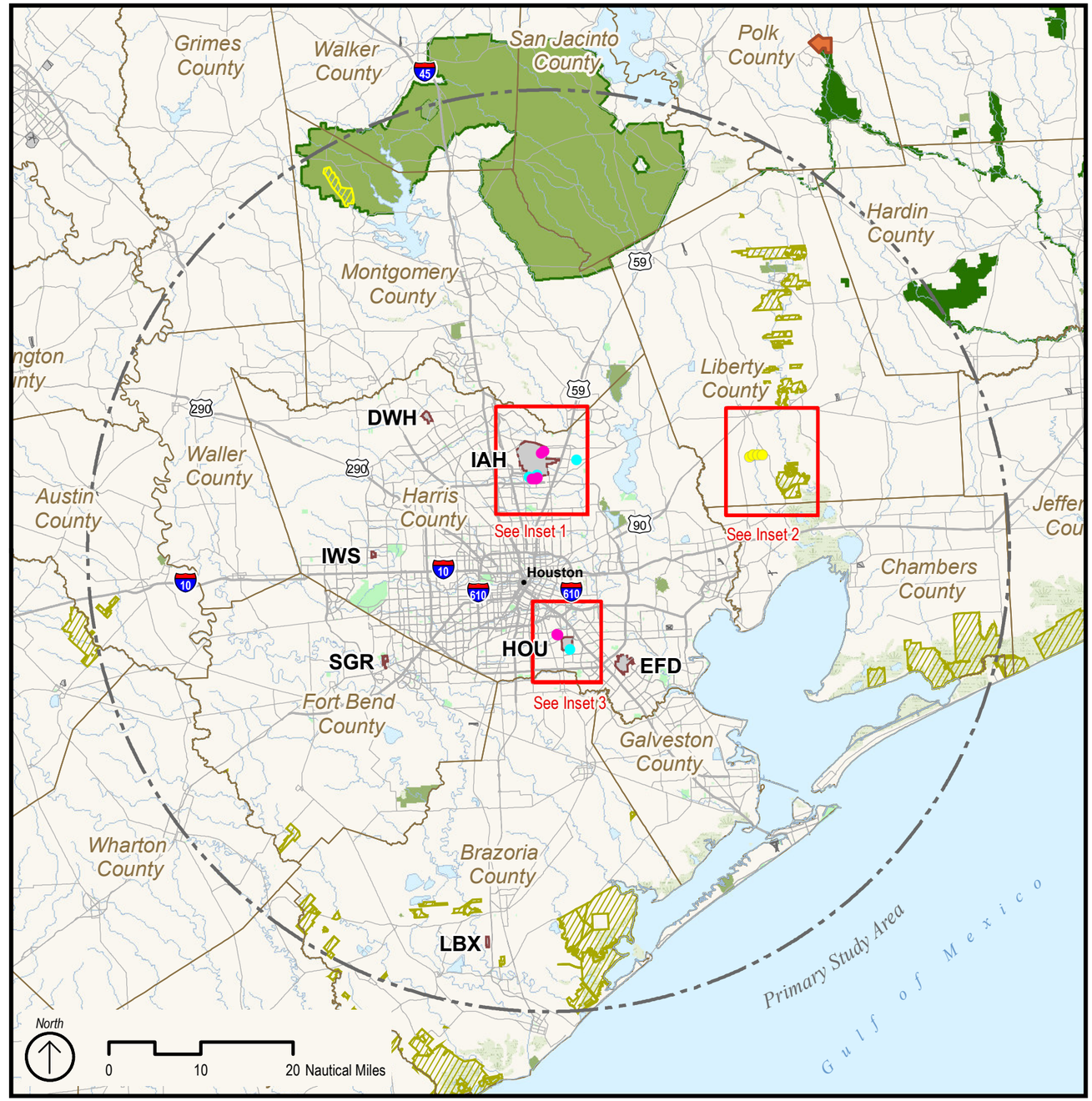

2014 Change in Noise DNL Levels

Noise Increases

- 1.5 dB or greater for location with a Proposed Action DNL >= 65 dB
- 3.0 dB or greater for location with a Proposed Action DNL >= 60 dB and < 65 dB
- 5.0 dB or greater for location with a Proposed Action DNL >= 45 dB and < 60 dB
- New to DNL 65 dB, but no 1.5 dB increase

Noise Decrease

- 1.5 dB for location with a No Action DNL >= 65 dB
- 3.0 dB for location with a No Action DNL >= 60 dB and < 65 dB
- 5.0 dB for location with a No Action DNL >= 45 dB and < 60 dB
- Removed from DNL 65 dB, but no 1.5 dB decrease

Data Source: Environmental Systems Research Institute, Inc.(ESRI) (Airport/Airport Runways), March 14, 2012; ESRI (State Boundaries/County Boundaries), February 14, 2012; ESRI (Cities), February 8, 2012; ESRI (Mountain Peaks), February 28, 2012; ESRI (Roads), March 14, 2012; National Atlas (Tribal Land/Wilderness Areas), February 08, 2012; Texas Natural Resource Information System (TNRIS) (Wildlife Management Areas), February 08, 2012; US Fish & Wildlife Service (National Wildlife Refuge), June 13, 2012; United States Dept of Agriculture (National Forest), May 07, 2012; National Park Service (National Park), February 07, 2012; TNRIS (State Parks or Forest/Local Parks), May 03, 2012; ESRI (Local Parks), May 03, 2012; TNRIS (Department of Defense), February 08, 2012; TNRIS (Railroad), January 2, 2013;

Prepared By: Harris Miller Miller & Hanson Inc., January, 2013

- Primary Study Area
- Study Airports
- Other Airports
- County/Parish Boundary
- Alabama-Coushatta Tribe of Texas Reservation
- Interstate Highway
- Highways
- Secondary Roads
- Railroad
- National Forest
- National Park
- State Park or Forest
- Local Park or Recreation Area
- National Wilderness Area
- National Wildlife Refuge
- State Wildlife Management Area
- Water
- River/Stream

Change of All Modeled Grid Points Exposed to Aircraft Noise, 2014

Figure 24

Houston OAPM EA

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Table 24 Comparison of Potential Population Exposed to Aircraft Noise, 2014

DNL Range (dB)	No Action Alternative	Proposed Action	Percent Change
Less than 45	4,712,877	4,699,857	-0.28%
45 to less than 50	806,553	805,644	-0.11%
50 to less than 55	316,576	332,078	4.90%
55 to less than 60	87,747	85,215	-2.89%
60 to less than 65	12,314	13,286	7.89%
65 to less than 70	821	808	-1.58%
70 to less than 75	10	10	0.00%
Greater than or equal to 75	0	0	0.00%
Total	5,936,898	5,936,898	
Source: Harris Miller Miller & Hanson Inc., December 2012. Prepared by: Harris Miller Miller & Hanson Inc., December 2012.			

Table 25 presents, for 2014, a summary of the population with potential to experience changes in noise exposure according to the criteria in FAA Order 1050.1E for significant and reportable noise increases. As indicated in the table, no population would experience increases in noise exposure under the Proposed Action that would be considered significant (i.e., an increase in DNL of 1.5 dB or greater in an area exposed to noise of DNL 65 dB or more). Nor would any population be exposed to reportable noise increases between DNL 60 dB and 65 dB because of the Proposed Action. Twenty-two people, represented by a single population centroid would experience a DNL 5 dB increase between DNL 45 to 60 dB in 2014 because of the Proposed Action.[152] Three additional modeling points (not associated with population) would also experience such an increase. As depicted in Figure 24, Inset 2, the aforementioned population centroid and three modeling points are located in Liberty County approximately 5 statute miles south of Dayton center. The points are located between Route 146 and Farm-to-Market (FM) 1409, and north of FM 1413.

Table 25 Change of Estimated Population Exposed to Aircraft Noise, 2014

DNL Noise Exposure Level under Proposed Action	Increase in DNL with Proposed Action	Population Exposed to Threshold Increase
DNL 65 dB and higher	DNL 1.5 dB or greater	None
DNL 60 dB to 65 dB	DNL 3.0 dB or greater	None
DNL 45 dB to 60 dB	DNL 5.0 dB or greater	22
Source: Harris Miller Miller & Hanson Inc., December 2012. Prepared by: Harris Miller Miller & Hanson Inc., December 2012.		

In areas exposed to aircraft noise of DNL 65 dB and higher, the 2014 changes in noise exposure at census block centroids resulting from implementation of the Proposed Action range from a decrease of DNL 0.1 dB to an increase of DNL 0.2 dB. In areas

[152] This location would be exposed DNL 40.7 dB in the 2014 No Action and DNL 45.7 dB in the 2014 Proposed Action. The coordinates of this population centroid are Latitude 29.972719 N, Longitude 94.884928 W.

exposed to aircraft noise from DNL 60 dB to 65 dB, the changes at census block centroids resulting from implementation of the Proposed Action range from a decrease of DNL 0.9 dB to an increase of DNL 0.5 dB. In areas exposed to aircraft noise from DNL 45 to 60 dB, changes in noise exposure at census block centroids range from a decrease of DNL 3.1 dB to an increase of DNL 5.0 dB.

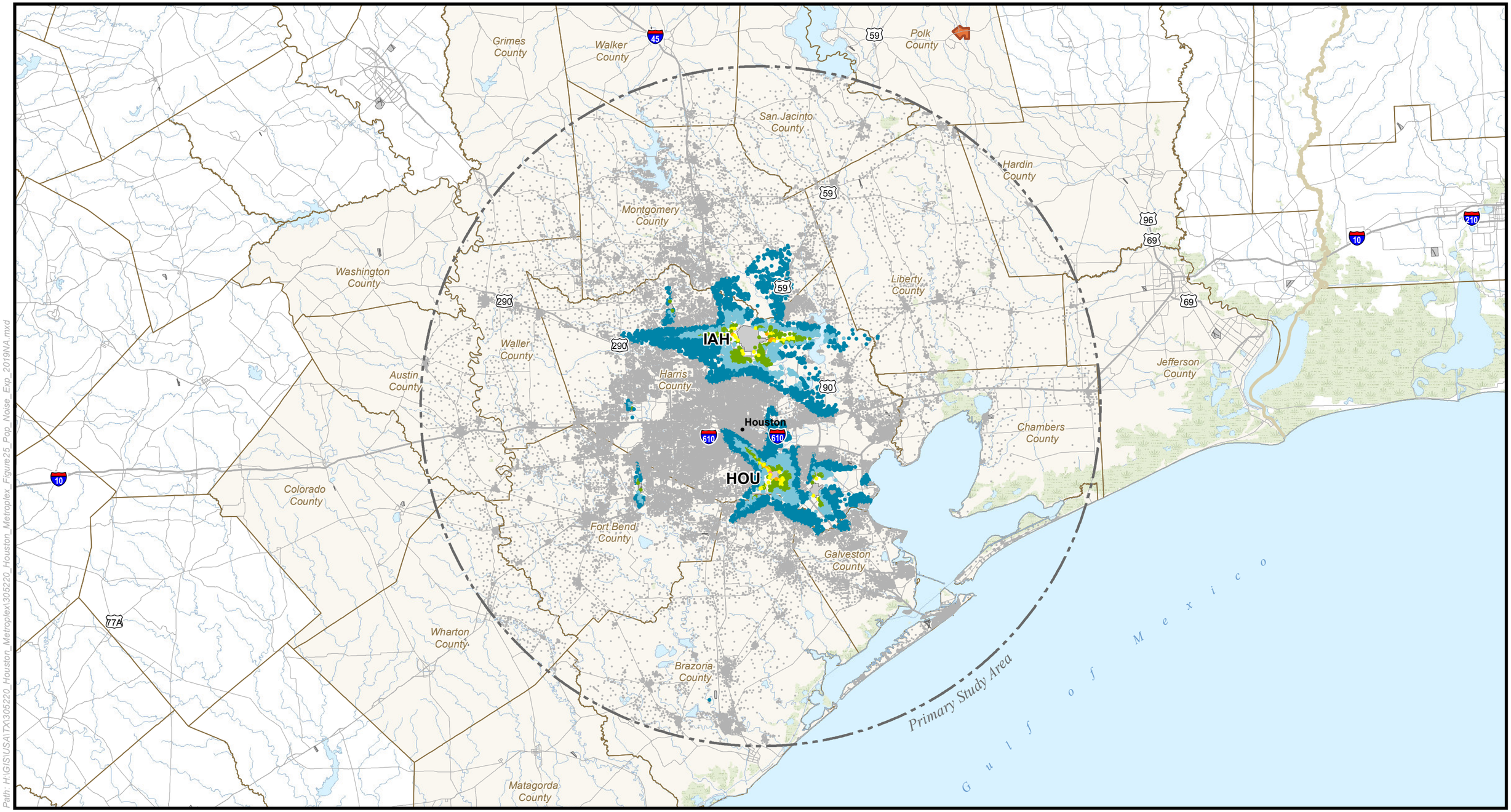
For 2014, a small number of people northwest of HOU, in an area too small to be identified with a specific population centroid, would be newly exposed to DNL 65 dB or greater because of the Proposed Action. However, the noise increase would be well below DNL 1.5 dB[153] and, therefore, would not be significant. Figure 24, Inset 3 depicts this location. Thirteen people, represented by a single census centroid located on the south side of HOU, would have a DNL 0.1 dB decrease as a result of the Proposed Action, also depicted in Figure 24, Inset 3. Figure 24, Inset 1 depicts additional locations around IAH that would move above or below DNL 65 dB. Aerial photography indicates that these locations are commercial, industrial, or vacant (see Figure 3). Moreover, none of these locations would experience a noise increase of DNL 1.5 dB or more.

The FAA's evaluation of potential 2019 impacts employed the same methodology and criteria as used in the potential 2014 impact analysis.

Figure 25 and Figure 26 show the calculated noise exposure levels for 2019 at census block centroids under the No Action Alternative and Proposed Action, respectively. Table 26 presents the estimated affected population from less than DNL 45 to greater than DNL 75 dB in 5 dB increments and the percent change from the No Action Alternative to the Proposed Action.

Figure 27 illustrates the increase or decrease in noise exposure levels at each grid point for 2019 when comparing the Proposed Action to the No Action Alternative and the criteria in Table 23. Additionally, it illustrates areas where noise levels would increase by less than DNL 1.5 dB but move above or below DNL 65 dB.

[153] These three locations have an increase of DNL 0.4 dB to DNL 0.5 dB.



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Prepared By: Harris Miller Miller & Hanson Inc., January, 2013

North

0 10 20 Nautical Miles

Primary Study Area
Airport Boundary
State Boundary
County/Parish Boundary

Interstate Highway
Highways
Secondary Roads
Water
River/Stream
Alabama-Coushatta Tribe of Texas Reservation

2019 No Action DNL Levels

- DNL < 45.0 dB
- DNL 45.0 - 50.0 dB
- DNL 50.0 - 55.0 dB
- DNL 55.0 - 60.0 dB
- DNL 60.0 - 65.0 dB
- DNL 65.0 - 70.0 dB
- DNL 70.0 - 75.0 dB
- DNL > 75.0 dB

Population Exposed to Aircraft Noise - No Action, 2019

Figure 25

Houston OAPM EA

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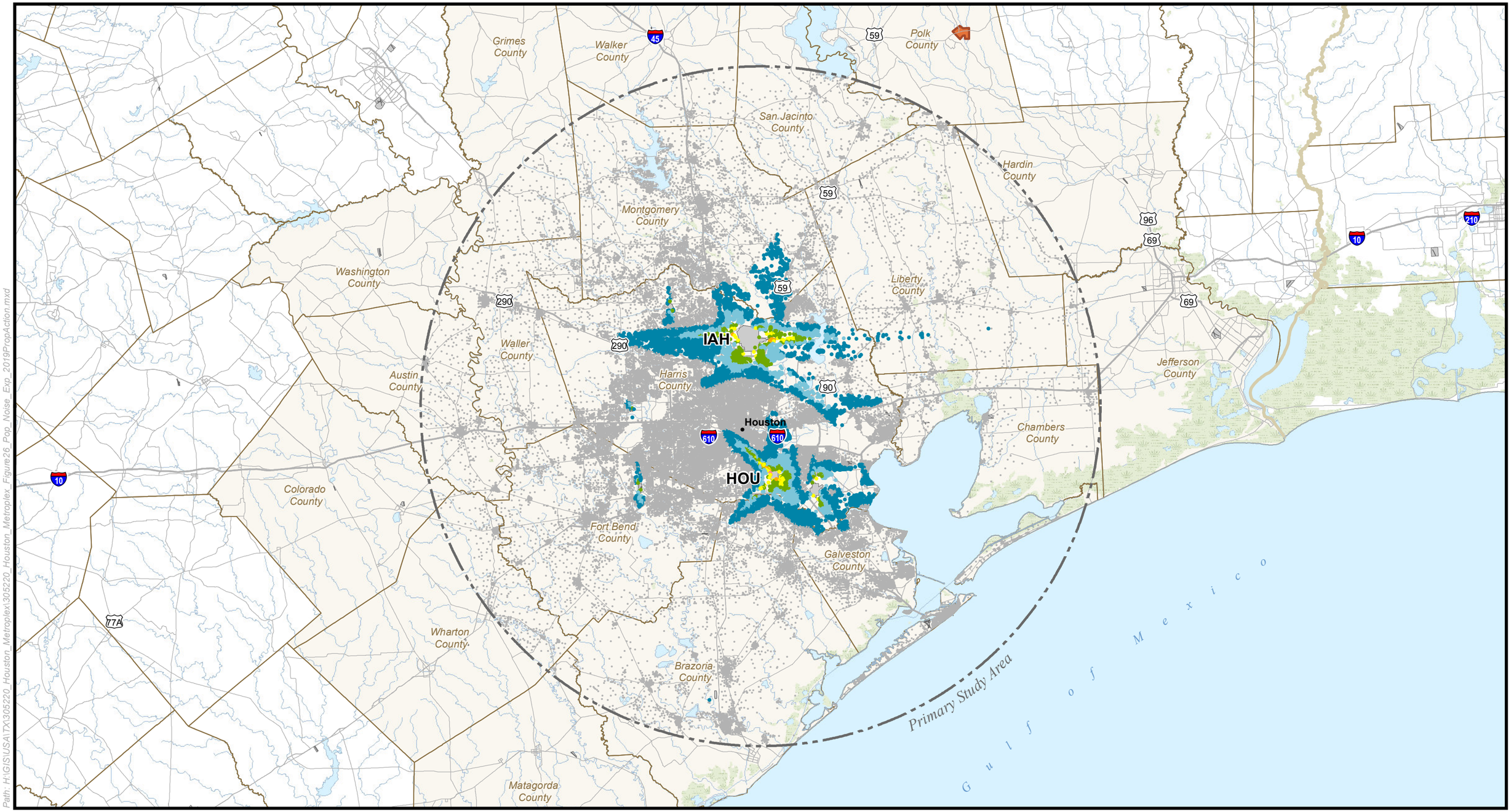

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Data Source: Environmental Systems Research Institute, Inc.(ESRI) (Airport/Airport Runways), March 14, 2012; ESRI (State Boundaries/County Boundaries), February 14, 2012; ESRI (Cities), February 8, 2012; ESRI (Roads), March 14, 2012; Houston-Galveston Area Council (Water Features), March 14, 2012; National Atlas (Lakes/Rivers), September 10, 2012 (Updated); National Atlas (Tribal Land/Wilderness Areas), February 08, 2012;

Prepared By: Harris Miller Miller & Hanson Inc., January, 2013

North

0 10 20 Nautical Miles

Primary Study Area
Airport Boundary
State Boundary
County/Parish Boundary
Interstate Highway
Highways
Secondary Roads
Water
River/Stream
Alabama-Coushatta Tribe of Texas Reservation

2019 Proposed Action DNL Levels

- DNL < 45.0 dB
- DNL 45.0 - 50.0 dB
- DNL 50.0 - 55.0 dB
- DNL 55.0 - 60.0 dB
- DNL 60.0 - 65.0 dB
- DNL 65.0 - 70.0 dB
- DNL 70.0 - 75.0 dB
- DNL > 75.0 dB

Population Exposed to Aircraft Noise - Proposed Action, 2019

Figure 26

Houston OAPM EA

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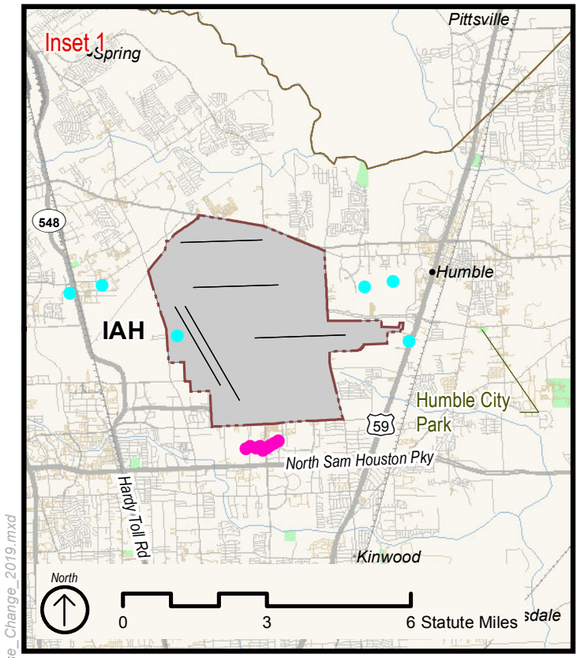

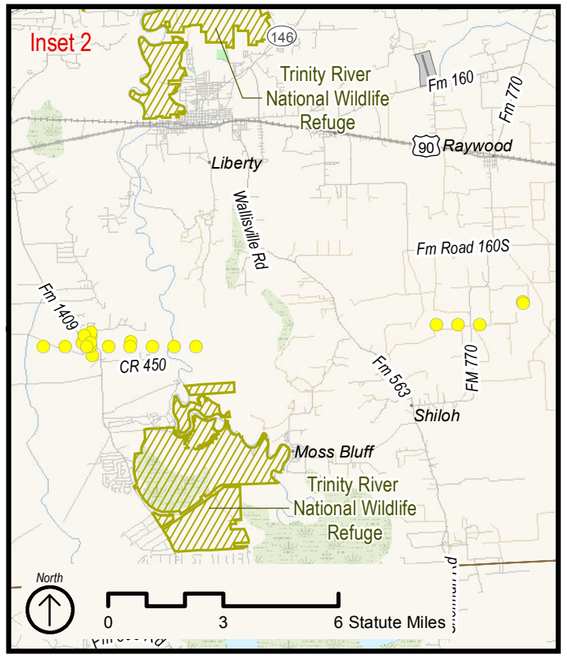

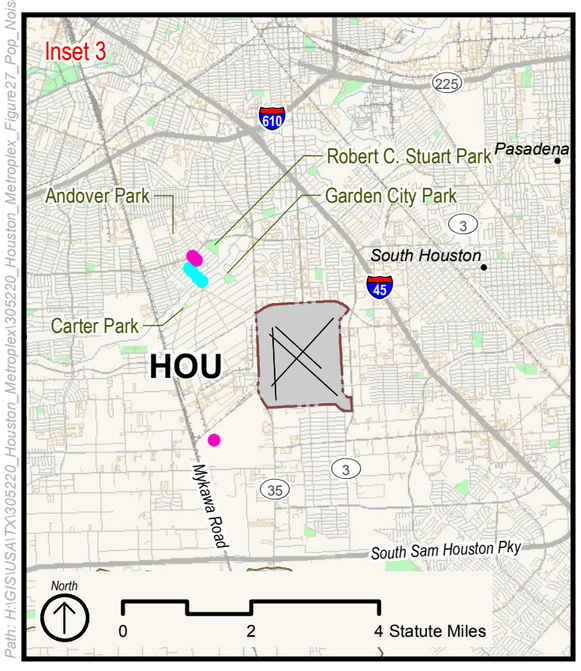

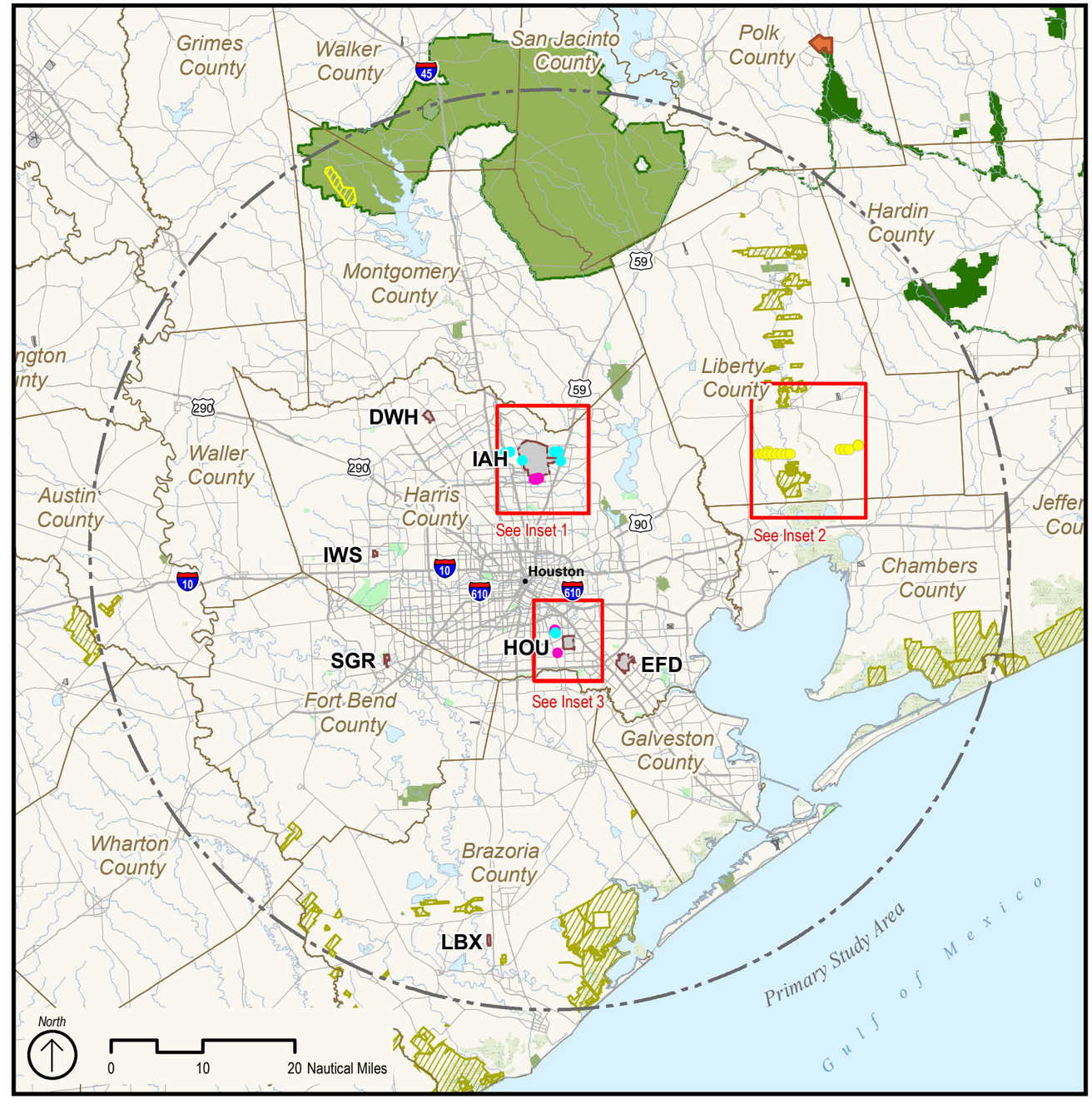

2019 Change in Noise DNL Levels

Noise Increases

- 1.5 dB or greater for location with a Proposed Action DNL >= 65 dB
- 3.0 dB or greater for location with a Proposed Action DNL >= 60 dB and < 65 dB
- 5.0 dB or greater for location with a Proposed Action DNL >= 45 dB and < 60 dB
- New to DNL 65 dB, but no 1.5 dB increase

Noise Decrease

- 1.5 dB for location with a No Action DNL >= 65 dB
- 3.0 dB for location with a No Action DNL >= 60 dB and < 65 dB
- 5.0 dB for location with a No Action DNL >= 45 dB and < 60 dB
- Removed from DNL 65 dB, but no 1.5 dB decrease

Data Source: Environmental Systems Research Institute, Inc.(ESRI) (Airport/Airport Runways), March 14, 2012; ESRI (State Boundaries/County Boundaries), February 14, 2012; ESRI (Cities), February 8, 2012; ESRI (Mountain Peaks), February 28, 2012; ESRI (Roads), March 14, 2012; National Atlas (Tribal Land/Wilderness Areas), February 08, 2012; Texas Natural Resource Information System (TNRIS) (Wildlife Management Areas), February 08, 2012; US Fish & Wildlife Service (National Wildlife Refuge), June 13, 2012; United States Dept of Agriculture (National Forest), May 07, 2012; National Park Service (National Park), February 07, 2012; TNRIS (State Parks or Forest/Local Parks), May 03, 2012; ESRI (Local Parks), May 03, 2012; TNRIS (Department of Defense), February 08, 2012; TNRIS (Railroad), January 2, 2013;

Prepared By: Harris Miller Miller & Hanson Inc., January, 2013

Primary Study Area
Study Airports
Other Airports
County/Parish Boundary
Alabama-Coushatta Tribe of Texas Reservation

Interstate Highway
Highways
Secondary Roads
Railroad
National Forest
National Park
State Park or Forest

Local Park or Recreation Area
National Wilderness Area
National Wildlife Refuge
State Wildlife Management Area
Water
River/Stream

Change of All Modeled Grid Points Exposed to Aircraft Noise, 2019

Figure 27

Houston OAPM EA

Path: H:\GIS\USA\TX\305220_Houston_Metroplex\305220_Houston_Metroplex_Figure27_Pop_Noise_Change_2019.mxd

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Table 26 Comparison of Estimated Population Exposed to Aircraft Noise, 2019

DNL Range (dB)	No Action Alternative	Proposed Action	Percent Change
Less than 45	4,570,480	4,562,565	-0.13%
45 to less than 50	871,244	868,797	-0.04%
50 to less than 55	365,703	377,201	0.19%
55 to less than 60	111,095	110,393	-0.01%
60 to less than 65	16,028	16,417	0.01%
65 to less than 70	2,338	1,515	-0.01%
70 to less than 75	10	10	0.00%
Greater than or equal to 75	0	0	0.00%
Total	5,936,898	5,936,898	
Source: Harris Miller Miller & Hanson Inc., December 2012. Prepared by: Harris Miller Miller & Hanson Inc., December 2012.			

Table 27 presents, for 2019, a summary of the population that would experience changes in noise exposure meeting the criteria in FAA Order 1050.1E for significant and reportable noise increases. As indicated in the table, no population would experience changes in noise exposure under the Proposed Action that would be considered significant (i.e., a change in DNL of 1.5 dB or greater in an area exposed to noise of DNL 65 dB or more). Nor would any population be exposed to reportable noise increases between DNL 60-65 dB because of the Proposed Action. Four hundred five people would experience a DNL 5 dB or greater increase between DNL 45 to 60 dB in 2019 because of the Proposed Action. The locations of these increases are depicted in Figure 27, Inset 2. Additional model grid points indicate that the noise change occurs over a region approximately 13 statute miles long, south of U.S. Highway (US) 90. Depicted in Figure 27 Inset 2, this location is 6-10 mi. south of Liberty, extending from FM 1409 in the southwest to FM 770 in the southeast. Most of the affected population centroids are slightly north of the intersection of FM 1409 and County Road (CR) 450.

Table 27 Change of Estimated Population Exposed to Aircraft Noise, 2019

DNL Noise Exposure Level under Proposed Action	Increase in DNL with Proposed Action	Population Exposed to Threshold Increase
DNL 65 dB and higher	DNL 1.5 dB or greater	None
DNL 60 dB to 65 dB	DNL 3.0 dB or greater	None
DNL 45 dB to 60 dB	DNL 5.0 dB or greater	405
Source: Harris Miller Miller & Hanson Inc., December 2012. Prepared by: Harris Miller Miller & Hanson Inc., December 2012.		

In areas exposed to aircraft noise of DNL 65 dB and higher, the changes in noise exposure at census block centroids resulting from implementation of the Proposed Action are DNL 0.4 dB or less. In areas exposed to aircraft noise from DNL 60 dB to 65 dB, the changes at census block centroids resulting from implementation of the Proposed Action range from a decrease of DNL 0.8 dB to an increase of DNL 0.8 dB. In areas exposed to aircraft noise from DNL 45 dB to 60 dB, changes in noise exposure at census block centroids range from a decrease of DNL 1.7 dB to an increase of DNL 8.7 dB.

For 2019, 58 people (represented by one population centroid) would be newly exposed to DNL 65 dB or greater because of the Proposed Action. This point is located just southwest of the Robert C. Stuart Park to the northwest of HOU. However, these noise increases would be well below DNL 1.5 dB and therefore would not be significant. The maximum increase in DNL attributable to the Proposed Action at this location would be only 0.2 dB. Such changes are extremely small and unlikely be noticed. Two centroids just to the west, representing 95 people, would be exposed to DNL 65 dB or greater under the No Action Alternative and would reduce to less than DNL 65 dB in the Proposed Action. A separate area to the southwest of HOU would be newly exposed to DNL 65 dB or greater, although aerial photography indicates this area is commercial, industrial, or vacant (see Figure 4). The three previously described locations are all depicted in Figure 27, Inset 3. Figure 27, Inset 1 depicts locations around IAH that would move above or below DNL 65 dB. Two population centroids would move below DNL 65 dB as a result of the Proposed Action – one to the west of the airport and east of Rt. 548, representing 83 people, and the second to the east of the airport and approximately three-quarters of a mile west of Rt. 59, representing 703 people. Aerial photography indicates that the other locations in Figure 27, Inset 1 with noise changes are commercial, industrial, or vacant (see Figure 3). Moreover, none of these locations would experience a noise increase of DNL 1.5 dB or more.

5.3 Compatible Land Use

This section presents a summary of the potential impacts to compatible land use under the Proposed Action, as compared to the No Action Alternative.

5.3.1 Overview of Impacts

The Proposed Action would not directly affect land use within the PSA in 2014 or 2019, and would not result in aircraft noise exposure exceeding the FAA's significance threshold for noise impacts in 2014 or 2019. Therefore, no significant impacts to compatible land use are expected.

5.3.2 Methodology

FAA Order 1050.1E states, "The compatibility of existing and planned land uses in the vicinity of an airport is usually associated with the extent of the airport's noise

impacts…. If the noise analysis … concludes that there is no significant impact, a similar conclusion usually may be drawn with respect to compatible land use."[155]

As stated previously, neither the Proposed Action nor the No Action Alternative would involve land acquisition, construction, or other ground disturbance activities. Thus, the compatible land use analysis for this EA relies on the changes in aircraft noise exposure between the Proposed Action and the No Action Alternative (see Section 5.2) as the basis for determining compatible land use impacts within the PSA.

5.3.3 Potential Impacts

No land acquisition, construction, or other ground disturbance activities would occur under the Proposed Action or the No Action Alternative; therefore, neither alternative would directly affect land uses within the PSA in 2014 and 2019.

As stated in Section 5.2 , the Proposed Action, when compared with the No Action Alternative, would not result in changes in aircraft noise exposure that would exceed the FAA's significance threshold in 2014 or 2019. As noted in Section 5.2 , some population centroids would be added to the area exposed to DNL 65 dB and higher (these centroids are identified in Figures 24 and 27) but none would experience a significant noise increase (i.e., DNL 1.5 dB or greater). Therefore, the Proposed Action would not cause significant compatible land use impacts.

Under the No Action Alternative, there would be no changes to air traffic routing in the PSA, so changes in aircraft noise exposure would not occur in either 2014 or 2019. Therefore, the No Action Alternative would not cause significant compatible land use impacts.

5.4 Department of Transportation Act, Section 4(f) Resources

This section presents a summary of the analysis of impacts on Section 4(f) resources under the Proposed Action and No Action Alternative. Section 4.2.3 provides information on potential Section 4(f) resources within the PSA and SSA, as depicted in Figure 18.

5.4.1 Overview of Impacts

The Proposed Action would not result in the use of any potential Section 4(f) property. No potential Section 4(f) properties would experience a DNL increase of 1.5 dB or more that would result in a noise exposure level at or above DNL 65 dB. Nor would the Proposed Action cause any reportable increases in noise exposure to potential Section 4(f) resources below DNL 65 dB. Therefore, the Proposed Action would not cause substantial impairment to any of these resources.

[155] FAA Order 1050.1E, Chg. 1, App. A, sec. 4, p. A-13.

5.4.2 Methodology

As noted in Section 4.2.3.1, the FAA evaluates potential effects on Section 4(f) resources in terms of both physical taking and constructive use. A physical taking would occur as a result of land acquisition, construction, or other ground disturbance activities on all or a portion of the potential Section 4(f) property. No such land acquisition, construction, or other ground disturbance activities would occur under either the Proposed Action or the No Action Alternative. Therefore, neither alternative would have the potential to cause a physical taking of any Section 4(f) resources. For this reason, the focus of the evaluation of potential Section 4(f) resources is on effects with a potential to cause a constructive use to occur. A constructive use would occur when impacts would substantially impair the Section 4(f) resources. Substantial impairment occurs only when the activities, features, or attributes of the resource that contribute to its significance or enjoyment are substantially diminished. With respect to aircraft noise, for example, to cause a constructive use the noise would have to be at levels high enough to have negative consequences of a substantial nature that would amount to a taking of the Section 4(f) resource for transportation purposes. Generally, constructive use associated with air traffic actions would only occur as the result of noise impacts or visual intrusion.

Section 4.2.3 identifies properties within the PSA for which conditions indicate that the property may constitute a resource protected by the provisions of DOT Act, Section 4(f). The FAA evaluated the potential Section 4(f) resources to determine if a constructive use would occur from implementation of the Proposed Action.

If recreation lands aided by the Department of Interior's Land and Water Conservation Fund (known as "Section 6(f) resources") are "used" by a transportation project, replacement satisfactory to the Secretary of the Interior is required. This analysis considers these resources as a part of the Section 4(f) impact analysis process. (See Appendix H for a listing of Section 6(f) resources.)

Within the PSA and SSA, the FAA calculated noise exposure levels for grid points with a uniform spacing of 3,000 ft. and 6,000 ft., respectively. As a result, this spacing generally places grid points throughout the larger Section 4(f) properties for which changes to predicted noise exposure are calculated. For those Section 4(f) properties that were not covered by the uniform grid interval (i.e., smaller parks, historic sites, and monuments), noise exposure was calculated as a single point located in the center of the property.

If the analysis showed that a potential Section 4(f) property would experience a significant noise increase (i.e., DNL increase of 1.5 dB or more at or above DNL 65 dB) or a reportable noise increase (i.e., DNL increase of 3 dB or more between DNL 60 dB and 65 dB or DNL increase of 5 dB or more between DNL 45 dB and 60 dB), the FAA further evaluated the potential Section 4(f) resource to determine whether the effects from implementation of the Proposed Action would rise to a level of being a constructive use.

To evaluate the potential for constructive use resulting from visual effects of changes in aircraft flight tracks under the Proposed Action, the FAA examined the general altitudes at which aircraft route changes would occur beyond the immediate environs of the Houston OAPM Airports to determine the potential for light emissions and other visual impacts. Section 5.10 provides further discussion of Light Emissions and Visual Impacts.

5.4.3 Potential Impacts

The FAA conducted noise modeling for the potential Section 4(f) resources discussed in Section 4.2.3. The modeling showed that the Proposed Action would not result in a significant noise increase (i.e., a DNL increase of 1.5 dB or more at or above DNL 65 dB) at any potential Section 4(f) resource. In addition, there are no potential Section 4(f) resources that would experience reportable noise increases (i.e., a DNL increase of 5 dB or more DNL 45 dB and 60 dB, or a DNL increase of 3 dB or more between DNL 60 dB and 65 dB). Appendix H lists those potential Section 4(f) resources that the FAA modeled for noise analysis and provides a comparison of noise exposure between the No Action Alternative and Proposed Action grid points associated with potential Section 4(f) resources.

Of the 3,799 grid points associated with potential Section 4(f) resources, the FAA found no reportable increases in noise in 2014 or 2019. Selected potential Section 4(f) resources are identified in Figure 24 and Figure 27 for reference purposes, but again, do not have a reportable increase.

The No Action Alternative would not change air traffic routes in the Houston area and the FAA anticipates no effects related to changes in aircraft noise exposure or visual intrusion. Therefore, the No Action Alternative would not result in a use of potential Section 4(f) resources.

As described in Section 5.10 , the Proposed Action would not involve changes to ground-based light sources and the potential visual effects would be substantially the same as any aircraft overflight, i.e., visual sight of aircraft, contrails, or aircraft lights at night. These effects would not materially differ from those occurring under the No Action Alternative, and therefore would not result in a constructive use of potential Section 4(f) resources in 2014 or 2019.

5.5 Historical, Architectural, and Cultural Resources

This section presents a summary of the analysis of impacts to Tribal Lands and historical resources under the Proposed Action and the No Action Alternative. Section 4.2.4 provides information on Tribal Lands and historical resources within the PSA. The FAA, in accordance with Section 106 of the *National Historic Preservation Act of 1966* and implementing regulations *Code of Federal Regulations,* Title 36, Part 800, has initiated consultation with the appropriate State Historic Preservation Officer (SHPO).

5.5.1 Overview of Impacts

There are no historically, architecturally, or culturally significant properties that would experience a DNL change of 1.5 dB resulting in a noise exposure level greater than or equal to DNL 65 dB. The Proposed Action would not cause reportable increases in noise at any of the resources studied and therefore the Proposed Action would not have an "adverse effect" under *Code of Federal Regulations,* Title 36, sec. 800.5(a). The FAA is consulting with the Texas Historical Commission (THC) to obtain concurrence with this finding. The FAA sent an initial outreach letter outlining the Proposed Action to the THC in August 2012, and the FAA sent a copy of this EA to the THC for review and comment.

5.5.2 Methodology

The *National Historic Preservation Act of 1966* requires the FAA to consider the effects of its undertakings on properties listed or eligible for listing in the National Register of Historic Places (NRHP). The FAA defined an area of potential effect (APE) to assess the potential effects of the Proposed Action on historic properties. Federal regulations define the APE as the geographic area or areas within which an undertaking may cause alterations in the character or use of historic properties directly or indirectly, if any such properties exist. The scale and nature of an undertaking influence the APE and may be different for different kinds of effects caused by the undertaking.[156]

Section 4.2.4 describes the process used for identifying potential Historic, Architectural, and Cultural resources. The FAA identified historic districts and historic sites within the PSA and calculated predicted changes in noise exposure that would result from implementation of the Proposed Action.

As discussed in Section 5.10 , the FAA does not expect the Proposed Action to result in significant visual effects. Therefore, the FAA defined the APE based on potential noise effects on historic properties. The analysis calculated noise exposure levels at points within the PSA representing these properties. The FAA then defined the APE for historic properties as the specific areas encompassing the historic properties within the PSA that would be exposed to DNL 45 dB and higher under the Proposed Action (in either 2014 or 2019).The analysis of historic properties considered whether such properties would experience a significant noise increase (i.e., DNL increase of 1.5 dB or more at or above DNL 65 dB) or a reportable noise increase (i.e., DNL increase of 3 dB or more between DNL 60 dB and 65 dB or DNL increase of 5 dB or more between DNL 45 dB and 60 dB). If a reportable noise increase were to occur, the FAA would consider further whether that increase would result in an adverse effect on historic properties.

The analysis of potential noise impacts to Tribal Lands were considered within both the PSA and the SSA. The assessment of noise effects on tribal resources considered the same changes in noise exposure levels considered for historic properties when comparing the Proposed Action and No Action Alternative.

[156] *Code of Federal Regulations,* Title 36, sec. 800.16(d).

5.5.3 Potential Impacts

Neither the Proposed Action nor the No Action Alternative would include any ground disturbance, construction, or land acquisition; therefore, neither would physically destroy nor alter any historic, architectural, or cultural resources, including any on Tribal Lands.

The FAA assessed noise levels at historic properties in the APE to determine if the Proposed Action would result in any noise increases that would diminish the integrity of a property's setting for those properties for which setting contributes to historical significance. Of the 363 historic and cultural properties analyzed, 51 would be exposed to DNL 45 dB or higher under the Proposed Action in either 2014 or 2019 and are considered in the APE. The analysis indicates that none would be exposed to Proposed Action noise levels of greater than DNL 52 dB. All but two sites identified in the APE would have a change (increase or decrease) in noise exposure of DNL 1 dB or less. The two sites with the greatest predicted change in noise exposure are the San Jacinto Battlefield and the U.S.S. Texas.[157] These two sites are located next to each other; in addition they both are potential Section 4(f) properties and are depicted and labeled on Figure 18. The increase in noise exposure under the Proposed Action compared to the No Action is in the range of DNL 4.2 dB and DNL 4 dB for both sites and both forecast years. The highest Proposed Action noise level at either site for either forecast year is DNL 47.1 dB. These changes are below the reportable levels identified in Section 5.5.2.

The noise levels at the Alabama-Coushatta Tribe of Texas Reservation for both the No Action and the Proposed Action, and both forecast years, are below DNL 40 dB. Noise level changes associated with the Proposed Action at these locations are less than DNL 1 dB.

The FAA found no noise increases that would diminish the integrity of a property's setting for those properties for which setting contributes to historical significance. Therefore, no adverse effect arising from aircraft noise exposure on historic properties would result from implementation of the Proposed Action.

Appendix I provides the predicted noise exposure information for both the Proposed Action and the No Action Alternative for the Alabama-Coushatta Tribe of Texas Reservation and all historic resources identified in the PSA.

As described in Section 5.10 , the Proposed Action would not involve changes to ground-based light sources. Therefore, it would not have an adverse effect on a historical, architectural, or cultural resource through introduction of a visual feature to the area that would diminish the integrity of the setting for those properties where setting contributes to the property's historic, architectural, or cultural significance. The

[157] The San Jacinto Battlefield is listed as a Historic District. The names listed here are as they appear in the National Register of Historic Places and as they are listed by the Texas Historic Commission. These sites are also known as San Jacinto Battlefield State Historic Site and Battleship Texas (BB-35), respectively.

FAA initiated consultation with the THC in August 2012. With the publication of this EA, the FAA is seeking concurrence from that agency with this finding.

Under the No Action Alternative, air traffic routes in the Houston area would not change. Therefore, there would be no effects related to changes in aircraft noise exposure or visual effects.

5.6 Air Quality

This section presents a summary of the analysis of air quality impacts under the Proposed Action and the No Action Alternative.

5.6.1 Overview of Impacts

Implementation of the Proposed Action would result in slightly more fuel burned compared to the No Action. However, the Proposed Action is presumed to conform with the State Implementation Plna (SIP). Accordingly, implementation would not cause or contribute to a new violation of the National Ambient Air Quality Standards (NAAQS). Therefore, implementation would not have a significant impact on air quality and a conformity determination is not required.

5.6.2 Methodology

Under FAA Order 1050.1E, significant air quality impacts would occur if an action would exceed one or more of the NAAQS for any of the time periods analyzed.[158] Section 176(c) of the Clean Air Act (CAA) requires that Federal actions conform to the appropriate State Implementation Plan (SIP) in order to attain the CAA's air quality goals. Section 176(c) states: "No department, agency, or instrumentality of the Federal Government shall engage in, support in any way or provide financial assistance for, license or permit, or approve any activity which does not conform to an implementation plan." A conformity determination is not required if the emissions caused by a Federal action would be less than *de minimis* levels established in regulations issued by EPA.[159]

FAA Order 1050.1E provides that further analysis for NEPA purposes is normally not required where emissions do not exceed EPA's *de minimis* thresholds.[160] The EPA regulations identify certain actions that would not exceed these thresholds, including ATC activities and adopting approach, departure, and en route procedures for aircraft operations above the mixing height specified in the applicable SIP (or 3,000 ft. AGL in places without an established mixing height).[161] In addition, the EPA regulations allow Federal agencies to identify specific actions as "presumed to conform" (PTC) to the applicable SIP.[162] In a notice published in the Federal Register, the FAA has identified several actions that "will not exceed the applicable *de minimis* emissions levels" and are

[158] FAA Order 1050.1E, Chg.1, App. A, sec. 2.3.
[159] *Code of Federal Regulations*, Title 40, sec. 93.153(b).
[160] FAA Order 1050.1E, Chg. 1, App. A, sec. 2.1c.
[161] *Code of Federal Regulations*, Title 40, sec. 93.153(c)(2)(xxii).
[162] Ibid., sec. 93.153(f).

therefore presumed to conform, including ATC activities and adopting approach, departure, and en route procedures for air operations.[163] The FAA's presumed to conform notice explains that aircraft emissions above the mixing height do not have an effect on pollution concentrations at ground level.[164] The notice also specifically notes that changes in air traffic procedures above 1,500 ft. AGL and below the mixing height "would have little if any effect on emissions and ground concentrations."[165]

As described in Section5.7 , the FAA analyzed the fuel burn resulting from the Proposed Action and the No Action Alternative.

5.6.3 Potential Impacts

Implementing the Proposed Action would result in a slight increase in fuel burn (e.g., 0.21 percent increase for 2014 and 0.28, percent increase for 2019) in an area with a 95 NM radius from the study center, as compared to the No Action Alternative. Increased fuel burn corresponds with an increase in air emissions. However, the Proposed Action would not affect any procedures below 1,500 ft. AGL that would cause an increase in fuel or emissions compared to the No Action Alternative. Any operational changes that could result in an increase in fuel burn would occur above 1,500 ft. AGL, with the majority of procedural changes expected to occur above 3,000 ft. AGL.

The Proposed Action would result in slightly more fuel burn and air emissions above 1,500 ft. AGL, as compared to the No Action Alternative. NIRS modeling of the alternatives for each design year substantiated this finding, showing a slight increase in fuel consumption and emissions compared to the No Action Alternative (see Section 5.7.3). There are no procedure changes associated with the Proposed Action that are expected to occur below 1,500 ft. AGL that would cause an increase in emissions, as compared to the No Action Alternative. Therefore, no further air quality analysis is necessary and a conformity determination is not required.

The Proposed Action would not affect ground vehicles. Therefore, no increase in ground vehicle use or emissions is expected.

Based on the above analysis, no further air quality analysis is necessary, a conformity determination is not required, and the Proposed Action would not have a significant impact on air quality.

Under the No Action Alternative, the FAA would not implement the Proposed Action. Therefore, no significant changes to the affected environment for air quality, previously described in Section 4.2.5 would occur from an FAA action.

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[163] U.S. National Archives and Records Administration, "Federal Presumed to Conform Actions Under General Conformity," *Federal Register* 72, no. 145 (July 20, 2007): 41565-41580.
[164] Id. at 41578.

[165] Id.

5.7 Natural Resources and Energy Supply

This section addresses the potential impacts of the Proposed Action with respect to natural resources and energy supply as compared with the No Action Alternative.

5.7.1 Overview of Impacts

The Proposed Action would result in relatively small increases (0.21 percent in 2014 and 0.28 percent in 2019) in aircraft fuel burned. These increases would not be expected to adversely affect local supplies of energy compared to the No Action Alternative. Therefore, the effects of the Proposed Action on natural resources and energy supply would not be significant.

5.7.2 Methodology

The FAA's NIRS model calculates aircraft-related fuel burn as an output along with calculating aircraft noise exposure. The inputs to NIRS to estimate aircraft-related fuel burn are the same as those used in the noise analysis, such as the average annual day flight schedules, flight tracks, and runway use. Refer to Sections 4.2.1, 5.2 , and Appendix G for discussions of noise exposure calculation methodology, inputs, and assumptions, which are also applicable to the fuel burn calculation methodology. This analysis uses changes in fuel burn as an indicator of changes in fuel consumption resulting from implementation of the Proposed Action compared with the No Action Alternative.

According to FAA Order 1050.1E: "For most actions, changes in energy demands or other natural resource consumption will not result in significant impacts. If an EA identifies problems such as demands exceeding supplies, additional analysis may be required in an EIS. Otherwise, it may be assumed that impacts are not significant."[168]

5.7.3 Potential Impacts

Table 28 presents the results of the fuel burn analysis for the Proposed Action and No Action Alternative. As shown in Table 28, compared with the No Action Alternative, the Proposed Action would result in 1,183 MT (0.21 percent) more fuel burned in 2014 and 2,013 MT (0.28 percent) more fuel burned in 2019. Given these relatively small increases, the FAA expects that the Proposed Action would not adversely affect local fuel supplies when compared with the No Action Alternative. Therefore, the effects of the Proposed Action on natural resources and energy supply would not be significant.

[168] FAA Order 1050.1E, Chg. 1, App. A, sec. 13.2b.

Table 28 Comparison of Energy Consumption, 2014 and 2019

	2014		2019	
	No Action Alternative	Proposed Action	No Action Alternative	Proposed Action
Fuel Burn (MT)	561,065	562,248	722,228	724,241
Volume Change (MT)	0	1,183	0	2,013
Percent Change (Proposed Action minus No Action / Divided by No Action) (MT)	0.00%	0.21%	0.00%	0.28%

Source: Harris Miller Miller & Hanson Inc., December 2012.
Prepared by: Harris Miller Miller & Hanson Inc., December 2012.

5.8 Climate

This section presents a summary discussion of greenhouse gas (GHG) emissions and Climate, as they relate to the Proposed Action and the No Action Alternative.

5.8.1 Overview of Impacts

Although fuel burn would increase slightly with the Proposed Action compared to the No Action Alternative (see Section 5.7), no significant project-related effects on climate are expected.

5.8.2 Methodology

In accordance with FAA guidance,[169] estimated CO_2 emissions were calculated from the amount of fuel burned under the No Action Alternative and the increased fuel burn projected for the Proposed Action in 2014 and 2019 (see Section 5.7). The resulting increases in CO_2 emissions were then calculated as a percentage of national and global CO_2e totals from all GHG sources.

5.8.3 Potential Impacts

Table 29 shows the project-related CO_2e emissions.[170] CO_2 emissions under the Proposed Action would be 3,732 MT of CO_2e, or less than one-third of a percent more than the No Action Alternative in 2014 and 6,352 MT of CO_2e, or less than one-third of a percent, more in 2019. These increases would comprise less than 0.000129 (1.29^{E-04}) percent and 0.000219 (2.19^{E-04}) percent, respectively for 2014 and 2019, of U.S.-based GHG emissions[171] and less than 0.00000762 (7.62^{E-06}) percent and 0.0000130 (1.30 $^{E-}$

[169] FAA Order 1050.1E, Chg. 1, Guidance Memo #3.
[170] As discussed in Section 4.2.7.1 CO_2 emissions are equivalent to CO_2e emissions for this analysis.
[171] The EPA reports national CO_2e emission totals of 3.2 billion tons CO_2e for 2010. EPA, "Greenhouse Gas Reporting Program (GHGRP) 2010: Reported Data": http://www.epa.gov/ghgreporting/ghgdata/reported/index.html

05) percent of global GHG emissions.[172] Therefore, the FAA does not expect the Proposed Action to have a significant effect on climate.

Table 29 Comparison of CO_2e Emissions, 2014 and 2019

	2014		2019	
	No Action Alternative	Proposed Action	No Action Alternative	Proposed Action
CO_2 Emissions (MT of CO_2e)	1,770,160	1,773,892	2,278,630	2,284,982
Proposed Action minus No Action (MT of CO_2e)	--	3,732	--	6,352
Percentage Change	--	0.21%	--	0.28%

Source: Harris Miller Miller & Hanson Inc., December 2012.
Prepared by: Harris Miller Miller & Hanson Inc., December 2012.

5.9 Fish, Wildlife, and Plants

This section presents a summary of the analysis of potential avian and bat species impacts under the Proposed Action and the No Action Alternative.

5.9.1 Overview of Impacts

The Proposed Action would not affect fish, plants, terrestrial wildlife, or their habitats because the Proposed Action does not involve land disturbing activities. The Proposed Action would not be expected to result in increased wildlife strikes when compared with the No Action Alternative because the proposed changes would cover a similar geographic area and duration as existing conditions and would occur primarily above 2,500 ft. AGL, where the FAA's Wildlife Strike Database has reported only a small proportion of strikes. Furthermore, the Houston OAPM Airports has reported only three strikes of threatened and endangered species in over 20 years and, as proposed changes are similar to existing conditions, the Proposed Action would not appreciably increase the risk of impact on threatened and endangered species. Therefore, the Proposed Action is not likely to adversely affect listed species or critical habitat. The FAA initiated informal consultation with the U.S. Fish and Wildlife Service (FWS) in August 2012 and is seeking concurrence with the FAA's finding.

5.9.2 Methodology

The FAA's Wildlife Strike Database is the best information available for assessing potential impacts of aircraft on wildlife. Strike reports over the past 22 years aggregated nationally as well as for individual airports are available from the database to understand existing conditions. Strike reports are comparable to known information on the presence of specific species of concern to corroborate the reports.

[172] The Intergovernmental Panel on Climate Change (IPCC) estimates global GHGs in 2004 at 49 Gigatonnes CO_2e, with CO_2 being the single largest source. IPCC, Working Group III, "Summary for Policymakers," 9th Session, Bangkok, Thailand, April 30 – May 4, 2007.

This analysis involved a review of arrival and departure flight tracks for the Houston OAPM Airports for the Proposed Action and No Action Alternative. Additionally, the altitude of flight tracks above and below 2,500 ft. AGL were reviewed, because research has documented that 88 percent of all wildlife strikes nationwide occur below 2,500 ft. AGL.[173] The FAA compared modifications in flight procedures to the occurrence of species and populations of concern to assess if existing wildlife strike reports might change under the Proposed Action.

5.9.3 Potential Impacts

The Proposed Action would not involve acquisition, construction, or other land disturbing activities. Therefore, impacts to fish, plants, terrestrial wildlife, or their habitats would not occur. The FAA considered the potential impacts of the Proposed Action relative to existing wildlife strikes and changes in strikes based on modified flight procedures.

Wildlife Strikes

Since 1990, the FAA has compiled reports of wildlife strikes with aircraft. The information is available to the public through the National Wildlife Strikes Database[174] and through analysis prepared in an annual report.[175] The Wildlife Strike Database reported 119,917 wildlife strikes nationally over a 22-year period between 1990 and 2011. Birds represent 97.1 percent of all strikes. Of those, 88 percent of strikes affecting commercial civil aircraft have occurred below 2,500 ft. AGL and 92 percent occurred below 3,500 ft. AGL. The Wildlife Strike Database reports that gulls have the highest occurrence of strikes (16%), followed by doves/pigeons (15%).

The Wildlife Strike Database enables research and information collection for strikes, reportable by airport, including species struck, height of strike, and type and extent of aircraft damage, although not all reports provide complete information. The Wildlife Strike Database reports 1,947 strikes at Houston OAPM Airports. One of the limitations of the data is that not all reports provide the full complement of available information. For example, 68 percent of the recorded bird strikes for the Houston OAPM Airports from 1990 through June 2012 did not identify the affected species. However, there are 623 reports at the Houston OAPM Airports that include species identification and are available for analysis. Table 30 provides information on wildlife strikes reported by the Houston OAPM Airports for data available from 1990 through June 30, 2012.[176]

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[173] FAA, "FAA Wildlife Strike Database": http://wildlife-mitigation.tc.faa.gov/wildlife/default.aspx (accessed June 22, 2012).
[174] Ibid.
[175] FAA, "Wildlife Strikes to Civil Aircraft in the United States 1990-2011," *Federal Aviation Administration National Wildlife Strike Database Serial Report, no. 18*, July 2012.
[176] FAA, "FAA Wildlife Strike Database": http://wildlife-mitigation.tc.faa.gov/wildlife/database.aspx. (At the time data of download for this EA, the database included 136,648 Strike Reports from 1/1/1990 through 6/30/2012.)

Table 30 FAA Wildlife Strike Database Summary Records for Houston OAPM Airports (1990 – June 2012)

Airport[1]	Strikes[2]	Species[3] (common name)	Height (ft. AGL)
George Bush Intercontinental/Houston (IAH)	824	Bald Eagle, Swallows, Blackbirds, Geese, Cattle Egret, Snowy Egret, Cedar Waxwing, Nighthawks, Doves, Meadowlark, Starling, Finches, Grackles, Gulls, Killdeer, Sparrows, Purple Martin, Red-tailed Hawk, Upland Sandpiper, Flycatchers	0-15,500
William P. Hobby (HOU)	951	Least Tern, Crows, Kestrel, Plover, Redstart, Robin, Barn Owl, Burrowing Owl, Swallows, Blackbirds, Cattle Egret, Great Egret, Snowy Egret, Tri-colored Heron, Swifts, Nighthawks, Doves, Ducks, Starlings, Grackles, Catbirds, Gulls, Red-tailed Hawk, Swainson's Hawk, Killdeer, Tern, Shrike, Merlin, Mockingbird, Orioles, Sanderlings, Upland Sandpiper, Yellow-crowned Night Heron, Brazilian Free-tailed Bat, Fruit Bat, Vesper Bats	0-12,000
Houston Southwest (AXH)	2	Unknown bird – Medium	0 -2,000
Lone Star Executive (CXO)	3	Turkey Vulture, Unknown bird – small	0 -1,000
David Wayne Hooks Memorial (DWH)	24	Doves, Sparrows, Crows, Vulture	10-5,500
Ellington Field (EFD)	100	Kestrel, Anhinga, Barn Owl, Swallows, Cattle Egret, Flycatcher, Doves, Ducks, Gulls, Hawks, Horned Larks, Killdeer, Meadowlark, Nighthawk, Sparrow, Vulture, Yellow-crowned Night Heron, Bats	0-3,500
Scholes International (GLS)	14	Least Tern, Gulls (various), Brown Pelican, Rock Pigeon	0-10,000
West Houston (IWS)	1	Unknown bird – Medium	2,500
Texas Gulf Coast Regional (LBX)	2	Vulture	900-1,000
Pearland Regional (LVJ)	1	American Crow	500
Sugar Land Regional (SGR)	12	Doves, Sparrows, Yellow-crowned Night Heron	0-800
Houston Executive (TME)	13	Barn Swallow, Cliff Swallow, Eastern Meadowlark, Northern Yellow Bat, Savannah Sparrow, Scissor-tailed Flycatcher	n/a[4]
Weiser Air Park (EYQ)	0	no reported strikes	n/a
Baytown (HPY)	0	no reported strikes	n/a
Chambers County (T00)	0	no reported strikes	n/a
La Porte Municipal (T41)	0	no reported strikes	n/a
RWJ Airpark (54T)	0	no reported strikes	n/a

Notes:
1. Data used for IAH, HOU, AXH, CXO, DWH, EFD, GLS, IWS, LBX, LVJ, SGR, and TME. No strikes reported for EYQ, HPY, T00, T41, and 54T. This table presents strike data for all 17 airports affected by the Proposed Action.
2. Total number of strikes, even if species or altitude were unknown or not reported
3. Summary list of the most common avian and bat species found in the database
4. For TME, only one incident included altitude information. That strike occurred as the aircraft landed on the runway.

Source: http://wildlife-mitigation.tc.faa.gov/wildlife/default.aspx (accessed August 30, 2012; last reported incident June 29, 2012)

The altitude of the strike was included on 71 percent of all wildlife strike reports. Table 31 provides a summary of wildlife strikes by altitude for the Houston OAPM Airports for data available from 1990 through 2012 (as available in June). Eighty-one (81) percent of the strikes associated with Houston OAPM Airports occurred below 2,500 ft.

Table 31 FAA Wildlife Strike Database Records for Houston OAPM Airports by Altitude (1990 – June 2012)

Type of Strike[1]	2,500 AGL or less	>2,500 AGL to <= 10,000 AGL	Greater than 10,000 AGL	Total
Identified Bird	394	28	0	422
Bats	9	0	0	9
Unknown Bird (avian)	39	3	1	43
Unknown Bird (avian) – Large	21	9	2	32
Unknown Bird (avian) – Medium	247	115	10	372
Unknown Bird (avian) – Small	393	93	5	491
Identified Non Avian	18	0	0	18
Total[2]	1,121	248	18	1,387
Percent[3]	81%	18%	1%	100%

Notes:
1. Includes total number of strikes, even if species was unknown. Uses data for IAH, HOU, AXH, CXO, DWH, EFD, GLS, IWS, LBX, LVJ, SGR, and TME. No strikes reported for EYQ, HPY, T00, T41, and 54T. This table presents strike data for all 17 airports affected by the Proposed Action.
2. Five-hundred sixty (560) reported strikes did not include altitude information and are not included in this table.
3. Percentages may not add to 100% due to rounding.

Source: http://wildlife-mitigation.tc.faa.gov/wildlife/default.aspx (accessed August 30, 2012; last reported incident June 29, 2012)

As discussed above, 623 of the strikes from Houston OAPM Airports included species identification. The Migratory Bird Treaty Act protects all the bird species identified in these reports. The only species identified in the database that are listed for protection under Federal or state endangered species laws are the Bald Eagle (one report) and the Least Tern (two reports).

Impact Assessment

The number of aircraft operations between the Proposed Action and No Action Alternative would be the same. Therefore, the assessment of the potential impacts focuses on changes to flight paths and the potential for impact due to wildlife strikes.

The changes to the arrival and departure corridors below 2,500 ft. AGL would not substantially alter flight paths. Therefore, the Proposed Action would not be expected to result in increased impacts to avian and bat wildlife, including listed species, compared with the No Action Alternative. Furthermore, for the majority of reported wildlife strikes at the Houston OAPM Airports, the FAA anticipates narrower arrival and departure corridors with implementation of the Proposed Action given the predictability associated with RNAV procedures. Based on the strikes of known species (623 reports), the Proposed Action is not likely to adversely affect avian and bat wildlife compared with the No Action Alternative.

The Proposed Action would not increase the number of aircraft operations in the Houston OAPM Airports compared with the No Action Alternative. Changes to air traffic flows would primarily occur above 2,500 ft. AGL. Thus, the FAA would not expect any adverse changes in impacts to avian and bat species under the Proposed Action as compared with the No Action Alternative because risk of avian and bat strikes occurs mainly below this altitude.

Changes to air traffic flows below 2,500 ft. AGL are unlikely to adversely affect avian and bat species (including listed species) as compared with the No Action Alternative because proposed changes are limited and similar to existing conditions.

The No Action Alternative would not involve changes to air traffic flows, land acquisition, construction, or other ground disturbance activities; therefore, no impacts to fish, wildlife, or plants would occur.

Therefore, the Proposed Action is not likely to adversely affect listed species or critical habitat. The FAA initiated informal consultation with the FWS in August 2012. The FAA sent a copy of this EA to the FWS for review and comment and to request concurrence with the FAA's finding.

5.10 Light Emissions and Visual Impacts

This section presents a summary of the analysis of light emissions and visual impacts under the Proposed Action and the No Action Alternative.

5.10.1 Overview of Impacts

Implementation of the Proposed Action would have no potential for impact from light emissions, as changing IFPs would not involve any land disturbing activities or construction of navigational facilities, airport improvements, or similar stationary objects. With respect to visual or aesthetic effects, the potential effects arising from changes to IFPs would be substantially the same as any aircraft overflight: visual sight of aircraft, contrails, or aircraft lights at night. These effects would not materially differ from those occurring under the No Action Alternative, and therefore would not be adverse.

5.10.2 Methodology

FAA Order 1050.1E treats light emissions separately from visual impacts. The former are the result of lighting on aviation facilities (e.g., airfields, terminal buildings, access roads, navigational facilities including those located away from an airport). In comparison, an assessment of visual (or aesthetic) impacts considers the extent that the Proposed Action (typically construction) would create a contrast with the existing visual or aesthetic setting and the extent to which such contrast would be objectionable.

According to FAA Order 1050.1E, "The visual sight of aircraft, aircraft contrails, or aircraft lights at night, particularly at a distance that is not normally intrusive, should not

be assumed to constitute an adverse impact."[177] Visual, or aesthetic, impacts are more difficult to define and evaluate than light emissions from facilities construction because the former are less readily measured and their effects on a visual landscape are inherently subjective. Visual or aesthetic impacts deal more broadly with the extent that the project contrasts with the existing environment and whether the community's jurisdictional agency considers this contrast objectionable. Visual impacts are normally related to the disturbance of the aesthetic integrity of an area caused by development, construction, or demolition, and thus, do not typically apply to airspace changes.

To evaluate the potential for indirect impacts resulting from changes in aircraft routings and visual intrusion, the general altitudes at which aircraft route changes occur beyond the immediate airport environs, which experiences overflights on a routine basis, are considered to evaluate the potential for light emissions and visual impacts.

5.10.3 Potential Impacts

The Proposed Action and the No Action Alternative do not include development, construction, or demolition of facilities. Therefore, the Proposed Action would not disturb the aesthetic integrity of an area or result in a visual contrast with the existing environment because of land disturbing or construction activities. The Proposed Action and the No Action Alternative would not involve changes to ground-based light sources, thus they would not cause adverse effects from light emissions that would result in annoyance or interference with normal human activities.

Changes in aircraft routes associated with the Proposed Action would generally, but not always, occur at altitudes above 3,000 ft. AGL. Those changes occurring below 3,000 ft. AGL would be near airports where aircraft operations are commonplace. No aspect of the Proposed Action would alter the visual quality or nature of aircraft silhouettes, contrails, or lighting systems. Therefore, the FAA does not expect the visual sight of aircraft and aircraft lights from aircraft overflying above 3,000 ft. AGL to be intrusive. Effects from aircraft flying at lower altitudes would generally be similar to operations already occurring in the general vicinity of airports. Further, below 3,000 ft. AGL, no aspect of the Proposed Action would alter the setting generally found in the generally urbanized or suburban setting within which the existing airports are located. Consequently, the Proposed Action would not result in adverse visual impacts.

Air traffic routes under the No Action Alternative would not change, and therefore, would not result in changes in light emissions to people on the ground, so no adverse impacts relating to light emissions would occur.

5.11 Environmental Justice

This section presents a summary of the analysis of environmental justice under the Proposed Action and the No Action Alternative.

[177] FAA Order 1050.1E, Chg. 1, App. A, sec. 12.2b.

5.11.1 Overview of Impacts

The Proposed Action would not result in disproportionately high and adverse human health or environmental effects on minority and low income populations, and there would be no environmental justice impacts.

5.11.2 Methodology

Under FAA Order 1050.1E, "When FAA determines that a project has significant effects pursuant to NEPA, the potential for disproportionately high and adverse effects pursuant to environmental justice must be analyzed."[178] The FAA examines environmental justice during evaluation of other impact categories, such as noise, air quality, water, hazardous materials, and cultural resources.

5.11.3 Potential Impacts

As explained elsewhere in this chapter and shown in Table 22, the FAA has determined that neither the Proposed Action nor the No Action Alternative would have a significant impact in any environmental impact category. Therefore, neither alternative would result in disproportionately high and adverse human health or environmental effects on minority and low income populations, and there would be no environmental justice impact.

5.12 Cumulative Impacts

Consideration of cumulative impacts applies to the impacts resulting from the implementation of the Proposed Action with other actions. CEQ regulations state:"'Cumulative impact' is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."[179]

5.12.1 Overview of Impacts

The implementation of the Proposed Action when considered with other past, present and reasonably foreseeable future actions would not be expected to result in significant cumulative impacts.

5.12.2 Methodology

For the purpose of assessing cumulative effects, the incremental direct and indirect impacts associated with the Proposed Action were considered in conjunction with the direct and indirect effects of other past, present, or reasonably foreseeable future projects, to determine whether they would cause significant effects.

[178] FAA Order 1050.1E, Chg. 1, App. A, sec. 16.2a.
[179] *Code of Federal Regulations*, Council on Environmental Quality Regulations, Title 40, sec. 1508.7.

Reasonably, foreseeable future actions refer to those projects with implementation likely in the year 2013 or later. They would be actions that a proponent would likely complete and for which plans have been developed with enough specificity to provide meaningful information to a decision maker and the interested public.

In determining the significance of the cumulative effects, the same thresholds of significance used to identify impacts that apply individually to the Proposed Action would also apply. Environmental impact categories that are not affected by the Proposed Action (see Section 4.3) are not examined for cumulative impacts because there would be no potential for the Proposed Action to cumulatively affect those environmental impact categories. Similarly, where FAA analysis of the Proposed Action indicates a neutral effect, or lack of an adverse effect, on an environmental impact category (i.e. Fish, Wildlife and Plants; Light Emissions and Visual Impacts; Environmental Justice) compared to the No Action alternative, that impact category is also not examined for cumulative impacts

The FAA reviewed projects within the vicinity of the Houston OAPM Airports to evaluate the potential for cumulative impacts. Table 21 provides a summary of potential projects proposed on or near the Houston OAPM Airports (see Section 4.4).

This analysis considers potential cumulative impacts related to implementation of the Proposed Action in four categories: (1) Noise (including potential impacts on populations in the PSA, Tribal Lands, compatible land use, potential Section 4(f) resources, and historic properties); (2) Air Quality; (3) Natural Resources and Energy Supply; and (4) Climate. The FAA evaluated the projects identified in Table 32 to determine the potential for cumulative impacts in these categories.

5.12.3 Potential Impacts

For each of the relevant past, present, and reasonably foreseeable future projects identified by the FAA, Table 32 presents a summary of the potential for cumulative effects. Additional discussion of potential cumulative impacts, by environmental resource category, follows the table.

Table 32 Potential for Cumulative Impacts from the Proposed Action and Other Past, Present, and Reasonably Foreseeable Future Actions

Project	Description	Potential for Cumulative Effects
Projects at Houston OAPM Airports		
Houston Intercontinental (IAH)Terminal B Improvements	Phase one of this project – scheduled for completion in 2013 – will create a new Terminal B concourse dedicated to domestic regional jet operations. Plans for the entire three-phase redevelopment project are over seven to 10 years, based on demand.	Construction began in 2012 and is expected to be ongoing after phase one in 2013. Projected flight operations activity levels for the Houston OAPM Proposed Action and No Action were modeled using TAF data, which included best available information on future planned flight operations levels. There is no indication that this project would alter aircraft operation levels in the TAF. No significant cumulative impacts are expected with the Proposed Action.

Project	Description	Potential for Cumulative Effects
Revision to IAH SIAPs serving Runways 26L /26R / 27	Revised altitudes on approaches	Revised SIAPs published in February 2012. These changes occurred at altitudes above 1,500 ft AGL and are sufficiently far from the airport that noise levels are (and would be) below DNL 65 dB. No potential for significant cumulative impact with the Proposed Action.
Revision to IAH SIAPs serving Runways 8L/ 8R/9	Revised altitudes on Runway 9 approaches (no change for the 8L/8R approaches that would affect aircraft altitudes)	Revised SIAPs published in May 2012. These changes occurred at altitudes above 1,500 ft AGL and are sufficiently far from the airport that noise levels are (and would be) below DNL 65 dB.. No potential for significant cumulative impact with the Proposed Action.
Houston Hobby (HOU) Terminal Building and other Facilities Expansion for Planned International Operations	Construction of five additional gates for international flights and construction of a Federal Inspection Services facility at HOU	The Proposed Action and No Action were modeled using TAF data, with additional HOU operations in the 2019 forecast based on information available about this project. No significant cumulative impacts are expected with the Proposed Action.
IAH Potential New Cross-field Taxiway and Terminal Improvements	Houston Airport System (HAS) is taking steps to upgrade terminal D to accommodate Airbus A-380 and Boeing B748 aircraft between 2012 and 2018. HAS is also discussing a cross-field taxiway.	Projected flight operations activity levels for the Houston OAPM Proposed Action and No Action were modeled using TAF data, which included best available information on future planned flight operations levels. There is no indication that this project would alter aircraft operation levels in the TAF. No significant cumulative impacts are expected with the Proposed Action.
Runway Extension at Lonestar Executive Airport (CXO)	Texas Department of Transportation (TxDOT) is considering extending Runway 14/32. The project is currently in the planning phase.	TxDOT would undertake separate environmental analysis to characterize impacts arising from facilities construction. This airport has too few operations to warrant noise analysis for this EA, as discussed in Section 4.1.4. No significant cumulative impacts are expected with the Proposed Action.
Potential Improvements to Facilities at Ellington Field (EFD)	Various GA facility development plans are planned for EFD.	Projected flight operations activity levels for the Houston OAPM Proposed Action and No Action were modeled using TAF data, which included best available information on future planned flight operations levels. There is no indication that this project would alter aircraft operation levels in the TAF. No significant cumulative impacts are expected with the Proposed Action.
Regional Airspace Projects		
Gulf of Mexico Lateral Separation Reduction / RNAV Routes	Publication and implementation of new RNAV routes across the Gulf of Mexico	CATEX approved September 2012. Procedures to be charted and implemented in January 2013. No significant cumulative impacts are expected with the Proposed Action.
BAZBL STAR STROS STAR ROYOH STAR COACH STAR	Changes to HOU arrival procedures, west of the airport	Procedure changes were published effective May 2012. The changes occurred outside of noise levels of DNL 45 dB as presented in Figure 26. The Proposed Action would cancel these four procedures and aircraft would use

Project	Description	Potential for Cumulative Effects
		new procedures that are included in the Proposed Action. No significant cumulative impacts are expected with the Proposed Action.
North Texas OAPM	The North Texas OAPM project would optimize air traffic operations in the Dallas – Fort Worth area.	FAA is undertaking separate NEPA analysis to characterize impacts arising from implementation. Points of boundary interface where potential North Texas OAPM changes to IFPs abut or coincide with Houston OAPM IFP changes were included in modeling for noise and air quality impacts for the Houston OAPM. No significant cumulative impacts are expected with the Proposed Action.
Surface Transportation Projects		
US 290 Corridor	Proposal to Construct Roadway Improvements from Farm-to-Market (FM) 2920 to Interstate Highway 610 (IH-610), Harris County, TX	Separate NEPA analysis would be undertaken by TxDOT and the Federal Highway Administration FHWA) to characterize impacts arising from construction and roadway use activities. No significant cumulative impacts are expected with the Proposed Action.
Grand Parkway (State Highway 99 [SH-99]) Segment B	Construction from SH-288 to IH-45, Brazoria and Galveston Counties, TX	Separate NEPA analysis would be undertaken by TxDOT and FHWA to characterize impacts arising from construction and roadway use activities. No significant cumulative impacts are expected with the Proposed Action.
Grand Parkway (SH-99) Segment E	Improvement Project, IH-10 to US-290, Harris County, TX	Segment E Revised Record of Decision (ROD) was issued on June 9, 2009 by FHWA. The Segment E FEIS Re-evaluation was approved by FHWA on June 9, 2009. No significant cumulative impacts are expected with the Proposed Action.
Grand Parkway (SH-99) Segment F-1	Highway Construction, US-290 to SH-249, Harris, Montgomery, Fort Bend, Liberty, Brazoria, Galveston and Chambers Counties, TX	The Second Segment F-1 FEIS Re-evaluation was approved by FHWA on May 22, 2012. No significant cumulative impacts are expected with the Proposed Action.
Grand Parkway (SH-99) Segment F-2	From SH-249 to IH-45, a new four-lane, controlled access divided highway. This segment borders David Wayne Hooks Airport (DWH).	The Segment F-2 Final Environmental Impact Statement (FEIS) Re-evaluation was approved FHWA on May 22, 2012. No significant cumulative impacts are expected with the Proposed Action.
Grand Parkway (SH-99) Segment G	From Interstate Highway IH-45 to U.S. Highway 59 (US-59), Harris and Montgomery Counties, TX	The Segment G FEIS Re-evaluation was approved by FHWA on May 22, 2012. No significant cumulative impacts are expected with the Proposed Action.
Grand Parkway (SH-99) Segments H and I-1	From US-59 (N) to Interstate Highway IH-10 (E), Transportation Improvement, Montgomery, Harris, Liberty and Chambers Counties, TX	TxDOT and FHWA would undertake separate NEPA analysis to characterize impacts arising from construction and roadway use activities. Public Hearings were held on August 9, 2011 and August 11, 2011 to inform the public and stakeholders of the proposed roadway improvements for Grand Parkway (SH-99) Segments H & I-1. No significant cumulative impacts are expected with the Proposed Action.

Project	Description	Potential for Cumulative Effects
Light Rail - North Corridor Fixed Guideway Project	Proposed Transit Improvements from University of Houston (UH)-Downtown Station to Northline Mall, Harris County, TX	Expected Completion in 2014. Separate NEPA analysis would be undertaken by TxDOT and FTA to characterize impacts arising from construction and operational activities. No significant cumulative impacts are expected with the Proposed Action.
Light Rail - Southwest Corridor Project	Proposed Fixed-Guideway Transit System, Houston, Harris County, TX	Public meetings concluded on June 12, 2012. TxDOT and FTA would undertake separate NEPA analysis to characterize impacts arising from construction and operational activities. No significant cumulative impacts are expected with the Proposed Action.

5.12.3.1 Potential for Cumulative Noise Impacts

Noise and noise-related impacts include changes in noise exposure for populations, Tribal Lands, compatible land use, potential Section 4(f) resources, and historic properties.

Implementation of the Proposed Action would not result in significant changes in noise exposure, as discussed in this chapter. Three of the categories of past, present, and reasonably foreseeable projects have the potential to contribute cumulatively to the noise impacts of the Proposed Action:

- **Projects at Houston OAPM Airports:** As discussed in Table 32, these projects would not be expected to have a significant cumulative noise impact.
- **Regional Airspace Projects:** Since the grid points having a value of DNL 65 dB or greater are concentrated in the vicinity of the study airports, the combination of the regional airspace actions with the Proposed Action would not be expected to have significant cumulative noise impacts. Project-specific analysis is presented in Table 32.
- **Surface Transportation Projects:** In general and when viewed in aggregate, the proposed surface transportation project corridor rights-of-way are typically at sufficient distances from airports such that the noise from the linear corridors and the noise in the vicinity of airports ordinarily would not overlap. Thus, no significant cumulative noise impacts are expected.
- The proposed US 290 corridor improvements are near David Wayne Hooks Memorial (DWH), one of the Analyzed Airports. The Proposed Action would not cause noise changes in the immediate vicinity of the airport. Therefore, when considered with the US 290 project, there is no potential for significant impact.

In summary, based on the review of past, present, and reasonably foreseeable projects, the FAA does not expect the Proposed Action to contribute to changes in noise exposure that would cumulatively result in significant impacts.

5.12.3.2 Potential for Cumulative Air Quality Impacts

As discussed in Sections 4.2.5.2 and 5.6.3, the Houston Metroplex spans a broad area. Within this area, much development has occurred, both in the vicinity of the OAPM airports, and away from the immediate environs of those airports as indicated by the geographical extent of the past, present, and reasonably foreseeable actions listed in Section 4.4. The application of federal and state air quality regulations along with significant technological improvements aimed at reducing impacts on air quality have acted to offset emission increases caused by regional population and development growth.

As discussed in Section 4.2.5.2 and presented in Table 17, the EPA has designated parts of the PSA as non-attainment areas for the 8-hour ozone NAAQS. As discussed in Section 5.6.1, Air Quality, the Proposed Action would not have a significant impact on air quality as compared to the No Action Alternative and is presumed to conform to the SIP; therefore, it would not have the potential to cause significant cumulative impacts. Moreover, given the cumulative nature of air quality, which examines effects from multiple emissions sources over extended geographical and temporal extents and which employs a regulatory scheme of inventorying permitted emissions and comparing those to NAAQS; it is anticipated that the cumulative impacts of all projects in the greater Houston metropolitan region, including the implementation of the Proposed Action would not result in any change to the attainment status for the various criteria air pollutants.

Based on the review of past, present, and reasonably foreseeable projects, the FAA does not expect the Proposed Action to contribute to changes in air quality that would cumulatively result in significant impacts.

5.12.3.3 Potential for Cumulative Impacts on Natural Resources and Energy Supply

As discussed in Section 5.7.3, implementation of the Proposed Action would not be expected to adversely affect local energy supplies. As noted in Section 4.3, with the exception of aviation fuel, implementation of the Proposed Action would not involve the use of local energy supplies or natural resources since there is no construction or land disturbing activities proposed. Past, present, and future actions in the Houston OAPM study area have consumed energy and would continue to consume energy and natural resources during their construction and operation.

In the vicinity of the OAPM airports, the aviation fuel distribution infrastructure is well developed and robust enough to support the proposed development projects (terminal building expansions, forecasted growth in aviation operations). As it relates to fuel distribution infrastructure capacity for aviation users, the Proposed Action is not expected to cumulatively affect local supplies of natural resources. The possibility of a significant cumulative impact is remote.

Although some of the other past, present, and reasonably foreseeable future actions would lead to increases in the amount of energy and resources consumed; none of these projects in combination with the Proposed Action is likely to cause increases in

fuel consumption that would exceed the capacity of the region to serve its energy needs. Although the Proposed Action would involve a small increase in fuel consumption, the change compared to the No Action is of such a small magnitude (0.28% increase) that its effect upon local energy supplies would not be measurable.

Therefore, based on the review of past, present, and reasonably foreseeable actions, the FAA does not expect the Proposed Action to have a significant cumulative impact on natural resources and energy supply. Action would not be expected to have significant cumulative noise impacts.

5.12.3.4 Potential for Cumulative Impacts on Climate

As discussed in Section 5.8.3, the slight increase in fuel burn caused by the Proposed Action would cause a corresponding increase in greenhouse gas (GHG) emissions. This increase would constitute an extremely small contribution to national and global GHG emissions (in 2019, less than 0.000219 percent of national GHG emissions and less than 0.0000130 percent of global GHG emissions).

The cumulative impact of this proposed action on the global climate when added to other past, present, and reasonably foreseeable future actions is not currently scientifically predictable. Aviation has been calculated to contribute approximately 3 percent of global carbon dioxide (CO_2) emissions; this contribution may grow to 5 percent by 2050. Actions are underway within the U.S. and by other nations to reduce aviation's contribution through such measures as new aircraft technologies to reduce emissions and improve fuel efficiency, renewable alternative fuels with lower carbon footprints, more efficient air traffic management, market-based measures and environmental regulations including an aircraft CO_2 standard. The U.S. has ambitious goals to achieve carbon-neutral growth for aviation by 2020 compared to a 2005 baseline, and to gain absolute reductions in GHG emissions by 2050. At present there are no calculations of the extent to which measures individually or cumulatively may affect aviation's CO_2 emissions. Moreover, there are large uncertainties regarding aviation's impact on climate. The FAA, with support from the U.S. Global Change Research Program and its participating federal agencies (e. g., NASA, NOAA, EPA, and DOE), has developed the Aviation Climate Change Research Initiative (ACCRI) in an effort to advance scientific understanding of regional and global climate impacts of aircraft emissions, with quantified uncertainties for current and projected aviation scenarios under changing atmospheric conditions.[180]

[180] Nathan Brown, et. al. The U.S. Strategy for Tackling Aviation Climate Impacts, (2010). 27th International Congress of the Aeronautical Sciences.

6 OUTREACH

This chapter and Appendix J describes the FAA's process for involving Native American Tribes, government agencies, elected officials, and the general public while developing the EA.

6.1 Initial Coordination

This section describes the initial coordination efforts undertaken from the beginning of the EA draft process until the time of its official release.

6.1.1 Early Coordination Letters to Tribes, Agencies, and Elected Officials

The FAA distributed an early notification letter to the Alabama-Coushatta Tribe of Texas, as well as 20 Federal, state, and local agencies, and 44 Federal and state elected officials in July and August 2012. The FAA sent the early notification letter for the following reasons:

- To advise of the initiation of the EA study
- To request any background data that those agencies or officials may have regarding the study areas associated with this EA
- To obtain an understanding of any issues, concerns, policies or regulations that the recipients may have regarding the environmental analysis planned as part of this EA

See Appendix J.1, *Letters to Native American Tribes, Government Agencies, and Elected Officials*, for examples of the early coordination letters (and attachments), as well as the distribution list.

6.1.2 Public Notice

The FAA placed public notice advertisements announcing this EA in 19 area newspapers. The newspapers published the notices twice between late July and early August in each of the 19 area newspapers. Appendix J.2, *Public Notices,* notes the specific publication dates for each newspaper. As with the letters described above, the purpose of the notices was to communicate the FAA's plan to conduct this EA and to solicit comments.

6.1.3 Website

The FAA created a website[181] to provide interested parties with a description of the OAPM projects, to provide periodic updates on the status of the EA, and to provide a venue for receipt of comments electronically via a dedicated e-mail account.[182] The

[181] OAPM Environmental, "Houston OAPM EA": http://www.oapmenvironmental.com/houston_metroplex/houston_introduction.html
[182] 9-ASW-HoustonOAPMcomment@faa.gov

FAA provided the web address in the Public Notice advertisements as well as the letters to elected officials.

6.1.4 Comments during Early Coordination

The Houston OAPM comment period occurred from July 20, 2012 to September 21, 2012. During and subsequent to this period, but prior to the publication of this EA, the FAA collected six (6) comment letters and two (2) comment emails containing 26 comments about the Early Coordination letters. Agency representatives and the general public provided a variety of comments from potential impacts to endangered species and migratory birds, scoping and EA categorical responses, to comments on potential aviation noise impacts. A majority of the comments required no further action by the FAA. See Appendix J.3, *Responses and Comments*, for comments received during the early coordination period and the FAA's responses to those comments.

6.2 Subsequent Coordination

Concurrent with the public release of this EA, the FAA published notices of availability of the document in the area newspapers. The FAA updated its project website to reflect the release of this document, including making the entire EA available electronically. In addition, the FAA sent letters to the previous recipients of the early coordination letters to update them on the status of the project planning, advise them of the release of this document, and solicit comments. For more information, see Appendix K, *List of Receiving Parties*.[183]

Prior to implementing the Proposed Action, the FAA will review comments received during a 30-day period that begins with the release of this EA. The FAA would address any substantive comments and revisions to this document prior to signing the FAA's Finding of No Significant Impact and Record of Decision, currently anticipated for no earlier than February 22, 2013.

[183] The FAA updated the mailing list because of comments received to the July and August coordination letters. Appendix K reflects the updated mailing list.