# Final Environmental Assessment
# Dillant-Hopkins Airport
# Keene, New Hampshire

The airport sponsor is preparing this Environmental Assessment (EA) to document potential impacts associated with acquiring avigation easements and mitigating off-airport vegetative obstructions to Runway 02/20 protected airspace.

Prepared for:
The City of Keene, NH and
Dillant-Hopkins Airport

Prepared by:
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January 2017

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**LIST OF APPENDICES**

# 1.0 Purpose and Need

## 1.1 INTRODUCTION

The City of Keene and Dillant-Hopkins Airport (EEN) has prepared this Environmental Assessment (EA) to address the potential environmental impacts associated with proposed safety improvement projects to be conducted at EEN. The proposed safety improvement projects subject to this EA include the acquisition of avigation easements and the associated mitigation of vegetative obstructions to Runway 02/20 protected air surfaces.

## 1.2 PURPOSE AND NEED

Dillant-Hopkins Airport is a general aviation facility providing air travel for pilots and aircraft ranging from small, single-engine aircraft to twin engine jets. The purpose of the project proposed in this EA is to satisfy Federal Aviation Administration (FAA) safety standards regarding the protection of protected navigable airspace by mitigating vegetative obstructions located on and off airport property.

The need for this project is derived from the analysis of aerial photogrammetric survey data that has identified obstructions to Runway 02/20 airspace. Obstructions identified on and off airport property must be effectively mitigated to comply with FAA regulations and to provide the highest achievable degree of safety to aircraft operations in a cost effective or economically efficient manner.

## 1.3 SCOPE

The purpose of this document is to inform regulatory agencies and the public of the likely environmental consequences associated with the proposed actions and their reasonable alternatives. The EA provides the FAA with information necessary to determine whether the impacts associated with the proposed project has the potential to significantly impact the environment. Based on this determination, the FAA will either issue a Finding of No Significant Impact (FONSI) or the agency will require the preparation of an Environmental Impact Statement (EIS) to further analyze the proposed project and its associated impacts.

This EA has been developed in accordance with the National Environmental Policy Act of 1969 (NEPA), the federal Council of Environmental Quality's (CEQ) NEPA regulations (40 Code of Federal Regulations [CFR] §§ 1500-1508), FAA Order 1050.1E, *Environmental Impacts: Policies and Procedures* and FAA Order 5050.4B, *National Environmental Policy Act Implementing Instructions for Airport Actions*.

According to NEPA, all major projects and/or actions funded by the federal government fall into one of three categories:

- Those normally requiring an Environmental Impact Statement (EIS);
- Those normally requiring an EA; and
- Those that are categorically excluded from environmental review.

In summary, projects requiring an EIS are those that are likely to significantly impact the environment. Projects requiring an EA are those that have the potential to impact the environment. Projects that are categorically excluded include those projects that are unlikely to impact the environment.

Typically, obstruction removal activities, such as vegetation removal, stump grubbing, and land grading, **on airport property** are categorically excluded from FAA environmental review as long as those actions do not involve extraordinary circumstances and/or resources protected under "special purpose" laws. Special purpose laws are defined as those federal laws and regulations outside the scope of NEPA, including federal wetland regulations, the Endangered Species Act of 1973, and the National Historic Preservation Act of 1966.

This project, however, cannot be categorically excluded as the airport sponsor is proposing the acquisition of avigation easements to facilitate the removal of obstructions located **off airport property**. In accordance with NEPA and FAA regulations, off-airport obstruction removal projects utilizing federal funding are subject to review within the context of an environmental assessment. This EA has been prepared to assess potential environmental impacts associated with the acquisition of avigation easements required for the mitigation of off-airport obstructions to Runway 02/20 protected air surfaces.

### 1.3.1 New Hampshire State Block Grant Program

In 1989, FAA initiated the State Block Grant Program, enabling certain states to assume the responsibility of administering federal Airport Improvement Program (AIP) grants at nonprimary commercial service and general aviation airports. The State of New Hampshire was selected by the FAA New England Region to become a member of the State Block Grant Program (SBGP) in 2008. As a member of this program, the New Hampshire Department of Transportation Bureau of Aeronautics (NHDOT), not the FAA, is responsible for providing grant and project administration oversight at nonprimary commercial and general aviation airports, including Dillant-Hopkins Airport. Airport actions conducted under the AIP typically under the FAA's Office of Airports scope become "SBGP actions" to be carried out under the SBGP. SBGP airports are subject to FAA safety and design standards; however NHDOT is responsible for administering the airport improvement program grants.

Similar to federal actions funded by FAA, states participating in the SBGP are obligated to meet NEPA requirements and must evaluate potential environmental impacts resulting from proposed airport improvement projects within the same framework as federal actions considered by FAA. This EA, therefore, has been prepared in accordance with NEPA requirements to satisfy terms of the SBGP contractual agreement. Acting as the agency responsible for AIP grant administration, NHDOT is also the principal agency responsible for the implementation of NEPA with regard to airport development projects proposed at most New Hampshire airports. As such, NHDOT oversees the NEPA process and issues determinations of significance regarding potential environmental impacts associated with proposed improvement projects (FAA shares these responsibilities for those projects receiving federal discretionary funds). Because NHDOT acts as FAA in this capacity, any reference to the term “FAA” regarding NEPA requirements is interchangeable with “NHDOT.” For the purposes of this document, New Hampshire SBGP officials are responsible for issuing a determination with regard to proposed airport actions.

# 2.0 Description of Proposed Actions

## 2.1 INTRODUCTION

As previously stated in Section 1.2 *Purpose and Need* of this EA, this project has been proposed to address existing safety hazards associated with obstructions to protected air surfaces at Dillant-Hopkins Airport. One of the FAA's primary responsibilities includes preventing and minimizing adverse impacts to the safe use of navigable airspace. FAA regulations, including FAR Part 77 *Safe, Efficient Use and Preservation of the Navigable Airspace* and FAA Order 8260.3B *United States Standard for Terminal Instrument Procedures (TERPS)*, establish surface dimensions and identify mitigating measures to enhance safe air navigation. Design alternatives presented in this EA have been prepared in accordance with FAA regulations to ensure proposed safety improvement projects provide the highest degree of safety to aircraft operations conducted at the airport.

## 2.2 ACQUISITON OF AVIGATION EASEMENTS

The identification of required avigation easements is the direct result of a comprehensive analysis of the protected airspace above an airport. Aerial photogrammetry of the airport and outlying areas provides both ground elevations and structural elevations (including trees, buildings, utility poles, etc.). This data is interpolated with air surface elevations to determine the extent of obstruction penetrations to protected airspace. Once the obstructions have been identified, obstruction locations for which the airport does not own the land or the rights to manage vegetation or structure height are determined. In most instances, the successful mitigation of off-airport obstructions is initiated with the acquisition of avigation easements. Once obtained, easements grant the airport rights to provide for perpetuity unobstructed airspace achieved through vegetation management or marking identified obstructions using FAA approved obstruction lighting (for those surfaces where lighting is permissible).

Once the appropriate parcels have been identified, boundary surveys of each parcel are conducted and easement boundaries are designed based on existing vegetative communities in relation to protected air surfaces. Utilizing the survey plan, legal description, and tax assessment information, an independent professional land appraiser makes an appraisal of the parcel and easement area. The appraiser then prepares a report of the parcel(s) which includes a fair market value of compensation for the easement(s). The report is then provided to an independent review appraiser in order to verify the initial appraisal and recommendation for just and fair compensation. Upon agreement between appraisers of fair market value for the easement(s), negotiations between the airport and landowner(s) for the purchase of the easement(s) commences. After the terms of easement and compensation have been negotiated, the easement is purchased and is recorded with the registry of deeds. The easement acquisition process, as outlined by FAA regulations, must be conducted in accordance with 49 CFR Part 24, *Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970*, as amended.

Aerial photogrammetry data, obtained in 2013, was used to perform the obstruction analysis of Runway 02/20 airspace. The obstruction analysis evaluated pertinent regulated air surfaces at the airport intended to be maintained free of obstructions, including but not limited to Federal Aviation Regulation (FAR) Part 77 surfaces, Terminal Instrument Procedures (TERPS) surfaces, Threshold Siting approach surfaces, and runway departure surfaces.

These surfaces have been established by the FAA and based primarily on the type of aircraft using the airport and the navigation aids in place for the purpose of safe air navigation. Obstructions within these surfaces pose significant hazards to an aircraft and its passengers. An airport's failure to adequately address obstructions to protected airspace violates federal grant assurances assumed by the airport, may lead to imposed restrictions limiting runway use and airport operations, and jeopardizes the airport's eligibility to receive federal funding for future improvement projects.

The results of the obstruction analysis indicate the need to acquire 32 avigation easements beneath the approach to Runway 20 to remove approximately four (4) acres of identified vegetative obstructions to the existing 20:1 Threshold Siting Surface and the Precision Approach Path Indicator (PAPI) Obstacle Clearance Surface (OCS)—two surfaces deemed critical by FAA to the safe operation of the runway. The acquisition of these easements allows the airport manage future and existing vegetative obstructions identified within the boundaries defined within each easement.

The easements proposed for acquisition by the city of Keene and the Dillant-Hopkins Airport are associated with residential development located approximately 2,300 feet north of the Runway 20 end.

## 2.3 MITIGATING VEGETATIVE OBSTRUCTIONS

As stated above, approximately four acres of obstructions to the Threshold Siting Surface and the PAPI OCS have been identified off airport property. Approximately 11.6 acres of obstructions to these two surfaces were identified on airport property. The recommended mitigation technique for identified obstructions includes vegetation removal. All obstructions occur to the north of the Runway 20 end. Obstruction removal provides the highest possible degree of safety to aircraft and airport abutters and enables the runway to operate without imposed restrictions. In total, approximately 15.60 acres of vegetative obstructions are proposed for removal. Obstructions located on and off airport property will be selectively removed. However, obstructions to the Runway 20 approach located on airport property are quite extensive and, in certain proposed alternatives, will require the removal of a majority of canopy trees within designated obstruction removal locations. Understory vegetation will remain undisturbed to the greatest extent possible.

After the necessary easements have been acquired by the airport and the easements have been recorded with the Registry of Deeds, the obstruction removal project will be designed, any necessary environmental permits will be obtained, and the project will be constructed. Off-airport property obstructions will be removed from established project limits within easement boundaries. Tree stumps will be removed and affected areas will be dressed with topsoil and seeded with grass. On airport property, obstructions will be cut as close to ground level as possible. Stump grubbing is not proposed within the forest stands subject to obstruction removal efforts. Understory vegetation will be left undisturbed to the greatest extent possible.

It is the airport's desire to develop and implement a forestry management plan for this region of airport property. The goal of such a plan will be to encourage the natural establishment of a mixed forest comprised of hard and softwood species. Continued management efforts will endeavor to maintain a lower tree canopy height, replacing the existing stand composed primarily of white pine trees currently penetrating airspace in this area.

# 3.0 Alternatives

## 3.1 INTRODUCTION

The objective of the following analysis is to identify alternatives that are determined to be reasonable and practicable for achieving project goals. Reasonable alternatives that meet the needs of Dillant-Hopkins Airport have been developed and evaluated based on operational, engineering, environmental, and economic considerations. Chapter 1 of FAA Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions* states a primary objective of NEPA is to "disclose to the interested public a clear and accurate description of potential environmental impacts that proposed federal actions and reasonable alternatives to those actions would cause." This EA has been prepared to satisfy NEPA requirements by presenting the potential environmental impacts associated with the acquisition of avigation easements for the removal of off-airport obstructions necessary to provide the highest possible degree of safety to operations conducted using Runway 02/20.

Dillant-Hopkins Airport has identified five alternatives associated with the Runway 02/20 easement acquisition and obstruction removal projects presented in this EA. In addition to Alternative 2 *Easement Acquisition and Obstruction Removal Plan*, Alternative 5 *Runway 2/20 1,587' Shift* will likely require the purchase of privately owned parcels and/or the acquisition of avigation easements in order to properly mitigate vegetative obstructions located off airport property to satisfy current FAA safety standards.

## 3.2 DESCRIPTION OF ALTERNATIVES

Dillant-Hopkins Airport has identified five alternatives associated with the proposed easement acquisition and obstruction mitigation necessary to enhance the safety of operations conducted on Runway 02/20 and to maintain current operational conditions for the runway. Each alternative will be will be evaluated based on consideration of the proposed actions described Section 2.0 of this EA.

### 3.2.1 Alternative 1 – Existing Conditions: No Action

Runway 02/20, the primary runway at the airport, is 6,200 feet long and 100 feet wide. The Runway 20 approach is considered a visual approach runway, due primarily to the absence of instrument approach procedures available to pilots. The runway is equipped with a Precision Approach Path Indicator (PAPI) on the east side of the runway. This navigational aid allows pilots to visually orient themselves along a proper glide slope while on approach to the runway.

The "No Action" alternative is prescribed by CEQ regulations for implementing NEPA to serve as a benchmark against which proposed federal actions can be evaluated. This alternative proposes that airport operations continue with the safety hazards associated with existing obstructions to Runway 02/20 airspace, see Figure 3-1 Alternative 1 *No Action-Existing Conditions*.

Consideration of the "No Action" alternative is based on the assumption that Dillant-Hopkins Airport would not pursue the acquisition of easements necessary to mitigate off-airport obstructions to Runway 02/20 approach surfaces. Furthermore, the "No Action" scenario assumes the airport will not remove penetrations to the protected airspace currently located on airport property. Adoption of this alternative would likely restrict the use of Runway 20 to day-time operations only and could potentially restrict certain aircraft currently using the runway from landing on the Runway 20 end. Furthermore, implementation of the "No Action" alternative jeopardizes the Airport's ability to obtain future FAA Airport Improvement Project funding due to the failure to honor existing grant assurances requiring the airport to maintain a safe operating environment.

### 3.2.2 Alternative 2 – Runway 02/20 Easement Acquisition and Obstruction Removal

Obtaining the necessary easements identified in this analysis enables the removal of all off-airport obstructions to critical approach surfaces. Alternative 2 proposes the removal of 15.31 acres of upland vegetation identified as obstructions located both on and off-airport property. Approximately four acres of obstructions to the PAPI Obstacle Clearance Surface and the Threshold Siting Surface are located off airport property. The remaining 11.1 acres of upland obstructions occur on airport property. Additionally, the removal of 0.29 acres of obstructions located on or immediately adjacent to a delineated wetland boundary located on-airport. Identified obstructions to the Runway 20 Threshold Siting and PAPI OCS approach surfaces are proposed for removal as this form of mitigation provides the highest possible degree of safety to aircraft utilizing the runway. This alternative also requires the acquisition of 32 avigation easements necessary to remove the obstructions located off-airport property, see Figure 3-2 *Easement Acquisition and Obstruction Removal Plan*.

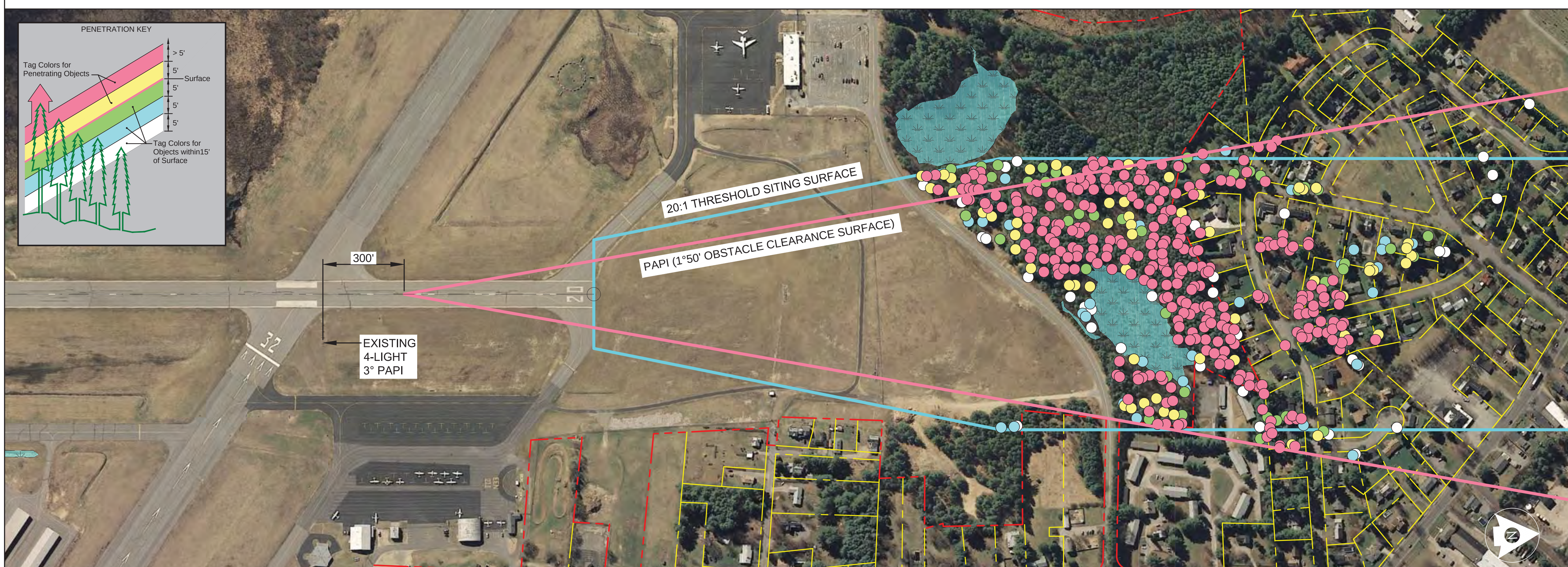
The implementation of Alternative 2 satisfies existing safety deficiencies identified in Section 1.2 *Purpose and Need* by improving the safety of operations conducted on Runway 20 and meeting FAA design and safety standards. This alternative effectively mitigates identified obstructions to critical Runway 20 approach surfaces and enables the runway to accommodate current levels of operation without restriction or alteration to existing visibility minimums.

A cost of $300,000 has been estimated to construct Alternative 2. This preliminary cost estimate does not include costs associated with coordinating the acquisition and purchase of avigation easements necessary to remove off-airport obstructions.


| | RUNWAY 2 | RUNWAY 20 |
|---|---|---|
| TODA | 6,200' | 6,200' |
| TORA | 6,200' | 6,200' |
| LDA | 6,200' | 6,200' |
| ASDA | 6,200' | 6,200' |

RUNWAY 2–20

0 400' 800'




RUNWAY 20

0 200' 400'

ORIGINAL SHEET – ARCH D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AERIAL PHOTOGRAMMETRY COLLECTED BY COL–EAST, INC. IN SEPTEMBER 2013

Legend

- AIRPORT PROPERTY LINE
- ABUTTER PROPERTY LINE
- OBSTRUCTION ID TAG
- EXISTING WETLANDS

NOTE:

TERPS 20:1 (STANDARD) VISUAL AREA OBSTACLE IDENTIFICATION SURFACE WAS ANALYZED. PAPI (OCS) IS MORE CRITICAL. TERPS NOT SHOWN FOR CLARITY.

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Permit-Seal

Client/Project

DILLANT-HOPKINS AIRPORT

KEENE, NEW HAMPSHIRE

Title

ALTERNATIVE 1
NO ACTION - EXISTING CONDITIONS

Project No. 195210676

Scale AS NOTED

Figure No. 3-1

Revision A


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AERIAL PHOTOGRAMMETRY COLLECTED BY COL-EAST, INC. IN SEPTEMBER 2013

Legend

AIRPORT PROPERTY LINE
ABUTTER PROPERTY LINE
7 EASEMENT NO.
UPLAND VEGETATION REMOVAL = ±15.31 AC
WETLAND VEGETATION REMOVAL = ±0.29 AC
DELINEATED WETLANDS

NOTES:

1. CLEARING BASED ON OBSTRUCTIONS WITHIN 10' OF EXISTING PAPI (OCS) AND EXISTING 20:1 THRESHOLD SITING SURFACE.
2. TERPS 20:1 (STANDARD) VISUAL AREA OBSTACLE IDENTIFICATION SURFACE WAS ANALYZED. PAPI (OCS) IS MORE CRITICAL. TERPS NOT SHOWN FOR CLARITY.

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DILLANT-HOPKINS AIRPORT

KEENE, NEW HAMPSHIRE

Title

ALTENATIVE 2
EASEMENT ACQUISITION AND
OBSTRUCTION REMOVAL PLAN

Project No. 195210676

Scale AS NOTED

Figure No. 3-2

Revision A

ORIGINAL SHEET - ARCH D

### 3.2.3 Alternative 3 – Displace Runway 20 Threshold 1,587' to the South and Relocate PAPI

As previously stated, Runway 20 is equipped with a PAPI to provide pilots with a safe glide slope while on visual approach to Runway 20. Where currently positioned, the OCS associated with PAPI is obstructed by a stand of mature trees consisting primarily of large white pines.

This alternative includes the displacement of the Runway 20 threshold 1,587 feet to the south and the relocation of the PAPI navigational aid to a location 1,000 feet south of the displaced threshold. Existing runway lights will be reconfigured and new pavement markings will also be required (this alternative may also require the relocation of the runway's Instrument Landing System (ILS) localizer antenna), see Figure 3-3 *Runway 20 1,587' Displaced Threshold and Relocated PAPI Plan*.

The implementation of Alternative 3 effectively removes Threshold Siting and PAPI OCS obstructions located off airport property and eliminates the need to acquire avigation easements to mitigate obstructions. Approximately 1.62 acres of upland vegetative obstructions located on airport property will be removed in this alternative. Obstruction removal within wetlands is not associated with this alternative.

Alternative 3 limits available runway length, reducing the Landing Distance Available (LDA) for Runway 20 and the Takeoff Run Available (TORA) and Takeoff Distance Available (TODA) for Runway 02 to 4,613 feet. In other words, aircraft taking off from Runway 02 are limited to using 4,613 feet of runway and must not run beyond the displaced threshold during takeoff. Conversely, aircraft on approach to Runway 20 cannot land in advance of the displaced threshold and are limited to 4,613 feet of runway after touchdown. Aircraft taking off from Runway 20 and landing on Runway 02 will have full runway length (6,200 feet) available for operations.

This alternative meets the objectives of the *Purpose and Need* statement in Section 1.2 of this document as it improves the safety of operations with regard to unobstructed airspace; however the reduced runway length creates an unsafe operating environment for jet aircraft currently using the runway, as jets typically require a minimum of 5,000 feet of usable runway length to operate safely.

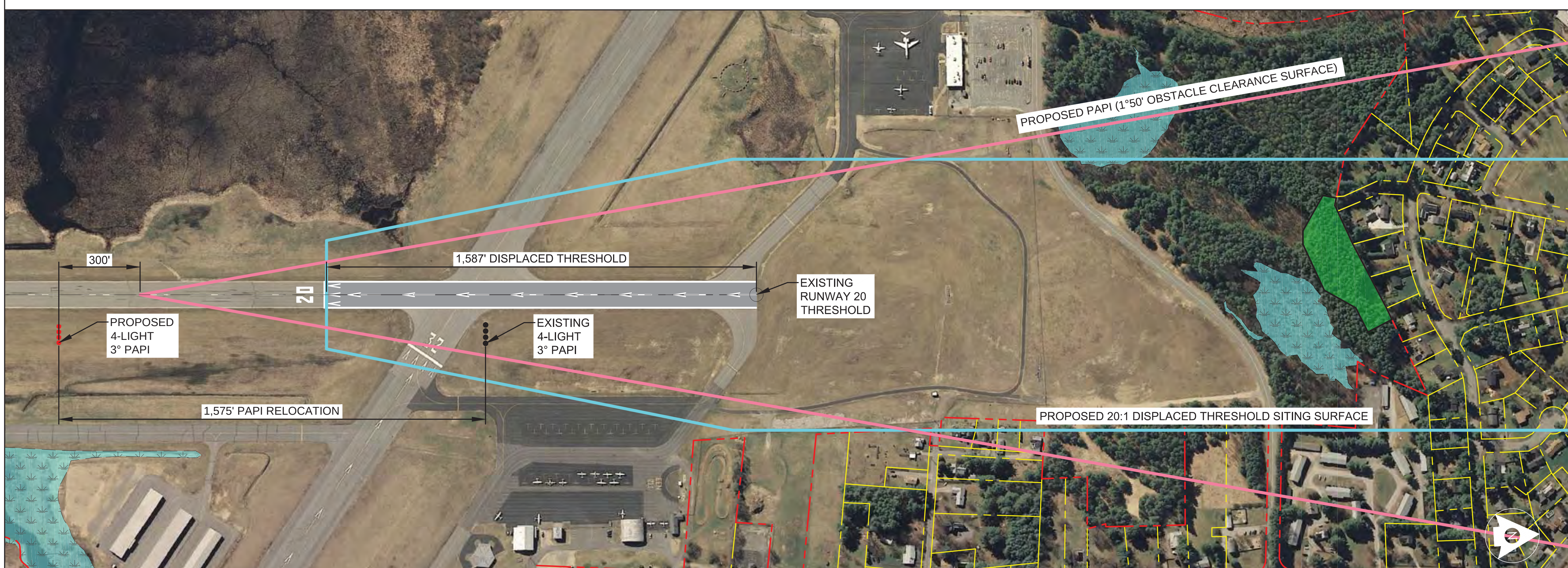
A cost of $450,000 has been estimated to construct Alternative 3.

### 3.2.4 Alternative 4 – Displace Runway 20 Threshold 2,485' to the South and Relocate PAPI

Alternative 4 proposes the displacement of the Runway 20 threshold 2,485 feet to the south. The Runway's PAPI equipment will be relocated 2,400 feet to the south of its current location. The 2,485-foot threshold dispacement decreases Runway 20 LDA and Runway 02 TORA to 3,715 feet, see Figure 3-4 *Runway 20 2,485' Displaced Threshold and Relocated PAPI Plan*.

| | RUNWAY 2 | RUNWAY 20 |
|---|---|---|
| TODA | 6,200' | 6,200' |
| TORA | 4,613' | 6,200' |
| LDA | 6,200' | 4,613' |
| ASDA | 6,200' | 6,200' |


RUNWAY 2–20




RUNWAY 20

ORIGINAL SHEET – ARCH D

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Legend

- AIRPORT PROPERTY LINE
- ABUTTER PROPERTY LINE
- UPLAND VEGETATION REMOVAL = ±1.62 AC
- EXISTING WETLANDS

NOTES:

1. CLEARING BASE ON OBSTRUCTIONS WITHIN 10' OF RELOCATED PAPI (OCS).
2. PROPOSED 20:1 DISPLACED THRESHOLD SITING SURFACE IS CLEAR OF ALL OBSTRUCTIONS WITHIN 15'.
3. TERPS 20:1 (STANDARD) VISUAL AREA OBSTACLE IDENTIFICATION SURFACE WAS ANALIZED. PAPI (OCS) IS MORE CRITICAL. TERPS NOT SHOW FOR CLARITY.

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Client/Project

DILLANT-HOPKINS AIRPORT

KEENE, NEW HAMPSHIRE

Title

ALTERNATIVE 3
RUNWAY 20 1,587' DISPLACED THRESHOLD AND RELOCATED PAPI PLAN

Project No. 195210676

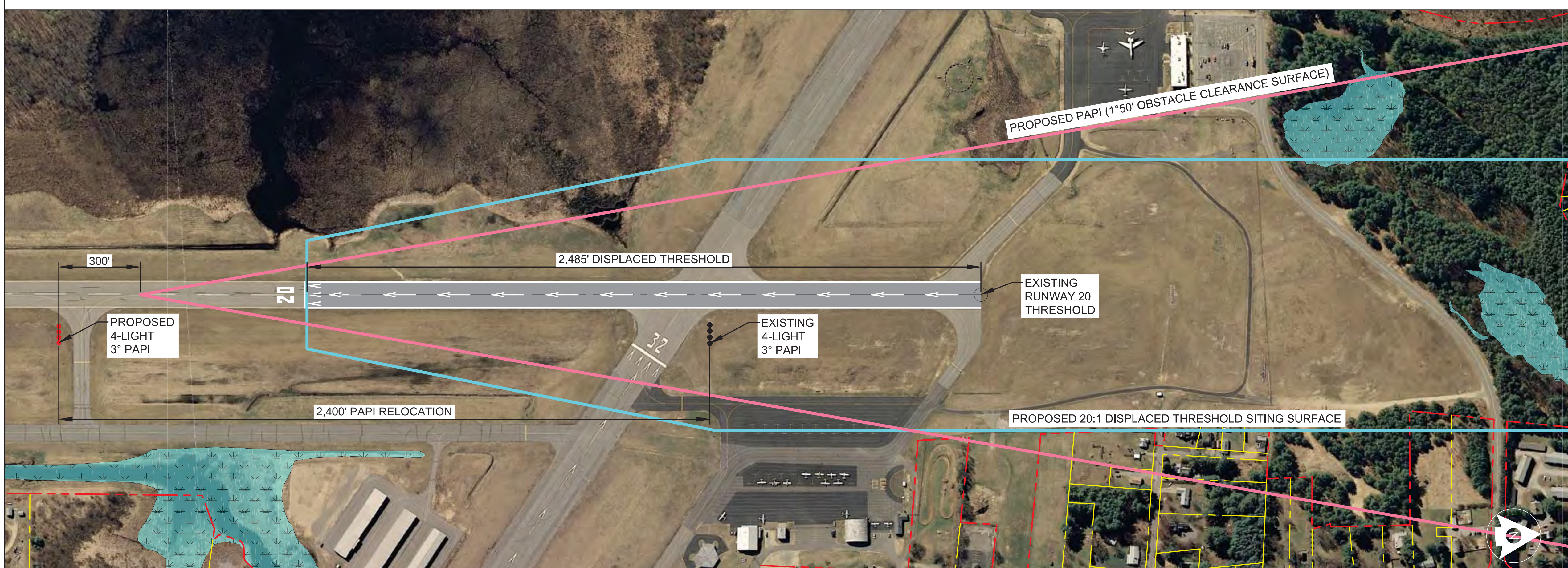
Scale AS NOTED

Figure No. 3-3

Revision A

| | RUNWAY 2 | RUNWAY 20 |
|---|---|---|
| TODA | 6,200' | 6,200' |
| TORA | 3,715' | 6,200' |
| LDA | 6,200' | 3,715' |
| ASDA | 6,200' | 6,200' |


RUNWAY 2–20




RUNWAY 20

ORIGINAL SHEET – ARCH D

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Legend

- AIRPORT PROPERTY LINE
- ABUTTER PROPERTY LINE
- EXISTING WETLANDS

NOTES:

1. PROPOSED PAPI (OCS) IS CLEAR OF ALL OBSTRUCTIONS WITHIN 10'.
2. PROPOSED 20:1 DISPLACED THRESHOLD SITING SURFACE IS CLEAR OF ALL OBSTRUCTIONS WITHIN 15'.
3. TERPS 20:1 (STANDARD) VISUAL AREA OBSTACLE IDENTIFICATION SURFACE WAS ANALIZED. PAPI (OCS) IS MORE CRITICAL. TERPS NOT SHOW FOR CLARITY.

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Permit-Seal

Client/Project

DILLANT-HOPKINS AIRPORT

KEENE, NEW HAMPSHIRE

Title

ALTERNATIVE 4
RUNWAY 20 2,485' DISPLACED THRESHOLD AND RELOCATED PAPI PLAN

Project No. 195210676

Scale AS NOTED

Figure No. 3-4

Revision A

The implementation of Alternative 4 effectively removes all penetrations from Runway 20 Threshold Siting and PAPI OCS approach surfaces, eliminating the need for on and off-airport tree clearing. The acquisition of avigation easements is not required for this alternative. Similar to Alternative 3 above, current runway lighting alignments will be reconfigured and new pavement markings will be necessary.

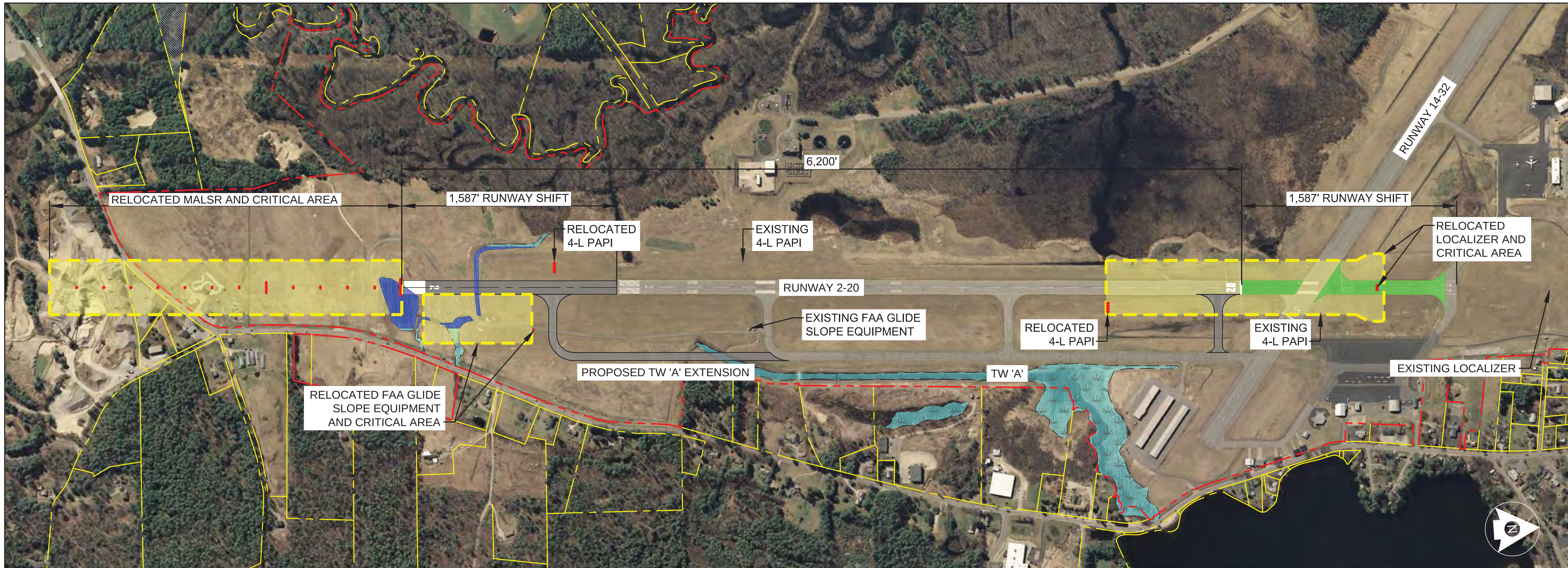
Alternative 4 meets the objectives of the Purpose and Need statement presented in Section 1.2 of the EA as it provides obstruction-free approach surfaces for Runway 20 in accordance with runway design standards. However, implementing this alternative effectively restricts runway use to single engine piston-powered aircraft due to the lack of available runway length necessary to safely accommodate larger aircraft currently using the runway.

The cost of constructing Alternative 4 are similar to those costs associated with constructing Alternative 3 and have been estimated at $475,000.

### 3.2.5 Alternative 5 – Shift Runway 02/20 1,587 Feet South

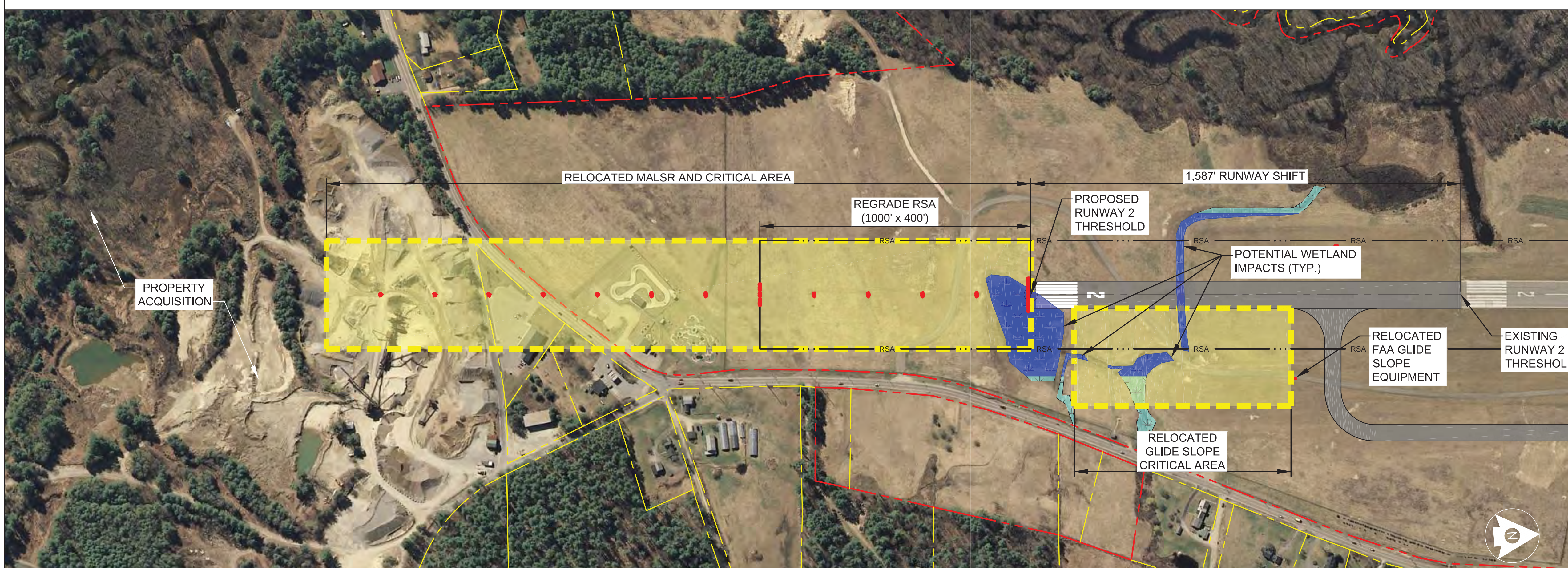
Alternative 5 proposes shifting Runway 02/20 1,587 feet to the south and maintaining the current runway length of 6,200 feet, see Figure *3-5 Runway 2-20 1,587' Shift*. This runway shift effectively eliminates off-airport obstructions to the Threshold Siting Surface and the PAPI OCS. Similar to Alternative 3, 1.62 acres of on-airport upland vegetation obstructing approach surfaces will be removed from the northern extent of airport property.

Alternative 5 requires a 1,587-foot shift of the Runway 20 threshold and an extension of the same length to the Runway 02 end. In addition to the construction of a runway extension, this alternative requires significant modifications to existing infrastructure. Necessary modifications include the relocation of the Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR). The MALSR is used by pilots during instrument approach to Runway 02 to align the aircraft with the runway centerline. The MALSR consists of a series of 12 lighting installations located in alignment with the runways centerline. Each light unit is positioned at the elevation of the runway threshold centerline. The first light station is located 200 feet to the south of the existing Runway 02 end and successive light stations are positioned 200 feet from one another thereafter in a southerly direction. To maintain the current ILS, the MALSR must be relocated, extending across Route 32. Rerouting or lowering a segment of Route 32 will likely be required to meet MALSR clearance requirements. The purchase of land and commercial enterprise will be required on both sides of Route 32 to accommodate the relocated MALSR lighting stations. Other navigational aids including the localizer and glide slope antennas, PAPI, runway edge lights, and runway identifier lights will also be relocated. Runway safety areas as well as localizer and glide slope critical areas must be reconstructed to FAA design standards—necessitating substantial earth moving and grading--to support the runway extension and ILS equipment relocation. Additionally, an extension of Taxiway 'A' may be required to maintain the current level of safety afforded to the existing runway. Parallel




RUNWAY 2–20

0 400' 800'




RUNWAY 2

0 200' 400'

ORIGINAL SHEET – ARCH D

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Legend

- AIRPORT PROPERTY LINE
- ABUTTER PROPERTY LINE
- EXISTING WETLANDS

| Revision | By | Appd. | YY.MM.DD |
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Permit-Seal

Client/Project

DILLANT-HOPKINS AIRPORT

KEENE, NEW HAMPSHIRE

Title

ALTERNATIVE 5
RUNWAY 2-20 1,587' SHIFT

Project No. 195210676

Scale AS NOTED

Figure No. 3-5

Revision A

taxiways are critical safety components at non-towered facilities as they eliminate the need for aircraft to taxi on an active runway prior to take-off and after landing.

The acquisition of avigation easements and obstruction removal will also likely be required as it is anticipated that the runway shift will result in off-airport obstructions to protected air surfaces associated with Runway 02. New aerial photogrammetric data must be obtained to determine the extent of obstructions to airspace resulting from the runway shift.

The implementation of Alternative 5 satisfies existing safety deficiencies identified in Section 1.2 *Purpose and Need* by improving the safety of operations conducted on Runway 20 and meeting FAA design and safety standards.

The cost of constructing Alternative 5 has been estimated 23.5 million dollars. This preliminary cost estimate does not include costs associated with coordinating the acquisition and purchase of avigation easements and/or land in fee simple necessary to construct the MALSR and remove off-airport obstructions.

## 3.3 SUMMARY OF ALTERNATIVES

As stated previously in Section 3.2.1, the “No Action” alternative does not address existing safety deficiencies associated with existing penetrations to protected air surfaces at the airport and therefore does not satisfy the defined purpose and need of the proposed project. By neglecting to mitigate obstructions, Runway 20 will be subject to operational restrictions and the airport would likely forfeit future FAA funding for infrastructure improvement and maintenance projects until safety deficiencies have been appropriately addressed.

The implementation of Alternative 2 proposes the acquisition of 32 avigation easements and removes all obstructions to Runway 20 Threshold Siting and PAPI Obstacle Clearance Surfaces. This alternative proposes the removal of 15.31 acres of vegetation from upland areas and up to 0.29 acres of perimeter wetland vegetation. Wetland impacts will be avoided by selectively hand-cutting obstructions during frozen ground conditions and implementing appropriate erosion and sediment controls. This alternative satisfies FAA safety design standards and facilitates continued use of the runway without imposed restrictions.

Alternative 3 proposes displacing the threshold for Runway 20 1,587 feet to the south and the relocation of the PAPI serving Runway 20. This option eliminates the need for avigation easements and vegetation removal off airport property and requires the removal of 1.62 acres of on-airport upland vegetative obstructions to the Threshold Siting Surface and PAPI OCS. Although Alternative 3 satisfies FAA design standards, a reduced runway length of 4,613 feet limits access to the airport by aircraft currently using the runway. Implementation of this alternative contradicts FAA grant assurances assumed by the airport to maintain the facility in such a manner that safely accommodates aircraft for which existing infrastructure has been constructed to serve.

Alternative 4 proposes displacing the Runway 20 threshold 2,485 feet south of its current location. The runway threshold displacement and PAPI relocation effectively removes obstructions from critical approach surfaces, eliminating the need for avigation easements and tree clearing efforts. Alternative 4 reduces the Runway 20 LDA and Runway 02 TORA to 3,715 feet, preventing certain aircraft currently using the runway from future use of the airport. Again, such an action conflicts with existing grant assurances and greatly compromises the airport's ability to participate in FAA's Airport Improvement Program.

Alternative 5 proposes shifting Runway 02/20 1,587 feet to the south and relocating essential ILS navigational aids and lighting systems. Alterations to Route 32, land and easement acquisition, and obstruction removal will also likely be required to shift the runway and associated infrastructure. Alternative 5 results in approximately two acres of wetland fill impacts and may also result in impacts to protected species habitat. Additionally, businesses located on Route 32 adjacent to the southern terminus of airport property may also be adversely impacted by this alternative. Alternative 5 is also the most cost prohibitive of the alternatives addressed in this analysis and it is doubtful FAA and NHDOT would support such a significant undertaking proposed to mitigate obstructions to protected airspace.

Based on operational, environmental, and economic considerations, Alternative 2 – *Runway 02/20 Easement Acquisition and Obstruction Removal* is determined to be the preferred alternative for mitigating obstructions to Runway 20 approach surfaces.

# 4.0 Existing Conditions

## 4.1 AIRPORT LOCATION AND VICINITY

Dillant-Hopkins Airport is located in Swanzey, New Hampshire (Cheshire County), in the southwest region of the state. The airport is approximately 1.5 miles south of the city of Keene's downtown business center and is accessed via State Route 32. Airport property is bound by the Ashuelot River to the west, residential development to the north, and State Route 32 to the east and south, see Figure 4-1 *Location Map*.

## 4.2 EXISTING FACILITIES

The airport is served by two runways, Runway 02/20 (primary) and Runway 14/32 (crosswind). Runway 02/20 is 6,200 feet long, 100 feet wide, and exhibits a north-south orientation. Runway 14/32 is 4,000 feet long, 150 feet wide, and exhibits an east-west orientation. Runway 02 is the only approach that offers an instrument approach at the airport. It allows for GPS (non-precision), ILS, and VOR approaches. All other runways are visual approach runways. Runway 02/20 is equipped with a partial parallel taxiway. A general aviation apron, several hangar complexes, and a Fixed Base Operator (FBO) reside to the east of Runway 02/20. A terminal building, aircraft parking, and a commercial/private hangar are situated to the west of Runway 02/20 and to the west of Runway 14/32.

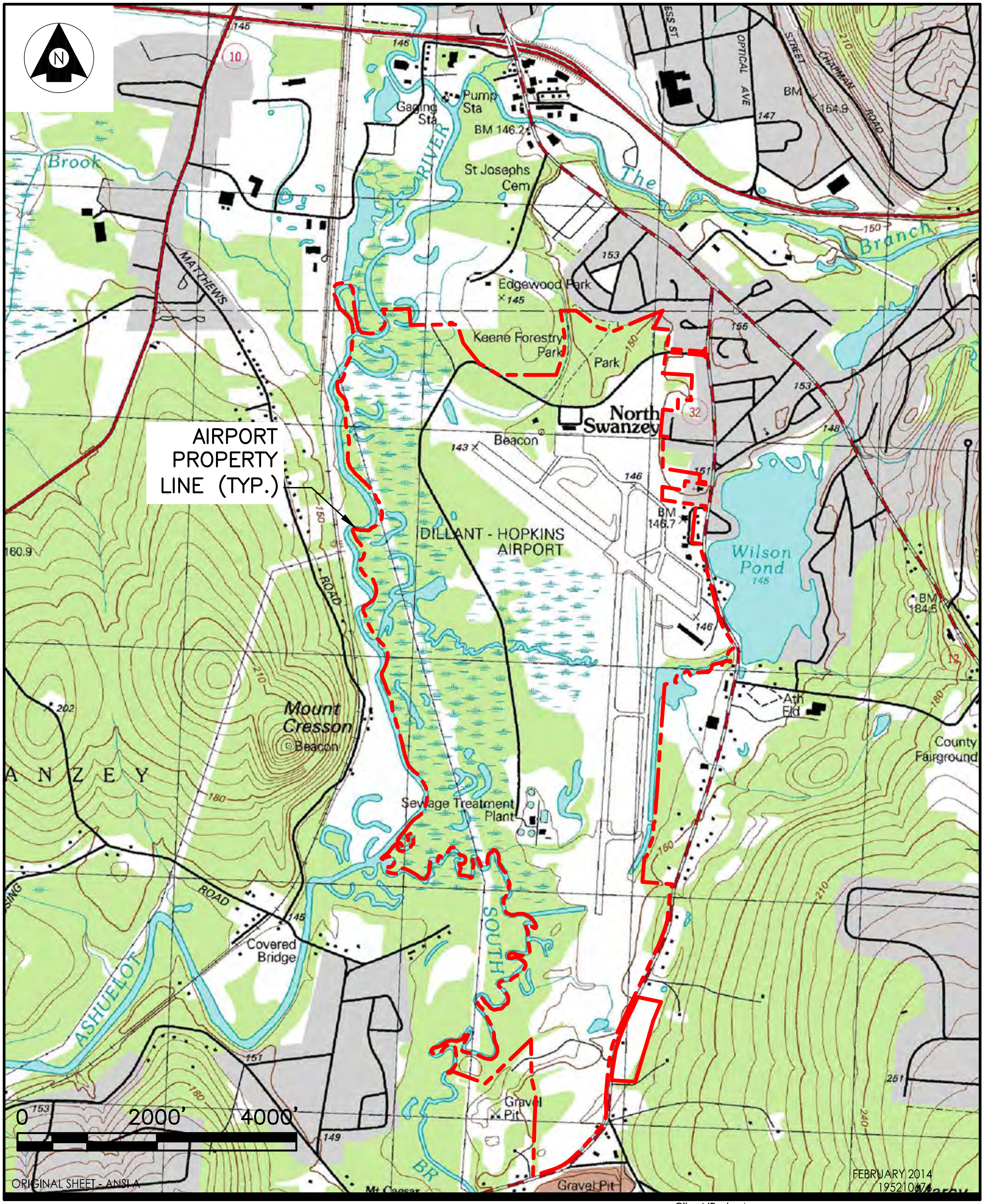
## 4.3 VICINITY LAND USE AND ZONING

Dillant-Hopkins Airport is subject to Swanzey's zoning regulations. According to the Swanzey Zoning Ordinance, as amended through March 12, 2013, Dillant-Hopkins Airport is located within the Airport Zoning District, established primarily to regulate building and vegetation height and land use in the vicinity of the airport. Adjacent land use is comprised of areas regulated by terms of Residential, Business, and Industrial Park zoning districts. The Ashuelot River and the South Branch Asheulot River, located west of the airfield, and Wilson Pond, located east of Route 32 are subject to the Swanzey Shoreland Protection District.

Residential and commercial development in the vicinity of the airport is generally sparse, with the exception of residential neighborhoods located north and east of Airport Road.

## 4.4 PLANNED DEVELOPMENT

In addition to the easement acquisition and obstruction mitigation efforts proposed in this EA, the airport has several safety improvement projects planned for implementation. Projects proposed for construction at the airport during the short-term planning period include the reconstruction of Runway 02/20 (6,200' x 100') and Runway 14/32 (4,000 x 150').




Client/Project

DILLANT-HOPKINS AIRPORT


Stantec

482 Payne Road
Scarborough ME 04074 U.S.A.
www.stantec.com


Figure No.

4-1

Title

LOCATION MAP

Runway reconstruction includes reclaiming and recycling existing runway pavements to then be incorporated into runway sub-base material. Four inches of new asphalt will then be applied to the runways. No expansion of paved areas or additional impervious surface material is associated with pavement rehabilitation efforts. In fact, during reconstruction, Runway 14/32 width may be reduced from 150 feet to 75 feet, potentially resulting in the removal of approximately 300,000 square-feet of impervious surface at the airport. After asphalt has been removed, Runway 14/32 shoulders will be graded, seeded with grass and maintained as turf safety area.

The reconstruction of Runway 02/20 also includes upgrading the runway safety area (RSA). The RSA is typically comprised of turf surfaces adjacent to the runway and extending beyond runway ends. RSAs must be designed to FAA standards and are intended to minimize pilot/passenger injury and damage to aircraft in the event an aircraft veers from the runway, overshoots the runway during landing, or undershoots the runway on approach. Dimensions of the RSAs must be maintained at specific grades, free of ruts and/or ditches, and void of fixed structures of any kind. RSA dimensions are determined, in part, by the approach category of the runway and by the aircraft typically expected to use the runway.

The RSA for Runway 02-20 is 8,200 feet long and 400 feet wide. Currently, a six foot outlet culvert & headwall associated with a 770 foot drainage pipe (6 foot diameter) buried beneath the runway is located within the RSA to the west of the Runway 02 end. Additionally, a 1,135 foot-long stormwater drainage ditch constructed on the west side of Runway 02 in 1991 to divert stormwater from the southwestern region of the runway also occurs in the RSA.

In accordance with current FAA design standards, the culvert outfall and drainage ditch must be removed from the RSA to satisfy FAA design requirements. The Runway 02/20 rehabilitation and RSA improvement project will include an 85-foot extension of the existing culvert. The culvert will be extended westerly within the existing drainage canal. The culvert extension will be buried with suitable fill material, graded to acceptable design standards, and maintained as mowed field. Similarly, the drainage ditch will be filled and graded to acceptable RSA dimensions, and a new ditch will be constructed (excavated) to similar dimensions and in the approximate location of the existing ditch, just beyond the westerly edge of the RSA.

The RSA improvements will result in approximately 28,260 square feet of wetland impact (4,460 sq. ft. associated with culvert extension & 23,800 sq. ft. associated with filling existing drainage ditch). Based on the size of the project's watershed, a Tier 3 Stream Crossing Major Impact Wetlands Permit is required from the New Hampshire Department of Environmental Services.

## 4.5 NATURAL ENVIRONMENT

Dillant-Hopkins Airport is located within the Ashuelot River watershed. The Ashuelot River flows in a southerly direction, along the western edge of airport property. The South Branch of the Ashuelot River flows in a northerly direction toward the western region of the airport and drains into the Ashuelot River to the west of the Runway 02 end. Wilson Pond, encompassed by many seasonal and full-time homes, is located east of the airport and NH Route 32. Wilson Pond is dam controlled and drains from its southern end through a man-made canal constructed in the eastern region of airport property. The canal drains through a 6-foot culvert beneath Runway 2 before discharging into the South Branch of the Ashuelot River. Airport property is comprised primarily of open grass fields adjacent to the airfield pavement and extending to the southern region of the airport, a large wetland complex associated with the Ashuelot River, and mature coniferous forest located to the north of Airport Road.

The obstruction removal project considered in this EA is proposed predominantly on airport property within the forested region located north of Airport Road—approximately four acres of obstructions are proposed for removal within residential parcels. This segment of airport property consists generally of an 80 acre forest composed of mixed hardwood and coniferous species.  Forested and scrub-shrub wetlands are present within the forest complex. This area provides ample habitat for a variety of wildlife including White-tailed deer, Eastern coyote, red fox, bobcat, and beaver.  Eastern wild turkey, pileated and downy woodpecker, and several species of songbirds also utilize the forest.

The immediate project location (on-airport) is composed primarily of a dense stand of mature white pine ranging between 85-100 feet in height with sparse understory vegetation. The area includes two isolated scrub-shrub/forested wetlands and small emergent wetland. One of the scrub-shrub/forested wetlands may be categorized as a dwarf-shrub bog comprised of black spruce, red maple, larch, leatherleaf, sheep-laurel, highbush blueberry, and sphagnum peat moss. The subject area is used recreationally by local residents and the bog is utilized as an educational resource for local academic institutions.

# 5.0 Environmental Consequences

## 5.1 INTRODUCTION

This section identifies and evaluates the potential environmental consequences of implementing the proposed actions described in Section 3.0. The environmental impacts involving "extraordinary circumstances" typically requiring the preparation of an EA and identified in Chapter 6 of FAA Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*, are utilized as a baseline for determining potential environmental impacts associated with federally-funded airport improvement projects. The following evaluation will also assist with determining the environmentally preferable alternative pursuant to NEPA for achieving project goals.

## 5.2 AIR QUALITY

In 1997, the FAA published *Air Quality Procedures for Civilian Airports & Air Force Bases* (Handbook), amended in 2004, to establish the scope of air quality assessments for proposed federal actions for compliance with the National Environmental Policy Act, the Clean Air Act (CAA) and other related regulations. In 1998, the FAA revised its policy on air quality modeling procedures and identified the Emissions and Dispersion Modeling System (EDMS) as the required model to perform air quality analyses for aviation sources. The revised policy ensures the consistency and quality of aviation analyses performed for the FAA.

The Handbook identifies criteria pollutants to be analyzed in relation to National Ambient Air Quality Standards (NAAQS). The criteria pollutants include Nitrogen Dioxide ($NO_2$), Sulfer Dioxide ($SO_2$), Carbon Monoxide (CO), Ozone ($O_3$), Particulate Matter (PM-2.5), and Lead (Pb). Regions in which one or more of the criteria pollutant levels exceeds air quality standards are referred to as nonattainment or maintenance areas. Federal actions proposed in nonattainment or maintenance areas are subject to various levels of NAAQS assessment, at times including EDMS modeling, to determine conformity with the Clean Air Act and NEPA regulations.

As Dillant-Hopkins Airport conducts fewer than 180,000 operations annually (the Airport averages between 45,000 and 50,000 annual operations) and Cheshire County is not currently in nonattainment status for any of the criteria pollutants, air quality assessment or modeling for the project proposed in this EA is not required. Furthermore, in accordance with 40 CFR 93.153(c)(2)(iv), the airport sponsor must maintain airport facilities and the airfield in such a manner that ensures the safe operation of the airport. Airport maintenance, repair, removal, replacement, and installation work that matches the characteristics, size and function of an airport as it existed before such maintenance or repair activity typically qualifies as routine maintenance—actions presumed to conform with General Conformity standards established in the CAA.

Impacts to air quality within and beyond the vicinity of the Airport are not expected as a result of constructing the airport improvement projects proposed in this EA. Minor impacts to air quality typically associated with construction activities, including odors generated by the use of heavy equipment, may result during the mitigation of the vegetative obstructions. These impacts will be limited to the duration of construction and localized to the construction site.

## 5.3 COASTAL RESOURCES

The New Hampshire Coastal Program is one of 34 federally approved coastal programs authorized under the Coastal Zone Management Act and is administered by the New Hampshire Department of Environmental Service (DES). The Coastal Program provides funding and staff assistance to towns and cities, and other local and regional groups who protect clean water, restore coastal habitats, and help make communities more resilient to flooding and other natural hazards. Proposed project locations are not located within any designated coastal zones, and do not therefore require correspondence and oversight from DES or other state agencies responsible for regulating activities subject to the New Hampshire Coastal Program.

## 5.4 COMPATIBLE LAND USE

The compatibility of existing and planned land uses in the vicinity of an airport is usually associated with the extent of potential aircraft-noise impacts from the airport as well as safety concerns with the land located beneath the protected airspace. Land uses occurring adjacent to and within the bounds of airport property include aviation, Business and Industrial Park Districts, Residential, and Special Lake Protection (Wilson Pond). Obstruction removal activities have been proposed on and off airport property, abutting and within private residential areas located to the north of Runway 20. The removal of vegetation will not alter current land uses nor will new land uses be proposed within project locations. Although the obstructions located on-airport currently provide limited noise abatement to residences, as the these trees are comprised primarily of a mature white pine canopy with a very sparse understory, slight increases in aircraft noise may be perceptible to abutters.

## 5.5 CONSTRUCTION IMPACTS

Temporary short-term impacts typically associated with construction are anticipated to result from obstruction removal activities. Anticipated temporary impacts include increased noise and emissions from the use of construction equipment and minor increases in traffic volume on nearby access roads.

Construction standards presented in FAA Advisory Circular 150/5370-10F, *Standards for Specifying Construction of Airports*, shall be incorporated into project design and specifications. In addition, best management practices (BMPs) preventing erosion and soil sedimentation will be integrated into project design to prevent water quality impacts to nearby water bodies. Construction contract documents will clearly state that it is the contractor's responsibility to operate in a manner that prevents temporary and permanent erosion, sedimentation, and air and water pollution.

Measures will be taken to prevent the discharge of pollutants from construction equipment such as fuels and lubricants within project locations. Designated staging areas where equipment fueling and maintenance will occur will be established well removed from wetlands and other surface water bodies. The use of temporary erosion and pollution measures will be specifically designed and implemented throughout the duration of the construction activities pursuant to federal, state, and local jurisdictional authorities.

Short-term impacts to air quality will result from the operation of construction equipment (skidders, forwarders, chippers, etc.). The contractor, as a condition of the contract, is obligated to provide maximum dust control measures consistent with BMPs for construction activities. Engine emissions and fumes will be extremely localized and short-term in duration.

Noise will be generated by the normal operation of construction equipment at the proposed project sites. Construction will be limited to daylight working hours in order to minimize annoyances to the surrounding community.

The projects proposed in this EA will require transporting material and equipment on public roads. State Route 32 and Airport Road will serve as the primary transportation corridors for construction vehicles (Greenwood Avenue will be utilized during off-airport operations). Safety precautions such as road signage and traffic flagging personnel, if necessary, will be utilized during construction activities.

## 5.6 DEPARTMENT OF TRANSPORTATION ACT: SEC 4(F)

Section 4(f) of the Department of Transportation Act requires the Secretary of Transportation investigate all alternatives before impacting any publicly owned lands designated as public parks, recreation areas, wildlife or waterfowl refuges of national, state, or local significance, or land having national, state, or local historical significance. No Section 4(f) lands will be impacted by actions proposed in this EA.

One parcel incorporated into airport property as reflected in the airport's Exhibit 'A' document was once owned by the Keene Forestry Association and granted to the Edgewood Civic Association in 1969. This 12.3 acre parcel located (in the town of Swanzey) north of the Runway 20 end between Airport Road and Greenwood Avenue, was then deeded to the city of Keene with several covenants including but not limited to:

- No buildings of any kind will be erected, used or otherwise maintained on said premises;
- Such premises shall be maintained in a natural wooded state substantially in the same condition in which the premises are on the date of the deed; and

- No camping, picnicking or other recreational use will be permitted on said premises.

This deed was amended in 1983 to indicate that trees on the conveyed parcel may be topped or removed to prevent hazards to air navigation with the intent to leave parcel vegetation in as natural a state as possible (Deed, Swanzey Tax Map 37 and Exhibit 'A' are included in Appendix C of this document). Again, this parcel is identified on the airport's Exhibit 'A' and the town of Swanzey tax map as airport property. This area is not identified or managed by either the city of Keene or the town of Swanzey as a public park or recreational area.

This region of airport property is comprised predominantly of mature white pine trees penetrating approach surfaces by approximately 20-40 feet. Approximately three acres of the eastern region of this deeded parcel will be affected by proposed obstruction removal activities. Topping may be proposed when decreasing the height and/or spread of a tree is desired. However, topping is no longer regarded by the American National Standards Institute (ANSI) and most accredited aboriculture groups as an acceptable practice to reduce a tree's height to a predetermined crown limit. Removing significant mass of a tree top and limbs compromises a tree's ability to survive and is therefore not recommended. Instead, removal of individual trees, in their entirety, to ground level is recommended. ANSI A300 *American National Standard for Tree Care Operations – Tree, Shrub, and Other Woody Plant Maintenance- Standard Practices* is included in Appendix F of this document.

The airport intends to actively manage the natural regeneration of vegetation within the proposed on-airport tree clearing area with the ultimate goal of establishing a mixed-species stand comprised of soft and hardwood trees. Management practices will encourage the growth of tree species reaching approximate maximum heights of 40-60 feet, depending on proximity to the Runway 20 end. Periodic thinning will be conducted to remove trees exhibiting the potential to grow into protected airspace.

## 5.7 FARMLANDS

The Farmland Protection Policy Act authorized the U.S. Department of Agriculture (USDA) to develop criteria for identifying effects of federal programs on the conversion of farmland to non-agricultural uses. The guidelines developed by the USDA became effective August 6, 1984, and apply to federal activities involving the undertaking, financing, or assisting in the construction of improvement projects or acquiring, managing, or disposing of land that is deemed to have prime or unique farmland qualities.

Actions proposed in this EA will occur within forested areas and a residential neighborhood adjacent to airport property not currently engaged in or designated for future agricultural use. Therefore, the proposed projects will not impact any land deemed to have prime or unique farmland qualities.

## 5.8 FISH, WILDLIFE, AND PLANTS

Pursuant to Section 7 of the Endangered Species Act, the U.S. Fish and Wildlife Service (USFWS) has been consulted in order to determine the presence of threatened or endangered species within the boundaries of Dillant-Hopkins Airport or adjacent properties. Similarly, the New Hampshire Natural Heritage Bureau (NHB) has also been contacted regarding the status of state-listed species and exemplary natural communities occurring within the vicinity of activities proposed in this EA.

Correspondence with NHB identified the occurrence of three state-listed species within the vicinity of the proposed project area. State-listed species include the Grasshopper sparrow, an upland grassland bird listed as *threatened*; the Northern leopard frog, listed as a species of *special concern*; and the Wood turtle, also listed as a species of *special concern*. Correspondence with USFWS identified the federally endangered Dwarf wedge mussel as occurring within the vicinity of the airport.

The NHB and USFWS have determined that proposed obstruction removal activities conducted in winter months during frozen ground conditions will not adversely impact state or federally protected wildlife species. See USFWS and NHB correspondence located in Appendix D of this document.

Additionally, a wetland located on airport property, approximately 1,900 feet north of the Runway 20 end (on centerline) and 100 feet north of Airport Road, includes a dwarf shrub bog. The bog, approximately two acres in area, is characterized by black spruce and larch trees along the perimeter of open water and shrub interior. Shrubs include leatherleaf, sheep laurel, winterberry, bog-rosemary and highbush blueberry. The bog is used as an educational tool by staff at Antioch University New England to illustrate a classic example of plant community succession within the bog.

Obstruction removal is proposed adjacent to the western, northern and eastern borders of the wetland. The bog occurs in a depression and perimeter trees (black spruce & larch) are significantly shorter than dominant upland species. Although approximately 0.3 acres of tree removal has been estimated to occur around the perimeter of this wetland, this estimate has been based on an interpretation of the obstruction data in relation to the surveyed wetland boundary. Preliminary site assessments indicate the removal of any vegetation from within the wetland will not be necessary. Individual trees identified as obstructions (large canopy trees) located on or just outside of the delineated wetland boundary may be mitigated either by whole tree removal or by selective topping in an effort to provide habitat “snags” where appropriate. In this instance, topping is not conducted to maintain a living tree at a desired elevation. Instead, obstructions can be topped and cut in such a manner that facilitates decay and the creation of cavities, creating habitat for a variety of wildlife and bird species including nuthatches, chickadees, woodpeckers, raccoons and fishers (these species are typically not regarded as hazards to aviation operations within the vicinity of an airport). The use of heavy equipment will not be permitted within the wetland. No impacts to the bog are anticipated.

## 5.9 FLOODPLAINS

Floodplains are defined in Executive Order 11988 as “the lowland and relatively flat areas adjoining inland and coastal waters including, at a minimum, that area subject to a one percent or greater chance of flooding in any given year, or in other words, the area that would be inundated by a 100 year flood.” This order directs federal agencies to “take action to reduce the risk of flood loss, to minimize the impacts of floods on human safety, health, and welfare, and to restore and preserve the natural beneficial values served by floodplains.”

An online review of floodplain maps issued by the Federal Emergency Management Agency (FEMA) determined that no part of airport property or properties affected by actions proposed in this EA occur within the 100-year flood zone. Airport safety improvement projects proposed in this EA will not contribute to the impacts of floods on human safety, health, and welfare nor will they compromise the beneficial values served by floodplains.

## 5.10 HAZARDOUS MATERIALS, POLLUTION PREVENTION AND SOLID WASTE

The proposed easement acquisitions and associated vegetative obstruction removal projects will not involve the use of hazardous materials nor will the projects generate a significant volume of solid waste. Designated staging areas will be established in upland locations for equipment fueling and daily maintenance (lubrication). Contractors will also be required to adhere to the pollution prevention measures and erosion and sedimentation controls identified in the Stormwater Pollution Prevention Plan (SWPPP) for Construction Activities prepared for the project in accordance with the National Pollutant Discharge Elimination System (NPDES) permitting program administered by the U.S. Environmental Protection Agency (EPA).

On airport property, felled trees and all wood debris resulting from the project will be removed from the site, unless otherwise determined to provide ecological benefit to the site. Within easements areas off airport property, affected landowners may request to maintain felled trees for firewood or other purposes. In all other instances, construction bid documents shall require trees and any wood to become the property of the contractor to be processed or disposed of in accordance with federal, state, and local regulations.

No changes in the quantity of type of solid waste generated at the airport, or changes in the method of collection at the facility, are anticipated.

## 5.11 HISTORICAL, ARCHITECTURAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

The National Historic Preservation Act of 1966 (NHPA), as amended, and the Archeological and Historic Preservation Act of 1974, as amended, require federal agencies to consider impacts of their actions to resources of historic, cultural, or archeological significance. Section 106 of the

NHPA requires consultation with the State Historic Preservation Officer (SHPO) and Tribal Historic Preservation Officer(s) (THPO) to determine potential adverse effects of a federal action to culturally significant resources and/or historic properties on or eligible for listing on the National Register of Historic Places.

However, as ground disturbance (stumping, grubbing, grading, etc.) is not proposed as a component of obstruction removal activities, impacts to potentially significant historic resources are not anticipated. The New Hampshire Division of Historical Resources has determined the project presented in this EA will have no impact on historic properties. See NHDHR correspondence located in Appendix D.

## 5.12 LIGHT EMISSIONS AND VISUAL IMPACTS

The FAA requires consideration of the extent to which any lighting associated with an airport action will create an annoyance or disturbance among residents in the vicinity of a proposed lighting installation or project. The installation of obstruction lighting is not proposed or associated with projects considered in this EA.

Presently, mature white pine trees on airport property identified as obstructions provide a visual buffer between residents living on Greenwood Avenue and the airfield. The removal of approximately 11.6 acres of canopy trees will effectively remove this buffer in the short term. However, dense regeneration of tree and shrub species is expected subsequent to the removal canopy trees. It is very likely that within 2-3 years, a visual buffer more substantial than that which currently exists will be established. If regeneration is properly managed to control the growth of white pine, a more diverse forest community exhibiting lower canopy height characterized by dense broadleaf growth and wood mass will result.

The removal of trees from within proposed easement areas will also alter the existing landscape of the Greenwood Avenue/Edgewood Avenue neighborhood.

## 5.13 NATURAL RESOURCES AND ENERGY SUPPLY

Energy requirements associated with a proposed airport improvement project generally fall into two categories: (1) those that relate to changed demands for stationary facilities (i.e. airfield lighting and terminal building heating), and (2) those that involve the movement of air and ground vehicles.

The preferred alternative will have no effect on energy consumption at the airport nor will the use of any rare materials or natural resources in short supply required for the actions proposed in this EA.

## 5.14 NOISE

As indicated in FAA Order 1050.1E, *Environmental Impacts: Policies and Procedures,* the FAA has determined that for aviation noise analysis the cumulative noise exposure of individuals to noise resulting from aviation activities must be established in terms of yearly day/night average sound level (DNL) as FAA's primary metric. A noise analysis can be prepared using the FAA's Integrated Noise Model (INM) in order to assess noise impacts resulting from airport improvement projects to noise sensitive areas (e.g. densely populated residential areas, historic sites, national parks and national wildlife refuges). According to Order 1050.1E, a significant noise impact results when the INM analysis demonstrates the proposed project will create an increase of DNL 1.5 decibel (dB) or more at or above DNL 65dB noise exposure in noise sensitive areas.

As the project proposed in this EA—the acquisition of avigation easements and the removal of vegetative obstructions located on and off airport property—will not lead to larger aircraft using the airport or to an increase in the number of operations conducted at the facility, an INM, analysis has not been conducted. Due to the lack of dense understory foliage and growth, existing trees identified for removal provide a limited degree of insulation or buffer for airport noise experienced by abutters. Although a slight increase in aircraft noise levels may be perceptible to some abutters in the short-term, obstruction removal activities proposed to mitigate obstructions to Runway 20 approach surfaces are not expected to alter existing noise contours at the airport. An assessment of the of potential noise impacts to abutting residents resulting from the removal of obstructing vegetation has been prepared by Sanchez Industrial Design at the request of the airport and is included in Appendix 'G,' see *Dillant-Hopkins Airport Noise Reduction by Trees*.

Short-term noise impacts typically associated with the use of heavy equipment may be experienced by airport abutters during harvesting operations. However, these impacts will be limited to normal daylight working hours for the duration of the proposed project. Long-term noise impacts may be expected to decrease slightly with the dense regeneration growth expected after cutting.

## 5.15 SECONDARY (INDUCED) IMPACTS

Major airport development projects may involve the potential for induced or secondary impacts on surrounding communities. Examples of such impacts include shifts in patterns of population movement and growth, public service demands, and changes in business and economic activity to the extent influenced by the proposed airport development project. When potential exists for secondary impacts, the EA shall describe in general terms the consideration of these factors.

Proposed on and off-airport obstruction removal activities are not expected to result in significant induced impacts as the safety improvement project will not contribute to shifts in population patterns, increased (or decreased) public service demands, or changes to local business activity.

## 5.16 SOCIOENCONOMIC IMPACTS, ENVIRONMENTAL JUSTICE, AND CHILDREN'S ENVIRONMENTAL HEALTH AND SAFETY RISKS

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations*, was issued on February 11, 1994. This Order established procedures for the U.S. Department of Transportation (USDOT) to "achieve environmental justice as part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects, including interrelated social and economic effects, of its programs, policies, and activities on minority populations and low-income populations in the United States."

Towards the prevention of disproportionately high and adverse effects on minority and low-income populations, USDOT monitors operations to assure that nondiscrimination is an integral part of its programs. USDOT policies, programs, and activities are subject to the requirements of NEPA, Title VI of the Civil Rights Act, Uniform Relocation Assistance and Real Property Acquisition Policies Act, Intermodal Surface Transportation Efficiency Act, and other USDOT statutes involving human health, social and economic impacts, or environmental matters. Socioeconomic, environmental justice and children's health and safety risk impacts are not anticipated as the proposed project will not result in: disproportionately high and adverse effects (human health, economic, or environmental) on minority and low income populations; disproportionate health and safety risks to children; extensive relocation of residents or community businesses contributing to severe economic hardship for affected communities; or disruptions of local traffic patterns thereby substantially reducing levels of service of roads serving the community.

FAA is also encouraged to identify and evaluate potential environmental health and safety risks that could disproportionately affect children. Such risks are typically attributable to materials (such as food, drinking and recreational water, soil, and air) children may come in contact with or ingest.

## 5.17 WATER QUALITY

The potential to degrade the water quality of ground water sources and local surface water bodies must be assessed when evaluating project alternatives considered in this EA. For the proposed projects in this EA, no wetland disturbances are anticipated. The selective removal of individual canopy trees may be required along the edge of Wetland 1. If required, the removal of these trees will not alter or impact the ecological integrity of this wetland. Construction activities, proposed during frozen ground conditions, are not anticipated to result in the siltation or pollution of wetlands or adjacent water bodies. Temporary erosion and pollution control measures will be specifically designed and implemented throughout the duration of construction activities pursuant to federal, state, and local jurisdiction authorities. Contractors will be required to provide spill containment equipment to prevent discharge of pollutants from construction equipment such as fuels, lubricants, or any other harmful or potentially harmful material into wetlands or any other body of water within the vicinity of the project area.

## 5.18 WETLANDS

Three wetlands have been identified on airport property within the vicinity of proposed obstruction removal activities. Wetland boundaries were delineated by a professional wetland scientist and are illustrated in Figure 5-1 *Wetlands Plan*. A wetland function and value assessment report has been prepared and is included in Appendix E of this report. Alterations to wetlands or impacts to existing functions and values are not anticipated to result from the safety improvement project addressed in this EA.

### 5.18.1 Wetland 1

Wetland 1 is a palustrine forested (PFO) and palustrine scrub-shrub (PSS) wetland, with the PFO only present on the eastern and western boundaries of the wetland. The interior of this wetland can be described as a dwarf shrub bog. The wetland boundary follows a distinct break in topography on all sides. Along the eastern edge of the wetland there is a culvert that drains into the wetland, likely from an adjacent parking lot located off-site. On the southern boundary of the wetland, a subsurface water flow through a natural berm providing a hydrologic connection to Wetland 2 was observed. At the time of the site visit, Wetland 1 contained standing water in areas at the wetland/upland boundaries and soils were saturated to the surface. The soil is characterized by a deep organic horizon with 36 inches of mucky peat. The forested portion of the wetland is dominated by larch (*Larix laricina*), black spruce (*Picea mariana*), and red maple (*Acer rubrum*), with highbush blueberry (*Vaccinium corymbosum*) dominating the outer shrub layer. There is an area on the eastern side of the wetland that is being overgrown with Asian bittersweet (*Celastrus orbiculatus*), a highly aggressive invasive vine. The interior of the wetland is dominated by shrubs and emergent vegetation. Black spruce, leatherleaf (*Chamaedaphne calyculata*), sheep-laurel (*Kalmia angustifolia*), common winterberry (*Ilex verticillata*) and bog-rosemary (*Andromeda polifolia*) dominate the shrub layer. The herbaceous layer contains bog-rosemary, three seed sedge (*Carex trisperma*) purple pitcherplant (*Sarracenia purpurea*), and small cranberry (*Vaccinium oxycoccos).* The ground in the interior of this wetland is covered by peat moss (*Sphagnum* sp).

### 5.18.2 Wetland 2

Wetland 2 is a palustrine emergent (PEM) wetland that receives hydrologic inputs as subsurface flow from Wetland 1 and continues as a depression near Airport Road. There is currently very little vegetation in the wetland and at the time of the survey, 2 inches of standing water was observed with some evidence of flow. The wetland likely was holding water due to the recent heavy rain in the days prior to the survey. The vegetation at the forested edge of the wetland includes white pine, red maple and gray birch (*Betula populifolia*) in the tree layer, with highbush blueberry in the shrub layer and arching dewberry (*Rubus recurvicaulis*) and a manna grass species (*Glyceria* sp.) occurring sparsely as herbs in the wetland. The soils in this wetland



Stantec

Stantec Consulting Services Inc.
482 Payne Road
Scarborough ME 04074 U.S.A.
Tel. 207.883.3355
Fax. 207.883.3376
www.stantec.com




Consultants

AERIAL PHOTOGRAMMETRY COLLECTED BY COL-EAST, INC. IN SEPTEMBER 2013

Legend

- AIRPORT PROPERTY LINE
- ABUTTER PROPERTY LINE
- DELINEATED WETLANDS

| Revision | By | Appd. | YY.MM.DD |
|---|---|---|---|

| | By | Appd. | YY.MM.DD |
|---|---|---|---|
| A DRAFT ENVIRONMENTAL ASSESSMENT | LRK | GAC | 14.03.31 |
| Issued | | | |

| File Name: fig_5-1_wetland_pln.dwg | LRK | GAC | GAC | 14.02.011 |
|---|---|---|---|---|
| | Dwn. | Chkd. | Dsgn. | YY.MM.DD |

Permit-Seal

Client/Project

DILLANT-HOPKINS AIRPORT

KEENE, NEW HAMPSHIRE

Title

WETLANDS PLAN

Project No. 195210676

Scale AS NOTED

Figure No. 5-1

Revision A

ORIGINAL SHEET - ARCH D

are characterized by a dark surface occurring as 12 inches of sand masked with organic materials.

### 5.18.3 Wetland 3

Wetland 3 is classified as a palustrine scrub-shrub (PSS) wetland that follows a distinct break in topography, similar to Wetland 1. This isolated wetland is dominated by a variety of tall shrubs and dead standing trees and can be considered a tall shrub swamp, with deep organic soils and inundation or saturation present throughout the growing season. The soils in this wetland met the characteristics to be considered a histosol (greater than 16 inches of organic material). There is a small ditch on the northwest side of the wetland that continues as an ephemeral drainage that crosses a foot trail and ends before reaching an unnamed tributary to the west. The dominant shrubs in this wetland are highbush blueberry and winterberry. Few red maple trees occur on the western edge of the wetland. Cinnamon fern (*Osmundastrum cinnamomeum*) dominates the herbaceous layer along the wetland edge. Thick shrubs and deep organic soils made access to the interior of the wetland difficult. Other shrubs observed in the wetland include, catberry (*Nemopanthus mucronatus*), possumhaw (*Viburnum nudum*), and maleberry (*Lyonia ligustrina*).

## 5.19 WILD AND SCENIC RIVERS

There are no rivers classified under the Wild and Scenic Rivers Act (PL 90-542, as amended) within the airport vicinity. Therefore, no impacts to this resource are anticipated to result from the proposed actions. The Ashuelot River, located approximately 4,000 feet to the west of proposed project activities, is a State of New Hampshire Designated River, is protected in accordance with NHRSA 483, *The Rivers Management & Protection Act*. No impacts to this resource will result from proposed obstruction removal efforts.

## 5.20 SUMMARY OF IMPACTS

This EA has been prepared to identify and evaluate potential impacts resulting from project alternatives to human and natural resources within the vicinity of the airport. Pursuant to NEPA considerations, the preferred alternative for achieving project goals is *Alternative 2 - Runway 02/20 Easement Acquisition and Obstruction Removal*. The proposed obstruction removal project will not adversely impact the ecological integrity or water quality of wetlands, state or federally protected species of flora or fauna, or historic or archaeologically sensitive resources. Nor will the implementation of Alternative 2 contribute to significant socioeconomic impacts as defined in NEPA. This alternative substantially enhances the safety of aircraft operations conducted on Runway 02/20 and enables continued use of the runway by the fleet of aircraft currently utilizing Dillant-Hopkins Airport.

# 6.0 Mitigation Measures

## 6.1 INTRODUCTION

Mitigation measures are actions that will be implemented during project design and construction to avoid and minimize environmental impacts to the greatest extent possible. Ultimately, mitigation must conform to the necessary permitting requirements provided in Section 7 of this EA. Mitigation measures (40 CFR § 1508.20) generally include the following:

- Avoiding the effect altogether by stopping or modifying the action;
- Minimizing the effect by limiting the degree or magnitude of the action and the activities associated with its implementation;
- Rectifying the effect by repairing, rehabilitating, or restoring the affected environment;
- Reducing or eliminating the effect over time by preservation and maintenance operations during the life of the action; and
- Compensation for the effect by replacing or providing substitute resources or environments.

Compensatory mitigation will not be required as a condition of environmental permitting required for construction activities.

Based on safety, operational, environmental, and economic considerations, it has been determined that the preferred alternative for achieving project goals is *Alternative 2 - Runway 02/20 Easement Acquisition and Obstruction Removal*. This alternative improves the safety of operations conducted on the runway, satisfies FAA airspace safety standards and minimizes potential environmental impacts to the greatest extent possible.

## 6.2 WATER QUALITY MITIGATION

Impacts to ground and surface water resources are not anticipated as a result of the projects proposed in this EA. Appropriate BMPs, such as removing trees in frozen ground conditions to limit soil disturbance to the greatest extent possible and the installation of silt fence and haybale barriers will be implemented during construction to prevent the degradation of adjacent surface water bodies. Construction equipment will not be allowed to operate within wetlands and evidence of adequate spill response equipment shall be demonstrated on site prior to initiating construction. The proposed safety improvement project will not result in an increase of impervious surface on or adjacent to the airport. Increased storm water runoff from the airport and off-airport project locations is not expected.

## 6.3 NOISE BUFFER MITIGATION

To improve noise buffering between abutters and aircraft ground operations after construction of proposed obstruction removal on airport property, the use of engineered berms and/or the planting of suitable vegetation may be considered during the design phase of the project. If deemed appropriate during design, the implementation of such mitigation measures will be subject to the approval of FAA and NHDOT.

## 6.4 CONSTRUCTION MITIGATION

In order to avoid potential water quality impacts associated with the construction of the proposed projects, temporary erosion and pollution control measures will be specifically designed and implemented throughout the duration of construction activities pursuant to federal, state, and local jurisdictional authorities.

Best management practices, including the implementation of erosion and sedimentation and pollution prevention controls, the operation of equipment during daytime hours only, and the construction of equipment access pads to prevent the off-site tracking of dirt and mud. Central locations for all equipment refueling and staging will be established in upland areas removed from wetlands in order to minimize the risk of ground and surface water quality impacts.

# 7.0 Jurisdictional Authorities, Actions and Permits

The following discussion outlines the jurisdictional authorities, actions, and permits that apply to the vegetative obstruction removal project proposed in this EA for construction at Dillant-Hopkins Airport.

## 7.1 FEDERAL JURISDICTIONS

### 7.1.1 National Environmental Policy Act (NEPA)

NEPA is the United States' basic charter for protection of the environment. NEPA was enacted with two primary objectives in mind: (1) preventing environmental damage and degradation, and (2) ensuring that federal agencies consider environmental factors with regard to federal actions. NEPA also established the federal Council on Environmental Quality, which is responsible for promulgating NEPA regulations (40 CFR § 1500 – 1508).

NEPA regulations mandate environmental protection for all federal agencies (excluding Congress, the judiciary, and the President). They also require federal agencies to assist in implementing the CEQ's NEPA regulations by adopting policy and procedures consistent with NEPA. The FAA has two such documents: FAA Orders 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions* and 1050.1.E, *Policies and Procedures for Considering Environmental Impacts*.

The analysis and documentation provided in this EA enables the FAA to either issue a Finding of No Significant Impact (FONSI), or, if additional analysis is necessary to evaluate the magnitude of potential impacts, require the preparation of an Environmental Impact Statement (EIS).

### 7.1.2 NPDES Notice of Intent (NOI) & Stormwater Pollution Prevention Plan (SWPPP) for Construction Activities

The NPDES stormwater program requires construction site operators engaged in clearing, grading and excavation activities that disturb one acre or more to obtain coverage for stormwater discharges from the site under a NPDES permit. Many states are authorized to implement the NPDES Stormwater permitting program. However, EPA is the permitting authority in several states, including New Hampshire. Within areas regulated by EPA, operators must meet the requirements of the EPA Final 2012 Construction General Permit (CGP).

In order to receive coverage under the CGP, an operator must submit to the EPA a complete and accurate Notice of Intent prior to initiating construction activities. The NOI certifies to EPA that an operator is eligible for permit coverage and provides information regarding the nature of construction and associated stormwater discharge.

Prior to submitting the NOI, all operators associated with a construction project must develop a stormwater pollution prevention plan (SWPPP).

The SWPPP, intended to eliminate the potential for introducing pollutants to stormwater must include, at a minimum, the following:

- Stormwater Team;
- Nature of Construction Activities;
- Emergency-Related Projects;
- Identification of Other Site Operators;
- Sequence and Estimated Dates of Construction Activities;
- Site Map;
- Potential Construction Site Pollutants;
- Non-Stormwater Discharges;
- Stabilization Practices;
- Pollution Prevention and Waste Management Procedures;
- Procedures for Inspection, Maintenance, and Corrective Action; and
- Staff Training

The SWPPP must be amended to reflect changes in operator status or modifications to construction plans, stormwater control and pollution prevention measures, or to any other activity that is no longer adequately reflected in the SWPPP. A current copy of the SWPPP must be kept on site and made available at the time of inspection or upon request by EPA.

## 7.2 STATE JURISDICTIONS

Typically, construction projects conducted in New Hampshire disturbing more than 100,000 square-feet of contiguous terrain are subject to approval from NHDES and conditions of the Alteration of Terrain permit. The project protects surface and groundwater resources and drinking water supplies by controlling soil erosion and managing stormwater runoff.

There is no stump or root grubbing associated with obstruction removal activities proposed on-airport (11.3 acres). Trees will be cut as close to ground level as possible to avoid soil disturbance. It is likely, however, that stump-grubbing will be associated with off-airport obstruction removal activities in an effort to restore affected areas to match existing landscapes within proposed easement locations as closely as possible. Although off-airport obstruction removal has been estimated to include approximately four acres, this estimate is based on the extent of canopy cover affected rather than actual disturbances to the ground. It is anticipated that actual area disturbed by stump removal will be below the 100,000 square-feet of contiguous terrain threshold. Therefore, it is expected that an Alteration of Terrain permit will not be required.

NHDES also regulates actions impacting wetlands within the State. The potential removal of trees identified as obstructions and located around the perimeter of Wetland 1 will not adversely impact the integrity of the wetland. Obstructions targeted for removal in close proximity to the wetland or just within the delineated wetland boundary will be removed in a manner that avoids disturbances to wetland soils and flora. Trees will be removed during frozen ground conditions and tree harvesting equipment will not be allowed within wetlands. Wetlands permitting subject to NHDES regulations will not be required.

## 7.3 LOCAL JURISDICTIONS

The implementation of proposed obstruction removal actions is not subject to jurisdictional approvals from municipal planning boards or conservation commissions. During the design phase of proposed actions, the project will be presented to the Swanzey and Keene Conservation Commissions for consideration and comment.

# Appendix A

## A.1 FAA/NHDOT DETERMINATION

# Cohen, Gregg

| | |
|---|---|
| **From:** | Niewola, Carol <Carol.Niewola@dot.nh.gov> |
| **Sent:** | Tuesday, January 31, 2017 3:28 PM |
| **To:** | Richard.Doucette@faa.gov |
| **Cc:** | John Wozmak (jwozmak@ci.keene.nh.us); Cohen, Gregg |
| **Subject:** | EEN: Environmental Assessment recommendation (SBG 08-11-2013 and SBG 08-13-2015) |
| **Attachments:** | FW: Stantec FTP Confirmation - EEN FINAL EA |

Richard,

NHDOT/Bureau of Aeronautics has had an opportunity to review the *Final Environmental Assessment, Dillant-Hopkins Airport, Keene, New Hampshire* dated January 2017 as was sent in an e-mail from Stantec (see attached). The assessments of possible environmental impacts were made in accordance with the National Environmental Policy Act (NEPA) and FAA guidance set forth in FAA Order 5050.4B, *NEPA Implementing Instructions for Airport Actions*, and other applicable environmental guidance. The proposed action has been shown to not rise to the level of significant per FAA guidance and we recommend an FAA finding of no significant impact.

**Carol L. Niewola, PE, CM**, Senior Aviation Planner
**NHDOT/Bureau of Aeronautics**, 7 Hazen Drive, P.O. Box 483, Concord, NH 03302-0483
O 603-271-1675 | C 603-419-0683 | F 603-271-1689 | cniewola@dot.state.nh.us or carol.niewola@dot.nh.gov
http://www.nh.gov/dot/org/aerorailtransit/aeronautics/index.htm
*Supporting New Hampshire Aviation Since 1941*

**DEPARTMENT OF TRANSPORTATION**
**FEDERAL AVIATION ADMINISTRATION**
**FINDING OF NO SIGNIFICANT IMPACT**

Keene Dillant-Hopkins Airport (EEN)
80 Airport Road
Keene, New Hampshire 03431

PROPOSED ACTION

The purpose of the proposed action is to satisfy Federal Aviation Administration (FAA) safety standards regarding the protection of navigable airspace by removing vegetative obstructions located on and off airport property. Approximately 15 acres of trees have been identified as obstructions to the Runway 20 (primary runway) approach surfaces. Approximately three acres of identified obstructions are located off airport property. The proposed action includes the removal of approximately 0.3 acres of trees from wetlands located on airport property.

Alternatives considered, in addition to the preferred alternative, to minimize the extent of tree clearing included two Runway 20 threshold displacement options, a runway shift alternative, and a No Action alternative. The threshold displacement alternatives resulted in reduced usable runway length determined to be too restrictive for aircraft currently using the runway. The 1,587-foot runway shift requires the relocation of the runway's existing MALSR and other critical ILS navigational aids as well as the relocation of a segment of State Route 32 and deemed too expensive to implement (estimated cost of 23.5 million dollars). The No Action alternative fails to remove trees obstructing the Runway 20 approach, which pose a hazard to operations conducted on the runway, particularly during periods of low visibility and inclement weather.

This action will not significantly affect environmental resources as obstructing trees will be selectively removed from the perimeter of the affected wetland (bog) without using mechanized equipment avoiding adverse impacts to wetland functions or values or the integrity of the bog (see von Oettingen, Suzi email dated December 17, 2013 located in Appendix D *Agency Correspondence*). No compensatory mitigation is required for the proposed action.

FEDERAL FINDING

After careful and thorough consideration of the facts contained herein, the undersigned finds that the proposed federal action is consistent with existing national policies and objectives as set forth in Section 101 of the National Environmental Policy Act (NEPA) and other applicable environmental requirements and will not significantly affect the quality of the human environment or otherwise include any condition requiring consultation pursuant to Section 101(2)(c) of the NEPA. As a result, FAA will not prepare an EIS for this action.

APPROVED: R Doucette DATE: 1/31/17
Richard Doucette
Manager, Environmental Programs

DISAPPROVED: ______________________ DATE: ______________

# Appendix B

## B.1 DILLANT-HOPKINS EA AD-HOC ADVISORY COMMITTEE MEETING MINUTES

**Dillant-Hopkins Airport**
**Ad-Hoc Airport Obstruction Removal**
**Committee Meeting Minutes**

**Tuesday, March 5, 2013** **4:00 PM** **3rd Floor, City Hall**

**Members Present:**

Robert Bergevin
Peter Palmiotto
Scott Ellsworth
James "Tim" Dunn
Richard Hersom
Dr. Ann Shedd

**Staff Present:**

Ed Mattern, Airport Director
Tom Mullins, City Attorney

**Others Present:**

**Members Not Present:**

Alfred "Gus" Leranduau

**Mayor Kendall Lane**

1. **Welcome Remarks** - Mayor Kendall Lane

Attorney Mullins opened the meeting at 4:07 PM. Mayor Lane arrived and thanked everyone for being here and for being willing to serve. Mayor Lane continued as well as being a sounding board, this Committee will provide a means of getting information back to the neighborhood and those interested in this issue. Ultimately City Council will have to make the decision as to what will be done about the obstruction removal at the airport. There are lots of options; City Council at this time does not know what it will do. Consultants have been hired; this Committee will be working primarily with the consultants to ensure that they review the areas that are of concern and of interest to you. The consultants will develop a report and a solution to be presented to the City Council. This Committee's role is vital to this process. This not only affects the Edgewood neighborhood, it also affects the entire City.

The Committee charge:

*To provide a communication channel between the City of Keene, the Dillant-Hopkins Airport and its consultants and the residents of the Edgewood Neighborhood, as it relates to the* *development of a mitigation strategy to address obstructions affecting the Dillant-Hopkins Airport.*

Activities of the Group will be ancillary and run parallel to the process the City must follow as outlined by the Federal Aviation Administration, New Hampshire Department of Transportation, Bureau of Aeronautics and the federal Airport Improvement Program.

Specific activities:

- To provide a regular communication vehicle between the City of Keene and Edgewood residents on issues related to the obstruction issues at the north end of the Dillant-Hopkins Airport.
- Provide input and advice to the City and its consultants on the methodology that might be employed, should the removal of trees be required.
- Provide input and advice to the City and its consultants on the development of a long-term forest management plan related to the Runway 20 approach.
- Regularly meet with the Airport Director, engineers and consultants for project status updates.

2. **Introductions**

Introductions were made and Attorney Mullins distributed information packets to those present. The contact information sheet was distributed for updating and submitted to Mr. Mattern.

3. **Committee Administration** - City Attorney

Attorney Mullins administered the Oath of Office to Scott Ellsworth. Attorney Mullins began his review of the information packet and recommended that Committee members become familiar with this information. Referring to the Committee Charge, Attorney Mullins noted that it is important to understand what the charge does not include. It does not include a determination as to whether or not something is an obstruction and whether or not it needs to be removed. The Federal Aviation Administration retains that right and will make its own decision. With respect to the Federal Aviation Administration's responsibility, a request was made to make available the rules dealing airport obstructions; these are included in the packet (Part 77-Safe and Efficient Use and Preservation of Navigable Spaces). Attorney Mullins provided a brief background on the Federal Aviation Administration's rule making authority under the Code of Federal Regulations (CFR) Title XIV. In the material provided by Attorney Mullins, page 4 of 11 Part C, is there for the Committee's review. Attorney Mullins noted he is available to answer any questions.

Attorney Mullins reviewed the Recommended Guidelines for Conducting a Meeting, included in the packet. Even though this is an Ad-Hoc Committee it is a public entity and is a committee of the City Council and falls under the rules of City committees. Attorney Mullins pointed out differences between public bodies and those committees coming from the private sector, including non-profits. Attorney Mullins pointed out that a quorum for this committee will be four members and that no business should be conducted without a quorum. Attorney Mulllins addressed the Rules of Procedure, standardized several years ago to provide a consistent standard of rules for all committees within the City. It is permissible for this Committee to adopt the Rules of Procedure at the next meeting, allowing time for review. The rules do track the requirements of RSA 91-A "Right to Know Law" with respect to meetings, times, dates, places, and minutes. A minute taker will be assigned to this Committee. Attorney Mullins addressed how/what changes can be made to the minutes. In response to Mr. Ellsworth, Attorney Mullins noted that non-public sessions are not expected for this Committee. Attorney Mullins outlined the statutory requirements governing non-public sessions. Attorney Mullins also addressed the Conflict of Interest Policy for the City. Attorney Mullins also recommended reading the primer, put together by the New Hampshire Municipal Association (2012), Guide for New Hampshire Elected Officials.

Attorney Mullins pointed out that included in the packet is also the letter, dated February 5, 2013 from the New Hampshire Department of Transportation regarding obstructions/clearing at the airport. Attorney Mullins noted that this is the state agency that federal funds/grants are passed through. Grant funding does include requirements, some of which are included in this letter.

Attorney Mullins concluded his presentation with a discussion on email communications. Communications via email amongst Committee members is discouraged. He pointed out that use of the "reply all" button can constitute an unlawful meeting of the Committee. Attorney Mullins also discussed what constitutes a meeting outside when members meet up at public places. In response to Dr. Shedd' concern, Attorney Mullins noted that the three members of this Committee that also serve on the Edgewood Association do not constitute a quorum, therefore email between them and the Association would not be an issue (low risk). Attorney Mullins noted that he is available to answer questions; he also outlined what his role is "not" with regards to this Committee.

**4. Election** – Chair and Vice Chair

Dr. Shedd nominated Peter Palmiotto as Chair. Mr. Dunn seconded the motion. Mr. Palmiotto declined due to personal reasons and unfamiliarity with the rules and regulations.

Mr. Palmiotto nominated Tim Dunn as Chair. Mr. Ellsworth seconded the motion which carried unanimously.

Mr. Bergevin nominated Scott Ellsworth as Vice-Chair. Mr. Hersom seconded the motion which carried unanimously.

Adoption of the Rules of Order: include on next agenda.

**5. Current Project Status**

Mr. Mattern offered to provide background information to anyone in need. Mr. Mattern continued that we have discovered that we have obstructions that affect the approach to the north end of the runway. We do not know the extent to which these obstructions are affecting the approach. We are looking to conduct a study that will answer those questions and identify the extent of the potential impact, and also to identify a manner in which we can mitigate these problems taking into consideration the alternatives that we have at our disposal. There could be different ways of dealing with an obstruction based on where they are and what their relative impact is. Mr. Mattern feels this will be a custom fit solution based on the data ultimately arrived at. We do not have the data at the moment. Mr. Mattern continued we are sort of at the mercy of the funding cycle for the Federal Aviation Administration and the State. They are paying for 90% and 2.5% of whatever the cost is. The City's share will be the remaining 7.5%. Mr. Mattern outlined the New Hampshire Department of Transportation, Bureau of Aeronautics role and responsibilities in communicating with the Federal Aviation Administration and submitting grant applications. He added that it is unlikely we would see a grant before June. Mr. Mattern referred to the letter in the packet and pointed out that the New Hampshire Department of Transportation, Bureau of Aeronautics will be acting on behalf of the Federal Aviation Administration. Our block-grant application will be submitted to them and they submit all the applications from throughout the state as one application. The state then administers the grant. Right now we are preparing a Scope of Services for the engineering firm to be able to then submit an application to the state by April 1, 2013. Mr. Mattern clarified that what is being done now is simply a planning project, and we will have to go through another funding cycle for the construction phase/property acquisition. Mr. Mattern noted that the lowest bidder can't be selected, and explained the independent fee evaluation process utilized. This does take time, and we are going through this now with three projects; we have the runway project, the environmental assessment, the property acquisition and other boundary survey type work.

Mr. Mattern briefly outlined what was in the Scope of Services and what the thinking is in terms of issues discussed at the public forums. He added we want to ensure we get every issue that was raised in there. Some of these things have to be evaluated based on compliance with the federal regulations. While it may be technically possible, it may be a violation of the rules and regulations or the grant assurances. We also want to include new aerial photogrammetry, as the current aerial data is 10 years old. Discussion continued and Mr. Mattern stated that he wants to make sure that we do more than we have to do. We want to see this remain a forest; the question is we need a forest that isn't going to interfere with aircraft. Mr. Mattern also offered that a noise consultant has been included in the scope, and noted that we can only submit things that are eligible items. At this point several side discussions ensued with members offering suggestions and noting concerns that were voiced at the public forums. Mr. Mattern reported that in conjunction with developing the Scope of Services last month we submitted three form 7460's to the Federal Aviation Administration for them to make a determination if these three trees are in violation.

## 6. Project Timeline

Mr. Mattern advised that this is the last item in the scope and it has not been defined as of yet. Mr. Mattern suggested that the whole scope process could take a year. In response to Mayor Lane, Mr. Mattern suggested that an application would have to be submitted next year for whatever we're going to do.

Dr. Shedd asked the Mayor if his office could help her obtain the documentation from 1969 when the land was designated as Keene Forestry Park. Mayor Lane replied we certainly could try.

Discussion ensued with regards to the PAPI system.

**7. Future meeting Schedule**

Committee members agreed to meet the first Tuesday of each month beginning on April 2, 2013, at 4 PM. Mr. Mattern agreed to see if the consultants were available to attend the next meeting.

**8. Adjournment**

A motion to adjourn was made and duly seconded at 5:44 PM. The motion carried unanimously.

Respectfully submitted by,
Mary Lou Sheats-Hall
Minute taker
March 6, 2013

**Dillant-Hopkins Airport**
**Ad-Hoc Airport Obstruction Removal**
**Committee Meeting Minutes**

**Tuesday, April 2, 2013** **4:00 PM** **3rd Floor, City Hall**

**Members Present:**

James "Tim" Dunn, Chair
Robert Bergevin
Peter Palmiotto
Scott Ellsworth, Vice-Chair
Richard Hersom
Dr. Ann Shedd
Alfred "Gus" Leranduau

**Staff Present:**

Ed Mattern, Airport Director

**Others Present:**

Dave Curran, Councilor
Leigh Bartlett, Stantec Consulting

**Members Not Present:**

1. **Call to Order** – Chair Dunn called the meeting to order at 4:00 PM. Roll call was conducted.

2. **Approval of Minutes – March 5, 2013**

Dr. Shedd made a motion to approve the minutes of March 5, 2013 with the following corrections: under "Elections" change Mr. Palmiotto to Mr. Hersom nominated Mr. Dunn as Chair. Mr. Leranduau seconded the motion which carried unanimously.

3. **Adoption of Rules of Order** –

Dr. Shedd made a motion to adopt the rules of procedure distributed at the March meeting. Mr. Ellsworth seconded the motion which carried unanimously.

4. **Current Project Status and Discussion** – Stantec Consulting

Mr. Mattern introduced Leigh Bartlett, of Stantec who is the Project Manager. Mr. Mattern referred the discussions at the previous meeting noting that the Scope of Services has not been finalized as of yet. The Scope of Services is being negotiated taking into account suggestions and recommendations made at the public forums, and also attempting to answer questions that were raised. Mr. Bartlett is here to answer any questions this Committee may have at this point.

Mr. Bartlett reported that he and Mr. Mattern have been reviewing minutes from the public forums to determine the questions they will try to answer with the Scope of Services. Right now the scope is very broad. Mr. Mattern interjected that the City has migrated away from this being a construction project; this will be a planning study and the timeline has been extended (another year) to carry out any necessary actions. In addition to the planning study the environmental assessment will also be conducted as part of the initial engineering effort to ensure we have good data.

Mr. Bartlett reiterated that there is no current data on Runway 20; the available data is from 2003 (aerial survey). Mr. Bartlett noted that ground based surveys have been done and pointed out the issues with this type of data. After the Scope of Services has been negotiated one of the first things done will be to get the new aerial photogrammetry completed so that the problems can be identified. After this the questions from the public forums will be looked at.

Mr. Bartlett addressed the timetable noting the planning and environmental studies should be completed within next six months after securing a contract with the City. Mr. Mattern suggested the contract/resolution should be moving forward to City Council within the next month. Mr. Mattern also pointed out that because this is a Block Grant it will also have to go through the Governor, and this process could take another seven weeks. Mr. Mattern noted this does allow time to gather more information from this Committee. Mr. Bartlett indicated that Stantec would be doing some work once the City has approved the contract. Mr. Bartlett distributed copies of the current aerial photographs that were presented at the public forums for discussion.

Questions raised by Committee members:

1. How does photogrammetry compare to other methods for measuring tree heights? Mr. Bartlett replied that he did look into air-based LIDAR (laser imaging and detection ranging), pointing out the expense that would be incurred and the fact that there is no one in New England doing it right now. In some sensitive areas, a surveyor has been positioned to survey as the tree is being cut.

2. Would the New Hampshire Wetlands Mapper maps be detailed enough to be useful? Mr. Bartlett didn’t think so because they are not detailed enough, and they probably don’t have tree top heights.

3. Were the tree heights known in 2003? Mr. Bartlett replied in the affirmative and discussed the photo of the Runway 02 end, noting that anything in yellow or red (not necessarily a hazard) is a penetration. He explained the legend; yellow is five feet into the imaginary surface, red is plus five feet, and green is within five feet of the surface, blue is within plus five feet, and white within 10 feet. Mr. Bartlett reiterated that this data is 10 years old. Mr. Bartlett went on to reiterate the different approach requirements (precision and visual). There was agreement amongst Committee members that new data is needed. Committee members were also pleased to see that there were minimal red dots around the bog. It was also noted that the trees are mature and there is probably little growth occurring. Mr. Bartlett indicated that the majority of the problems are the tall pine tree stands.

4. Are there lines on these photos indicting the property lines for the City and for Swanzey and the wetlands locations? Mr. Bartlett replied in the negative noting that most of the wetlands are in Swanzey. There is a red line in the photo that delineates the City property from private property. A wetlands scientist will be mapping the wetlands to delineate them for this project. Mention was made of the new Surface Water Protection Ordinance and the need for it to be adhered to should it pass. Mr. Bartlett noted that the property lines depicted in the photo are not surveyed property lines; they are from the City's tax map (GIS) information.

5. How much has the Runway 20 approach deteriorated in the past couple of years and what effect will waiting another year have on night flying? Mr. Ellsworth noted that night flying is avoided, and that there are trees that come up into the path. Mr. Ellsworth referred to the film that was shown at the public forum and reiterated that the problem is the safety factor of landing on Runway 20 (south) with no electronic lights or visual cues. The facts surrounding the PAPI system replacement and discovery of the problem with obstructions were reiterated by Mr. Bartlett. Mr. Bartlett also clarified that the PAPI is not considered an instrument approach; it is considered a visual approach.

Mr. Mattern pointed out that in addition to what Stantec is working on the City is pursuing a second grant project which will enable boundary surveys to be conducted. Mr. Mattern continued that the only way the FAA will fund these projects is through a property acquisition grant. The City is working with Stantec to identify the 20-25 properties that might be affected. Mr. Bartlett clarified that property acquisition does not mean acquisition of land; it refers to easement acquisition so the City/airport would have the right to cut down a tree if it were a penetration. Mr. Mattern agreed that a better job needed to be done clarifying this language to assuage property owners' fears than was done at the public forums. Committee members agreed they didn't realize that people would be compensated for easements/tree removal. Mr. Mattern went on to explain the FAA requirements and guidelines for acquiring easements and the process that the City would follow. Mr. Bartlett also pointed out that if cutting where to take place an ongoing vegetation management plan would be needed; and that there hasn't been one to this point.

6. What would happen if a property owner didn't want to negotiate an easement? Also there were two parcels transferred to the City in 1969 and the Parks & Recreation Department doesn't have great documentation on the portion that is a park. Both the City Clerk and the Parks Department are trying to find the documentation of when this was designated as Keene Forestry Park. Mr. Bartlett noted that he does not have this documentation, but a pin could be placed there if this is what the people desire.

7. What would the impact be to a pilot if the PAPI system were updated and moved 100 meters down the runway; would this alleviate some of the problems the neighborhood is experiencing? Mr. Bartlett noted that this is part of the study that Stantec will be conducting. Chair Dunn pointed out the importance of pilot safety, also noting the importance of the people who live under the planes.

8. Is there a project to replace the PAPI's? Mr. Mattern pointed out that there are two different runways; the City did go forward with replacement of the south end PAPI, and the City has

not replaced the PAPI's on this runway.

9. How often is the approach from the south used compared to the approach from the north? Mr. Mattern noted that the approach from the south is used about 80 percent of the time.

10. If the PAPI system replacement project moves forward will there be two studies or an option for replacement in place, or replacement of them a certain distance down the runway? Mr. Mattern reported that this study is being conducted now, and this will all have to be resolved before there the PAPI replacement project can move forward.

Discussion ensued with regards to the problems faced back in the 1980's and the reconstruction project that took place.

11. Reference was made to the grant application for 4.5 million dollars to resurface Runway 20/Runway 02 and the question was asked how much more would it be to increase it 300 feet? Mr. Bartlett pointed out that the approaches would have to be looked at because of the stringency requirements and also there are wetlands at that end. Mr. Bartlett also pointed out the additional permitting that would be required, and the fact that an impervious surface would be added to that end, in addition to the wetlands impact.

12. Will the resurfacing take place before the PAPI issue is resolved? Mr. Mattern noted that the resurfacing is not considered new construction; it is just resurfacing. Mr. Mattern feels the bidding for the resurfacing will begin in May or June 2013, and expects the engineering study to be completed before that. Mr. Bartlett clarified there really are no electrical upgrades being done, and explained that the resurfacing is a reclaiming project. Councilor Curran clarified that the PAPI system is different than the runway lights. Mr. Mattern pointed out that the PAPI system is adjacent to the runway.

13. Will air quality monitoring be part of the environmental assessment? Mr. Bartlett noted that he does not think that monitoring is part of the assessment. It was noted that the neighborhood also has concerns about the diesel pollution caused by trucks going back and forth from the Water Treatment Plant, and the potential increase in exposure if the trees are removed. Addressing the pollution concerns Mr. Palmiotto pointed out the potential for developing a better buffer than what exists there now. Discussion ensued on the various species that could be used and the importance of a management program. Mr. Mattern added that the maintenance would be part of the operational budget, not a Capital Improvement Program or anything that needed to repeatedly go before City Council.

Mr. Mattern noted the goal is for this to remain a forest; it will just be a little different than what is there now.

**5. <u>Next Meeting Date</u> -** Tuesday, May 14, 2013. The meeting date was changed from the first Tuesday of the month to the second Tuesday in May.

**6. <u>Adjournment</u>**

A motion was made and duly seconded to adjourn at 5:06 PM.

Respectfully submitted by,
Mary Lou Sheats-Hall
Minute taker
April 4, 2013

Edited by
Ed Mattern, Airport Director

**Dillant-Hopkins Airport**
**Ad-Hoc Airport Obstruction Removal**
**Committee Meeting Minutes**

**Tuesday, May 14, 2013** **4:00 PM** **Dillant-Hopkins Airport**

**Members Present:**

James "Tim" Dunn, Chair
Robert Bergevin
Peter Palmiotto
Scott Ellsworth, Vice-Chair
Richard Hersom
Dr. Ann Shedd
Alfred "Gus" Leranduau

**Staff Present:**

Ed Mattern, Airport Director

**Others Present:**

Gregg Cohen, Stantec Consulting

**Members Not Present:**

1. **Call to Order**

Chair Dunn called the meeting to order at 4:03 PM. Roll call was conducted.

2. **Approval of Minutes – April 2, 2013**

A motion was made and seconded to approve the minutes of April 2, 2013, Committee meeting. The motion was passed by unanimous vote.

3. **Project Status Update** – Airport Director

Mr. Mattern introduced Mr. Gregg Cohen, Environmental Analyst with Stantec, indicating that he was here as a resource as the Committee walked the affected forest area. Mr. Mattern then provided an update on the project status, indicating that the scope of services was nearly complete. He said that it does contain a number of items referenced in an e-mail he received from Chair Dunn, which included boundary surveys of off-airport parcels, environmental assessment and noise impact. He went on to say that an independent fee estimate was currently being performed by Ballentine Aviation Consulting, to validate the scope and proposed fee. It is expected that this process will be complete within the next few weeks.

Mr. Mattern also addressed the question of whether the clearing of the approach will increase traffic. Mr. Mattern said that use of any approach is dependent on the weather conditions at the time of landing and that it is always a pilot's choice of which runway to use.

4. **Site Visit**

The Committee then walked from the terminal building up Airport Road and entered the wooded area just north of the Runway 20 threshold. Committee members attempted to visualize the location of the approach surfaces on the ground. It was suggested that some sort of monument might help. Mr. Mattern thought that might be possible.

As the committee walked through the woods, Mr. Palmiotto explained the nature of the forest, indicating that the existing canopy was preventing the understory from developing. He suggested that, if the canopy was to be removed, the forest would rapidly regenerate with a mixture of hardwoods and pine. With regard to damage to the forest during a removal effort, he said that, because of the nature of modern logging equipment, minimal harm would be done to the forest floor particularly if done during the winter when the ground is snow covered or frozen. He thought the operation could be completed rather quickly – possible a week to 10 days. Of critical importance would be the development of a forest management plan that would actively address the types of trees that were permitted to regenerate. He spoke very positively about the prospects for a successful project with proper planning.

The Committee then moved on to the bog area. Mr. Palmiotto explained how the bog might have been formed. He also pointed out some of the unique features of the bog, both animal and plant life. He suggested that it would be possible to address the obstruction issue without undue harm to the bog, provided that proper techniques where employed. He did not think additional light reaching the bog would have any negative impact on the bog.

The Committee then progressed to the north along the Airport property boundary then west. It then walked the path back to the airport through the former Keene Fire Department training area. Comments were made relative to the possibility of having the area cleared of the abandon fire training equipment.

General comments were made about the value of walking the area with a number of members saying they learned a great deal.

5. **Next Meeting Date -** Tuesday, June 4, 2013.

6. **Adjournment**

A motion was made and seconded to adjourn at 5:35 PM. The motion passed by unanimous vote.

Respectfully submitted by,
Ed Mattern,
Airport Director

**Dillant-Hopkins Airport**
**Ad-Hoc Airport Obstruction Clearing**
**Committee Meeting Minutes**

**Tuesday, June 4, 2013** **4:00 PM** **Airport Terminal Building**

**Members Present:**

James "Tim" Dunn, Chair
Peter Palmiotto
Richard Hersom
Dr. Ann Shedd
Alfred "Gus" Leranduau
Scott Ellsworth, Vice-Chair (arrived at 4:59 PM)

**Staff Present:**

Ed Mattern, Airport Director

**Others Present:**

**Members Not Present:**

Robert Bergevin

1. **Call to Order** – Chair Dunn called the meeting to order at 4:00 PM.

2. **Approval of Minutes** – May 15, 2013

Dr. Shedd made a motion to approve the minutes of May 15, 2013 with the following changes/corrections:

- Page 1; change "Char" Dunn to "Chair Dunn".
- Second to last paragraph add "along" after "north" to the sentence with "the Committee then progressed to the north …
- Second to last paragraph, last sentence change to "clearly abandoned".
- Page 2, last line change "on members" to "of members".
- Section 4 – Site Visit, second paragraph change "no harm would be done" to "minimal harm would be done to the forest floor particularly if done during the winter when the ground is snow covered or frozen".

Mr. Hersom seconded the motion which carried unanimously.

3. **Adoption of the Revised Rules of Order** – Mr. Mattern reported that this issue was accomplished at a previous meeting, and did not need to be placed on the agenda.

4. **Engineering Scope of Services** – Airport Director

Mr. Mattern stated that we have gathered all the information we've been discussing over the last six or seven months, along with all the Federal Aviation Association (FAA) and New Hampshire Department of Transportation (NHDOT) requirements to develop a Scope of Services that we've negotiated with Stantec Consulting. Mr. Mattern noted as required a "fee estimate" will be accomplished. Ballantine Aviation Consulting will be conducting the independent fee estimate. Mr. Mattern explained that Ballantine Aviation will review the Scope of Services and estimate what the fees should be; this process is required by the FAA and the state. Mr. Mattern noted the continuous efforts to fine tune the contract with Stantec to incorporate the findings of this Committee and the public input. Mr. Mattern expects this issue to go before the Finance, Organization and Personnel Committee (FOP) next Thursday for authorization to execute the contract. Mr. Mattern noted his intent to go over the major components that are covered in the Scope of Services. Mr. Mattern advised that the Committee members are welcome to view the Scope of Services (draft); copies will not be distributed at this time. Mr. Mattern stated his concern with copies being available to the public that City Council does not have. He agreed to check with the City Clerk to see if it is appropriate to include the Scope of Services in the FOP packet.

Dr. Shedd asked Mr. Mattern how the Scope of Services relates to the FAA grant application. Mr. Mattern stated that this is a requirement we go through to be able to then take the number that we came up with in our negotiations with Stantec; we use that number as the basis to include in the grant application. Mr. Mattern reiterated the differences between a planning project and a construction project. He continued that the total cost of the project is $143,000 (90% comes from the feds, 2.5% from the state, and 7.5% from the City). Mr. Mattern also reported that there is legislation pending that will increase the state's portion.

Mr. Mattern stated that there are four main components within the Scope of Services.

- <u>Preliminary Work</u>- things that have already been done including the ground survey data (airport and around the neighborhood), and submission of Form 7460 which is the notice of proposed construction or alteration required by the federal government.

- <u>Data Collection</u>- this includes the coordination and contracts for the aerial photogrammetry. This data will determine more clearly the actual elevation of the trees there. A boundary survey for those properties off-airport will also be conducted to determine where specific obstructions may/may not exist on these specific properties. This includes the Engineering Study of the Air Space Analysis, and the Clearing Limits Plan. There are 10 mini-studies included in the overall context of this study to allow for additional question studies that may arise. A Noise Consultant is also included in this section.

- <u>Environmental Assessment</u> – this includes the wetlands delineation; surveying them accurately to identify them on the map, and avoid them during any work. There is a predetermined process outlined and governed by the federal government in terms of what can be looked at as part of the Environmental Assessment; they are listed in the scope.

Chair Dunn asked if the increase in night traffic is included here once the obstructions are removed. Mr. Mattern noted that the airport is open 24 hours a day, and that he does not expect to see a sudden increase in people that will use the airport. Mr. Mattern suggested that this (increase in traffic) could be used as one of the mini-studies.

In response to Mr. Palmiotto, Mr. Mattern noted that there is no finite list of airport users; the airport is open/available to anyone who wants to use the it. Additionally there are no requirements for check-in or to make pre-arrangements for use of the airport.

Discussion issues raised in sidebars:

1. Is there a tracking system or requirements for recording the number of flights in/out of the airport? Mr. Mattern replied in the negative adding that we are an uncontrolled airport. Mr. Mattern used the analogy that the airport is like a highway.

2. Will there be an increase in night flights once the obstructions are removed? Mr. Mattern explained there is a formula used that says for every based aircraft you have "x" number of operations (take-off/landing) per year. He does not foresee an increase in night flights. The capacity of the airport is 240,000 operations annually; we are well below that. There is no future for commercial air service at the airport (study is available on the City website).

3. Isn't it a safety issue with the FAA- don't they have to know where planes are? Mr. Mattern explained there are two ways people fly- instrument flight rules and visual flight rules.

4. How do we evaluate the cost benefit ratio of operating an airport if there are records of how many flights are happening in/out of it? Mr. Mattern explained that this airport is not unique; there are about 2400 airports of which only about 900 of them are controlled.

5. Why doesn't the City Council want to know what the value of the airport is in terms of commerce- how do you manage when you don't know the traffic flow?

Chair Dunn advised that these topics were out of the Committee's jurisdiction and suggested the discussion get back on track. Mr. Mattern advised that this is something we have the ability to ask the consultants to look at.

6. Don't the noise consultants need to know how many/types of planes are coming and going to know what kind of noise they will be making? The noise also affects the social impact (to be studied).

7. Medical transfers are a very important feature of this airport.

8. Noise issues with the Aerobatics Club practice sessions.

- General Administration – following the processes of Executive Order 12372 and notifying all the appropriate agencies of what we are doing. This also includes processing the reimbursements associated with the grant.

Mr. Mattern reiterated that the cost of the project is approximately $143,000 which was validated by the independent Fee Consultant.
The schedule has changed some due to the length of time it has taken to develop the scope. The project should take 4 to 6 months.

Mr. Mattern asked for input on how to ask for cooperation from the 22 property owners (boundary surveys). Mr. Mattern noted that this will be a full boundary survey to take place after the photogrammetry is completed. The number of properties located in Swanzey will be determined from the aerial photogrammetry. Mr. Mattern explained that the City does have Airport Zoning, as does Swanzey which covers these properties; voluntary cooperation is being asked for as the City has no easements or permissions at this time.

Questions, comments, and suggestions:

- Are these 22 landowners aware of what is happening?
- Keep the stakeholders informed. Make personal contact.
- Letters have been used as a means of communication/notification.
- Check the sign-in sheets from the public forums to see how many of these 22 landowners attended.
- Invite them to one of these meetings.
- Provide them personal updates.
- Some of these landowners are very old.
- Is the Edgewood Neighborhood Association informing people through the group's emails and newsletters?
- Mr. Mattern will email Chair Dunn information about what exactly will happen with the boundary surveys which Chair Dunn will share in the Association's newsletter.
- This is an airport problem; should the Association be doing the communicating at this level? Notifying property owners that the City wants to survey their property is probably outside the purview of the Association.
- Chair Dunn will share information provided by the Edgewood Neighborhood Association to the property owners with Mr. Mattern.
- Mr. Mattern is available to answer questions from property owners.
- There is a public presentation provided for in the Scope of Services as part of the Environmental Assessment.

5. **Discussion-**

   **a. Wildlife**
   **b. Potential Dog Park**

Chair Dunn noted that there is a lot of wildlife in the area (foxes and bears), and he doesn't see how people with dogs would want to bring them to this area. Chair Dunn indicated that the proposed Dog Park site is adjacent to the wetlands. Dr. Shedd noted the closeness to the bog and possible affects the Dog Park here could have on the ecological system. She also noted there is no Management Plan in place; which is not good stewardship of the forest. Dr. Shedd will be meeting with Andy Bohannon next week to discuss defining the boundaries of the two parcels donated for the forest. Mr. Mattern indicated the site was probably proposed as an option because of the infrastructure that is already in place (restrooms and parking lot). He also noted that this is only one of the sites that are under consideration.

Mr. Mattern addressed the question raised at the last meeting regarding the area of the approach noting that it has been surveyed. It doesn't depict where the tree clearing limits might be, it only reflects the "paddle" (trapezoid approach to the airport).

6. **Next Meeting Date** – To be determined.

7. **Adjournment**

A motion was made and duly seconded to adjourn at 5:09 PM.

Respectfully submitted by,
Mary Lou Sheats-Hall
Minute taker
June 5, 2013

**Dillant-Hopkins Airport**
**Ad-Hoc Airport Obstruction Removal**
**Committee Meeting Minutes**

**Tuesday, August 6, 2013** **4:00 PM** **Airport Terminal Bldg.**

**Members Present:**
James "Tim" Dunn, Chair
Robert Bergevin
Richard Hersom
Dr. Ann Shedd
Alfred "Gus" Lerandau

**Staff Present:**
Ed Mattern, Airport Director

**Others Present:**

**Members Not Present:**
Peter Palmiotto
Scott Ellsworth, Vice-Chair

1. **Call to Order** – Chair Dunn called the meeting to order at 4:00 PM. Roll call was conducted.

2. **Approval of Minutes – May 14, 2013**

Dr. Shedd motioned to approve the minutes of May 14th, 2013, meeting. Mr. Hersom seconded the motion which passed with a unanimous vote.

3. **Adoption of Rules of Order** –

4. **Current Project Status and Discussion** – Engineering Scope of Services

Mr. Mattern described the overall contents of the Scope of Services as meeting the requirements as set by Federal Standards but that there is flexibility as to what is emphasized on the final report. Mr. Mattern noted that the Scope has been approved by the State and the Federal Aviation Administration and that for the most part the plan was complete and ready to move forward. Dr. Shedd asked about the total cost reported in the Scope and how much the City would be contributing. Mr. Mattern concluded that the total cost is at $153,000 dollars and the City would be responsible for five percent of that. Dr. Shedd felt that City's portion is $11,000.

Dr. Shedd had several concerns and questions for Mr. Mattern with respect to the Scope of Services:

1. Article 4 of Environmental Assessment item 1.1 wetland delineation description.

Dr. Shedd pointed out that the six foot culvert headwall mentioned was not part of the scope for this project. Mr. Mattern noted that this was administrative mix-up and would be corrected.

2. Dr. Shedd noted that the “swampy area farther to the West” should be looked at during the spring to make sure that the wetlands delineation is accurate. Mr. Mattern agreed that there is an opportunity to double check in the spring and that it was a good idea.

3. Ms. Shed asked if the preliminary work described in article 1 was done. Mr. Mattern explained that for the most part, this work has already been done. Dr. Shedd asked if there would be another public meeting after the work was completed. Mr. Mattern stated that there would be a public meeting to present the draft report, most likely before the City Council.

4. Dr. Shedd questioned the dimensions for the Aerial photogrammetry as being reported as 235 acres. Mr. Mattern stated that they wanted to cover the whole area and that it is hard to narrow down the collection of data to one plot. Mr. Mattern clarified that the inner trapezoid on the map represented what has been presented. He also pointed out that the yellow triangle is the Approach Surface and the orange represented the Transition Surface.

Mr. Hersom asked if we are talking about expanding the airport. Mr. Mattern said there are no plans to expand the airport, stating that the trees had encroached upon a part of the approach which has always been there. Mr. Mattern explained that currently the airport could expand its operations up to 235,000 operations per year without physically expanding the bounds of the airport. Mr. Hersom expressed his concerns about any expansion; health, noise, property values and proposed that cost and benefits be looked at very closely. Mr. Mattern agreed that those items should be important and suggested that it was outside of the scope of what was being worked on by this Committee. Mr. Mattern stated that it was his job to get the information to City Council where the decisions would be made. Dr. Shedd agreed with Mr. Mattern, saying that a different forum would be the place to address those concerns.

Dr. Shedd continued with her questions:

5. Dr. Shedd asked two questions from page, 3 article 3, number 1; What constitutes a ‘basic engineering study’ and what is meant by displacing a threshold for a runway. Mr. Mattern explained that displacing the threshold effectively reduces the runway and its relative effectiveness. Mr. Mattern explained that a ‘basic report’ would contain more summary information, with standard sections addressed.

6. Dr. Shedd pointed to page 3, item 2 Obstruction Analysis, asking Mr. Mattern to explain the distinctions being made between the two surfaces outlined in this section. Mr. Mattern explained that depending on the surface classification there are different geometries. The surfaces are separated so that the appropriate geometries are applied with respect to obstructions and that neither surface necessarily could be considered as governing the other.

7. Dr. Shedd asked, on page 3, was the Development of Airspace Plan showing the analyzed surfaces presented. Mr. Mattern stated it was not.

8. Dr. Shedd; On page 4 item 2.1. Is the working group being referred to in this section "this group". Mr. Mattern identified the Committee as the working group being referred to.

Chair Dunn asked why the 2.1 was shortened by 200 meters. Mr. Mattern stated that in 1989 the runway needed to be reconstructed (not rehabilitated). Mr. Mattern stated that they looked at detailed studies and found a way to relocate the runway, minimize the impact on property owners and that the shortening was due to the resulting approach with the runways new position. Mr. Hersom asked if it that meant that the runway could not be extended to the south. Mr. Mattern stated that he would have to check on the current regulations as the geometries specified are subject to change.

Chair Dunn asked Mr. Bergevin if the runway was extended 300ft, if he saw any problems landing from the south. Mr. Bergevin stated that the runway was not a problem from a pilot's perspective but an extension would benefit jets. Overall, Mr. Bergevin said an extension would help. Mr. Lerandau asked if the runway was extended by 300 feet would it be down near route 32 and if the Department of Transportation be involved. Mr. Bergevin indicated that the extension was just a supposition and that it would be a tremendous cost. Mr. Mattern noted that an extension of 300 feet would also affect the approach and the hill could still very well be an issue with respect to approach regulations.

Dr. Shedd asked if the air quality report on page 6 section 6.63 include the PM2.5. Mr. Mattern stated that he does not know if that is included as part of that assessment. Dr. Shedd thought that it could be included through extrapolation from data gathered at airports. Mr. Mattern asked that Dr. Shedd send him the material and he would see that the engineers get to take a look at.

Dr. Shedd suggested, with reference to page 8. Section 3.9, Public Notice, that abutters be notified individually instead of via the newspaper. Mr. Mattern indicated that he was not oppose to that approach and would like to get everyone involved in the process.

Chair Dunn asked a questioned on b7 3.612, Wild and Scenic Rivers: When the City cleared cut for the east/west runway did they do a survey with a Wild and Scenic River assessment. It was determined that this type of survey was not applicable to that specific effort.

Dr. Shedd asked what the next steps are. Mr. Mattern indicated that an aerial and ground survey would be the next steps along with sending out notices to abutters where the boundary surveys would be taking place. Once the data is in, a model would be built. Dr. Shedd asked if with respect to other portions of land on the property, like the 34 acres owned by the City, be part of the boundary study. Mr. Mattern stated he would find out if that was possible.

Mr. Mattern asked anyone interested in the airport's economic impact to see the Economic impact study on airport on the City's web site. He noted that six and a half million dollars is attributed to the airport and that the airport has an operating expense of $560,000 dollars of which all but about $60,000 was covered by direct revenue.

**5. Next Meeting Date -** Tuesday, September 3, 2013.

**6. Adjournment**

A motion was made by Mr. Bergevin made a motion to adjourn the motion was duly seconded to adjourn at 5:06 PM.

Respectfully submitted by,
John Hehir
Minute taker, August 9, 2013

**Dillant-Hopkins Airport**
**Ad-Hoc Airport Obstruction Removal**
**Committee Meeting Minutes**

**Tuesday, October 1, 2013 4:00 PM Airport Terminal Bldg.**

**Members Present:**
James "Tim" Dunn, Chair
Richard Hersom
Dr. Ann Shedd
Alfred "Gus" Lerandeau

**Staff Present:**
Ed Mattern, Airport Director

**Others Present:**
Leigh Bartlett – Stantec
Katelin Nickerson – Stantec

**Members Not Present:**
Peter Palmiotto
Scott Ellsworth, Vice-Chair
Robert Bergevin

1. **Call to Order –**

Chair Dunn called the meeting to order at 4:00 PM. Roll call was conducted.

2. **Approval of Minutes – August 6, 2013**

Dr. Shedd noted that references to 'Ms. Shedd' should be changed to 'Dr. Shedd'.
Ms. Shedd motioned to approve the minutes of August 6th, 2013, as corrected. Mr. Hersom seconded the motion which passed with a unanimous vote.

3. **Presentation: Aerial Survey Results - Stantec**

Mr. Mattern introduced Leigh Bartlett and Katelin Nickerson from Stantec. Mr. Mattern stated that the data is starting to come in, to the point where they can begin to assess the impact to the airport and off airport properties. Mr. Mattern emphasized that they are still in the process of collecting more data but early indications suggest less impact than he expected. Mr. Matter also noted that they will continue efforts to minimize impact further. Mr. Mattern informed the Committee that letters have gone out to property owners informing them about the proposed boundary survey, noting the purpose is to be able to identify which property a specific tree may be on. Mr. Mattern prefaced the results by stating that there are not many properties that appear to have obstructions at the present time. Mr. Mattern stated that a number of responses, about eight or nine, have come in and that an authorization to do the boundary survey is just and only that, including only activity related to performing the survey.

Dr. Shedd indicated that she had some questions concerning the survey she asked if the scope of the survey is still about 20 properties. Mr. Mattern responded that there are about 25 properties and that 28 or 29 letters have been sent out to both owners and occupants, noting that sometimes the owners were not the occupants of the properties.

Dr. Shedd asked if the letter indicated that a full boundary survey would be performed on the property (it was not clear on the letter). Mr. Mattern concurred that it would be a full boundary survey and that point will be disclosed once the work product becomes public record. Dr. Shedd asked when and how will it become public record. Mr. Mattern surmised that it would become public record when the project is completed. Mr. Mattern turned the meeting over to Mr. Bartlett of Stantec.

Mr. Bartlett explained that they had engaged an aerial mapping company to perform the photogrammetric survey which was done in early September and that the data came in last week. Mr. Bartlett displayed the photos, which he described as an orthorectified image depicting the various tree heights as imposed points on top of the photos. Mr. Bartlett indicated that the photogrammetric data is essential to addressing other questions raised at the public meeting, like is it possible to move 'the PAPI'. Mr. Bartlett explained that they were dealing with a 20-1 visual approach. Mr. Bartlett explained briefly, the different colors on the map, indicating that the magenta and darker purple areas were primary areas of concern. Mr. Bartlett then ran a video showing what an approach looked like with respect to some of the taller tree areas. Mr. Bartlett estimated that the taller trees are 90-100 feet tall and that the video corroborated the data in the survey. Mr. Dunn noted that the plane appeared to be to the right of center of the runway. Mr. Bartlett and Mr. Mattern explained that the camera could be on the right side of the plane or not lined up perfectly with the direction of the plane.

Mr. Mattern noted that the white line depicted on the mapping is the airport property line and that the problem area ends pretty much along the boundary with little intrusion upon private properties. Dr. Shedd asked how well does the old map previously distributed, with dots, correlate to the new map. Mr. Bartlett stated that it hasn't changed very much with the exception of a few trees that have grown since, noting that many trees had probably reached a peak height. Mr. Bartlett concluded that 'step one', collecting this data, was done and added that Ms. Nickerson had delineated the wetlands and that information would be integrated into the map.

4. **Presentation: Wetland Delineation Effort – Stantec**

Ms. Nickerson characterized the wetlands as by being primarily naturally formed with deep organic soil. Ms. Nickerson noted that the surrounding soil was very sandy and included the formation of several Oxbow lakes. Ms. Nickerson identified two wetlands and noted one small area where wetlands were formed, at least in part, by anthropologic activities. Mr. Bartlett pointed that area out on the projection of the aerial survey. Dr. Shedd noted that there is expert documentation of Wood Frog egg masses in the swamp areas (by Peter Palmiotto of Antioch University). Ms. Nickerson stated she had looked into vernal pool regulations. Dr. Shedd noted that the water is at a very low point with respect to other years. Ms. Nickerson acknowledged Dr. Shedd's point. Ms. Nickerson continued with her observations by stating that she did not find any rare plants but did not dismiss the possibility of the presence of such. Ms. Nickerson noted that there are not any proposed impacts to the wetlands and they should be fine. Dr. Shedd noted that the best management practices will be very important especially with respect to ensuring that any trees removed are not dragged through or too close to the wetlands and that the use of any heavy equipment in the area should be monitored closely.

Mr. Lerandeau emphasized that they had previously agreed to follow best management practices. Mr. Bartlett agreed that this has been established. Mr. Mattern emphasized that if a removal was deemed necessary that details surrounding the removal would be included as part of that project to ensure that it would be done in a responsible fashion. Mr. Bartlett noted the presence of Bittersweet on the far east end of the survey where the culvert comes out of the parking lot and wondered if in any removal efforts could include extermination of this plant. Mr. Mattern asked what Bittersweet was. Ms. Nickerson explained that it was an exotic invasive vine that kills trees. Ms. Nickerson informed him that it would keep spreading but probably would not take hold in the wetlands as it tends to grow in dry soils. Dr. Shedd suggested that if it was on City owned property that the City could possibly get involved with its extermination. Ms. Nickerson noted that Bittersweet also thrived in 'disturbed areas'. Dr. Shedd expressed that disturbing the area was one of her concerns and referenced another invasive plant called the Japanese Knotweed plant as a potential problem. Dr. Shedd asked if individual trees will ever be marked so that people walking through the forest can easily grasp the impact. Mr. Bartlett responded that there are no plans to do so in the short term but if there is a clearing project marking would be part of that effort. Mr. Mattern summed up by stating that we will try to do some additional surveying and during that same time Stantec will continue to look at some of other alternatives. Dr. Shedd asked if any properties on route 32 might be affected. After locating potential properties on the mapping, Mr. Mattern stated that these properties were not of concern as they were not on the approach surface.

5. **Boundary Survey Update – Airport Directory**

6. **Discussion – Leaded Aviation Fuel**

Chair Dunn passed out an article on leaded aviation fuel and expressed concern over whether an increase in flights or the removal of trees might create a problem with particulates becoming a pollutant to the surrounding area. Mr. Mattern noted that leaded fuel was an issue for airports in the 90's and the FAA removed leaded fuels for non-aircraft vehicles. Mr. Mattern noted a desire to remove leaded fuels from aviation fuels for similar reasons, that the formula for these fuels has been changed reducing the lead content by about %50 (100 Low Lead) however, aircrafts need leaded fuel for safety related reasons. Mr. Mattern discovered that there is an alternative for a very limited number of aircraft but they would require an expensive conversion, about $20,000 per aircraft. Mr. Mattern noted that even if conversions were undertaken, fuel supplies still use ethanol which cannot be in aircraft fuel. Mr. Mattern informed the Committee that they have asked as part of the environmental assessment, that Stantec include an impact for leaded fuel in the evaluation. Mr. Mattern also informed the Committee that leaded fuel, accounts for about 7% of the usage at the airport, a relatively small quantity. Mr. Mattern continued by stating that the FAA published a fact sheet on leaded fuel which stated that there is a 5 year wait before suppliers will be required to remove leaded fuel from the supply chain along with a recommendation for airports to implement "best management practices" to reduce impact. Mr. Mattern noted that Dillant-Hopkins Airport is already adhering to these best practices; Vapor recovery systems have been installed and run-up areas have been designated away from where vapors would affect the surrounding areas. Mr. Lerandeau lauded the airport for implementing these practices. Chair Dunn asked how it is known that the usage is 7%. Mr. Mattern explained that they could tell by looking at the fuel flowage fee, of which is 7% is attributed to leaded fuel. Dr. Shedd asked if the ground service fleet might be operating off of bio-diesel fuel. Mr. Mattern stated that it was. Dr. Shedd asked Mr. Mattern to look into the effects associated with the use of PM 2.5 and will send Mr. Mattern some links to such information. Dr. Shedd noted that this fuel produces a very fine vapor that if breathed in can result in a number of serious health issues. Dr. Shedd asked for a copy of the mapping survey. Mr. Bartlett agreed to provide it after finishing some refinements to its formatting and the inclusion of the wetland delineation. Mr. Bartlett thought it would be emailed out sometime next week to Committee members.

7. **Next Meeting Date:** November 5th, 2013

Mr. Bartlett noted that there will be much more data and information to discuss at that meeting.

8. **Adjournment**

A motion was made by Mr. Lerandeau to adjourn the motion was duly seconded and passed with a unanimous vote. Chair Dunn adjourned the meeting at 5:06 PM.

Respectfully submitted by,
John Hehir, Minute taker
October 10, 2013

Edited by,
Ed Mattern, Airport Director

**Dillant-Hopkins Airport**
**Ad-Hoc Airport Obstruction Removal**
**Committee Meeting Minutes**

**Tuesday, November 5, 2013 4:00 PM Airport Terminal Building**

**<u>Members Present:</u>**
James "Tim" Dunn, Chair
Richard Hersom
Dr. Ann Shedd
Alfred "Gus" Lerandeau
Peter Palmiotto (Late)
Robert Bergevin (Late)

**<u>Staff Present:</u>**
Ed Mattern, Airport Director

**<u>Others Present:</u>**
Leigh Bartlett – Stantec
Jason Gass – Stantec
Janice Bland - Stantec

**<u>Members Not Present:</u>**
Scott Ellsworth, Vice-Chair

1. **<u>Call to Order</u> –**

Chair Dunn called the meeting to order at 4:03 pm. Roll call was conducted.

2. **<u>Approval of Minutes</u> – October 1, 2013**

Mr. Lerandeau pointed out that the motion made under item #8 of the minutes was made by himself and not Mr. Bergevin.
Mr. Lerandeau made a motion to accept the minutes as corrected. The motion was seconded by Dr. Shedd and passed a unanimous vote.

3. **<u>Presentation: Alternative Analysis - Stantec</u>**

Mr. Mattern noted that the crux of the material is ready for review save for some polishing and introduced Leigh Bartlett of Santec as presenter of the analysis.
Mr. Bartlett passed out a report titled *Runway 20 Approach Obstruction Mitigation Alternatives* to the Committee members and started the review of the alternatives. Mr. Bartlett stated that these alternatives were covered during a recent public forum. Mr. Bartlett noted that there are currently airspace problems that present a safety concern to the approach to runway 20, most notably tall trees obstructing the approach to runway 20. Mr. Bartlett began his review of the options.

- No Action

Mr. Bartlett: If no action is taken Federal Aviation Administration funding would be put into jeopardy since there is a clear and identifiable problem present that can be corrected.

- Relocate the entire runway

Mr. Bartlett stated that this would push the runway down toward Swanzey. Mr. Bartlett noted that this came up as a potential option primarily because of all the clearing on that end of the airport. Mr. Bartlett pointed out that if this alternative was to be pursued it would involve moving the existing MALSR lighting, requiring a bridge over route 32 to support the extent of these lights, wetlands mitigation, the purchase of additional land, the movement of navigational aids (Glide Slope Indicators), re-grading of the safety area, and a total cost of 23.5 million dollars that the Federal Aviation Administration would not be contributing to. Mr. Lerandeau asked which road would require a bridge. Mr. Bartlett responded that route 32 would require the bridge. Mr. Bergevin asked how far of a move this would be. Mr. Bartlett noted that the runway would be shifted by 2000 feet. Mr. Dunn inquired if the runway was just being extended back to what it was before a reduction of 300 feet in 1989 and why it would extend into other land not owned by the airport. Mr. Mattern explained that what is being proposed is a shift of the runway by 2000 feet.

- Relocate PAPIs

Mr. Bartlett explained that this action would effectively move the point along the runway that the planes could land with the existing layout, where the trees would not be obstructions. Mr. Bartlett explained that the PAPIs would need to be moved 2000 feet to the south shortening the landing distance to 3,200 feet. Mr. Bartlett noted that this distance would be prohibitive to the landing of jet powered aircraft. Mr. Hersom asked if this was a feasible option. Mr. Bartlett responded that it was and indeed all alternatives being considered here are feasible, however jets would not be able to land due to the reduction of usable runway. Dr. Shedd asked how long the cross-wind runway is. Mr. Mattern noted that it was 4000ft in one direction and 3000 feet in the other direction (due to obstructions). Mr. Mattern noted that he had seen, on occasion, a jet land on this runway, but it was rare and not of sufficient length to facilitate the majority jet traffic. Mr. Mattern also noted that there were no navigational aids along this runway.

- Displace Runway Threshold

Mr. Bartlett explained that this would require moving the threshold 650 feet down the runway and the PAPI's 1000 feet. Mr. Bartlett noted that with this option the threshold clearing would be fine but that the PAPI obstacle clearance surface would still require clearing, less clearing than what they are currently considering for the Obstruction Clearing alternative. Mr. Bartlett was not sure exactly how much clearing would be required. Mr. Bartlett also noted that this would reduce the runway use as well. Mr. Hersom noted that it was difficult to fully consider this option not knowing how much less clearing would result.

- Obtain abrogation easements and clearing penetration the runway (Obstruction Clearing)

Dr. Shedd asked what an abrogation easement entailed. Ms. Bland of Stantec explained that an abrogation easement is a term the Federal Aviation Administration uses to acquiring an easement over a property to clear trees for aviation purposes. Ms. Bland explained that there is a process involved including: title searches, appraisal efforts, and negotiations with owners that would need to conform to federal, state and local requirements. Ms. Bland further explained that a property owner is required to be offered just compensation for the removal of trees and if there were trees that were not obstructions they would not be able to clear those trees. Under such an easement Dr. Shedd asked if the easement would convey with the property in perpetuity. Ms.

Bland stated that it would, adding if trees subsequently became an obstruction the Federal Aviation Administration would have the rights to remove those trees. Mr. Palmiotto asked if they could then remove the trees without compensation. Ms. Bland responded that they could then remove the trees without compensation.

Mr. Mattern commented on the experience with easements on the south end of the airport. Mr. Mattern noted that the easements were all negotiated and achieved on a voluntary basis with a tailored solution for each property owner. Mr. Mattern explained that an abrogation easement is basically an owner selling rights to space above the ground and that they will have to follow the Federal Aviation Administration's process to ensure fair compensation to the owners adding that the City would be performing the maintenance on the property. Mr. Palmiotto asked if there was any effort during that time and effort to establish easements on the north side of the airport. Mr. Mattern indicated that the project was focused strictly on that end of the airport (runway #2).

Mr. Bartlett added that attention to runway 20 has historically been of concern and consideration noting that the land was purchased with a deed that allowed the airport to cut the trees. Dr. Shedd noted that the land was donated by the City and that the initial language was that the land remains in a natural state but in the 1980's the need for the airport to cut trees was recognized. Mr. Lerandeau asked if an easement is sold, if the City could come in at any time and cut down trees. Mr. Mattern said that they had to right to do so only when they become an obstruction and that the conditions would be clearly written into the easement. Mr. Hersom asked if subsequent clearing would be at the cost of the owner. Mr. Mattern and Mr. Bartlett stated that subsequent clearing costs would be covered by the City.

Dr. Shedd asked what the alternative to a voluntary easement agreement is. Mr. Mattern responded by saying that they are not looking to play the involuntary card and that is the basis we are operating on right now. Mr. Mattern noted that any other tack would be decided by the City Council. Dr. Shedd thought it would be important to know what exactly the involuntary route would be so as to communicate those details to others in the area. Ms. Bland explained that the Federal Aviation Administration would require that offers are made to the property owners and that would need to be moved on first. Mr. Bartlett asked Ms. Bland what percentage of properties typically goes to the involuntary route. Ms. Bland responded that a very small percentage goes that route. Ms. Bland noted that there is room to reach an administrative settlement. Mr. Mattern stated that previously we have acted and will act more as an advocate for the property owners to get as much money as possible.

Mr. Dunn expressed that right now the area in question is a desirable place to live because of these big pine trees from an aesthetic perspective. Mr. Dunn felt it to be somewhat unjust that one property be compensated for the removal of trees while an adjacent property's value would be diminished because its surrounding view is compromised by the removal of trees on other properties. Mr. Hersom interjected that he felt that the quality of life will go down and that the removal of the trees would result in health hazards and incredible noise pollution resulting in people not wanting to buy houses near this part of the airport. Mr. Hersom pondered what the gain was and suggested that it boiled down to providing runway capacity to facilitate jet traffic. Mr. Bergevin stated that he was amongst those that would welcome the removal of trees from his property. Mr. Palmiotto wants to know about the details to the obstruction clearing alternative.

Mr. Bartlett indicated that those details will be more disclosed at the next meeting. Mr. Bartlett feels that it will not be a clear cut, but more of a selective cutting. Mr. Bartlett stated that details will also include a vegetative management plan and that he would like to hear a forester's estimate on how fast and what kind of trees would grow in place of those removed.

Dr. Shedd asked Mr. Bartlett to further explain the map in handout. Mr. Bartlett noted that the marked parcels are the ones that would require a purchase. Dr. Shedd asked if the parcels with red are in need of easement. Mr. Bartlett responded maybe. Dr. Shedd asked about the gray dotted lines. Mr. Bartlett responded that those were planimetrics used to mark the edge of tree lines. Mr. Bartlett continued; we haven't talked to Federal Aviation Administration about what surfaces we would have to clear to. Mr. Bartlett feels that the clearing will probably not be as drastic as depicted once all the various surface areas are addressed with the Federal Aviation Administration. Dr. Shedd asked if that information would be available at the next meeting. Mr. Bartlett explained that there are five surfaces that need to be considered, that he would try to have more details about the extent of clearing but there still may be some questions with respect to the transitional surfaces.

Mr. Palmiotto added that it is really valuable to have alternatives outlined and noted that it is really critical that the right surface for the base line be established. Mr. Palmiotto suggested that moving the surface areas presents the best opportunity to truly mitigate impact on the neighborhoods and would be a palatable solution. Mr. Bartlett concurred but stressed that the impact to jet traffic would have to be considered. Dr. Shedd asked if there would be any air quality monitoring as part of the environmental assessment. Mr. Bartlett did not believe there would be unless the City would be willing to pay for the monitoring program.

4. **Boundary Survey Update – Airport Director**

Mr. Mattern reported to the Committee that he has gotten about a fifty percent positive response from owners willing to concur with the boundary survey. Mr. Mattern stated that they will follow up with non-responders via telephone. Mr. Palmiotto added that he has two of his students from Antioch University doing and inventory and management plan for wild life on the property. Mr. Bartlett offered to share the wetland's report to help the students with their efforts.

5. **Next Meeting Date:** December 3, 2013

8. **Adjournment**

Mr. Lerandeau made a motion to adjourn, seconded by Mr. Palmiotto, passing unanimous vote. Chair Dunn adjourned the meeting at 5:01 PM.

| | |
|---|---|
| Respectfully submitted by, | Edited by |
| John Hehir, Minute taker | Ed Mattern, Airport Director |
| November 7, 2013 | |

**DRAFT**

**Dillant-Hopkins Airport**
**Ad-Hoc Airport Obstruction Removal**
**Committee Meeting Minutes**

**Tuesday, December 5, 2013 4:00 PM Airport Terminal Building**

**Members Present:**
Richard Hersom
Dr. Ann Shedd
Alfred "Gus" Lerandau
Robert Bergevin
Scott Ellsworth, Vice-Chair
Peter Palmiotto

**Staff Present:**
Ed Mattern, Airport Director

**Others Present:**
Leigh Bartlett – Stantec
Janice Bland – Stantec
Douglas Barrett - SID

**Members Not Present:**
James "Tim" Dunn, Chair

1. **Call to Order** –

Chair Ellsworth called the meeting to order at 4:03 pm. Roll call was conducted.

2. **Approval of Minutes – November 5, 2013**

Dr. Shedd pointed out that under item number 3 the sentence: 'Mr. Bartlett stated that these alternatives were covered during a recent public hearing' should be changed to: 'Mr. Bartlett stated that these alternatives were raised during a recent public forum.

Dr. Shedd pointed out that references to abrogation easement should be changed to avigation easement.

Mr. Lerandau made a motion to accept the November minutes as corrected, seconded by Mr. Bergevin, passing a unanimous vote.

3. **Noise Discussion – Douglas Barrett, SID, Inc.**

Mr. Bartlett opened the topic by noting that there was concern about the potential for increased noise pollution resulting from the removal of trees brought up at a public forum. Mr. Bartlett introduced Mr. Douglas Barrett a 'noise expert' from SID Inc. to speak to this concern.

Mr. Barrett noted that he also lives in Keene and has worked in the field of noise control for about 25 years and has been a principle in many airport ground studies. Mr. Barrett discussed some of the sources and barriers to noise at a typical airport. Mr. Barrett then addressed the question of how much noise reduction the trees in question provided. Mr. Barrett clarified that in observing the area and referencing FAA information used in building noise models that he estimated that tree removal would not result in any significant difference in noise levels. Mr. Barrett did acknowledge that trees can mask airport noises and interacted with wind to further mute noises from the airport. Mr. Barrett expressed his opinion that new forest growth would provide more noise reduction in the long run compared to the mature pines presently in place. Mr. Ellsworth asked how long it would take for new forest growth to happen. Mr. Palmiotto estimated a time period of 5 to 10 years to achieve 15 feet of growth. Dr. Shedd expressed her opinion that the trees did reduce a significant amount of noise and that it will take many years for effective growth to happen. Dr. Shedd stated that she thought it would be important to manage any regrowth and choose the right species to plant in order to make noise reduction effective and predictable. Mr. Palmiotto added that it would be a good idea to manage re-growth and that pruning at regular intervals would help make the effort more effective.

Mr. Barrett suggested that the topography of the area, where there is a ridge present, would have more effect on noise reduction than any trees could have. Dr. Shedd questioned Mr. Barrett's assessment of the topography, noting the 'flat' nature of the area. Mr. Barrett also put forth that a berm could be built.

4. **<u>Environmental Assessment: Next Step – Stantec Inc.</u>**

Mr. Greg Cohen was introduced as the presenter of a slide show that highlighted the next steps at hand. Mr. Cohen noted that his main objective is to present the alternative regarding evaluation of displaced threshold that eliminates off airport obstruction removal. He also will cover the NEPA (National Environmental Policy Act) process and what the future direction is.

Mr. Cohen noted that FAA projects like the one at hand are subject to the conditions and requirements set forth in the National Environmental Policy Act of 1969 intended to promote the enhancement and protection of environmental assets by requiring assessments and mitigation plans for federally funded projects. Mr. Cohen covered the Environmental Assessment process noting the roles of the New Hampshire Department of Transportation and the Federal Aviation Administration.

Mr. Cohen enumerated and reviewed the alternatives that would most likely be considered within the scope of an Environmental Assessment.

- No Action
- Obtain avigation easements and remove obstructions both on and off City property.
- Displace Runway 20 threshold (approximately 1600 feet) effectively eliminating off-airport obstruction clearing. Mr. Cohen reviewed the operational impacts of this alternative:
    - Inadequate runway length for C2 aircraft operations
    - Jeopardizing future grant assurances for the airport
    - Lights must be relocated
    - PAPIs must be relocated
- Displace Runway 20 threshold to eliminate all obstruction clearing.

Joe Briggs from C&S air operations stated that they (C&S) have about 1100 flights per year in and out of Keene and that they need the existing operational length of the runway to remain intact and expressed C&S's position of being against the displacement alternative.

Mr. Bergevin noted that having C&S in town is critical to the local economy and suggested that by forcing air operations to another location could jeopardize their staying in town. Mr. Ellsworth noted that there are other important reasons to maintain current operational conditions noting other visitors contributing to the local economy that utilize jet operations. Mr. Hersom made note of the property taxes paid by residents in proximity to the airport. Dr. Shedd expressed her surprise and disappointment that an air quality study could not be included in part of the Environmental Assessment. Mr. Cohen responded that the NEPA regulations were rigid and a bit antiquated, that air quality study or a noise model would require a different funding source. Mr. Mattern asked if an air quality study is it a big effort. Mr. Cohen responded no, it would take about a week but stated what it will reveal may be suspect, noting the study could only provide a baseline. Mr. Mattern said he will look into the possibility further seeking out a creative way to get the testing done.

Mr. Cohen noted that the next thing to happen will be submission of a draft Environmental Assessment to NH DOT and the FAA for review. Santec will then incorporate the comments to the review and submit the final Environmental Assessment. Mr. Palmiotto asked if the Committee members will we see the draft version of the Environmental Assessment. Mr. Mattern noted that the Committee is officially dissolved at the end of the year though it may be reconstituted by the mayor. Mr. Mattern added that the draft would not be ready by the end of the year, but they would be looking for comments. Mr. Mattern also noted that an update of activities will be given to the City Council on December 19th.

5. **Keene City Council Update – Airport Director**

6. **Next Meeting Date:** Pending City Council approval the next meeting will be held on January 7, 2014

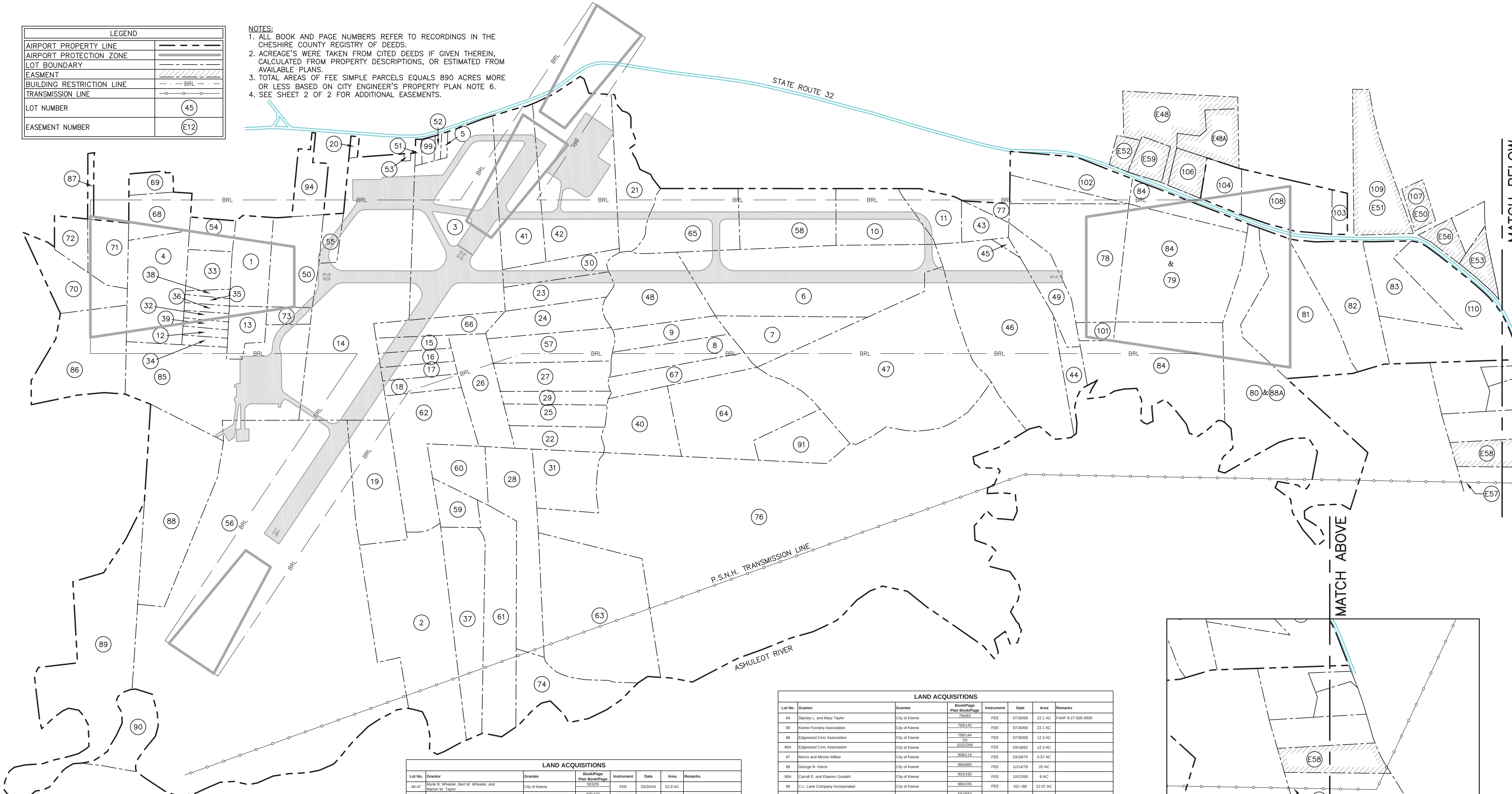
8. **Adjournment**

Mr. Bergevine made a motion to adjourn, seconded by Mr. Palmiotto, passing unanimous vote. Chair Ellsworth adjourned the meeting at 5:30 PM.

Respectfully submitted by,
John Hehir, Minute taker
December 7, 2013

# Appendix C

## C.1 AIRPORT EXHIBIT 'A' AND PARCEL DEED




## LAND ACQUISITIONS

| Lot No. | Grantor | Grantee | Book/Page Plan Book/Page | Instrument | Date | Area | Remarks |
|---|---|---|---|---|---|---|---|
| 1-2 | Sibilla Guenster | City of Keene | 499/167 | FEE | 04/01/42 | 32.6 AC | |
| 3 | Mary M. Sprague | City of Keene | 498/113 | FEE | 04/01/42 | 29.1 AC | |
| 4 | Helen M. Kershaw | City of Keene | 499/168 | FEE | 04/01/42 | 9.1 AC | |
| 5 | Charles M. Sears | City of Keene | 499/164 | FEE | 03/31/42 | 0.3 AC | |
| 6 | Gus Wetmore | City of Keene | 499/561 | FEE | 10/05/42 | 25.1 AC | |
| 7-9 | Gus Wetmore | City of Keene | 503/509 | FEE | 08/17/43 | 16.2 AC | |
| 10 | Maude M. Ward, Helen Ward Adams, and Harold Adams | City of Keene | 499/560 | FEE | 10/05/42 | 6.8 AC | |
| 11 | Maud M. Ward, ,Helen Ward Adams, and Harold J. Adams | City of Keene | 504/106 | FEE | 12/15/42 | 3.3 AC | |
| 12-13 | Clarence J. Trombly | City of Keene | 499/157<br>1/174 | FEE | 03/30/42 | 3.3 AC | |
| 14-19 | Bessie B. Rutter | City of Keene | 498/95 | FEE | 03/30/42 | 48.3 AC | |
| 20 | Bessie B. Rutter | City of Keene | 506/367 | FEE | 01/10/44 | 0.3 AC | |
| 21-29 | Leander and Margaret M. Page | City of Keene | 501/25 | FEE | 08/11/42 | 42.2 AC | |
| 30 | Clifford C. Wilber | City of Keene | 501/27 | FEE | 08/11/42 | 3.1 AC | |
| 31 | Claude Ballou | City of Keene | 504/505 | FEE | 07/19/43 | 5 AC | |
| 32 | Morgan H. Dix | City of Keene | 499/151 | FEE | 03/30/42 | 0.6 AC | |
| 33 | M. Lydia Bishop | City of Keene | 499/150 | FEE | 03/30/42 | 3 AC | |
| 34 | Eunice A. Jones | City of Keene | 499/154<br>1/174 | FEE | 03/30/42 | 0.7 AC | |
| 35 | Walter R. Burroughs, Administrator of the Estate of Ida M. Burroughs | City of Keene | 501/29 | FEE | 08/11/42 | 2.03 AC | |
| 36 | Edwin G. Landers | City of Keene | 499/169<br>1/174 | FEE | 04/01/42 | 0.6 AC | |
| 37 | William Mcintyre | City of Keene | 506/16 | FEE | 08/25/43 | 8 AC | |
| 38 | George Howard | City of Keene | 499/153<br>1/174 | FEE | 03/30/42 | 0.5 AC | |
| 39 | Grace A. Swan | City of Keene | 499/166<br>1/174 | FEE | 03/31/42 | 0.6 AC | |
| 40 | Jennie F. Bourne | City of Keene | 504/583 | FEE | 08/17/43 | 7 AC | |
| 41 | Jerome J. Sullivan | City of Keene | 499/165 | FEE | 03/31/42 | 9.89 AC | |
| 42 | Clarence H. and Margaret Demar | City of Keene | 499/160 | FEE | 03/30/42 | 19.5 AC | |
| 43 | Franklin Ellsworth Safford | City of Keene | 504/103 | FEE | 12/15/42 | 2.1 AC | |
| 44-45 | Myrle B. Wheeler, Bert W. Wheeler, and Marion W. Taylor | City of Keene | 504/104 | FEE | 12/15/42 | 2.8 AC | |

## LAND ACQUISITIONS

| Lot No. | Grantor | Grantee | Book/Page Plan Book/Page | Instrument | Date | Area | Remarks |
|---|---|---|---|---|---|---|---|
| 46-47 | Myrle B. Wheeler, Bert W. Wheeler, and Marion W. Taylor | City of Keene | 503/29 | FEE | 03/30/43 | 52.9 AC | |
| 48 | Perley F. Safford | City of Keene | 499/473 | FEE | 08/20/42 | 7.0 AC | |
| 49 | Perley F. Safford | City of Keene | 504/105 | FEE | 12/15/42 | 4.4 AC | |
| 50 | Minnie I. Pollard | City of Keene | 499/156 | FEE | 03/30/42 | 6.04 AC | |
| 51 | Robert L. Mallat | City of Keene | 499/155 | FEE | 03/30/42 | 0.24 AC | |
| 52-53 | Frank J. and Christe L. Domina | City of Keene | 499/152 | FEE | 03/30/42 | 0.4 AC | |
| 54 | Carroll H. Chickering, Administrator of the Estate of Grace I. Chickering | City of Keene | 498/121 | FEE | 04/04/42 | 2.2 AC | |
| 55 | Irene S. Barton | City of Keene | 499/163 | FEE | 03/31/42 | 1.5 AC | |
| 56 | Grace S. Hewitt | City of Keene | 498/114 | FEE | 04/02/42 | 110 AC | |
| 56 | Charles E. Frazier | City of Keene | 499/170 | FEE | 04/02/42 | 110 AC | |
| 57-58 | Susie May Ballou, John L. Ballou, Earl Ballou, Nellie S. Thompson, and Hermon W. Ballou | City of Keene | 504/384 | FEE | 06/07/43 | 14 AC | |
| 59-61 | Waldemar L. Christopherson | City of Keene | 506/17 | FEE | 08/25/43 | 23.8 AC | |
| 62 | Perley F. Safford and John Doe | City of Keene | 501/55 | FEE | 08/24/42 | 9 AC | |
| 63-64 | Charles K. Whitcomb Will of Hannah P. Whitcomb | City of Keene | 512/368 | FEE | 02/08/45 | 35.1 AC | |
| 65 | Leander Page | City of Keene | 504/36 | FEE | 11/05/42 | 6.8 AC | |
| 66 | Walter R. Burroughs Administrator of the Estate of Ida M. Burroughs | City of Keene | 501/29 | FEE | 08/11/42 | 2.03 AC | |
| 67 | Walter E. Day | City of Keene | 513/562 | FEE | 07/24/45 | 2.5 AC | |
| 68 | Carlo Bianchi and Company | City of Keene | 520/433 | FEE | 07/27/46 | 4 AC | |
| 69 | Helen M. Kershaw | City of Keene | 524/337 | FEE | 07/27/46 | 1.5 AC | |
| 70 | Keene Forestry Association | City of Keene | 641/198 | FEE | 05/22/57 | 5.3 AC | |
| 71 | Marie C. Sweet | City of Keene | 641/200 | FEE | 05/22/57 | 4.0 AC | |
| 72 | Earl A. and Idella M. Brown | City of Keene | 641/204 | FEE | 05/22/57 | 2.2 AC | |
| 73 | Keene Forestry Association | City of Keene | 641/198 | FEE | 05/22/57 | 1.3 AC | |
| 74 | Clifford H. Goodell | City of Keene | 641/199 | FEE | 05/22/57 | 5 AC | |
| 76 | Hazel S. Ballou and Guy E. Ballou | City of Keene | 697/579 | FEE | 08/24/62 | 160 AC | |
| 77 | Winston C. and Doris W. Ferguson | City of Keene | 646/25 | FEE | 10/01/57 | 0.6 AC | |
| 78 | Perley F. Safford | City of Keene | 646/28 | FEE | 10/01/57 | 14.2 AC | |
| 79 | Stanley L. and Mary A. Taylor | City of Keene | 646/33 | FEE | 10/01/57 | 19.5 AC | |
| 80 | Carroll E. and Eleanor Goodell | City of Keene | 801/219 | FEE | 09/10/69 | 24.4 AC | FAAP 9-27-005-0909 |
| 81 | Keene Sand and Gravel Incorporated | City of Keene | 793/365 | FEE | 03/27/69 | 12.75 AC | |
| 82 | Rose F. Dubois | City of Keene | 771/219 | FEE | 09/29/67 | 10.9 AC | |
| 83 | Elsa Bolewski | City of Keene | 803/193 | FEE | 10/22/69 | 5.5 AC | |

## LAND ACQUISITIONS

| Lot No. | Grantor | Grantee | Book/Page Plan Book/Page | Instrument | Date | Area | Remarks |
|---|---|---|---|---|---|---|---|
| 84 | Stanley L. and Mary Taylor | City of Keene | 794/83 | FEE | 07/30/69 | 22.1 AC | FAAP 9-27-005-0909 |
| 85 | Keene Forestry Association | City of Keene | 799/145 | FEE | 07/30/69 | 22.1 AC | |
| 86 | Edgewood Civic Association | City of Keene | 799/144<br>7/0 | FEE | 07/30/69 | 12.3 AC | |
| 86A | Edgewood Civic Association | City of Keene | 1032/269 | FEE | 03/18/83 | 12.3 AC | |
| 87 | Morris and Minnie Wilber | City of Keene | 808/119 | FEE | 03/18/70 | 0.57 AC | |
| 88 | George R. Harris | City of Keene | 960/860 | FEE | 12/14/78 | 20 AC | |
| 88A | Carroll E. and Eleanor Goodell | City of Keene | 803/195 | FEE | 10/22/69 | 6 AC | |
| 89 | C.L. Lane Company Incorporated | City of Keene | 980/335 | FEE | 02/--/80 | 22.07 AC | |
| 90 | Abraham Cohen and Deborah Cohen | City of Keene | 592/583 | FEE | 03/10/54 | 3 AC | |
| 91 | Kendall C. Page | City of Keene | 721/380 | FEE | 06/18/64 | 5.3 AC | |
| 94 | James D. Walker and Norman H. Cotton | City of Keene | 987/14 | FEE | 07/31/80 | 3.1 AC | ADAP 6-33-0008-06 |
| 99 | Rose B. Mariaschin | City of Keene | 1005/244 | FEE | 08/10/81 | 0.6 AC | ADAP 6-33-0008-06 |
| 101 | Norma J. Safford | City of Keene | 1118/467 | FEE | 01/03/86 | 1.0 AC | AIP 3-33-0008-03 |
| 102 | Norma J. Safford | City of Keene | 1118/465 | FEE | 01/03/86 | 8.3 AC | AIP 3-33-0008-03 |
| 103 | Benjamin and Virginia Brown | City of Keene | 1494/548 | FEE | 06/30/94 | 1.04 AC | AIP 3-33-0008-08 |
| 104 | Richard and Sandra Desoteaux | City of Keene | 1511/234 | FEE | 12/19/94 | 2.4 AC | AIP 3-33-0008-08 |
| 106 | Harold and Joan Kontrovitz | City of Keene | 1594/729 | FEE | 04/02/97 | 2.2 AC | AIP 3-33-0008-12 |
| 106 | City of Keene | Kevin F. Slone | 1709/741 | FEE | 07/13/99 | 2.1 AC | AIP 3-33-0008-13 |
| 107 | Hans Bolewski | City of Keene | 1595/274 | FEE | 04/07/97 | 1.6 AC | AIP 3-33-0008-12 |
| 107 | City of Keene | Andrew A. Hall | 1719/048 | FEE | 09/09/99 | 1.6 AC | AIP 3-33-0008-12 |
| 108 | Arnold and Marylou Stymest | City of Keene | 1519/881 | FEE | 05/22/97 | 6.8 AC | AIP 3-33-0008-12 |
| 109 | Elsa Bolewski | City of Keene | 1666/757 | FEE | 09/25/98 | 8.1 AC | AIP 3-33-0008-13 |
| 109 | City of Keene | Anthony B. Alhf | 1704/829 | FEE | 06/16/99 | 8.1 AC | AIP 3-33-0008-13 |
| 110 | Alps Corporation | City of Keene | 1666/758 | FEE | 09/28/98 | 15.4 AC | AIP 3-33-0008-13 |

Dufresne-Henry
Portland, Maine
Tel. (207) 775-3211 • FAX (207) 775-6434
www.dufresne-henry.com

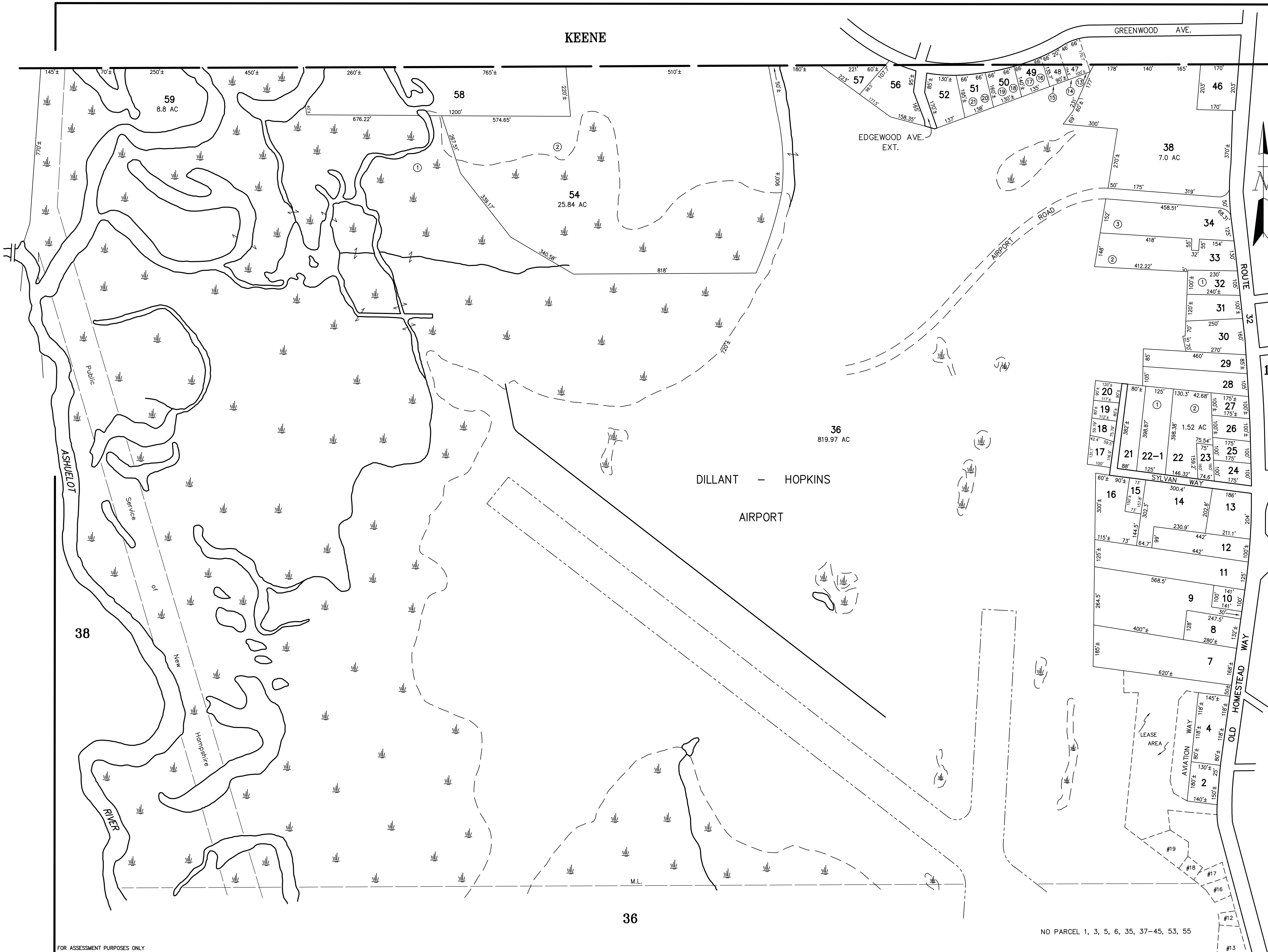
| Rev. | Description | By | Date |
|---|---|---|---|

KEENE NEW HAMPSHIRE

DILLANT-HOPKINS AIRPORT
AIP PROJECT NO. 3-33-0008-20

# EXHIBIT A

| | |
|---|---|
| Project No. | 81200074.01 |
| Proj. Manager | RD YARNOLD |
| Proj. Designer | RD YARNOLD |
| Drawn By | LR KING |
| Checked By | RD YARNOLD |
| Scale | 1"=400' |
| Approved | DC DARGIE |
| Date | APRIL 2006 |




PREPARED BY PHOTOGRAMMETRIC METHODS BY
JOHN E. O'DONNELL & ASSOCIATES
AUBURN, MAINE
1974
CURRENT TO APRIL 1, 2012

**LEGEND**

| | |
|---|---|
| ADJACENT SHEET NO. | 12 |
| COMMON OWNERSHIP | OR |
| DEVELOPMENT LOT NO. | 2 |
| SCALED DIMENSION | ± |

PROPERTY MAP
# SWANZEY
NEW HAMPSHIRE

DIGITIZED IN 1995 BY
CARTOGRAPHIC ASSOC. INC.
PROFESSIONAL CONSULTANTS
MUNICIPAL MAPPING – GIS – PUBLIC WORKS INFORMATION MANAGEMENT
11 PLEASANT STREET, P.O. BOX 267, LITTLETON, NEW HAMPSHIRE 03561
(603)444-6768 – 1(800)322-4540 – FAX (603)444-1366 – WWW.CAI-INFO.COM

SCALE IN FEET
0 200 400

85

GOES WITH #86

I, JOHN R. GOODNOW, Clerk of Keene Forestry Association, hereby certify that at a meeting of the stockholders of the corporation duly called and held on July 15, 1969, at which all of the stockholders were present and voting, the following resolution was adopted:

"VOTED: To sell and convey to Edgewood Civic Association a tract of land in Swanzey containing approximately 12.3 acres bounded northerly on lands of Colby and Shedd, westerly by land of Lane and southerly and easterly by land of the City of Keene and to authorize the President, Marion Y. Shedd, to execute, acknowledge and deliver a deed of the same."

John Goodnow

CONSIDERATION LESS THAN $100.00

WARRANTY DEED

KEENE FORESTRY ASSOCIATION, a New Hampshire corporation having its principal place of business at Keene, Cheshire County, State of New Hampshire, for consideration paid, grant to EDGEWOOD CIVIC ASSOCIATION, a voluntary corporation organized under the laws of the State of New Hampshire and having its principal place of business at said Keene, Cheshire County and State of New Hampshire, with WARRANTY covenants:-

A certain parcel of land situated in SWANZEY, Cheshire County, New Hampshire, bounded and described as follows:-

Beginning at a stone bound at the southeasterly corner of the lands herein described; thence north 12° 7' 20" east along lands of the City of Keene 580 feet, more or less, to a point; thence north 60° west crossing the strip of land and roadway hereafter referred to and along land of Colby formerly known as Edgewood Development and shown on a map titled, "Plan of Edgewood" by C. Howard Walker and surveyed by Samuel Wadsworth, dated April, 1913 on file in the Cheshire County Registry of Deeds in Book 7, Page 0, 217 feet, more or less, to a point; thence north 40° 25' west alonglands of Colby and Shedd 401 feet, more or less, to a corner marked by an iron pin at the Keene-Swanzey town line; thence westerly bounding on Shedd land along the town line 182 feet, more or less, to a point 50 feet westerly of a brook at lands of C.L. Lane; thence southwesterly along lands of Lane 745 feet, more or less, on a line parallel to and 50 feet westerly of a brook to a point at land conveyed to the City of Keene; thence south 70° 30' east a distance of 242.73 feet, more or less, to a point; thence south 71° 53' east a distance of 83.24 feet, more or less, to a point; thence south 73° 45' east a distance of 251 feet, more or less, along land conveyed to the City of Keene to a concrete monument; thence south 71° 55' east bounding on other land of the City of Keene a distance of 230 feet, more or less, to the point of beginning.

Said parcel being 12.3 acres, more or less.

Being part of the premises conveyed to said Keene Forestry Association by deeds recorded in Vol. 347, Page 490, Vol. 426, Page 421, Vol. 379, Page 244, and Vol 404, Page 586, Cheshire Registry.

Also granting any and all rights owned by Keene Forestry Association in and to the strip of land east of land of Colby and west of land of Safford extending southerly from Greenwood Avenue to the above described parcel and the roadway running through the same.

WITNESS the hand and corporate seal this 24 day of July 1969.

WITNESS: KEENE FORESTRY ASSOCIATION

J. N. Evans

BY: Marion Young Shedd
President

STATE OF NEW HAMPSHIRE
Cheshire, ss

July 24 1969

On this date, before me, the undersigned officer, personally appeared MARION Y. SHEDD, who acknowledged herself to be the President of Keene Forestry Association, a corporation, and that she as such President being authorized so to do, executed the foregoing instrument for the purposes therein contained, by signing the name of the corporation by herself as President.

IN WITNESS WHEREOF I have hereunto set my hand and official seal.

J. N. Evans NOTARY PUBLIC

85

CHESHIRE COUNTY
REGISTRY OF DEEDS,
KEENE, NEW HAMPSHIRE
Received JUL 30 1969
at 3-40 o'clock P
Recorded in Vol. 799 Page 142
Attest: [illegible] Register

3-10 P.2

SEE ALSO EASEMENT #45 FOR CLARIFICATION

799-144

WARRANTY DEED

EDGEWOOD CIVIC ASSOCIATION, a New Hampshire voluntary corporation with a principal place of business at Keene, New Hampshire,, for consideration paid, grant to the CITY OF KEENE, a municipal corporation located in Cheshire County, New Hampshire, with WARRANTY covenants:

A certain parcel of land situated in SWANZEY, Cheshire County, New Hampshire, bounded and described as follows:

Beginning at a stone bound at the southeasterly corner of the lands herein described; thence north 12° 7' 20" east along lands of the City of Keene 580 feet, more or less, to a point; thence north 60° west crossing the strip of land and roadway hereafter referred to and along land of Colby formerly known as Edgewood Development and shown on a map titled, "Plan of Edgewood" by C. Howard Walker and surveyed by Samuel Wadsworth, dated April, 1913 on file in the Cheshire County Registry of Deeds in Book 7, Page 0, 217 feet, more or less, to a point; thence north 40° 25' west along lands of Colby and Shedd 401 feet, more or less, to a corner marked by an iron pin at the Keene-Swanzey town line; thence westerly bounding on Shedd land along the town line 182 feet, more or less, to a point 50 feet westerly of a brook at lands of C. L. Lane; thence southwesterly along lands of Lane 745 feet, more or less, on a line parallel to and 50 feet westerly of a brook to a point at land conveyed to the City of Keene; thence south 70° 30' east a distance of 242.73 feet, more or less, to a point; thence south 71° 53' east a distance of 83.24 feet, more or less, to a point; thence south 73° 45' east a distance of 251 feet, more or less, along land conveyed to the City of Keene to a concrete monument; thence south 71° 55' east bounding on other land of the City of Keene a distance of 230 feet, more or less, to the point of beginning.

Said parcel being 12.3 acres, more or less.

Also granting any and all rights owned by Keene Forestry Association in and to the strip of land east of land of Colby and west of land of Safford extending southerly from Greenwood Avenue to the above described parcel and the roadway running through the same.

Being all of the premises conveyed to Edgewood Civic Association by Keene Forestry Association dated July 24, 1969 to be recorded.

The above described parcel of land is conveyed subject to the following restrictions and conditions which shall be covenants running with the land for the benefit of the grantor, Edgewood Civic Association, and for the benefit of all land situated in the Edgewood section of Keene, New Hampshire, which restrictions and conditions the City of Keene, by the acceptance of this deed, agrees to observe and maintain:

1. No roads or other public ways, including the presently existing road, shall be constructed, used or maintained on or within the herein described premises for any purpose other than as an access road for fire protection purposes and/or to install, repair and maintain such water, sewer, electric or telephone lines as may from time to time be installed on, under or over said premises.

2. No buildings of any kind will be erected, used or otherwise maintained on said premises.

3. Such premises shall be maintained in a natural wooded state substantially in the same condition in which the premises are on the date of this deed.

4. No camping, picnicing or other recreational use will be permitted on said premises.

5. No parking areas will be constructed, maintained or used by the City of Keene on its adjacent land within 200 feet of the within described premises.

6. No airport beacon light will be located on adjacent land of the City of Keene nearer to the within described premises than is the present airport beacon light at the Keene airport.

7. The City of Keene, by accepting this deed, agrees to erect and maintain a gate, or other similar barrier, on the presently existing road through the within described premises at a point not more than two hundred (200) feet distant from Greenwood Avenue and to keep the same closed so as to bar traffic over such road except when such road is being used for the limited purposes permitted by this deed.

WITNESS its hand and corporate seal this 24 day of July, 1969.

WITNESS: George R. Hanna

EDGEWOOD CIVIC ASSOCIATION

By Hermann J. Kreissle
President

STATE OF NEW HAMPSHIRE
CHESHIRE, SS.

Accepted for
CITY OF KEENE BY: Richard E. Bean
Richard E. Bean, Mayor

On this the 24 day of July, 1969, before me, George R. Hanna the undersigned officer, personally appeared Hermann J. Kreissle, who acknowledged himself to be the President of Edgewood Civic Association, a corporation, and that he, as such President, being authorized so to do, executed the foregoing instrument for the purposes therein contained, by signing the name of the corporation by himself as President.

In witness whereof I hereunto set my hand and official seal.

George R. Hanna
~~Notary Public~~
Justice of the Peace

2

86.

CHESHIRE COUNTY
REGISTRY OF DEEDS,
KEENE, NEW HAMPSHIRE
Received JUL 30 1969
at 3 - 40 o'clock P M
Recorded in Vol. 799 Page 144
Attest: [signature] Register

City

FAULKNER, PLAUT, HANNA & ZIMMERMAN
ATTORNEYS-AT-LAW
KEENE, N. H.

3-40 P.M.

~~86-A~~
100
=
86

## AMENDMENT CLARIFYING A WARRANTY DEED

WHEREAS, the Edgewood Civic Association, a New Hampshire voluntary corporation with a principal place of business at Keene, New Hampshire, on July 24, 1969, conveyed to the City of Keene, a municipal corporation located in Cheshire County, New Hampshire, a certain parcel of land in Swanzey, New Hampshire, containing 12.3 acres, more or less; and

WHEREAS, the said warranty deed contains certain restrictions on the use of the land conveyed including the following:

> "3. Such premises shall be maintained in a natural wooded state, substantially in the same condition in which the premises are on the date of the deed."

NOW, THEREFORE, BE IT AGREED by the parties hereto that for consideration paid, receipt of which is hereby acknowledged, the Edgewood Civic Association and the City of Keene hereby agree that the trees on the conveyed parcel may be cut or topped in order that they will not constitute an obstruction to air navigation in violation of Part 77 of Federal Aviation Regulations. While the parties agree that a tree may be removed in total if the cutting or topping would destroy it completely, it is the intent of the parties to leave the conveyed parcel in as natural a state as possible with as much vegetation while not constituting a hazard to air navigation in any way.

This instrument is intended to be an amendment clarifying the warranty deed described above and recorded in Cheshire County Registry of Deeds on July 30, 1969, at 3:40 PM, in Volume 799 at Page 144.

IN WITNESS WHEREOF, the parties hereto have affixed their seals and the hands of their duly authorized officers this 18th day of March, 1983.

EDGEWOOD CIVIC ASSOCIATION

By: ______________________
Philip P. Mangones, President

CITY OF KEENE

By: Patrick MacQueen
Patrick MacQueen, City Manager

STATE OF NEW HAMPSHIRE

March 18, 1983

Then personally appeared the above-named Philip P. Mangones and Patrick MacQueen, known to me and known to me to be the President of the Edgewood Civic Association and the City Manager of the City of Keene respectfully and acknowledged the foregoing instrument to be the fee act and deed of those organizations.

Before me.

Charles H. Morang
Charles H. Morang
Justice of the Peace

# Appendix D

## D.1 AGENCY CORRESPONDENCE

| | |
|---|---|
| From: | vonOettingen, Susi |
| To: | Gass, Jason; Tuttle, Kim |
| Subject: | Re: Further Correspondence: Dillant-Hopkins Airport, Keene NHB13-3216 |
| Date: | Tuesday, December 17, 2013 7:46:38 AM |
| Attachments: | image001.png |

Hi Jason,

I would concur with Kim's assessment of no impacts likely to occur to federally and state listed endangered dwarf wedgemussels based on the project description and time of year restrictions for tree harvesting. No further consultation is needed with this office.

Susi von Oettingen

****************************************
Susi von Oettingen
Endangered Species Biologist
New England Field Office
70 Commercial Street, Suite 300
Concord, NH 03301
(W) 603-223-2541 ext. 22

www.fws.gov/newengland

Celebrate the 40th anniversary of the Endangered Species Act!

On Mon, Dec 16, 2013 at 3:58 PM, Tuttle, Kim <Kim.Tuttle@wildlife.nh.gov> wrote:

> Jason,
>
> The NHFG Nongame and Endangered Wildlife Program has reviewed NHB13-3216 for the proposed removal of obstruction trees on 15.6 acres to the Runway 20 approach path. The NHB database check identified the following species in the vicinity of the project:
>
> Dwarf Wedge Mussel (*Alasmidonta heterodon*) E E Contact the NH Fish & Game Dept and the US Fish & Wildlife Service
>
> Grasshopper Sparrow (*Ammodramus savannarum*) T -- Contact the NH Fish & Game Dept
>
> Northern Leopard Frog (*Rana pipiens*) SC -- Contact the NH Fish & Game Dept
>
> Wood Turtle (*Glyptemys insculpta*) SC -- Contact the NH Fish & Game Dept
>
> Codes: "E" = Endangered, "T" = Threatened, “SC” = Special Concern

As the tree removal is planned for the winter months beginning in December 2014 and the project location is located approximately 0.8 miles east of the Ashuelot River, we do not expect impacts to any of the above named species. Additionally, no mechanized tree clearing equipment will be allowed in wetlands. There are no vernal pools within the proposed project area. No tree removal is proposed within the vicinity of tributary streams nor will any stream crossings be required.

Please let us know if the scope or the timing of the job changes. As the dwarf wedge mussel is also federally endangered, you may want to check the Service's website for further information.  I have also cc'd Susi von Oettingen on this email.

http://ecos.fws.gov/ipac/

Sincerely,

Kim Tuttle
Certified Wildlife Biologist
NH Fish and Game
Nongame and Endangered Species Program
603-271-6544

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From: Gass, Jason [mailto:Jason.Gass@stantec.com]
Sent: Monday, December 16, 2013 2:36 PM
To: Tuttle, Kim
Subject: RE: Further Correspondence: Dillant-Hopkins Airport, Keene NHB13-3216

The project is proposed for construction in December 2014. A black spruce/larch bog has been identified within the center of the proposed clearing area. Aerial survey of vegetation within the project boundaries has identified trees potentially located along the perimeter of the bog as obstructions to runway approach surfaces. The bog is a depression flanked by primarily 100-foot pine trees. Due to the manner in which aerial data is collected—by surveying points in a canopy from a plane—it is difficult to determine whether these tree stems actually occur within delineated boundaries. We have conservatively estimated approximately 0.3 acres of vegetation to be removed occurs within wetlands. As previously stated however, the vast majority of trees to be removed consist of 100' pines, therefore, it is highly unlikely any perimeter bog tree species/wetland vegetation will be affected.

We are in the planning level of this project. Prior to entering the permitting phase, additional site work will be conducted to verify the location of individual tree stems within delineated wetland boundaries. Should it be necessary to mitigate obstructions within the wetland boundary, individual pines will be felled either mechanically or by hand in such a manner that the tree does not fall into the bog. Again, although it is unlikely that wetland tree species must be mitigated, pruning trees to a height below protected air surfaces will be considered to avoid removing the tree in its entirety. No mechanized tree clearing equipment will be allowed in wetlands. There are no vernal pools within the proposed project area (mature pine stand located in sandy soils with virtually no understory vegetation). No tree removal is proposed within the vicinity of tributary streams nor will any stream crossings be required.

Very sorry for the original oversight and lack of prudent information. If you should need any more project detail, don't hesitate to contact me or Gregg Cohen (information below).

Regards,


**Jason Gass**

***Aviation Planner***
***Stantec***
Phone: 207-887-3437
jason.gass@stantec.com

**Gregg Cohen**

Senior Environmental Analyst

Stantec
482 Payne Road Scarborough Court Scarborough ME 04074
Phone: (207) 887-3824
Cell: (207) 807-5847
Fax: (207) 883-3376
gregg.cohen@stantec.com

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**From:** Tuttle, Kim [mailto:Kim.Tuttle@wildlife.nh.gov]
**Sent:** Monday, December 16, 2013 1:46 PM
**To:** Gass, Jason
**Subject:** RE: Further Correspondence: Dillant-Hopkins Airport, Keene NHB13-3216

Jason,

When is the project scheduled? How will wetland impacts be avoided? Please describe types of wetlands to be impacted by the tree removal. How many sq. ft. of temporary and permanent wetland impacts? Will vernal pools be impacted? What kind of equipment will be used? Will any trees be removed along tributary streams (intermittent or perennial) to the Ashuelot River? Will there be any stream crossings?

Sincerely,

Kim Tuttle
Certified Wildlife Biologist
NH Fish and Game
Nongame and Endangered Species Program
603-271-6544

From: Gass, Jason [mailto:Jason.Gass@stantec.com]
Sent: Monday, December 16, 2013 1:34 PM
To: Tuttle, Kim
Subject: Further Correspondence: Dillant-Hopkins Airport, Keene

Ms. Tuttle,

After correspondence with Melissa Coppola of the NH Natural Heritage Bureau indicated four different endangered species (one federally-listed) within the vicinity of our project area at the Dillant-Hopkins Airport in Keene, it was recommended that the project information be forwarded to you for further review. I have attached a project narrative, project map (including tree clearing boundaries), and a .pdf of Ms. Coppola's determination. Thank you for your time and effort in this matter, and if you have any questions, please feel free to contact me with the information below.

Regards,


**Jason Gass**

***Aviation Planner***
***Stantec***
Phone: 207-887-3437
jason.gass@stantec.com


Design with community in mind

stantec.com

# Memo

NH Natural Heritage Bureau
NHB Datacheck Results Letter

**To:** Jason Gass, Stantec Consulting Services, Inc.
482 Payne Road
Scarborough, ME 04074

**From:** Melissa Coppola, NH Natural Heritage Bureau
**Date:** 12/13/2013 (valid for one year from this date)
**Re:** Review by NH Natural Heritage Bureau
NHB File ID: NHB13-3216 Town: Keene, Swanzey Location: Tax Maps: 37
Description: Clearing of vegetation obstructions to Runway 20 of the Dillant-Hopkins Airport in Swanzey, NH and Keene, NH.
**cc**: Kim Tuttle, Susi von Oettingen

As requested, I have searched our database for records of rare species and exemplary natural communities, with the following results.

**Comments: There is also a small bog in close proximity to the airport. Trees in the bog would never get tall enough to be an obstruction. Harvesting equipment should stay out of the bog area.**

| **Invertebrate Species** | **State[1]** | **Federal** | **Notes** |
|---|---|---|---|
| Dwarf Wedge Mussel (*Alasmidonta heterodon*) | E | E | Contact the NH Fish & Game Dept and the US Fish & Wildlife Service (see below). |

| **Natural Community** | **State[1]** | **Federal** | **Notes** |
|---|---|---|---|
| Silver maple - false nettle - sensitive fern floodplain forest | -- | -- | Threats are primarily changes to the hydrology of the river, land conversion and fragmentation, introduction of invasive species, and increased input of nutrients and pollutants. |

| **Vertebrate species** | **State[1]** | **Federal** | **Notes** |
|---|---|---|---|
| Grasshopper Sparrow (*Ammodramus savannarum*) | T | -- | Contact the NH Fish & Game Dept (see below). |
| Northern Leopard Frog (*Rana pipiens*) | SC | -- | Contact the NH Fish & Game Dept (see below). |
| Wood Turtle (*Glyptemys insculpta*) | SC | -- | Contact the NH Fish & Game Dept (see below). |

[1]Codes: "E" = Endangered, "T" = Threatened, "SC" = Special Concern, "--" = an exemplary natural community, or a rare species tracked by NH Natural Heritage that has not yet been added to the official state list. An asterisk (*) indicates that the most recent report for that occurrence was more than 20 years ago.

*Contact for all animal reviews: Kim Tuttle, NH F&G, (603) 271-6544. Contact for federally-listed species: Susi von Oettingen, US FWS, at (603) 223-2541.*

---

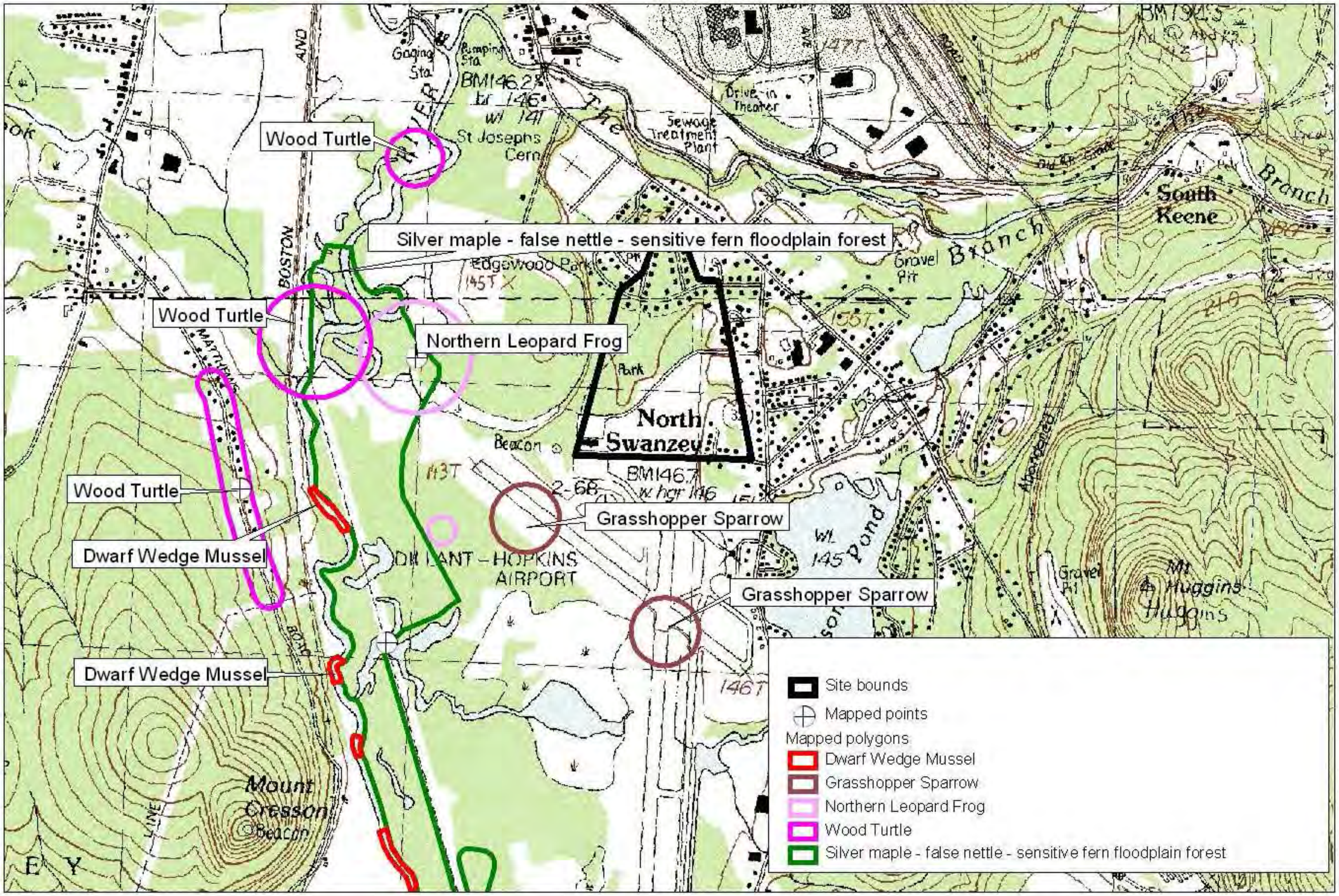
A negative result (no record in our database) does not mean that a sensitive species is not present. Our data can only tell you of known occurrences, based on information gathered by qualified biologists and reported to our office. However, many areas have never been surveyed, or have only been surveyed for certain species.  An on-site survey would provide better information on what species and communities are indeed present.

NHB13-3216

NH Natural Heritage Bureau

Known locations of rare species and exemplary natural communities

Note: Mapped locations are not always exact. Occurrences that are not in the vicinity of the project are not shown.




*Historical record

1:20000

Valid for one year from this date: 13 Dec 2013

# New Hampshire Natural Heritage Bureau - Animal Record

## Dwarf Wedge Mussel (*Alasmidonta heterodon*)

| **Legal Status** | | **Conservation Status** | |
|---|---|---|---|
| Federal: | Listed Endangered | Global: | Critically imperiled due to rarity or vulnerability |
| State: | Listed Endangered | State: | Critically imperiled due to rarity or vulnerability |

**Description at this Location**

Conservation Rank: Fair quality, condition and/or landscape context ('C' on a scale of A-D).

Comments on Rank:

Detailed Description: 2010: Ashuelot River - Cresson Bridge to Homestead Dam: Critical habitat throughout this stretch of river. 496 mussels collected and relocated. Relocation site 1: 17 animals relocated from vicinity of Thompson covered bridge. Relocation site 2: 166 animals relocated from pre-drawdown survey. Relocation site 3: 313 animals relocated from surveys conducted during drawdown.2003: Obs_id 2421: 1 adult male observed. Obs_id 2459: 14 seen, age and sex unknown. 2001: A total of 13 shells at six sites along a two-mile stretch of river. Upstream of this stretch, four sites in a 1.25-mile stretch downstream of the confluence of the Ashuelot and The Branch each had no *A. heterodon* found. Sites 5 - 8: one shell observed. Site 10: 5 shells and some juveniles observed. Site 11: four shells observed.

General Area: 2010: Ashuelot River - Cresson Bridge to Homestead Dam: High quality habitat throughout stretch of river. Mussels occurred on stable banks, often in less than 6 inches of water.2003: Freshwater - Stream or river (Obs_id 2421). 2001: Up- and down-stream of an effluent pipe for a wastewater treatment plant. Site 5: Very slow flow (less than 0.05 m/s), substrate of large boulders and sand. Canopy fairly dense, and the river is well shaded. Site 6: Flow fairly quick (0.2-0.4 m/s). River is 10-15 yards wide, 1-4 feet deep, with a substrate of large boulders, gravel, and sand. Heavy riparian canopy. Site 7: Slow flow (less than 0.10 m/s). River is 1-6 feet wide, with a substrate a mix of sand, gravel, and boulders. Receives a lot of sunlight, since riparian canopy minimal. Site 8: Very slow flow (less than 0.10 m/s). River is 20-25 yards wide and less than 3 feet deep except for deeper spots along the banks. Substrate is almost entirely sand with silt and clay on the margins and much woody debris (almost no stable substrate). Little riparian canopy. Site 10: Flow rate very slow (less than 0.10 m/s). River is 2-6 feet (up to 11 feet) deep. Substrate mostly sand and silt but becoming very rocky where the mussels were found. Woody debris common throughout. Site 11: Very slow flow (less than 0.10 m/s). River generally 2-6 feet deep, reaching 8-10 feet. Substrate rocky (boulders, cobble, sand) in mussel area.

General Comments: 2010: Mussel survey was coordinated with the removal of the Homestead Dam on the Ashuelot River, as well as repairs to the Thompson covered bridge. Prior to bridge repairs, all mussels found near the footprint of the construction work were relocated to Relocation site 1. Prior to dam removal, all mussels found upstream to Cresson Bridge were collected and relocated to Relocation site 2. During the impoundment drawdown following the dam removal, all mussels observed were collected and relocated to Relocation site 3.2003: Scuba search of 500 yard site (2.5 hrs. x 2 people)found one large (>40mm) male DWM. Tesselated darters abundant throughout. Also *A. undulata* (>50 live) and *S. undulatus* (20-50 live). Lat./long. by Terrain Navigator near mid-point of site (Obs_id 2421). Information taken from "Freshwater Mussels of the Ashuelot River -- Keene to Hinsdale, August 2003," written by Ethan Nadeau of Biodrawversity consulting firm. Report submitted to NHFG and USFWS (Obs_id 2459).

Management Comments: 2001: Diverse mussel communities at sites 10 and 11, 700 and 1500 yards downstream of the effluent pipe, respectively, suggest no lasting negative consequences from the wastewater effluent.

**Location**

Survey Site Name: Keene

Managed By: Dickinson Memorial Forest

| | | | |
|---|---|---|---|
| County: | Cheshire | USGS quad(s): | Keene (4207283) |
| Town(s): | Swanzey | Lat, Long: | 425245N, 0721853W |
| Size: | 61.8 acres | Elevation: | |

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 2010: Relocation sites 1 & 2: Upstream of Cresson Bridge. Relocation site 3: Downstream of Cresson Bridge.2003: Obs_id 2421: 30-60 meters upstream of the covered bridge at Swanzey Dam. (Swanzey Dam Site #16, Freshwater Mussels of the Ashuelot River -Keene to Hinsdale, August 2003) (Obs_id 2421). From NH Rte 10 in Swanzey, take Sawyers Crossing Road ca. 2 miles east to the covered bridge over the Ashuelot River. 2001: Site 5: canoe upstream ca. 1.6 miles to where powerlines border the river upstream of a bend. Site 6: ca. 900 yards downstream of site 5 and 1000 yards upstream from the wastewater treatment plant effluent pipe. Site 7: ca. 600 yards upstream of the effluent pipe, just downstream of a bend in the river. Site 8: ca. 100 yards upstream of the effluent pipe, along the western shore. Site 10: ca. 200-300 yards upstream of the covered bridge, on the western side of the river. Site 11: canoe downstream of the covered bridge ca. 700 yards to an area on the eastern side of the river downstream of a sharp bend with a steep, rocky bank.

**Dates documented**

| | | | |
|---|---|---|---|
| First reported: | 2001-08-08 | Last reported: | 2010-08-12 |

The U.S. Fish & Wildlife Service has jurisdiction over Federally listed species. Please contact them at 70 Commercial Street, Suite 300, Concord NH 03301 or at (603) 223-2541.

# New Hampshire Natural Heritage Bureau - Community Record

## Silver maple - false nettle - sensitive fern floodplain forest

| **Legal Status** | | **Conservation Status** | |
|---|---|---|---|
| Federal: | Not listed | Global: | Not ranked (need more information) |
| State: | Not listed | State: | Imperiled due to rarity or vulnerability |

**Description at this Location**

Conservation Rank: Excellent quality, condition and landscape context ('A' on a scale of A-D).
Comments on Rank:

Detailed Description: 1997: Extensive floodplain patches exist along this portion of the Ashuelot River, characterized by closed and open or patchy canopy closure of *Acer saccharinum* (silver maple) in the low floodplain, and silver maple, *Acer rubrum* (red maple), and *Prunus serotina (*black cherry) in the high terrace floodplain. The dbh of one silver maple was 62.6 inches. Patches of *Onoclea sensibilis* (sensitive fern), *Cinna latifolia* (drooping woodreed), *Boehmeria cylindrica* (false nettle), *Cinna arundinacea* (common woodreed), *Matteuccia struthiopteris* (ostrich fern), *Bidens frondosa* (common beggar-ticks), and scattered *Parthenocissus quinquefolia* (Virginia creeper) created a patchwork of dominant herbs and vines.

General Area: 1997: Highly variable microtopography along this stretch creates a variable natural community assemblage with slough channels, emergent marshes, flowing and still water, levees, high and low terraces, etc. Soils were predominantly fine sandy loams with loamy sands as well. Powerlines, open fields (old and newly cut) at edges, the airport, cutting of trees that had fallen across the river were the signs of human influence along this stretch, but they seem to have had little influence on the floodpla in dynamics. Edge species encroach slightly, but the interior floodplain seems to be in good condition, and free of major influence. On the western side of the river, the road may pose some disturbance, but perhaps not to the floodplain on the eastern side.

General Comments: This is one of the best large patch floodplains on a medium size river in New Hampshire.

Management Comments:

**Location**

Survey Site Name: South Ashuelot Confluence
Managed By:

| | | | |
|---|---|---|---|
| County: | Cheshire | USGS quad(s): | Keene (4207283) |
| Town(s): | Swanzey | Lat, Long: | 425400N, 0721653W |
| Size: | 273.6 acres | Elevation: | 460 feet |

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: From Rte. 9 in Keene take Rte. 32 south to Sawyer's Crossing. Park at covered bridge. Canoe upstream to confluence.

**Dates documented**

First reported: 1997-07-30 Last reported: 1997-07-30

# New Hampshire Natural Heritage Bureau - Animal Record

## Grasshopper Sparrow (*Ammodramus savannarum*)

| **Legal Status** | | **Conservation Status** | |
|---|---|---|---|
| Federal: | Not listed | Global: | Demonstrably widespread, abundant, and secure |
| State: | Listed Threatened | State: | Not ranked (need more information) |

**Description at this Location**

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 2004: 4 adult males, 2 adult females. How observed: heard, seen (Obs_id 2442). 2 adult males. How observed: heard, seen (Obs_id 2441). 2 adult males. How observed: heard, seen (Obs_id 2440). 3 adult males, 1 adult female. How observed: heard, seen (Obs_id 2443). 2003: 2 adult males, 1 adult unkown (Obs_id 764).
General Area: 2004: Terrestrial - Grassland / Field (Obs_id 2442).
General Comments: 2004: one female observed carrying food on July 16, suggesting young were nearby (Obs_id 2442).
Management Comments:

**Location**

Survey Site Name: Dillant-Hopkins Airport
Managed By:

| | | | |
|---|---|---|---|
| County: | Cheshire | USGS quad(s): | Keene (4207283) |
| Town(s): | Swanzey | Lat, Long: | 425309N, 0721615W |
| Size: | 49.3 acres | Elevation: | |

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 2004: Dillant-Hopkins Airport: south end of main runway (Obs_id 2442, 764). Runway intersection area (Obs_id 2441). Northwest end (Obs_id 2440). Extreme southern end of property (Obs_id 2443).

**Dates documented**

| | | | |
|---|---|---|---|
| First reported: | 2003-06-06 | Last reported: | 2004-07-16 |

The New Hampshire Fish & Game Department has jurisdiction over rare wildlife in New Hampshire. Please contact them at 11 Hazen Drive, Concord, NH 03301 or at (603) 271-2461.

# New Hampshire Natural Heritage Bureau - Animal Record

## Northern Leopard Frog (*Rana pipiens*)

| **Legal Status** | | **Conservation Status** | |
|---|---|---|---|
| Federal: | Not listed | Global: | Demonstrably widespread, abundant, and secure |
| State: | SC | State: | Rare or uncommon |

**Description at this Location**

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 2009: Area 12393: 1 observed.2008: Area 11539: Adult males heard. Too many to count.
General Area: 2008: Area 11539: Area they were calling from is described as shrub - wetland and flooded forests. Also a wet meadow nearby.
General Comments:
Management Comments:

**Location**

Survey Site Name: South Ashuelot Confluence
Managed By:

| | | | |
|---|---|---|---|
| County: | Cheshire | USGS quad(s): | Keene (4207283) |
| Town(s): | Swanzey | Lat, Long: | 425433N, 0721649W |
| Size: | 32.8 acres | Elevation: | |

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 2009: Area 12393: (W 72 16 18.102 / N 42 47 50.226).2008: Area 11539: Swanzey. Northern end of Airport Road between 90 degree turn in road and Ashuelot River.

**Dates documented**

First reported: 2008-04-19 Last reported: 2009-04-17

The New Hampshire Fish & Game Department has jurisdiction over rare wildlife in New Hampshire. Please contact them at 11 Hazen Drive, Concord, NH 03301 or at (603) 271-2461.

# New Hampshire Natural Heritage Bureau - Animal Record

## Wood Turtle (*Glyptemys insculpta*)

| **Legal Status** | | **Conservation Status** | |
|---|---|---|---|
| Federal: | Not listed | Global: | Apparently secure but with cause for concern |
| State: | SC | State: | Rare or uncommon |

**Description at this Location**

Conservation Rank: Not ranked
Comments on Rank:

Detailed Description: 2009: Area 12314: 1 female observed, about 8-9" long and 6-7" wide. Area 12375: 1 observed. Area 12394: 1 observed, estimated 6 years old.2002: Area 12215: 1 male observed.
General Area: 2009: Area 12314: Field. Area 12375: Bank of Ashuelot River. Area 12394: Roadside.
General Comments:
Management Comments:

**Location**

Survey Site Name: Mount Cresson
Managed By: Yale-Toumey Forest

| | | | |
|---|---|---|---|
| County: | Cheshire | USGS quad(s): | Keene (4207283) |
| Town(s): | Swanzey | Lat, Long: | |
| Size: | 61.8 acres | Elevation: | |

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 2009: Area 12314: Near 139 Matthews Road, Swanzey. Area 12375: In Ashuelot near Keene - Swanzey town line. Area 12394: Rte. 32, just east of bridge over Ashuelot (42.87664 / 72.27605. WGS 84).2002: Area 12215: Cross-country trail behind Keene State College athletic fields, Krif Road.

**Dates documented**

| | | | |
|---|---|---|---|
| First reported: | 2002-08-17 | Last reported: | 2009-08-05 |

The New Hampshire Fish & Game Department has jurisdiction over rare wildlife in New Hampshire. Please contact them at 11 Hazen Drive, Concord, NH 03301 or at (603) 271-2461.

Please mail the completed form and required material to:

New Hampshire Division of Historical Resources
State Historic Preservation Office
Attention: Review & Compliance
19 Pillsbury Street, Concord, NH 03301-3570

RECEIVED
NOV 26 2013

| DHR Use Only | |
|---|---|
| R&C # | 5271 |
| Log In Date | 11 / 26 / 13 |
| Response Date | 12 / 2 / 13 |
| Sent Date | 12 / 2 / 13 |

# Request for Project Review by the New Hampshire Division of Historical Resources

☒ This is a new submittal
☐ This is additional information relating to DHR Review & Compliance (R&C) #:

## GENERAL PROJECT INFORMATION

Project Title Vegetative Obstruction Removal and Easement Acquisition

Project Location Dillant-Hopkins Airport

City/Town Keene/Swanzey, NH Tax Map Keene: 40, 41, 146 Swanzey: 37 Lot # K40: 19, 74, 78, 59...K41: 8, 9, 11, 13-21, 50-58, 62-65, 69-70...K146: 1-3, 8, 14-15...S37: 38, 47-57

NH State Plane - Feet Geographic Coordinates: Easting 822982~~82~~ Northing 149902~~30~~
*(See RPR Instructions and R&C FAQs for guidance.)*

Lead Federal Agency and Contact *(if applicable)*
*(Agency providing funds, licenses, or permits)*
Permit Type and Permit or Job Reference #

State Agency and Contact *(if applicable)*

Permit Type and Permit or Job Reference #

## APPLICANT INFORMATION

Applicant Name Dillant-Hopkins Airport

Mailing Address 80 Airport Road Phone Number 6033579835

City Keene State NH Zip 03431 Email

## CONTACT PERSON TO RECEIVE RESPONSE

Name/Company Jason Gass/Stantec

Mailing Address 482 Payne Road Phone Number 2078873437

City Scarborough State ME Zip 04074 Email jason.gass@stantec.com

*This form is updated periodically. Please download the current form at* www.nh.gov/nhdhr/review. *Please refer to the Request for Project Review Instructions for direction on completing this form.* Submit one copy of this project review form for each project for which review is requested. Include a self-addressed stamped envelope to expedite review response. Project submissions will not be accepted via facsimile or e-mail. This form is required. Review request form must be complete for review to begin. Incomplete forms will be sent back to the applicant without comment. Please be aware that this form may only initiate consultation. For some projects, additional information will be needed to complete the Section 106 review. All items and supporting documentation submitted with a review request, including photographs and publications, will be retained by the DHR as part of its review records. Items to be kept confidential should be clearly identified. For questions regarding the DHR review process and the DHR's role in it, please visit our website at: www.nh.gov/nhdhr/review or contact the R&C Specialist at christina.st.louis@dcr.nh.gov or 603.271.3558.

**PROJECTS CANNOT BE PROCESSED WITHOUT THIS INFORMATION**

*Project Boundaries and Description*

- ☒ Attach the relevant portion of a 7.5' USGS Map (photocopied or computer-generated) ***indicating the defined project boundary.*** *(See RPR Instructions and R&C FAQs for guidance.)*
- ☒ Attach a detailed narrative description of the proposed project.
- ☒ Attach a site plan. The site plan should include the project boundaries and areas of proposed excavation.
- ☒ Attach photos of the project area (overview of project location and area adjacent to project location, and specific areas of proposed impacts and disturbances.) *(Informative photo captions are requested.)*
- ☒ A DHR file review must be conducted to identify properties within or adjacent to the project area.
  Provide file review results in **Table 1** or within project narrative description. *(Blank table forms are available on the DHR website.)*
  File review conducted on 11/06/2013.

*Architecture*

Are there any buildings, structures (bridges, walls, culverts, etc.) objects, districts or landscapes within the project area? ☒ Yes ☐ No
If no, skip to Archaeology section. If yes, submit all of the following information:

Approximate age(s): 30 years

- ☒ Photographs of ***each*** resource or streetscape located within the project area, with captions, along with a photo key. (Digital photographs are accepted. All photographs must be clear, crisp and focused.)
- ☐ If the project involves rehabilitation, demolition, additions, or alterations to existing buildings or structures, provide additional photographs showing detailed project work locations. (i.e. Detail photo of windows if window replacement is proposed.)

*Archaeology*

Does the proposed undertaking involve ground-disturbing activity? ☐ Yes ☒ No
If yes, submit all of the following information:

- ☐ Description of current and previous land use and disturbances.
- ☐ Available information concerning known or suspected archaeological resources within the project area (such as cellar holes, wells, foundations, dams, etc.)

**Please note that for many projects an architectural and/or archaeological survey or other additional information may be needed to complete the Section 106 process.**

**DHR Comment/Finding Recommendation** *This Space for Division of Historical Resources Use Only*

☐ Insufficient information to initiate review ☐ Additional information is needed in order to complete review

☑ No Potential to cause Effects ☐ No Historic Properties Affected ☐ No Adverse Effect ☐ Adverse Effect

Comments: As long as no ground disturbance

*If plans change or resources are discovered in the course of this project, you must contact the Division of Historical Resources as required by federal law and regulation.*

Authorized Signature: Richard Boisvert DSHPO Date: 12-2-13

# Appendix E

## E.1 WETLAND DELINEATION REPORT AND FUNCTIONS AND VALUES ASSESSMENT DILLANT HOPKINS AIRPORT, SWANZEY, NH

**Stantec Consulting Services Inc.**
30 Park Drive
Topsham ME 04086
Tel: (207) 729-1199
Fax: (207) 729-2715

February 14, 2014
195210676

Leigh Bartlett
Stantec Consulting
482 Payne Road
Scarborough, ME 04074

**Subject: Wetland Delineation and Function-Value Assessment Report**
**Dillant Hopkins Airport, Swanzey, New Hampshire**

Dear Leigh,

As requested, on September 18, 2013, Stantec Consulting (Stantec) completed wetland delineations at the Dillant Hopkins Airport in Swanzey, New Hampshire. Wetland boundaries were determined using the technical criteria established by the U.S. Army Corps of Engineers (Corps) in the *Corps of Engineers Wetlands Delineation Manual*[1] and in the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region*[2] as required by the New Hampshire Department of Environmental Service (NHDES) and the Town of Swanzey. Wetland boundaries were marked with pink numbered flagging and were located using a Trimble® Global Positioning System (GPS) Pro Series Receiver. Photographs and copies of the original field notes are available upon request.

Stantec also assessed the ability of the wetlands withinthe project site to provide certain functions and values. Wetland functions and values were assessed using the *Highway Methodology Workbook, Wetland Functions and Values: A Descriptive Approach*.[3] This method bases function and value determinations on the presence or absence of specific criteria for each of the 13 wetland functions and values (see definitions below). These criteria are assessed through direct field observations and a review of existing resource maps and public databases. As part of the evaluation, the most important functions and values associated with the on-site wetlands are identified. In addition, the ecological integrity of the wetlands is evaluated based on the existing levels of disturbance and the overall significance of the wetlands within the local watershed.

- ***Groundwater Interchange (Recharge/Discharge)*** – This function considers the potential for the project area wetlands to serve as groundwater recharge and/or discharge areas. It refers to the fundamental interaction between wetlands and aquifers, regardless of the size or importance of either.

---

[1] Environmental Laboratory. 1987. *Corps of Engineers Wetlands Delineation Manual.* Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station. Vicksburg, MS.
[2] U.S. Army Corps of Engineers. 2012. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0)*, ed. J. S. Wakeley, R. W. Lichvar, and C. V. Noble. ERDC/EL TR-12-1. Vicksburg, MS: U.S. Army Engineer Research and Development Center.
[3] U.S. Army Corps of Engineers. 1999. *The Highway Methodology Workbook Supplement, Wetland Functions and Values: A Descriptive Approach.* U.S. Army Corps of Engineers. New England Division. 32pp. NAEEP-360-1-30a.

- ***Floodwater Alteration (Storage and Desynchronization)*** – This function considers the effectiveness of the wetlands in reducing flood damage by attenuating floodwaters for prolonged periods following precipitation and snow melt events.
- ***Fish and Shellfish Habitat*** – This function considers the effectiveness of seasonally or permanently flooded areas within the subject wetlands for their ability to provide fish and shellfish habitat.
- ***Sediment/Toxicant Retention*** – This function reduces or prevents degradation of water quality. It relates to the effectiveness of the wetland to function as a trap for sediments, toxicants, or pathogens, and is generally related to factors such as the type of soils, the density of vegetation, and the position in the landscape.
- ***Nutrient Removal/Retention/Transformation*** – This wetland function relates to the effectiveness of the wetland to prevent or reduce the adverse effects of excess nutrients entering aquifers or surface waters such as ponds, lakes, streams, rivers, or estuaries.
- ***Production Export (Nutrient)*** – This function relates to the effectiveness of the wetland to produce food or usable products for humans or other living organisms.
- ***Sediment/Shoreline Stabilization*** – This function considers the effectiveness of a wetland to stabilize stream banks and shorelines against erosion, primarily through the presence of persistent, well-rooted vegetation.
- ***Wildlife Habitat*** – This function considers the effectiveness of the wetland to provide habitat for various types and populations of animals typically associated with wetlands and the wetland edge. Both resident and/or migrating species must be considered.
- ***Recreation (Consumptive and Non-Consumptive)*** – This value considers the suitability of the wetland and associated watercourses to provide recreational opportunities such as hiking, canoeing, boating, fishing, hunting, and other active or passive recreational activities.
- ***Educational/Scientific Value*** – This value considers the effectiveness of the wetland as a site for an “outdoor classroom” or as a location for scientific study or research.
- ***Uniqueness/Heritage*** – This value relates to the effectiveness of the wetland or its associated water bodies to provide certain special values such as archaeological sites, unusual aesthetic quality, historical events, or unique plants, animals, or geologic features.
- ***Visual Quality/Aesthetics*** – This value relates to the visual and aesthetic qualities of the wetland.
- ***Endangered Species Habitat*** – This value considers the suitability of the wetland to support threatened or endangered species.

## OVERALL SITE DESCRIPTION

The project area is approximately 25 acres in size and is located along the northern property boundary of the Dillant Hopkins Airport, in Swanzey, New Hampshire. This area is open to the public with walking trails observed throughout. The survey extents consist of one undeveloped area north of the airport bordered by the airport to the south, an unnamed tributary to the Ashuelot River to the west, and residential areas to the north and east. The upland forested area consists of relatively flat topography with large white pine (*Pinus strobus*) eastern hemlock (*Tsuga Canadensis*) and red spruce (*Picea rubens*) trees.

According to the U.S. Department of Agriculture *Soil Survey of Cheshire County, New Hampshire*,[4] there are two soil types mapped within the survey area. The upland areas consist of Caesar loamy sand, an excessively drained alluvial soil. Two of the three wetlands located in the survey area occur in areas with soils mapped as Greenwood mucky peat, a very deep, and very poorly drained organic soil.

## WETLAND DELINEATION RESULTS

Stantec identified three wetlands within the defined delineation area. These wetlands are shown on Figure 5-1 and are further described below.

### WETLAND 1

Wetland 1 is a palustrine forested (PFO)[5] and palustrine scrub-shrub (PSS) wetland, with the PFO present along the fringe of the eastern and western boundaries of the wetland. The interior of this wetland can be described as a dwarf shrub bog.[6] The wetland boundary follows a distinct break in topography on all sides. Along the eastern edge of the wetland a culvert that drains into the wetland, from an area located off-site. On the southern boundary of the wetland, Stantec observed a hydrologic connection to Wetland 2. At the time of the site visit, Wetland 1 contained standing water along the wetland/upland boundaries and all soils within the wetland were saturated to the surface. The soil is characterized by a deep organic horizon with 36+ inches of mucky peat. Free water was observed starting at 2 inches in the soil test pit. The forested portion of the wetland is dominated by larch (*Larix laricina*), black spruce (*Picea mariana*), and red maple (*Acer rubrum*), with highbush blueberry (*Vaccinium corymbosum*) dominating the outer shrub layer. There is an area on the eastern side of the wetland that is being overgrown with Asian bittersweet (*Celastrus orbiculatus*), a highly aggressive invasive vine. The interior of the wetland is dominated by shrubs and emergent vegetation. Black spruce, leatherleaf (*Chamaedaphne calyculata*), sheep-laurel (*Kalmia angustifolia*), common winterberry (*Ilex verticillata*) and bog-rosemary (*Andromeda polifolia*) dominate the interior wetland shrub layer. The herbaceous layer contains bog-rosemary, three seed sedge (*Carex trisperma*) purple pitcherplant (*Sarracenia purpurea*), and small cranberry (*Vaccinium oxycoccos)*. The ground surface in the interior of this wetland is also covered by peat moss (*Sphagnum* sp).

### WETLAND 2

Wetland 2 is a palustrine emergent (PEM) wetland that receives hydrologic inputs from Wetland 1 and continues as a depression near Airport Road. There is currently very little vegetation in the wetland and at the time of the survey, 2 inches of standing water was observed with some evidence of flow. The wetland likely was holding water due to the recent heavy rain in the days prior to the survey. The vegetation at the forested edge of the wetland includes white pine, red maple and gray birch (*Betula populifolia*) in the tree layer, with highbush blueberry in the shrub layer and arching dewberry (*Rubus recurvicaulis*) and a manna

[4] Web Soil Survey, Natural Resources Conservation Service, United States Department of Agriculture. Available at: http://websoilsurvey.nrcs.usda.gov/ [accessed December 2012].
[5] Wetland classifications per: Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. FWS/OBS-79/31, U.S. Fish and Wildlife Service, Office of Biological Services, Washington, D.C.
[6] Gawler, S., and Cutko, A. 2010. *Natural Landscapes of Maine: A Guide to Natural Communities and Ecosystems.* Maine Natural Areas Program, Maine Department of Conservation, Augusta, Maine.

grass species (*Glyceria* sp.) occurring sparsely as herbs in the wetland. The soils in this wetland are characterized by a dark surface occurring as 12 inches of sand masked with organic materials.

### WETLAND 3

Wetland 3 is classified as a palustrine scrub-shrub (PSS) wetland that follows a distinct break in topography, similar to Wetland 1. This isolated wetland is dominated by a variety of tall shrubs and dead standing trees and can be considered a tall shrub swamp, with deep organic soils and inundation or saturation present throughout the growing season. The soils in this wetland are characterized by having over 36" of organic material. There is a small ditch on the northwest side of the wetland that continues as an ephemeral drainage that crosses a foot trail and ends before reaching the unnamed tributary to the west. The dominant shrubs in this wetland are highbush blueberry and winterberry. A few red maple trees occur on the western edge of the wetland. Cinnamon fern (*Osmundastrum cinnamomeum*) dominates the herbaceous layer along the wetland edge. Thick shrubs and deep organic soils made access to the interior of the wetland difficult. Other shrubs observed in the wetland include, catberry (*Nemopanthus mucronatus*), possumhaw (*Viburnum nudum*), and maleberry (*Lyonia ligustrina*).

## FUNCTIONS AND VALUES ASSESSMENT

The ability of the project area wetlands to provide the listed functions and values is described in detail below. Table 1 at the end of this section summarizes the results of the assessment.

### GROUNDWATER INTERCHANGE (RECHARGE/DISCHARGE)

There are no identified aquifers underlying the project area. Both wetlands receive water from surface water inputs, and no groundwater discharge was observed during the site visit. Large watercourses are present farther west of the wetlands, which may provide this function, but it is unlikely that significant groundwater recharge/discharge is occurring within the identified wetlands. Therefore, Wetlands 1, 2, and 3 do not provide this function.

### FLOODWATER ALTERATION (STORAGE AND DESYNCHRONIZATION)

All 3 wetlands are located upslope from Airport Road and adjacent to the airport runways which are large impervious areas. Wetland 1 has a direct input of stormwater through a culvert from a residential area nearby. Wetlands 1 and 3 are distinct depressions in the landscape with poorly drained soils. They likely retain stormwater and prevent it from flowing downslope to the road and adjacent airport. Wetland 2 has limited storage capacity but it does receive overflow from Wetland 1. Floodwater alternation would be considered a principal function of Wetlands 1 and 3, and a non-principal function of Wetland 2.

### FISH AND SHELLFISH HABITAT

None of the wetlands in the project area are associated with a waterbody or watercourse and therefore do not provide this function.

**Reference: Wetland Delineation Report and Function and Value Assessment, Dillant Hopkins Airport, Swanzey, New Hampshire**

## SEDIMENT/TOXICANT RETENTION

Wetland 1 receives direct runoff through a culvert from surrounding residential areas that has potential to carry sediments (e.g., sand/salt) and toxicants (e.g., gasoline and oils). Considering the proximity of all 3 wetlands to the surrounding residential areas to the north and east they all likely receive inputs from runoff. Wetlands 1 and 3 contain dense vegetation and deep organic soils that have the ability to trap sediments; therefore, this would be considered a principal function of these wetlands. Wetland 2 has limited vegetation and sandy soils therefore this would not be a function of this wetland.

## NUTRIENT REMOVAL/RETENTION/TRANSFORMATION

Similar to sediment/toxicant retention, all 3 wetlands on-site receive nutrient inputs from the surrounding residential development. Wetlands 1 and 3 contain dense vegetation and areas of standing water with high storage capacity, both wetlands are likely saturated for most of the growing season. Wetland 2 is not densely vegetated, and its sandy soils are not characteristic of a wetland with this function. This would be considered a principal function of Wetlands 1 and 3, and not a function of Wetland 2.

## PRODUCTION EXPORT (NUTRIENT)

Wetlands 1 and 3 likely contain significant food source for wildlife, with a high diversity of flowering plants that provide food for birds, small mammals, and nectar-gathering insects. The abundance of shrubs with beneficial fruit, specifically winterberry and highbush blueberry, are a significant source of food for birds and mammals. These 2 wetlands have high vegetative diversity, yet they lack an abundance of economically or commercially used products. Therefore, both Wetlands 1 and 3 provide production export as a principal function, while Wetland 2 does not provide this function.

## SEDIMENT/SHORELINE STABILIZATION

Wetlands 1, 2, and 3 do not provide this function as they are not associated with a watercourse or waterbody.

## WILDLIFE HABITAT

Wetlands 1 and 3 likely provide wildlife habitat to a variety of songbirds and small mammals, along with amphibians and potentially reptiles. Based on the timing of the survey, Stantec did not observe any of these species during the site visit. However, based on the density and diversity of the plant community, and the presence of diverse habitat types including forested wetland, peat bog, and scrub-shrub wetland, the wetlands likely provide habitat for these species. Signs of woodpeckers, specifically pileated woodpeckers (*Dryocopus pileatus*) were observed in the survey area. The dead standing trees in Wetland 3 would serve as good habitat for a variety of woodpeckers and other insect-eating birds. Wetlands 1 and 3 provide habitat and potential breeding areas for amphibians; however, this could not be observed due to the time of year of the site visit. A visit in the spring during amphibian breeding season would be necessary to determine this function. All 3 wetlands' adjacency to mature forested uplands also provide good habitat for white tailed deer (*Odocoileus virginianus*). Some browsing of plants in and near each wetland indicated the presence of the species in the area. The presence of Asian bittersweet in Wetland 1 does not affect this function but could affect this function in the future if it is not managed. Due to these factors, it was determined that

**Reference: Wetland Delineation Report and Function and Value Assessment, Dillant Hopkins Airport, Swanzey, New Hampshire**

wildlife habitat would be considered a principal function of both Wetlands 1 and 3, and not a function for Wetland 2.

### RECREATION (CONSUMPTIVE AND NON-CONSUMPTIVE)

All 3 wetlands are located in an undeveloped area open to the public. There are walking trails throughout the area that allow visitors to observe the wetlands as well as the surrounding mature upland forest. The wildlife habitat could provide for good bird watching as well as other wildlife observations. Wetlands 1 and 3 provide this function, however they are not considered a principal value. This is not a value of Wetland 2.

### EDUCATION/SCIENTIFIC VALUE

All 3 wetlands are located on accessible public land. The unique habitat and plant diversity of Wetlands 1 and 3 existing in a well-developed landscape, are of educational value due to the accessibility of the wetlands by the general public. Antioch University in nearby Keene, NH uses Wetland 1 as an educational tool and brings graduate students to the wetland to study the plant community and the wetland's different stages of succession. Educational and scientific value would be considered a principal value of Wetlands 1 and 3 and not a value for Wetland 2.

### UNIQUENESS/HERITAGE

Wetlands 1 and 3 are unique habitats occurring in a developed part of the state. The unique and diverse habitat of Wetland 1 is threatened by a community of Asian bittersweet currently taking over the eastern edge of the wetland. If the Asian bittersweet establishes itself here, it will reduce the quality and uniqueness of this wetland and surrounding upland. To our knowledge, the New Hampshire Department of Historical Resources has not been contacted regarding this project. The uniqueness of Wetland 1 should be considered a principal value, while Wetland 3 has this value but it would not be considered to be principal. Wetland 2 does not provide this value.

### VISUAL QUALITY/AESTHETICS

The survey site is very accessible to the public, Wetlands 1 and 3 can be observed from the walking paths throughout the area but the interior of these wetlands is hard to access considering the deep organic soils and seasonal inundation. Visual quality is a value for Wetlands 1 and 3, but not a principal value. The presence of Asian bittersweet could affect the visual quality of Wetland 1 in the future. Visual quality is not a value for Wetland 2.

### ENDANGERED SPECIES HABITAT

To our knowledge, the New Hampshire Natural Heritage Bureau has not been contacted regarding this project; therefore, it is unknown if there are records of threatened or endangered species utilizing habitat in the vicinity of this project site. Some of the wetland areas identified contain unique habitat associated with threatened or endangered species; therefore, the wetlands may provide this value, but it is unknown at this time.

**Reference: Wetland Delineation Report and Function and Value Assessment, Dillant Hopkins Airport, Swanzey, New Hampshire**

## Table 1: Summary of Wetland Functions and Values Provided by the Project Area Wetlands

| Function/Value | Wetland 1 | Wetland 2 | Wetland 3 |
|---|---|---|---|
| Groundwater Recharge/Discharge | -- | -- | -- |
| Floodwater Alteration | P | x | P |
| Fish and Shellfish Habitat | -- | -- | -- |
| Sediment/Toxicant Retention | P | -- | P |
| Nutrient Removal | P | -- | P |
| Production Export | P | -- | P |
| Sediment/Shoreline Stabilization | -- | -- | -- |
| Wildlife Habitat | P | -- | P |
| Recreation | x | -- | x |
| Education/Scientific Value | P | -- | P |
| Uniqueness/Heritage | P | -- | x |
| Visual Quality/Aesthetics | x | -- | x |
| Endangered Species Habitat | unk | unk | unk |

P = Principal Function/Value
x = Function Value Provided, not Principal
unk = Unknown at this time

### FUNCTIONS AND VALUES ASSESSMENT CONCLUSION

Based on Stantec's functions and values assessment, Wetlands 1 and 3 are both highly functioning wetlands, with Wetland 1 providing 7 principal functions and values and Wetland 3 providing 6 principal functions and values. Wetland 2 is a low functioning wetland and provides only 1 function or value.

### PROJECT IMPACTS

There are no proposed impacts to the 3 wetlands located within the survey area. All cutting of trees is planned to occur outside of the wetland boundaries. However, Stantec recommends that best management practices be used when cutting near wetlands to prevent erosion and sedimentation into the adjacent wetlands.

### STATE AND FEDERAL WETLAND REGULATIONS

The NHDES and the Corps regulate the wetlands identified within the survey area. NHDES permits are required to dredge, fill, or construct a structure in a wetland, surface water or adjacent to a municipally designated prime wetland. None of the wetlands within the survey area are designated as prime wetlands. As previously stated, there are no proposed impacts to the wetlands at this time.

**Reference: Wetland Delineation Report and Function and Value Assessment, Dillant Hopkins Airport, Swanzey, New Hampshire**

## LOCAL REGULATIONS

The wetlands identified on the project site are under the jurisdiction of the Town of Swanzey (Town), as part of the Swanzey Wetlands Conservation District, per Section VII of the 2013 Zoning Ordinance. Because no impacts to the wetlands are proposed as part of this project, permits from the Town are not expected to be required under this section of the Zoning Ordinance. Stantec recommends further consultation with the Town's Planning Board and/or Code Enforcement Officer to determine the specific permitting requirements for the proposed project.

Regards,

Katelin Nickerson
Project Scientist

Reviewed By:

Bryan Emerson
CWS # 276

# Appendix F

## F.1 ANSI A300 AMERICAN NATIONAL STANDARD FOR TREE CARE OPERATIONS-TREES, SHRUBS, AND OTHER WOODY PLANT MAINTENANCE-STANDARD PRACTICES

# Contents



# Forward

(This foreword is not part of American National Standard A300 Part 1-2001.)

An industry-consensus standard must have the input of the industry that it is intended to affect. The Accredited Standards Committee A300 was approved June 28, 1991. The committee includes representatives from the residential and commercial tree care industry, the utility, municipal, and federal sectors, the landscape and nursery industries, and other interested organizations. Representatives from varied geographic areas with broad knowledge and technical expertise contributed.

The A300 standard can be best placed in proper context if one reads its Scope, Purpose, and Application. This document presents performance standards for the care and maintenance of trees, shrubs, and other woody plants. It is intended as a guide in the drafting of maintenance specifications for federal, state, municipal, and private authorities including property owners, property managers, and utilities.

The A300 standard stipulates that specifications for tree work should be written and administered by a professional possessing the technical competence to provide for, or supervise, the management of woody landscape plants. Users of this standard must first interpret its wording, then apply their knowledge of growth habits of certain plant species in a given environment. In this manner, the user ultimately develops their own specifications for plant maintenance.

ANSI A300 Part 1 – Pruning, should be used in conjunction with the rest of the A300 standard when writing specifications for tree care operations.

Suggestions for improvement of this standard should be forwarded to: NAA300 Secretary, c/o National Arborist Association, 3 Perimeter Rd. - Unit 1, Manchester, NH 03103, USA or Email: naa@natlarb.com.

This standard was processed and approved for submittal to ANSI by Accredited Standards Committee on Tree, Shrub, and Other Woody Plant Maintenance Operations – Standard Practices, A300. Committee approval of the standard does not necessarily imply that all committee members voted for its approval. At the time it approved this standard, the A300 committee had the following members:

Tim Johnson, Chair (Artistic Arborist, Inc.)
Bob Rouse, Secretary (National Arborist Association, Inc.)

| Organizations Represented | Name of Representative |
|---|---|
| American Forests | Staff (Observer) |
| American Nursery and Landscape Association | Craig J. Regelbrugge |
| American Society of Consulting Arborists | Andrew Graham |
| | Donald Blair (Adviser) |
| | Beth Palys (Adviser) |
| American Society of Landscape Architects | Ron Leighton |
| Asplundh Tree Expert Company | Geoff Kempter |
| Associated Landscape Contractors of America | Preston Leyshon |
| | Jeff Bourne (Alt.) |
| The Davey Tree Expert Company | Joseph Tommasi |
| | Dick Jones (Alt.) |
| | Richard Rathjens (Adviser) |
| The F.A. Bartlett Tree Expert Company | Peter Becker |
| | Dr. Thomas Smiley (Alt.) |
| International Society of Arboriculture | Ed Brennan |
| | Sharon Lilly (Alt.) |
| National Arborist Association | Ronald Rubin |
| Tom Mugridge (Alt.) National Park Service | Robert DeFeo |
| Professional Grounds Management Society | Kevin O'Donnell |
| Society of Municipal Arborists | Andrew Hillman |
| U.S. Forest Service | Ed |
| Macie_ | Mike Galvin (Alt.) |
| | Philip D. Rodbell (Alt.) |
| Utility Arborist Association | Jeffery Smith |
| | Matt Simons (Alt.) |

## American National Standard for Tree Care Operations –

# Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices

# (*Pruning*)

## 1 ANSI A300 standards

### 1.1 Scope
ANSI A300 standards present performance standards for the care and maintenance of trees, shrubs, and other woody plants.

### 1.2 Purpose
ANSI A300 standards are intended as guides for federal, state, municipal and private authorities including property owners, property managers, and utilities in the drafting of their maintenance specifications.

### 1.3 Application
ANSI A300 standards shall apply to any person or entity engaged in the business, trade, or performance of repairing, maintaining, or preserving trees, shrubs, or other woody plants.

### 1.4 Implementation
Specifications for tree maintenance should be written and administered by an arborist.

## 2 Part 1 – Pruning standards

### 2.1 Purpose
The purpose of this document is to provide standards for developing specifications for tree pruning.

### 2.2 Reasons for pruning
The reasons for tree pruning may include, but are not limited to, reducing risk, maintaining or improving tree health and structure, improving aesthetics, or satisfying a specific need. Pruning practices for agricultural, horticultural production, or silvicultural purposes are exempt from this standard.

### 2.3 Safety

**2.3.1** Tree maintenance shall be performed only by arborists or arborist trainees who, through related training or on-the-job experience, or both, are familiar with the practices and hazards of arboriculture and the equipment used in such operations.

**2.3.2** This standard shall not take precedence over arboricultural safe work practices.

**2.3.3** Operations shall comply with applicable Occupational Safety and Health Administration (OSHA) standards, ANSI Z133.1, as well as state and local regulations.

# 3 Normative references

The following standards contain provisions, which, through reference in the text, constitute provisions of this American National Standard. All standards are subject to revision, and parties to agreements based on this American National Standard shall apply the most recent edition of the standards indicated below.

• ANSI Z60.1, Nursery stock
• ANSI Z133.1, Tree care operations - Pruning, trimming, repairing, maintaining, and removing trees, and cutting brush - Safety requirements
• 29 CFR 1910, General industry 1)
• 29 CFR 1910.268, Telecommunications 1)
• 29 CFR 1910.269, Electric power generation, transmission, and distribution 1)
• 29 CFR 1910.331 - 335, Electrical safety-related work practices 1)

# 4 Definitions

4.1 **anvil-type pruning tool:** A pruning tool that
has a sharp straight blade that cuts against a flat metal cutting surface, in contrast to a hook-and-bladetype pruning tool (4.21).

4.2 **apical dominance:** Inhibition of growth of lateral buds by the terminal bud.

4.3 **arboriculture:** The art, science, technology, and business of commercial, public, and utility tree care.

4.4 **arborist:** An individual engaged in the profession of arboriculture who, through experience, education, and related training, possesses the competence to provide for or supervise the management of trees and other woody plants.

4.5 **arborist trainee:** An individual undergoing on-the-job training to obtain the experience and the competence required to provide for or supervise the management of trees and other woody plants. Such trainees shall be under the direct supervision of an arborist.

4.6 **branch bark ridge:** The raised area of bark in the branch crotch that marks where the branch and parent meet.

4.7 **branch collar:** The swollen area at the base of a branch.

4.8 **callus:** Undifferentiated tissue formed by the cambium around a wound.

4.9 **cambium:** The dividing layer of cells that forms sapwood (xylem) to the inside and inner bark (phloem) to the outside.

4.10 **cleaning:** Selective pruning to remove one or more of the following parts: dead, diseased, and/ or broken branches (5.6.1).

4.11 **climbing spurs:** Sharp, pointed devices affixed to a climber's boot used to assist in climbing trees. (syn.: gaffs, hooks, spurs, spikes, climbers)

4.12 **closure:** The process of woundwood covering a cut or other tree injury.

4.13 **crown:** The leaves and branches of a tree measured from the lowest branch on the trunk to the top of the tree.

4.14 **decay:** The degradation of woody tissue caused by microorganisms.

4.15 **espalier:** The combination of pruning, supporting, and training branches to orient a plant in one plane (5.7.2).

4.16 **establishment:** The point after planting when a tree's root system has grown sufficiently into the surrounding soil to support shoot growth and anchor the tree.

4.17 **facility:** A structure or equipment used to deliver or provide protection for the delivery of an essential service, such as electricity or communications.

4.18 **final cut:** A cut that completes the removal or reduction of a branch or stub.

4.19 **frond:** A leaf of a palm.

4.20 **heading:** 1. Cutting a currently growing, or a 1-year-old shoot, back to a bud. 2. Cutting an older branch or stem back to a stub in order to meet a defined structural objective. 3. Cutting an older branch or stem back to a lateral branch not large enough to assume apical dominance in order to meet a defined structural objective. Heading may or may not be an acceptable pruning practice, depending on the application.

4.21 **hook-and-blade-type pruning tool:** A pruning tool that has a sharp curved blade that overlaps a supporting hook; in contrast to an anvil-type pruning tool (4.1). (syn.: by-pass pruner)

4.22 **interfering branches:** Crossing, rubbing, or upright branches that have the potential to damage tree structure and/or health.

4.23 **internodal cut:** A cut located between lateral branches or buds.

4.24 **lateral branch:** A shoot or stem growing from a parent branch or stem.

4.25 **leader:** A dominant or co-dominant, upright stem.

4.26 **limb:** A large, prominent branch.

4.27 **lion's tailing:** The removal of an excessive number of inner, lateral branches from parent branches. Lion's tailing is not an acceptable pruning practice (5.5.7).

4.28 **mechanical pruning:** A utility pruning technique where large-scale power equipment is used to cut back branches (5.9.2.2).

4.29 **parent branch or stem:** A tree trunk, limb, or prominent branch from which shoots or stems grow.

4.30 **peeling:** For palms: The removal of only the dead frond bases at the point they make contact with the trunk without damaging living trunk tissue. (syn.: shaving)

4.31 **petiole:** A stalk of a leaf or frond.

4.32 **phloem:** Inner bark conducting tissues that transport organic substances, primarily carbohydrates, from leaves and stems to other parts of the plant.

4.33 **pollarding:** The maintenance of a tree by making internodal cuts to reduce the size of a young tree, followed by the annual removal of shoot growth at its point of origin (5.7.3).

4.34 **pruning:** The selective removal of plant parts to meet specific goals and objectives.

4.35 **qualified line-clearance arborist:** An individual who, through related training and on-thejob experience, is familiar with the equipment and hazards in line clearance and has demonstrated the ability to perform the special techniques involved. This individual may or may not be currently employed by a line-clearance contractor.

4.36 **qualified line-clearance arborist trainee:**
An individual undergoing line-clearance training and who, in the course of such training, is familiar with the hazards and equipment involved in line clearance and has demonstrated ability in the performance of the special techniques involved.

This individual shall be under the direct supervision of a qualified line-clearance arborist.

4.37 **raising:** Selective pruning to provide vertical clearance (5.6.3).

4.38 **reduction:** Selective pruning to decrease height and/or spread (5.6.4).

4.39 **remote/rural areas:** Locations associated with very little human activity, land improvement, or development.

4.40 **restoration:** Selective pruning to improve the structure, form, and appearance of trees that have been severely headed, vandalized, or damaged (5.7.4).

4.41 **shall:** As used in this standard, denotes a mandatory requirement.

4.42 **should:** As used in this standard, denotes an advisory recommendation.

4.43 **stub:** An undesirable short length of a branch remaining after a break or incorrect pruning cut is made.

4.44 **thinning:** Selective pruning to reduce density of live branches (5.6.2).

4.45 **throwline:** A small, lightweight line with a weighted end used to position a climber's rope in a tree.

4.46 **topping:** The reduction of a tree's size using heading cuts that shorten limbs or branches back to a predetermined crown limit. Topping is not an acceptable pruning practice (5.5.7).

4.47 **tracing:** The removal of loose, damaged tissue from in and around the wound.

4.48 **urban/residential areas:** Locations, such as populated areas including public and private property, that are normally associated with human activity.

4.49 **utility:** An entity that delivers a public service, such as electricity or communications.

4.50 **utility space:** The physical area occupied by a utility's facilities and the additional space required to ensure its operation.

4.51 **vista pruning:** Selective pruning to allow a specific view (5.7.5).

4.52 **watersprouts:** New stems originating from epicormic buds. (syn.: epicormic shoots)

4.53 **wound:** An opening that is created when the bark of a live branch or stem is penetrated, cut, or removed.

4.54 **woundwood:** Partially differentiated tissue responsible for closing wounds. Woundwood develops from callus associated with wounds.

4.55 **xylem:** Wood tissue. Active xylem is sapwood; inactive xylem is heartwood.

4.56 **young tree:** A tree young in age or a newly transplanted tree.

# 5 Pruning practices

## 5.1 Tree inspection

**5.1.1** An arborist or arborist trainee shall visually inspect each tree before beginning work.

**5.1.2** If a condition is observed requiring attention beyond the original scope of the work, the condition should be reported to an immediate supervisor, the owner, or the person responsible for authorizing the work.

## 5.2 Tools and equipment

**5.2.1** Equipment and work practices that damage living tissue and bark beyond the scope of the work should be avoided.

**5.2.2** Climbing spurs shall not be used when climbing and pruning trees.
Exceptions:
-when limbs are more than throwline distance apart and there is no other means of climbing the tree;
-when the bark is thick enough to prevent damage to the cambium;
-in remote or rural utility rights-of-way.

## 5.3 Pruning cuts

**5.3.1** Pruning tools used in making pruning cuts shall be sharp.

**5.3.2** A pruning cut that removes a branch at its point of origin shall be made close to the trunk or parent limb, without cutting into the branch bark ridge or collar, or leaving a stub (see Figure 5.3.2).

**5.3.3** A pruning cut that reduces the length of a branch or parent stem should bisect the angle between its branch bark ridge and an imaginary line perpendicular to the branch or stem (see Figure 5.3.3).

**5.3.4** The final cut shall result in a flat surface with adjacent bark firmly attached.

**5.3.5** When removing a dead branch, the final cut shall be made just outside the collar of living tissue.

**5.3.6** Tree branches shall be removed in such a manner so as not to cause damage to other parts of the tree or to other plants or property. Branches too large to support with one hand shall be precut to avoid splitting of the wood or tearing of the bark (see Figure 5.3.2). Where necessary, ropes or other equipment shall be used to lower large branches or portions of branches to the ground.

**5.3.7** A final cut that removes a branch with a narrow angle of attachment should be made from the outside of the branch to prevent damage to the parent limb (see Figure 5.3.7).

**5.3.8** Severed limbs shall be removed from the crown upon completion of the pruning, at times when the tree would be left unattended, or at the end of the workday.

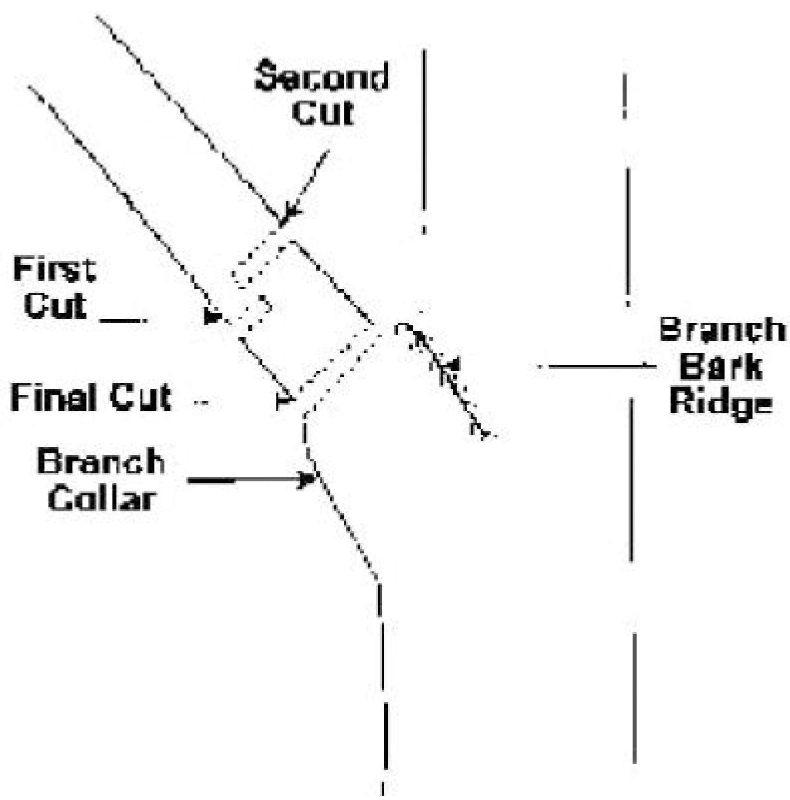


**Figure 5.3.2.** – A pruning cut that removes a branch at its point of origin shall be made close to the trunk or parent limb, without cutting into the branch bark ridge or collar, or leaving a stub. Branches too large to support with one hand shall be precut to avoid splitting of the wood or tearing of the bark.

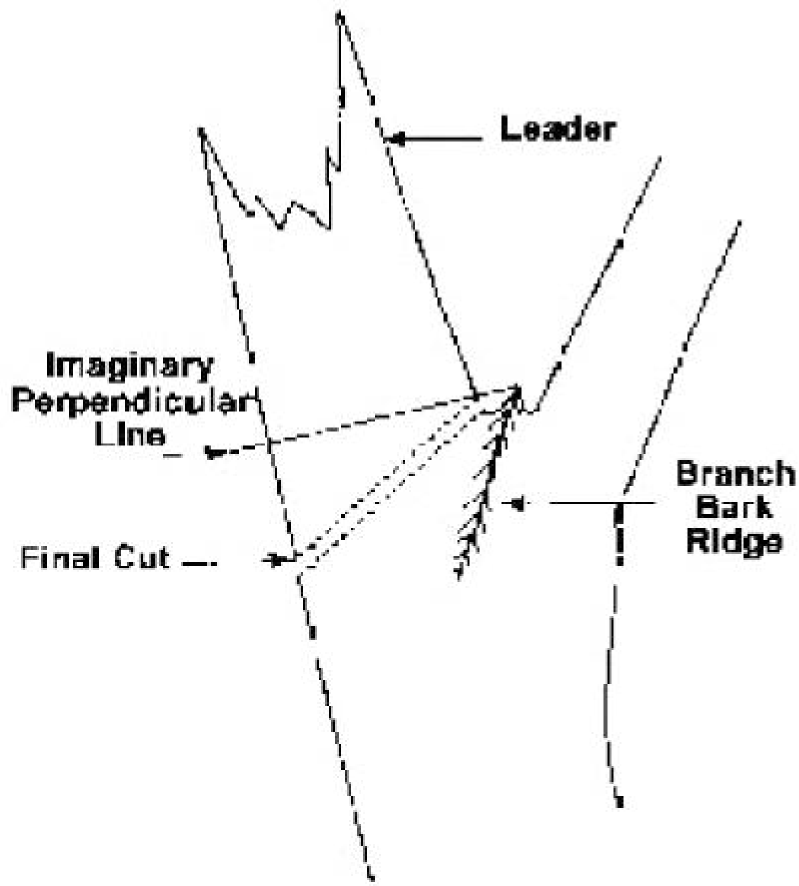



**Figure 5.3.3**. – A pruning cut that reduces the length of a branch or parent stem should bisect the angle between its branch bark ridge and an imaginary line perpendicular to the branch or stem .

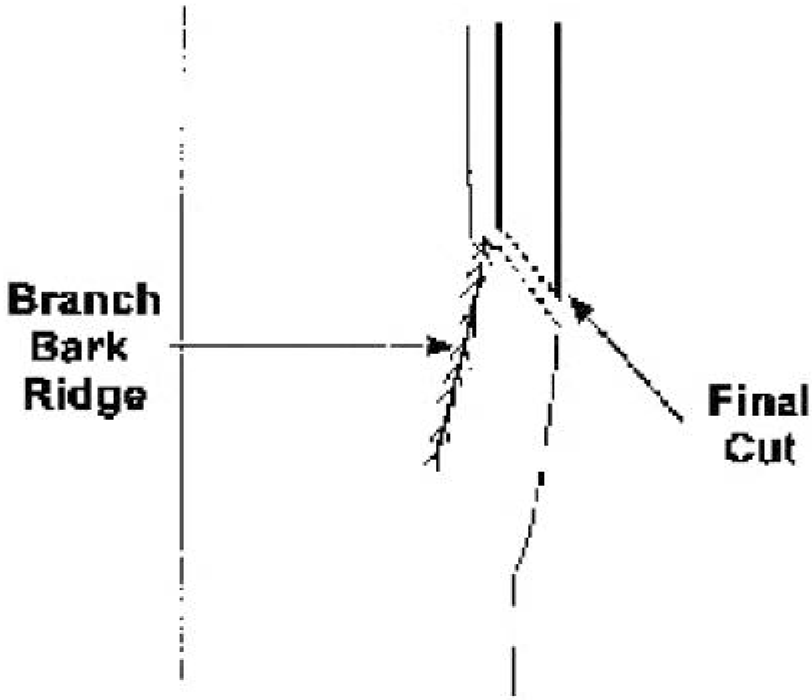



**Figure 5.3.7**. – A final cut that removes a branch with a narrow angle of attachment should be made from the outside of the branch to prevent damage to the parent limb.

## 5.4 Wound treatment

**5.4.1** Wound treatments should not be used to cover wounds or pruning cuts, except when recommended for disease, insect, mistletoe, or sprout con trol, or for cosmetic reasons.

**5.4.2** Wound treatments that are damaging to tree tissues shall not be used.

**5.4.3** When tracing wounds, only loose, damaged tissue should be removed.

## 5.5 Pruning objectives

**5.5.1** Pruning objectives shall be established prior to beginning any pruning operation.
To obtain the defined objective, the growth cycles and structure of individual

species and the type
of pruning to be performed should be considered.

**5.5.3** Not more than 25 percent of the foliage should be removed within an annual growing season. The percentage and distribution of foliage to be removed shall be adjusted according to the plant's species, age, health, and site.

**5.5.4** Not more than 25 percent of the foliage of a branch or limb should be removed when it is cut back to a lateral. That lateral should be large enough to assume apical dominance.

**5.5.5** Pruning cuts should be made in accordance with 5.3 Pruning cuts.

**5.5.6** Heading should be considered an acceptable practice for shrub or specialty pruning when needed to reach a defined objective.

**5.5.7** Topping and lion's tailing shall be considered unacceptable pruning practices for trees.

## 5.6 Pruning types

Specifications for pruning should consist of, but are not limited to, one or more of the following types:

**5.6.1 Clean:** Cleaning shall consist of selective pruning to remove one or more of the following parts: dead, diseased, and/or broken branches.
**5.6.1.1** Location of parts to be removed shall be specified.
**5.6.1.2** Size range of parts to be removed shall be specified.

**5.6.2 Thin:** Thinning shall consist of selective pruning to reduce density of live branches.
**5.6.2.1** Thinning should result in an even distribution of branches on individual limbs and throughout the crown.
**5.6.2.2** Not more than 25 percent of the crown should be removed within an annual growing season.
**5.6.2.3** Location of parts to be removed shall be specified.
**5.6.2.4** Percentage of foliage and size range of parts to be removed shall be specified.

**5.6.3 Raise:** Raising shall consist of selective pruning to provide vertical clearance.
**5.6.3.1** Vertical clearance should be specified.
**5.6.3.2** Location and size range of parts to be removed should be specified.

**5.6.4 Reduce:** Reduction shall consist of selective pruning to decrease height and/or spread.

**5.6.4.1** Consideration shall be given to the ability of a species to tolerate this type of pruning.
**5.6.4.2** Location of parts to be removed and clearance should be specified.
**5.6.4.3** Size range of parts should be specified.

## 5.7 Specialty pruning

Consideration shall be given to the ability of a species to tolerate specialty pruning, using one or more pruning types (5.6).

### 5.7.1 Young trees

**5.7.1.1** The reasons for young tree pruning may include, but are not limited to, reducing risk, maintaining or improving tree health and structure, improving aesthetics, or satisfying a specific need.
**5.7.1.2** Young trees that will not tolerate repetitive pruning and have the potential to outgrow their space should be considered for relocation or removal.
**5.7.1.3 At planting**
**5.7.1.3.1** Pruning should be limited to cleaning (5.6.1).
**5.7.1.3.2** Branches should be retained on the lower trunk.
**5.7.1.4 Once established**
**5.7.1.4.1** Cleaning should be performed (5.6.1).
**5.7.1.4.2** Rubbing and poorly attached branches should be removed.
**5.7.1.4.3** A central leader or leader(s) as appropriate should be developed.
**5.7.1.4.4** A strong, properly spaced scaffold branch structure should be selected and maintained.
**5.7.1.4.5** Interfering branches should be reduced or removed.

### 5.7.2 Espalier

**5.7.2.1** Branches that extend outside the desired plane of growth shall be pruned or tied back.
**5.7.2.2** Ties should be replaced as needed to prevent girdling the branches at the attachment site.

### 5.7.3 Pollarding

**5.7.3.1** Consideration shall be given to the ability of the individual tree to respond to pollarding.
**5.7.3.2** Management plans shall be made prior to the start of the pollarding process for routine removal of watersprouts.
**5.7.3.3** Internodal cuts shall be made at specific locations to start the pollarding process. After the initial cuts are made, no additional internodal cut shall be made.
**5.7.3.4** Watersprouts growing from the cut ends of branches (knuckles) should be removed annually during the dormant season.

### 5.7.4 Restoration

**5.7.4.1** Restoration shall consist of selective pruning to improve the structure,

form, and appearance of trees that have been severely headed, vandalized, or damaged.
**5.7.4.2** Location in tree, size range of parts, and percentage of watersprouts to be removed should be specified.

**5.7.5 Vista pruning**
**5.7.5.1** Vista pruning shall consist of selective pruning to allow a specific view.
**5.7.5.2** Size range of parts, location in tree, and percentage of foliage to be removed should be specified.

## 5.8 Palm pruning

**5.8.1** Palm pruning should be performed when fronds, fruit, or loose petioles may create a dangerous condition.

**5.8.2** Live healthy fronds, initiating at an angle of 45 degrees or greater from horizontal, with frond tips at or below horizontal, should not be removed.

**5.8.3** Fronds removed should be severed close to the petiole base without damaging living trunk tissue.

**5.8.4** Palm peeling (shaving) should consist of the removal of only the dead frond bases at the point they make contact with the trunk without damaging living trunk tissue.

## 5.9 Utility pruning

**5.9.1 General**
**5.9.1.1** The purpose of utility pruning is to prevent the loss of service, comply with mandated clearance laws, prevent damage to equipment, avoid access impairment, and uphold the intended usage of the facility/utility space.
**5.9.1.2** Only a qualified line clearance arborist or line clearance arborist trainee shall be assigned to line clearance work in accordance with ANSI Z133.1, 29 CFR 1910.331 – 335, 29 CFR 1910.268 or 29 CFR 1910.269.
**5.9.1.3** Utility pruning operations are exempt from requirements in 5.1 Tree Inspection:
5.1.1 An arborist or arborist trainee shall visually inspect each tree before beginning work.
5.1.2 If a condition is observed requiring attention beyond the original scope of the work, the condition should be reported to an immediate supervisor, the owner, or the person responsible for authorizing the work.
**5.9.1.4** Safety inspections of the work area are required as outlined in ANSI Z133.1 4.1.3, job briefing.

### 5.9.2 Utility crown reduction pruning

#### 5.9.2.1 Urban/residential environment

**5.9.2.1.1** Pruning cuts should be made in accordance with 5.3, Pruning cuts. The following requirements and recommendations of 5.9.2.1.1 are repeated from 5.3 Pruning cuts.

**5.9.2.1.1.1** A pruning cut that removes a branch at its point of origin shall be made close to the trunk or parent limb, without cutting into the branch bark ridge or collar, or leaving a stub (see Figure 5.3.2).

**5.9.2.1.1.2** A pruning cut that reduces the length of a branch or parent stem should bisect the angle between its branch bark ridge and an imaginary line perpendicular to the branch or stem (see Figure 5.3.3).

**5.9.2.1.1.3** The final cut shall result in a flat surface with adjacent bark firmly attached.

**5.9.2.1.1.4** When removing a dead branch, the final cut shall be made just outside the collar of living tissue.

**5.9.2.1.1.5** Tree branches shall be removed in such a manner so as not to cause damage to other parts of the tree or to other plants or property. Branches too large to support with one hand shall be precut to avoid splitting of the wood or tearing of the bark (see Figure 5.3.2). Where necessary, ropes or other equipment shall be used to lower large branches or portions of branches to the ground.

**5.9.2.1.1.6** A final cut that removes a branch with a narrow angle of attachment should be made from the bottom of the branch to prevent damage to the parent limb (see Figure 5.3.7).

**5.9.2.1.2** A minimum number of pruning cuts should be made to accomplish the purpose of facility/utility pruning. The natural structure of the tree should be considered.

**5.9.2.1.3** Trees directly under and growing into facility/utility spaces should be removed or pruned. Such pruning should be done by removing entire branches or by removing branches that have laterals growing into (or once pruned, will grow into) the facility/utility space.

**5.9.2.1.4** Trees growing next to, and into or toward facility/utility spaces should be pruned by reducing branches to laterals (5.3.3) to direct growth away from the utility space or by removing entire branches. Branches that, when cut, will produce watersprouts that would grow into facilities and/or utility space should be removed.

**5.9.2.1.5** Branches should be cut to laterals or the parent branch and not at a pre-established clearing limit. If clearance limits are established, pruning cuts should be made at laterals or parent branches outside the specified clearance zone.

#### 5.9.2.2 Rural/remote locations – mechanical pruning

Cuts should be made close to the main stem, outside of the branch bark ridge and branch collar. Precautions should be taken to avoid stripping or tearing of bark or excessive wounding.

### 5.9.3 Emergency service restoration

During a utility-declared emergency, service must be restored as quickly as possible in accordance with ANSI Z133.1, 29 CFR 1910.331 – 335, 29 CFR 1910.268, or 29 CFR 1910.269. At such times it may be necessary, because of safety and the urgency of service restoration, to deviate from the use of proper pruning techniques as defined in this standard. Following the emergency, corrective pruning should be done as necessary.

# Annex A (informative)

## Reference publications

International Society of Arboriculture (ISA). 1995. Tree Pruning Guidelines . Savoy, IL: International Society of Arboriculture (ISA).

# Appendix G

## G.1 DILLANT-HOPKINS AIRPORT NOISE REDUCTION BY TREES (SANCHEZ INDUSTRIAL DESIGN)

**Sanchez Industrial Design Inc.**
39 Page Street
Keene, NH 03431
Tel. (603) 903-7229
Fax (608) 831-9997

February 16, 2014

Mr. Leigh Bartlett, PE
Stantec
482 Payne Road
Scarborough, ME 04074

Subject: Noise Reduction Provided by Trees at Dillant-Hopkins Airport

Dear Mr. Bartlett:

This letter provides my findings regarding the potential for trees to provide noise reduction for certain activities occurring at Dillant-Hopkins Airport in Swanzey, NH.

Trees can provide noise reduction, however, this benefit occurs only when the trees break the direct line of sight from the listener to the noise source. For residents of the Edgewood neighborhood, this may occur during takeoff roll when aircraft are departing to the south on Runway 20 and also during the use of thrust reversers for aircraft arriving to the north on Runway 02. In addition, trees may provide some noise reduction benefit when aircraft taxi to or from the terminal area and also during preflight runups of propeller aircraft. However, during the loudest aircraft events heard in the Edgewood neighborhood, typically departures to the north on Runway 02 and arrivals to the south on Runway 20, trees do not provide any noise reduction benefit while aircraft fly directly over the neighborhood.

Even when trees do break the line of sight to aircraft, the noise reduction may be less than is commonly thought. Some contributing factors may include an "out of sight, out of mind" effect related to the visual shielding that trees provide and also the potential for noise masking provided by wind and rustling leaves. While neither of these factors reduces noise levels, each may help to reduce the potential for annoyance caused by unwanted noise sources, and thereby increase the perceived benefit of the trees. To estimate the actual noise reduction provided by trees, the International Organization for Standardization (ISO) provides a set of practices for evaluating the attenuation of sound during propagation outdoors. [1] In addition to having widespread acceptance worldwide, portions of this standard are utilized by various federal agencies in the United States.[2] The ISO standard states that "the foliage of trees and shrubs provides a small amount of attenuation, but only if it is sufficiently dense to completely block the view along the propagation path, i.e. when it is impossible to see a short distance through the foliage."[3]

The ISO standard provides estimates of noise reduction depending upon the distance of sound propagation through dense foliage, but in all cases caps attenuation at the values computed for distances of 200 meters (about 650 feet). Under the proposed action, the width of trees to be removed between Airport Road and the backyards of the closest homes on the south side of Greenwood Avenue would vary between approximately 170 and 300 meters (approximately 550 to 1,000 feet). Therefore, for some homes, the maximum sound

[1] International Organization for Standardization, "ISO 9613-2: Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation," Geneva, Switzerland, 1996.

[2] For example, the Federal Highway Administration uses the tree attenuation algorithms in its Traffic Noise Model (TNM) and the Federal Aviation Administration, while not having its own noise model for propagation of groundborne noise, has adopted the ISO procedures on a case-by-case basis for numerous studies.

[3] International Organization for Standardization, Annex A, "Additional types of attenuation," Table A.1.

attenuation attributable to 200 meters would apply. At mid-range frequencies of 500 to 1,000 Hz[4] the maximum attenuation would be 10 to 12 dB,[5] and typically would be perceived approximately as a halving in loudness.

It should be noted that the estimated sound attenuation described above assumes that the existing trees meet the ISO standard's requirement for dense foliage that "completely blocks the view along the propagation path." The existing forest, however, is comprised primarily of mature white pines, which consist of tall trunks with most branches located near the tops of the trees. In addition, there is little understory. Based on this, it is possible that the existing forest provides less attenuation than the ISO standard would estimate. In contrast, new vegetation that would re-grow in place of the existing forest would be a hardwood and coniferous blend and would include a more robust, fuller understory than the existing forest. Therefore, although there may be a short-term loss of noise reduction immediately following the tree clearing, it is likely that within several years the re-grown forest would provide greater noise reduction than the existing forest.

Sincerely yours,

**Sanchez Industrial Design Inc.**

Douglas E. Barrett

Principal Consultant

[4] Frequency is described in terms of "Hertz" (Hz), sometimes referred to as cycles per second.
[5] Sound levels and also noise reduction (attenuation) are described in terms of decibels (dB).

# Appendix H

## H.1 COMMENTS

This appendix includes public comments received in response to the Draft Environmental Assessment prepared for Dillant-Hopkins Airport. The EA has been prepared to address existing safety hazards to aircraft operations resulting from trees penetrating the Runway 20 approach. Written comments received during the public comment period have been summarized in table format and included in this appendix.

The vast majority of comments received were from residents of the Edgewood Neighborhood, which abuts airport and city property north of the Runway 20 end. Nearly all comments express concern with adverse impacts including decreased property values and diminished quality of life to residents of Edgewood resulting from clearing trees obstructing the Runway 20 approach. Payment to landowners for the acquisition of easements is intended to compensate for losses in property value. Payment for the easement may be used for replanting yard or buffer vegetation to mitigate property value impacts.

Quality of life impacts referenced in comments include the loss of the forested aesthetic of the neighborhood, increased noise and air pollution, and potential associated health impacts. Several comments question statements made in the EA regarding rapid regrowth within clearing areas and the absence of vernal pools and an aquifer underlying the proposed project area. Several other comments inquired why alternatives proposing a four degree PAPI glide path and 300-foot runway extension to Runway 02 were not considered. One comment supporting the implementation of the preferred alternative to improve the safety of aircraft operations was received.

Implementation of the preferred alternative (Alternative 2) will alter the existing viewscape due to the number of mature pines that must be removed. Many of the existing pine trees are 100 feet tall or taller and penetrate the approach by 30-40 feet. Topping these trees is not viable as removing such a large portion of the trees' mass would ultimately kill the trees, resulting in an unsightly stand of dead standing snags and creating further safety hazards to those abutting and using the forest. However, those trees that penetrate approach surfaces by 10-15' or less may be pruned or topped (not a recommended arboricultural practice) without killing the trees, depending on factors such as species, height and health of the subject tree(s). Efforts will be undertaken during design of the project to identify trees that must be removed and those that can be pruned or topped. Trees not yet encroaching upon approach surfaces will be preserved to the extent possible.

Several comments question the capability of dense regeneration of vegetation within areas affected by tree removal. However, as referenced in the *Edgewood Civic Association Parcel Management Plan, December 2013* prepared by Antioch University New England graduate students, a diversity of tree species including red maple, red oak, white oak, sugar maple and hemlock exists within the forested area south of Edgewood. Thinning the canopy would introduce substantially more sunlight into these areas, encouraging the proliferation of hardwood tree species and other shade intolerant species. After cutting, new growth and forest regeneration is anticipated to consist of dense shrub and sapling species. After several years such regrowth could provide denser, more effective visual and noise buffers between Edgewood and the airport than currently exists.

This position, as it relates to increased noise from the airport experienced by abutters is supported by the assessment of noise reduction provided by trees prepared by Douglas Barrett of Sanchez Industrial Design Inc. and provided in Appendix G of the F EA. In his assessment, Mr. Barrett discusses estimates provided by the International Organization for Standardization (ISO) for evaluating the potential for vegetation to attenuate noise. According to the ISO standard, the foliage of trees and shrubs provides a small amount of noise attenuation provided vegetation is sufficiently dense (over a span of 200 meters) to completely block the view in the sound propagation corridor. Under such conditions, noise levels from the airport may be perceived "approximately as a halving in loudness." Mr. Barrett continues that the existing mature pine forest, with a sparsely vegetated understory, may not meet the ISO definition for dense vegetation and may therefore provide less attenuation than the ISO standard would estimate. Mr. Barrett concludes that although there may be a short-term loss of noise reduction immediately following tree cutting, several years of regrowth would likely provide greater noise reduction than the current forest.

One comment implies the EA suggests that a doubling of noise levels resulting from the loss of the forest buffer would not be a significant impact to residences abutting the airport and provides documentation how one airport (T.F. Green Airport in Rhode Island) "more realistically" recognizes the impact of ground-operations noise to airport abutters. The EA does not suggest or imply that noise levels will double as a result tree cutting. As stated above, the Sanchez Industrial Design assessment included in the EA suggests the existing white pine forest does not provide suitable buffer capable of "halving" ground operation loudness in accordance with ISO estimate standards. Furthermore, the reference to T.F. Green's treatment of aircraft noise is not a suitable comparison. All airports should strive to limit noise related impacts from ground operations to the greatest extent possible. However, T.F. Green is located in the center of Warwick, a city with a population greater than 80,000 people. The airport is a commercial service facility averaging over 100 daily scheduled commercial flights and nearly 2 million annual enplanements (departing passengers). Current carriers include JetBlue, Southwest, Delta, United Airlines, and US Airways. The commercial fleet using the airport includes, among other aircraft, Boeing 727s and 737s, and an Airbus A321.

Active management of regrowth in the forest will limit the potential for tall-growing pines and encourage the establishment of a lower-growing hardwood stand. The transition from a mature pine stand to a mixed hardwood stand will undoubtedly take years to realize; however the transitional period will not limit current recreational opportunities. Existing trails within the forest between Airport Road and Edgewood can be preserved and biking, walking, cross-country skiing, wildlife viewing, and other activities currently conducted in the forest can continue. An effective forest management plan, if adopted as recommended, will not only aim to manage vegetation height but will also consider and provide for recreational and wildlife enhancement opportunities. Such a plan will also establish protocol for invasive species control. It should be noted that several comments reference impacts to recreational use of the Keene Forestry Park, located north of Airport Road within city property and proposed project locations. At the time the Draft EA was prepared, the City of Keene did not have documentation designating this area as a public park, nor does the park appear on the city's website where public parks and open spaces managed by the city are listed. The Keene Forestry Park is illustrated in several maps in the *City of Keene Active and Passive Recreation Management Plan, May 2012* however there is no discussion or description of the park in the management plan.

Increases in air pollution resulting from tree cutting were also commonly referenced in comments received. As stated in the EA, an air quality analysis was not required as Cheshire County is not in nonattainment for criteria pollutants and the airport conducts fewer than 180,000 operations annually. The airport the airport is not expanding infrastructure nor will the existing fleet of aircraft utilizing the facility be altered. For these reasons, current air pollution levels associated with aircraft emissions are not expected to change. The ability of trees to capture and store atmospheric carbon dioxide and to filter other pollutants is not disputed in the EA. The ability of this region of the forest to effectively sequester carbon may be lessened by the removal of mature trees until mature tree species are reestablished. Many other factors, however, must be analyzed to determine whether proposed tree removal will contribute to increased pollution and global or regional warming as a result of diminished carbon sequestering and carbon release. The importance of such analysis, though beyond the scope of this EA, should not be dismissed. However, the safety of pilots using the airport must also be considered when evaluating potential impacts associated with removing obstructions located in critical approach surfaces.

Several comments challenged the statement made in the Wetland Function and Value Assessment that no aquifers are present in the vicinity of wetlands evaluated during the preparation of the Draft Environmental Assessment. This statement is incorrect, and as several commenters indicated, a stratified drift aquifer underlies the airport region. Within the context of wetland functions and values considered, due to the deep and poorly drained organic soils, groundwater recharge is not considered a principal function of wetlands evaluated. Impacts to the aquifer from actions proposed in the EA are not expected.

Comments also suggested the EA indicated that vernal pools are not within or adjacent to proposed project locations. These comments are inaccurate. The Wetland Function and Value Assessment indicated that at the time of the field survey, evidence of breeding amphibians was not observed. The assessment stated that analysis of the area should be conducted during the spring breeding season to determine the presence of amphibians. A vernal pool inventory will be conducted at the seasonally appropriate time prior to conducting tree removal operations. The wetland delineation was performed by Katelin Nickerson. Ms. Nickerson also prepared the wetlands report included in the Draft EA. Bryan Emerson reviewed the delineation and report and subsequently stamped the report. Mr. Emerson did not visit the project area.

Finally, several comments inquired why alternatives clearing to a 4 degree PAPI approach slope or a shorter extension (300') to Runway 02 were not considered. In accordance with FAA Advisory Circular 150/5340-30G 7.5 d 3, the standard visual glideslope for a PAPI is 3 degrees. For non-jet runways, the glideslope may be increased to 4 degrees to provide obstacle clearance. Runway 02-20 facilitates jet traffic and cannot be increased to slopes beyond 3 degrees. Additionally, a 300-foot extension to Runway 02 in conjunction with a displacement of the Runway 20 threshold, was not considered because similar to Alternative 5, this alternative requires the relocation of many of the navigational aids (MALSR, glide slope equipment and critical areas, PAPIs, etc.) serving the runway. Runway 02 airspace would also require analysis to assess potential impacts to protected air surfaces. Usable runway length for certain operations would be limited 4,913 feet (depending on the runway end utilized during the operation), potentially restricting certain aircraft currently using the airport from operating on the runway.

# APPENDIX H – PUBLIC COMMENTS

| Personal Information | | | |
|---|---|---|---|
| No. | Name | Street | City, State Zip |
| 1 | Lee Kendall | 46 Lynwood Ave | Keene, NH 03431 |
| 2 | Sally Parsons | 48 Edgewood Ave | Keene, NH 03431 |
| 3 | Susan North | 4 Kenworth Ave | Keene, NH 03431 |
| 4 | Joe McMahon | 25 Lynwood Ave | Keene, NH 03431 |
| 5 | Teri Perkins | 91 Greenwood Ave | Keene, NH 03431 |
| 6 | Katharina Rooney | 642 Main Street | Keene, NH 03431 |
| 7 | Peter Rooney | 642 Main Street | Keene, NH 03431 |
| 8 | Virginia C. Dunnell | 30 Lynwood Ave | Keene, NH 03431 |
| 9 | Steven Wilson | 99 Greenwood Ave | Keene, NH 03431 |
| 10 | Geraldine Frederiksen | 675 Main Street | Keene, NH 03431 |
| 11 | Jennifer Reno | 34 Edgewood Ave | Keene, NH 03431 |
| 12 | Mark A. Meess | 59 Greenwood Ave | Keene, NH 03431 |
| 13 | Craig H. Smith | 637 Main Street | Keene, NH 03431 |
| 14 | Ann Arthur-Smith | 637 Main Street | Keene, NH 03431 |
| 15 | Linda A. Piekarski | 15 Edgewood Ave | Keene, NH 03431 |
| 16 | Marianne Marsh | 122 Greenwood Ave | Keene, NH 03431 |
| 17 | Lynda D. Elkind | 108 Greenwood Ave | Keene, NH 03431 |
| 18 | Karen Honeycutt | 71 Greenwood Ave | North Swanzey, NH 03431 |
| 19 | Christopher Alexey | 77 Greenwood Ave | North Swanzey, NH 03431 |
| 20 | Jennifer L. Myers | 77 Greenwood Ave | North Swanzey, NH 03431 |
| 21 | John Dunnell | 30 Lynwood Ave | Keene, NH 03431 |
| 22 | Sandra Cenerry | 114 Greenwood Ave | Keene, NH 03431 |
| 23 | Rosalie Sinclair | 24 Lynwood Ave | Keene, NH 03431 |
| 24 | Timothy Rabslean | 24 Lynwood Ave | Keene, NH 03431 |
| 25 | Alan L. Ross, DMD | 114 Greenwood Ave | Keene, NH 03431 |
| 26 | Deb Miller | 24 Lynwood Ave | Keene, NH 03431 |
| 27 | Jon Mason | 24 Lynwood Ave | Keene, NH 03431 |
| 28 | Ron Hitchings | 14 Leawood Ave | Keene, NH 03431 |
| 29 | Judith Hitchings | 14 Leawood Ave | Keene, NH 03431 |
| 30 | James G. Frederiksen | 675 Main Street | Keene, NH 03431 |
| 31 | Gia Farina | 74 Greenwood Ave | Keene, NH 03431 |

<table>
<tr><th colspan="4">Personal Information</th></tr>
<tr><th>No.</th><th>Name</th><th>Street</th><th>City, State Zip</th></tr>
<tr><td>32</td><td>Beth Daniels</td><td>74 Greenwood Ave</td><td>Keene, NH 03431</td></tr>
<tr><td>33</td><td>Christie F. Wright</td><td>66 Greenwood Ave</td><td>Keene, NH 03431</td></tr>
<tr><td>34</td><td>Suzanne Nadeau</td><td>3 Kenworth Ave</td><td>Keene, NH 03431</td></tr>
<tr><td>35</td><td>Jeff MacMurry</td><td>7 Leawood Ave</td><td>Keene, NH 03431</td></tr>
<tr><td>36</td><td>John T. Boudreau</td><td>91 Greenwood Ave</td><td>Keene, NH 03431</td></tr>
<tr><td>37</td><td>Diana Wilson</td><td>99 Greenwood Ave</td><td>Keene, NH 03431</td></tr>
<tr><td>38</td><td>Rhonda Capasso Tralli</td><td>109 Greenwood Ave</td><td>Keene, NH 03431</td></tr>
<tr><th>Item</th><th>Concerns</th><th>Notes</th><th>Needs</th></tr>
<tr><td>A</td><td>Avigation Easement Acquisition</td><td rowspan="10">• Unknown whether city will lower tax assessments. Neighborhood collectively pays $500,000 in taxes annually.<br>• 12 acres deeded to City of Keene from Edgewood Civic Association<br>• 22 acres deeded to City from Keene Forestry Association<br>• Many of the neighborhood buildings were built in the 1960s<br>• Potential shift from a single-family home community to a rental community</td><td rowspan="10">Full Environmental Impact Statement</td></tr>
<tr><td>A.1</td><td>Loss market value</td></tr>
<tr><td>A.2</td><td>Quality of life</td></tr>
<tr><td>A.3</td><td>Neighborhood Demographics (could change over time)</td></tr>
<tr><td>B</td><td>Keene Forestry Park</td></tr>
<tr><td>B.1</td><td>Air Quality</td></tr>
<tr><td>B.2</td><td>Noise</td></tr>
<tr><td>B.3</td><td>Aesthetics (short term)</td></tr>
<tr><td>B.4</td><td>Odor</td></tr>
<tr><td>B.5</td><td>Light</td></tr>
</table>

| Personal Information | | | | |
|---|---|---|---|---|
| **No.** | **Name** | | **Street** | **City, State Zip** |
| 1 | Dwight Anderson | | 103 Greenwood Ave | Keene, NH 03431 |
| **Ref.** | **Concerns** | **Notes** | | **Needs** |
| 3.2.3 | Alternative 3 did not consider rebuilding 300’ extension to Runway 02 | Rebuilding this section of pavement would provide 4,913’ for LDA, TORA and TODA, enough runway length for planes currently using the runway and significantly reducing the amount of trees cut on airport property and eliminating need to acquire easements off airport property. | | Explanation of why this alternative was not considered. |

| Personal Information | | | |
|---|---|---|---|
| **No.** | **Name** | **Street** | **City, State Zip** |
| 1 | Ann Shedd, MD | 59 Greenwood Avenue | Keene, NH 03431 |

| Ref. | Concerns | Notes | Needs |
|---|---|---|---|
| 5.6 | Portion of area to be cleared recognized as park | City of Keene's Park and Recreation Active and Passive Recreation Management Plan (2012) | Environmental Impact Statement |
| 5.12 | 2-3 year visual buffer is likely to be reestablished | • Sandy soil<br>• American Beech – prevalence of Beech bark disease/Beech snap<br>• Hemlock wooly adelgid found in Cheshire County<br>• Overgrowth of invasive species: Japanese knotweed, Bittersweet, wild grapes, glossy buckthorn | |
| 5.13 | Natural resources and energy supply | • Increased energy demands for winter heating and summer cooling | |
| 5.14 | Noise | Sited Noise Statement from Rhode Island Airport Corporation (http://www.pvdairport.com/corporate/environment/noise-faqs) | Noise measurements during ground operations before and after tree clearing.<br><br>Consideration of noise sound insulation program. |

| Ref. | Concerns | Notes | Needs |
|---|---|---|---|
| 5.2; 5.16 | Air quality | • Health and safety risks disproportionately affect children.<br>• Aircraft operations and GSV operations produce airborne pollutants which may aggravate asthma and increase risk of other cardiac and pulmonary diseases.<br>• Evidence that urban forests decrease concentrations of particulates and other air-borne pollutants (US Forest Service Northeast Division: Nowak et al, Air pollution removal by urban trees and shrubs in the US, *Urban Forestry and Urban Greening,* 4(2006) 115-123, and Nowak et al: Modeled PM2.5 removal by trees in ten US cities and associated health effects, *Environmental Pollution* 178 (2013) 395-402)<br>• Carbon impacts of the project of clearing 15 acres of an urban forest<br>• Reduction of important ecosystem service and more exposure of vulnerable children to health and safety risks. | Air quality study -<br>Further evaluation of the environmental impacts of the proposed tree-clearing could contribute to 2008 research titled "Research Needs Associated with Particulate Emissions at Airports"<br><br>Creative approaches to mitigate the lost carbon storage |
| 5.18;<br>App E | Wetland Delineation / Function and Value Report | • Inaccuracy should be noted, the entire area overlies an extensive stratified drift aquifer as identified by Natural Resource Inventory Appended to City's 2012 Comprehensive Plan<br>• Wetlands 1 and 3 are part of a larger wetland complex abutting an oxbow, which is part of the Ashuelot River floodplain<br>• It should be noted that the Environmental Assessment stated there are no vernal pool areas; however in spring 2012 wood-frog egg masses were noted in Wetland 3by the Director of Ashuelot Valley Environmental Observatory (verbal communication)<br>• Threatened, rare or endangered species<br>• Historically observed boundaries of Wetland 1 and 3 using Sept 2013 data may not be a long enough assessment period<br>• Her observations of the wetlands flags in relationship to spongy soil, and water levels during her outings seem to be different<br>• EA wetlands surveyor Katelin Nickerson and signed off by Bryan Emerson, has Bryan ever been on the EEN Project Site? | Complete on-site wildlife survey to identify threatened or endangered species<br><br>Complete more accurate wetlands delineation |

<table>
<tr><th colspan="4">Personal Information</th></tr>
<tr><th>No.</th><th>Name</th><th>Street</th><th>City, State Zip</th></tr>
<tr><td>1</td><td>Joseph P. Briggs</td><td>C&S Wholesale Grocers, Inc., 7 Corporate Drive</td><td>Keene, NH 03431</td></tr>
<tr><th>Item</th><th>Concerns</th><th>Notes</th><th>Needs</th></tr>
<tr><td>1</td><td>Airport is economically important to surrounding businesses and community</td><td rowspan="5"><ul><li>C&S hired independent arborist to review EA prepared by Stantec</li><li>Independent arborist agrees with proposal by Stantec</li><li>Independent arborist concluded that topping trees is not feasible for most of the trees</li><li>Arborist strongly suggests only cutting trees in buffer areas that are an actual obstruction or close to becoming an obstruction in order to preserve to the maximum extent possible a visual and sound barrier</li></ul></td><td rowspan="5">Stantec EA recommendation is most logical alternative to EEN’s current issues</td></tr>
<tr><td>2</td><td>Airport is integral part of company’s operations</td></tr>
<tr><td>3</td><td>Safety issues at north end of runway due to significant tree growth</td></tr>
<tr><td>4</td><td>Tree growth limits access to airport from north side</td></tr>
<tr><td>5</td><td>C&S utilizes jets that require over 6,000 feet runway length in average weather conditions and longer in inclement weather</td></tr>
</table>

<table>
<tr><th colspan="4">Personal Information</th></tr>
<tr><th>No.</th><th>Name</th><th>Street</th><th>City, State Zip</th></tr>
<tr><td>1</td><td>James Gardner<br>Dorothy Bauer</td><td>27 Birch Street</td><td>Keene, NH 03431</td></tr>
<tr><th>Item</th><th>Concerns</th><th>Notes</th><th>Needs</th></tr>
<tr><td>1</td><td>EA omits major topics related to tree removal</td><td rowspan="5">• Trees and forest are important for dealing with carbon dioxide emissions<br>• Heavy precipitation instances have increased 71% from 1958-2012 in the Northeast, which is potential cumulative environmental impact<br>• NHDOT should take note of the opinions of the Intergovernmental Panel on Climate Change</td><td rowspan="5">Environmental Impact Statement (EIS) is needed</td></tr>
<tr><td>2</td><td>More information is needed on environ. Impact of tree removal</td></tr>
<tr><td>3</td><td>Flooding is a potential impact</td></tr>
<tr><td>4</td><td>Most greenhouse gases accumulate over time and mix globally</td></tr>
<tr><td>5</td><td>US forests currently absorb and store roughly 16% of all CO2 emissions</td></tr>
</table>

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<tr><th colspan="4">Personal Information</th></tr>
<tr><th>No.</th><th>Name</th><th>Street</th><th>City, State Zip</th></tr>
<tr><td>1</td><td>Peter Weinert</td><td>7 Riverton Street</td><td>Keene, NH 03431</td></tr>
<tr><th>Item</th><th>Concerns</th><th>Notes</th><th>Needs</th></tr>
<tr><td>1</td><td>Disastrous effect on Edgewood neighborhood</td><td rowspan="4">• Possibility of increasing the approach angle from 3 degrees to 4 degrees<br>• Neighborhood views of the forest will be replaced by views of the airport and industrial area</td><td rowspan="4">Provide plans or studies showing alternatives for providing safe landings for planes</td></tr>
<tr><td>2</td><td>Tree removal will increase air and noise pollution</td></tr>
<tr><td>3</td><td>Decreased property values</td></tr>
<tr><td>4</td><td>Cost of runway expansion is too expensive, but he has not seen any studies</td></tr>
</table>

| Personal Information | | | |
|---|---|---|---|
| **No.** | **Name** | **Street** | **City, State Zip** |
| 1 | James T. Dunn | One Riverton Street | Keene, NH 03431 |
| **Item** | **Concerns** | **Notes** | **Needs** |
| **1** | City was supposed to maintain the area as a pedestrian park and manage forest so didn't become safety issue | • City mismanagement allowed a fire fighting training facility to be built in the buffer forest<br>• Huge area clear cut in the 1990s and property was taken via eminent domain | Determine alternative to mitigate pilot safety concerns for Runway 20 approach |
| **2** | City negligence has caused trees to become a safety concern | | |
| **3** | Keene taxpayers aid the airport with $30,000 annually | | |
| **4** | Increase PAPI approach angle from 3 degrees to 4 degrees | | |

| Personal Information | | | |
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| **No.** | **Name** | **Street** | **City, State Zip** |
| 1 | James T. Dunn | One Riverton Street | Keene, NH 03431 |
| **Item** | **Concerns** | **Notes** | **Needs** |
| **1** | Buffer forest is a city park that is used by walkers, hikers, skiers, and snowshoers | • City never complied with original agreement to maintain trees and now is safety concern, especially for student pilots<br>• Questions the validity of Stantec's finding of "no significant environmental impact" | Determine alternative to mitigate pilot safety concerns for Runway 20 approach |

| Personal Information | | | |
|---|---|---|---|
| **No.** | **Name** | **Street** | **City, State Zip** |
| 1 | Dwight Anderson<br>Leanne Anderson | 103 Greenwood Avenue | Keene, NH 03431 |
| **Item** | **Concerns** | **Notes** | **Needs** |
| **1** | Reduction of property values by an estimated 10.1% – 27.4%. Tax revenues impacted by reduced property values. Keene taxpayers will have to make up lost revenue. | • Hard to have faith in the Stantec EA since it missed aquifer under the airport<br>• Forest will not regrow in 2-3 years<br>• No consideration of neighborhood | Proceed with Alternative 3.2.3 in the Stantec EA |
| **2** | Mortgages may have a cancel clause if property value decreases | | |
| **3** | City negligent in managing trees | | |

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<tr><td>1</td><td>Mark Meess</td><td>59 Greenwood Ave</td><td>Keene, NH 03431</td></tr>
<tr><th>Item</th><th>Concerns</th><th>Notes</th><th>Needs</th></tr>
<tr><td>1</td><td>Alternative 2 does not include cost of obtaining easements or lost revenue to the city</td><td rowspan="5"><ul><li>Cannot quantify changes of quality of living without air quality and noise studies</li><li>Only a generic sample avigation easement has been provided by Stantec</li><li>The neighborhood contributes about $500,000 in taxes to the city each year</li></ul></td><td rowspan="5">Easement needs to be amended to exclude “noise, vibrations, fumes, dust, fuel particles and all other effect”.<br>Stantec needs to perform noise and air quality study.<br>Boundary survey for forest parcel.<br>Consider other options for mitigating safety concerns including changing glide slope from 3 degrees to 4 degrees and move threshold 200-300 feet.</td></tr>
<tr><td>2</td><td>If property values are decreased by 10%, the city will lose $50,000 in taxes each year</td></tr>
<tr><td>3</td><td>Uncertainty regarding the 1983 addendum to the original deed transferring the Edgewood Civic Association parcel to the city</td></tr>
<tr><td>4</td><td>Boundaries of Civic Association parcel have never been made clear</td></tr>
<tr><td>5</td><td>Alternative 2 maximizes damage to the environment</td></tr>
</table>

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| **No.** | **Name** | **Street** | **City, State Zip** |
| 1 | Karen Honeycutt | 71 Greenwood Ave. | North Swanzey, NH 03431 |
| **Item** | **Concerns** | **Notes** | **Needs** |
| **1** | Aesthetic benefits of property will diminish with tree clearing | • The backyard view is the main reason bought the property two years ago<br>• Distrust with Stantec because ended up with the same conclusion as the airport<br>• Most residents of the neighborhood chose to live in Edgewood because of the beauty of its natural setting<br>• Would not have purchased property if the view was of an airport rather than the forest | Determine alternative to mitigate pilot safety concerns for Runway 20 approach |
| **2** | Reduce property values | | |
| **3** | Edgewood residents are being ignored | | |
| **4** | Removing trees significantly impacts quality of life | | |
| **5** | Potentially negate rights of residents | | |

| Personal Information | | | |
|---|---|---|---|
| **No.** | **Name** | **Street** | **City, State Zip** |
| 1 | Edgewood Neighborhood Association | 1 Riverton St | Keene, NH 03431 |
| **Item** | **Concerns** | **Notes** | **Needs** |
| **1** | Removing the trees will significantly impact the quality of life, reduce property values, and potentially negate residents' rights | • Petition signed by 112 residents/citizens | Consider other alternatives |

| Personal Information | | | |
|---|---|---|---|
| **No.** | **Name** | **Street** | **City, State Zip** |
| 1 | Teri & John Boudreau | 91 Greenwood Ave. | Keene, NH 03431 |
| **Item** | **Concerns** | **Notes** | **Needs** |
| **1** | Concerns of neighborhood residents are being dismissed | • Many neighborhood residents do not oppose "topping" the trees deemed too tall<br>• Many pilots flying into the airport have suggested alternate solutions | Work toward a mutually acceptable solution |
| **2** | City negligence has created this issue | | |

| Personal Information | | | |
|---|---|---|---|
| **No.** | **Name** | **Street** | **City, State Zip** |
| 1 | Sarah Ellsworth | 123 Greenwood Ave. | Keene, NH 03431 |
| **Item** | **Concerns** | **Notes** | **Needs** |
| **1** | Tree clearing encompasses almost three quarters of the neighborhood. | • Included in the letter is the EA from the Kenai Municipal Airport Obstruction Removal Project<br>• Trees filter water as well as noise and vibrations from airport<br>• Many young, 20-40 feet deciduous trees in the Keene Forestry Park could help restore the park to a forest if done carefully<br>• Possibly light obstructions | Review Kenai Municipal Airport and determine other alternatives.<br>Provide provision to top trees and develop stepwise plan with neighborhood buffer.<br>Provide plan to replant trees for future growth. |
| **2** | Character of entire neighborhood will be erased. Aesthetic tragedy. | | |
| **3** | Lead is still used in Avgas, therefore removal of tress will increase health concerns for residents | | |
| **4** | Kenai plan is more cooperative with the neighborhood and transparent overall | | |

| Personal Information | | | |
|---|---|---|---|
| **No.** | **Name** | **Street** | **City, State Zip** |
| 1 | Eloise Clark | P.O. Box 255 (Friends of Open Space in Keene) | Keene, NH 03431 |
| **Item** | **Concerns** | **Notes** | **Needs** |
| **1** | Disruption of unique wetland bog sited within the study zone | • Friends of Open Space in Keene had concerns with the proposed land alterations when presented two years ago | Request a sufficient buffer of vegetation be maintained around the park's bog in order to minimize disturbance from machinery |
| **2** | No foot or vehicle traffic should be allowed in the bog as very sensitive to disturbance | | |
| **3** | Excessive run-off of water during heavy rainfall events | | |
| **4** | Erosion of sediment into the bog is likely due to the heavy machinery required for the work | | |

| Personal Information | | | |
|---|---|---|---|
| **No.** | **Name** | **Street** | **City, State Zip** |
| 1 | Cheryl Burrows | 26 Liberty Lane | Keene, NH 03431 |
| **Item** | **Concerns** | **Notes** | **Needs** |
| **1** | Impact to birds in area, especially grass sparrows, migratory ducks and hawks. Impact to dwarf mussels. | • Questions the statement that there are no vernal pools as amphibians have been seen and heard in wetlands<br>• Keene currently has poor air quality due to the inversion issues caused by the valley setting<br>• Her daughter has serious asthma issues from growing up in Keene | Implement the "No Action" alternative |
| **2** | Air quality will be negatively affected by tree removal. | | |
| **3** | Aircraft exhaust emits lead and other gases into the air. | | |
| **4** | Tree clearing will contribute to more noise and light pollution. | | |

| Personal Information | | | |
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| **No.** | **Name** | **Street** | **City, State Zip** |
| 1 | Edgewood Neighborhood Association | One Riverton Street | Keene, NH 03431 |
| **Item** | **Concerns** | **Notes** | **Needs** |
| **1** | Property values will decrease | • The residents' voices have been ignored or not specifically addressed<br>• An increase in the PAPI approach angle will mitigate safety concerns<br>• Edgewood residents pay over $500,000 per year in taxes | Support in their struggle to help the City do what is right, not just for the Airport, but for the whole community |
| **2** | The environment in and around the neighborhood will diminish | | |
| **3** | Health to the Edgewood residents at risk due to planes emitting hazardous particulates. | | |
| **4** | Trees provide noise reduction | | |

| Personal Information | | | |
|---|---|---|---|
| **No.** | **Name** | **Street** | **City, State Zip** |
| 1 | Carolyn Paris | 38 Edgewood Street | Keene, NH 03431 |
| **Item** | **Concerns** | **Notes** | **Needs** |
| **1** | Quality of life, health, and property value is in jeopardy | • Suggests having pilots land further down the runway, or cut only specific tree tops | Determine alternatives to mitigate pilot safety concerns for Runway 20 approach |
| **2** | Will not be able to go outside in the summer due to the toxic fumes and noise | | |

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<tr><th>No.</th><th>Name</th><th>Street</th><th>City, State Zip</th></tr>
<tr><td>1</td><td>Brant and Lynda Elkind</td><td>108 Greenwood Ave.</td><td>Keene, NH 03431</td></tr>
<tr><th>Item</th><th>Concerns</th><th>Notes</th><th>Needs</th></tr>
<tr><td>1</td><td>Tree removal will reduce the value of their home</td><td rowspan="2">• Many of the users of the airport do not live in Keene or NH and do not pay local taxes<br>• Airport serves minority<br>• Commission and Airport Manager have “not been truthful” with their presentations<br>• The neighborhood provides the city $500,000 in taxes yearly<br>• The airport has never broken even</td><td rowspan="2">Determine a viable alternative that may include marking trees, changing the PAPI glide slope, or moving the PAPI.</td></tr>
<tr><td>2</td><td>Tree removal will diminish quality of life in the neighborhood</td></tr>
</table>

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<tr><td>1</td><td>Mark Meess</td><td>59 Greenwood Ave.</td><td>Keene, NH 03431</td></tr>
<tr><th>Item</th><th>Concerns</th><th>Notes</th><th>Needs</th></tr>
<tr><td>1</td><td>Many households will refuse to sign easements</td><td rowspan="2">• The EA provided by Stantec is a “rubber stamp” document</td><td rowspan="2">Tree-topping should be offered to landowners.<br>Consideration should be given to constructing a visual/sound berm.<br>Mark and light vegetative obstructions.<br>Master plan for future vegetative management.</td></tr>
<tr><td>2</td><td>Tree-topping will provide a buffer between airport and neighborhood while awaiting regrowth of vegetation</td></tr>
</table>

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<tr><th>No.</th><th>Name</th><th>Street</th><th>City, State Zip</th></tr>
<tr><td>1</td><td>Jonathon Miller<br>Debra Miller</td><td>24 Lynwood Ave.</td><td>Keene, NH 03431</td></tr>
<tr><th>Item</th><th>Concerns</th><th>Notes</th><th>Needs</th></tr>
<tr><td>1</td><td>Increase noise and pollution</td><td rowspan="7"><ul><li>Trees make an excellent buffer between airport and Edgewood neighborhood</li><li>Believes decision to clear trees was made long ago</li><li>Trust is broken with the process because they feel the airport has not been forthcoming</li><li>Airport doesn’t benefit the city economically</li></ul></td><td rowspan="7">Selectively “topping” trees if the landowners would prefer it.<br>Displace threshold to minimize tree clearing.<br>Move navigational instrument.<br>Replantings.</td></tr>
<tr><td>2</td><td>Ecosystem will be negatively affected</td></tr>
<tr><td>3</td><td>Wind funneling will be a concern for neighborhood residents</td></tr>
<tr><td>4</td><td>Dangerous winds will be hazardous to the property structures</td></tr>
<tr><td>5</td><td>Toxic fumes</td></tr>
<tr><td>6</td><td>Property values will plummet</td></tr>
<tr><td>7</td><td>Quality of life</td></tr>
</table>

**To:** Federal Aviation Administration, NH Department of Transportation
**Re:** Public Comment - Environmental Assessment for Keene Dillant-Hopkins Airport

I ask that you follow up on the April 2014 Environmental Assessment with a full Environmental Impact Statement. The EA states that there will be no appreciable socioeconomic impact of the proposed tree-clearing. Many residents of Edgewood have a very different perception.

Our current forested buffer was established when the Edgewood Civic Association deeded 12 acres to the City of Keene, with clear intent that it function as a buffer from the Airport and its activities. An additional 22 acres was deeded to the City from the Keene Forestry Association, and in the 1970s these parcels were designated as Keene Forestry Park. With the tree-clearing project, in the short term we will experience loss of the aesthetics (including "curb appeal") and personal enjoyment of our wooded neighborhood and the abutting Keene Forestry Park. We will be impacted by increased light and noise and odors from the Airport, and from the Keene Wastewater Treatment Facility that is on Airport Road. Air quality will also be at issue, at very least until a forest is re-established. These air quality issues may have an impact on the health of our residents, particularly the elderly and our children.

In the long term, properties in Edgewood that will be under avigation easements will have a lower market value, if they are marketable at all with the terms of the easements in place. Properties not under easement will likely also experience a drop in market value with the change in quality of life in the neighborhood, and with over a third of the properties in the neighborhood under the easement restrictions. It is still not known whether the City of Keene will lower tax assessments in the neighborhood in the aftermath of the tree-clearing project. At this point, the neighborhood collectively pays about $500,000 in property taxes annually.

Edgewood was established in 1913, and many of its homes were built in the second through fourth decades of the twentieth century; virtually all had been built by the 1960s. The neighborhood has a definite sense of community, with gatherings on the neighborhood common and neighbors stopping to chat as they stroll the streets or the Forestry Park paths. Our children are trusted to play outside together throughout the neighborhood. A number of the seniors in the neighborhood have lived in Edgewood for 30 to 50 years. The Edgewood Civic Association (now the Edgewood Neighborhood Association) was founded in the immediate aftermath of Pearl Harbor Day in 1941, and today is an active and engaged presence. With the impact of the Airport's proposed tree-clearing project, the demographics of the area may change significantly, potentially shifting from primarily long-term single-family ownership to more rentals and less "spirit of place."

Please take this into consideration as you make your determination of the impact of this project.

Sincerely
Lee A. Kendall
46 Lynwood Ave.
Keene, NH
03431

**To:** Federal Aviation Administration, NH Department of Transportation
**Re:** Public Comment - Environmental Assessment for Keene Dillant-Hopkins Airport

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Sally Parsons
48 Edgewood Ave.
Keene NH 03431

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**Re:** Public Comment - Environmental Assessment for Keene Dillant-Hopkins Airport

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Susan North
Susan North

4 Kenworth Ave.
Keene NH 03431

**To:** Federal Aviation Administration, NH Department of Transportation
**Re:** Public Comment - Environmental Assessment for Keene Dillant-Hopkins Airport

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Joe McMahon 25 Lynwood Ave
Joe McMahon
Teri Perkins 91 Greenwood Ave
Teri Perkins

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Katharina Rooney

Katharina Rooney 642 Main St.
Keene NH

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Peter Rooney 642 Main St.

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VIRGINIA C DUNNELL    30 LYNWOOD AVE.

Virginia C Dunnell

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Steven Wilson 99 Greenwood Ave

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GERALDINE FREDERIKSEN
Geraldine Frederiksen

675 Main St
Keene

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Jennifer Reno
Jennifer Reno
34 Edgewood Ave
Keene, NH

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[signature]

MARK A. MEESS

59 GREENWOOD AVE
KEENE, NH

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**Re:** Public Comment - Environmental Assessment for Keene Dillant-Hopkins Airport

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CRAIG H. SMITH

637 MAIN ST.
KEENE

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637 Main St.
Keene, NH 03431

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15 Edgewood Ave

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Marianne Marsh
122 Greenwood Ave,
Keene

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Lynda D. Elkind 108 Greenwood Ave, Keene
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Karen Honeycutt
71 Greenwood Ave.
Keene, NH 03431

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Christopher Alexay
77 Greenwood Ave
N. Swanzey, NH

5/22/2014

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Please take this into consideration as you make your determination of the impact of this project.

Jennifer L. Myers
77 Greenwood Ave
N. Swanzey, NH 03431

5/22/2014

**To:** Federal Aviation Administration, NH Department of Transportation
**Re:** Public Comment - Environmental Assessment for Keene Dillant-Hopkins Airport

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JOHN DUNNELL 30 Lynwood Ave.
Keene, N.H.

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Sandra Canezza

114 Greenwood Ave Keene, NH

**To:** Federal Aviation Administration, NH Department of Transportation
**Re:** Public Comment - Environmental Assessment for Keene Dillant-Hopkins Airport

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Thank you,
Rosalie Sinclair
24 Lynwood Ave.
Keene, NH

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**Re:** Public Comment - Environmental Assessment for Keene Dillant-Hopkins Airport

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Timothy Robdean
24 Lynwood Ave
Keene NH

**To:** Federal Aviation Administration, NH Department of Transportation
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Thank you,

Dr Alan Ross

114 Greenwood Ave
Keene, NH

ALAN L. ROSS DMD

**To:** Federal Aviation Administration, NH Department of Transportation
**Re:** Public Comment - Environmental Assessment for Keene Dillant-Hopkins Airport

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24 Lynwood Ave
Keene NH

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Jon Mason
24 Lynwood Ave
Keene, NH

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RON HITCHINGS
14 LEAWOOD AVE
KEENE, NH.

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Judith Hitchings
14 Leawood Ave, Keene, NH
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James G. Frederiksen
675 Main St.
Keene. NH.

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GIA FARINA
Gia Farina
74 GREENWOOD AVE

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Beth DANIELS
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74 Greenwood Ave

**To:** Federal Aviation Administration, NH Department of Transportation
**Re:** Public Comment - Environmental Assessment for Keene Dillant-Hopkins Airport

I ask that you follow up on the April 2014 Environmental Assessment with a full Environmental Impact Statement. The EA states that there will be no appreciable socioeconomic impact of the proposed tree-clearing. Many residents of Edgewood have a very different perception.

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In the long term, properties in Edgewood that will be under avigation easements will have a lower market value, if they are marketable at all with the terms of the easements in place. Properties not under easement will likely also experience a drop in market value with the change in quality of life in the neighborhood, and with over a third of the properties in the neighborhood under the easement restrictions. It is still not known whether the City of Keene will lower tax assessments in the neighborhood in the aftermath of the tree-clearing project. At this point, the neighborhood collectively pays about $500,000 in property taxes annually.

Edgewood was established in 1913, and many of its homes were built in the second through fourth decades of the twentieth century; virtually all had been built by the 1960s. The neighborhood has a definite sense of community, with gatherings on the neighborhood common and neighbors stopping to chat as they stroll the streets or the Forestry Park paths. Our children are trusted to play outside together throughout the neighborhood. A number of the seniors in the neighborhood have lived in Edgewood for 30 to 50 years. The Edgewood Civic Association (now the Edgewood Neighborhood Association) was founded in the immediate aftermath of Pearl Harbor Day in 1941, and today is an active and engaged presence. With the impact of the Airport's proposed tree-clearing project, the demographics of the area may change significantly, potentially shifting from primarily long-term single-family ownership to more rentals and less "spirit of place."

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Christie F. Wright
66 Greenwood Ave

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Suzanne Nadeau
Suzanne Nadeau 3 Kenworth Ave

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JEFF MACMURRAY J McMurray 7 OAKWOOD AVE, KEENE NH

John T Bardeau 91 Greenwood Ave, Keene NH

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Diana Wilson
29 Greenwood Ave Keene NH 03431

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Please take this into consideration as you make your determination of the impact of this project.

Rhonda Capasso Tralli - 109 GREENWOOD AVE.
RHONDA CAPASSO TRALLI

## Cohen, Gregg

**From:** Dwight & Leanne Anderson <dlanderson@ne.rr.com>
**Sent:** Monday, April 07, 2014 12:50 PM
**To:** Cohen, Gregg
**Subject:** DILLANT-HOPKINS AIRPORT DEA (April 2014)

Mr. Cohen

In regards to your DEA report for Dillant- Hopkins Airport in Keene NH, I have a question regarding; Alternatives 3: Description of Alternatives 3.2: Alternative 3.2.3.
When the runway (2/20) was last redone there was 300' of runway on the south end abandoned. With the displacement of 1587' it seems it would be relatively easy to rebuild
that portion giving 4913' for LDA,TORA, and TODA. That would leave only 87' of new runway, that would give the Airport sufficient runway length for currant planes, and as your
report states they are not planning for larger planes in the future. This would not require the Avigation Easements or the cutting of a large amount of acreage on Airport or
private property I'm wondering if this option was considered and if not why wasn't it considered?
I anticipate your answer.

Dwight Anderson
103 Greenwood Ave.
Keene NH 03431
603-352-0534
dlanderson@ne.rr.com

To: Federal Aviation Administration, NH Department of Transportation
Re: Public Comment on Environmental Assessment for Keene Dillant-Hopkins Airport

I would strongly encourage your consideration of an Environmental Impact Statement related to the Keene Dillant-Hopkins Airport's obstruction-clearing project. The Environmental Assessment for this project, prepared by Stantec Consulting, does not adequately examine a number of potential environmental impacts.

**SECTION 5.6** states that the area to be cleared is not recognized as park by the City of Keene or the Town of Swanzey. In fact, the area does include at least a portion of the Keene Forestry Park, recognized in the City of Keene Park's and Recreation Active and Passive Recreation Management Plan (2012) as well as in other City documents. (A map used in preparation of that plan is attached.) There are a number of trails through the area, used for walking, biking, cross-country skiing or snow-shoeing, and for nature observation. The quality of the trails and the experience of users will certainly be impacted by the removal of the white pine forest.

**SECTION 5.12** states that "it is very likely that within 2-3 years a visual buffer more substantial than that which currently exists will be established." This is an unrealistic expectation, given the sandy soil of the area (remnant of a sandy delta of a river that flowed into the glacial Lake Ashuelot). Much of the existing understory around the peat bog (Wetland 1) consists of American beech; given the prevalence of beech bark disease/beech snap throughout the northeast, counting on these to regenerate a mature forest is unrealistic. In addition, the hemlock wooly adelgid has been found within Cheshire County (in Pisgah Park), so hemlock as a strong component of regenerated forest may be unlikely. Another concern in the aftermath of forest-clearing is the prospect of overgrowth of invasive species: Japanese knotweed is growing profusely to the east of the Airport property, where trees were previously cleared along NH Rte 32, there is significant growth of Bittersweet and wild grapes along Airport Road and the Wetlands section of the EA identifies Bittersweet growing at the eastern boundary of Wetland #1, and glossy buckthorn has been noted nearby. Even observing Best Management Practices to minimize disturbance of soils in the area during forest clearing, growth of any or all of these invasives in the project area will be difficult to avoid.

**SECTION 5.13**, related to natural resources and energy supply, does not address the loss of cooling effect, by shading and by evaporative heat loss through transpiration in the woodland, for those homes to the north of the forest to be cleared. It is likely that energy use for summertime cooling will increase. Those homes will also lose the function of the forest as a windbreak during the winter, and may have increased energy demands for heating.

**SECTION 5.14**, related to noise, suggests that a doubling of noise-levels by loss of the forest buffer would not be significant to homeowners in the area. Other airports have more realistically acknowledged the impact of ground-operation noise on their neighbors. For example, this statement is found on the website of PVD Airport in Rhode Island: *Even when making only a minor contribution to overall noise exposure (measured in DNL), aircraft ground operations noise still has the potential to cause speech interference, sleep disturbance, and community annoyance in nearby residential areas. Sound levels sufficient to cause speech interference may make conversation difficult or interfere with use of the telephone or with listening to television or radio. Sufficiently high sound levels also may cause sleep disturbance, especially during warmer months when windows are more likely to be open. Sound levels that are not loud enough to cause speech interference or sleep disturbance still may cause community annoyance, especially during events of unpredictable or indefinite duration such as aircraft idling or pre-*

*flight run-ups. For these reasons, supplemental metrics such as Lmax and SEL can be useful in describing and understanding ground operations noise.*
(http://www.pvdairport.com/corporate/environment/noise-faqs)
It should be noted that the forest has functioned as a buffer for noise, not only from aircraft (with jets not infrequently heard idling for as long as 30 minutes before take-off) but from airport ground-service vehicles (GSV) and from non-airport traffic, primarily diesel-fuelled septic service trucks travelling to and from Keene's Wastewater Treatment Plant at the end of Airport Road.
Should not at least *some* measurements of sound-levels during ground operations be made in the residential area, before and after clearing of any trees? Should consideration be given to a Residential Sound Insulation Program, at least for those homes most directly affected by loss of the forest buffer?

**SECTION 5.16** states that there should be consideration of **"health and safety risks that could disproportionately affect children."** There is clear evidence that aircraft operations and GSV operations produce airborne pollutants which may aggravate reactive airway disease such as asthma, in addition to increasing the risks of other cardiac and pulmonary diseases. There is also clear evidence that urban forests decrease concentrations of particulates and other air-borne pollutants, by removal of 03, NO2, SO2, CO, and by trapping and settling of particulates PM1-10. (From the US Forest Service Northeast Division: Nowak et al, Air Pollution removal by urban trees and shrubs in the US, *Urban Forestry and Urban Greening,* 4(2006) 115-123, and Nowak et al: Modeled PM2.5 removal by trees in ten US cities and associated health effects, *Environmental Pollution* 178 (2013) 395-402: copies of both articles are attached.)

**Until the Edgewood forest regenerates, there will be a reduction of this important ecosystem service, and more exposure of vulnerable children to health and safety risks.** With a goal stated in the EA that the forest that regenerates should consist of a mix of deciduous and coniferous trees, there will be less year-round benefit than currently exists.

While the FAA may not require air quality studies for an airport of Keene's size, Cheshire County has already experienced air quality indicators over threshold for "non-attainment status" on several occasions. While much of this effect is likely due to community use of woodstoves, there has been no direct measurement of the short-term (temporally related to aircraft operations), near-range, or long-term levels of air-quality indicators in the area of EEN or its abutting residential areas. Should these measurements not be undertaken?

The FAA participated in generation of a 2008 document titled "Research Needs Associated with Particulate Emissions at Airports" (onlinepubs.trb.org/onlinepubs/acrp/acrp_rpt_006.pdf). Further evaluation of the environmental impact of the proposed tree-clearing could contribute to that body of research, and there are academic resources within the community capable of participating in that evaluation (eg Keene State College, Antioch University).

**Carbon impacts of the project**

Although not required as part of the EA, it seems imperative to acknowledge the carbon impact of clearing 15 acres of urban forest. This is especially important in light of the April 2014 report of the Intergovernmental Panel on Climate Change and the May 2014 US National Climate Assessment, both highlighting the urgency of response to the mounting challenges of climate change.
A 2013 USFS article (Nowak et al, Carbon storage and sequestration by trees in urban and community areas of the US, *Environmental Pollution* 178 (2013) 229-236), suggests that in NH urban and community forests actively sequester an average of 0.217 kg carbon/sq meter tree cover/year. For the 15 acres of the EEN project, this amounts to over 13 tons of carbon sequestered per year – in addition to the carbon that is already stored long-term in the biomass of the trees. A 2014 study indicates that the rate of tree carbon accumulation (i.e. sequestration) increases continuously with tree size. While there may be

eventual regeneration of an urban forest in the project area, it will be some time before these vital functions related to carbon impacts and climate change can be restored. During the design phase of the clearing project, creative approaches to mitigating the lost carbon storage should be seriously pursued.

**WETLAND DELINEATION/FUNCTION AND VALUE REPORT**

A significant inaccuracy should be noted in the report's statement that the project area does not overlie any aquifer or have any role in aquifer recharge. In fact, the entire area overlies an extensive stratified drift aquifer. This is readily noted in the Natural Resource Inventory appended to the City of Keene's 2012 Comprehensive Master Plan (see attachment). The capacity of the bog (Wetland 1) for aquifer recharge is potentially significant.

It should be noted that Wetlands 1 and 3 are part of a larger wetlands complex: they abut an oxbow which is part of the Ashuelot River floodplain. The EA states that there are no vernal pools in the area; it should be noted, however, that in the spring of 2012 wood-frog egg masses were noted in Wetland 3 by the director of the Ashuelot Valley Environmental Observatory (verbal communication). The forested areas of the project area clearly serve as upland for the entire wetlands complex.

The EA contains correspondence from the NH Heritage Bureau stating that there is "no record in the database" of threatened, rare, or endangered species in the wetlands in the project area, but qualifies this with the statement that "many areas have never been surveyed, or have only been surveyed for certain species. An on-site survey would provide better information on what species and communities are present." Particularly with regard to Wetland 1, **it would seem only prudent to follow up on this recommendation and do a more thorough survey of the bog**.

The EA's wetlands delineation, completed in September 2013, appears to fall well short of historically observed boundaries of Wetlands 1 and 3 (which have been observed to have unusually low water levels for the last several years). Around Wetland 3, there are several sites with old, faded flagging as much as 6-12 feet beyond the 2013 delineation, possibly from a past delineation that seems more in keeping with historical boundaries and current conditions. (Photograph attached) While I am not a wetlands scientist, in the spring of 2014 I observed standing water well beyond the 2013 delineation flagging (photograph attached), as well as typical wetland vegetation and appreciably "spongy" soil. A more accurate wetlands delineation could significantly affect the calculation of wetlands acreage within which trees will be cleared. It would also be very important to clarify before undertaking the design phase of the obstruction-clearing project.

The EA's wetlands report was completed by Katelin Nickerson, a wetlands scientist certified in the State of Maine, and was signed off by another wetlands scientist, Bryan Emerson, based in Maine but certified in New Hampshire. I would like to ask whether Mr. Emerson had been on-site at the EEN project area.

In short, not only does this Environmental Assessment present a limited array of alternatives but it does not fully explore the potential environmental impact of its preferred Alternative, #2. I strongly recommend pursuit of a more thorough and accurate Environmental Impact Statement.

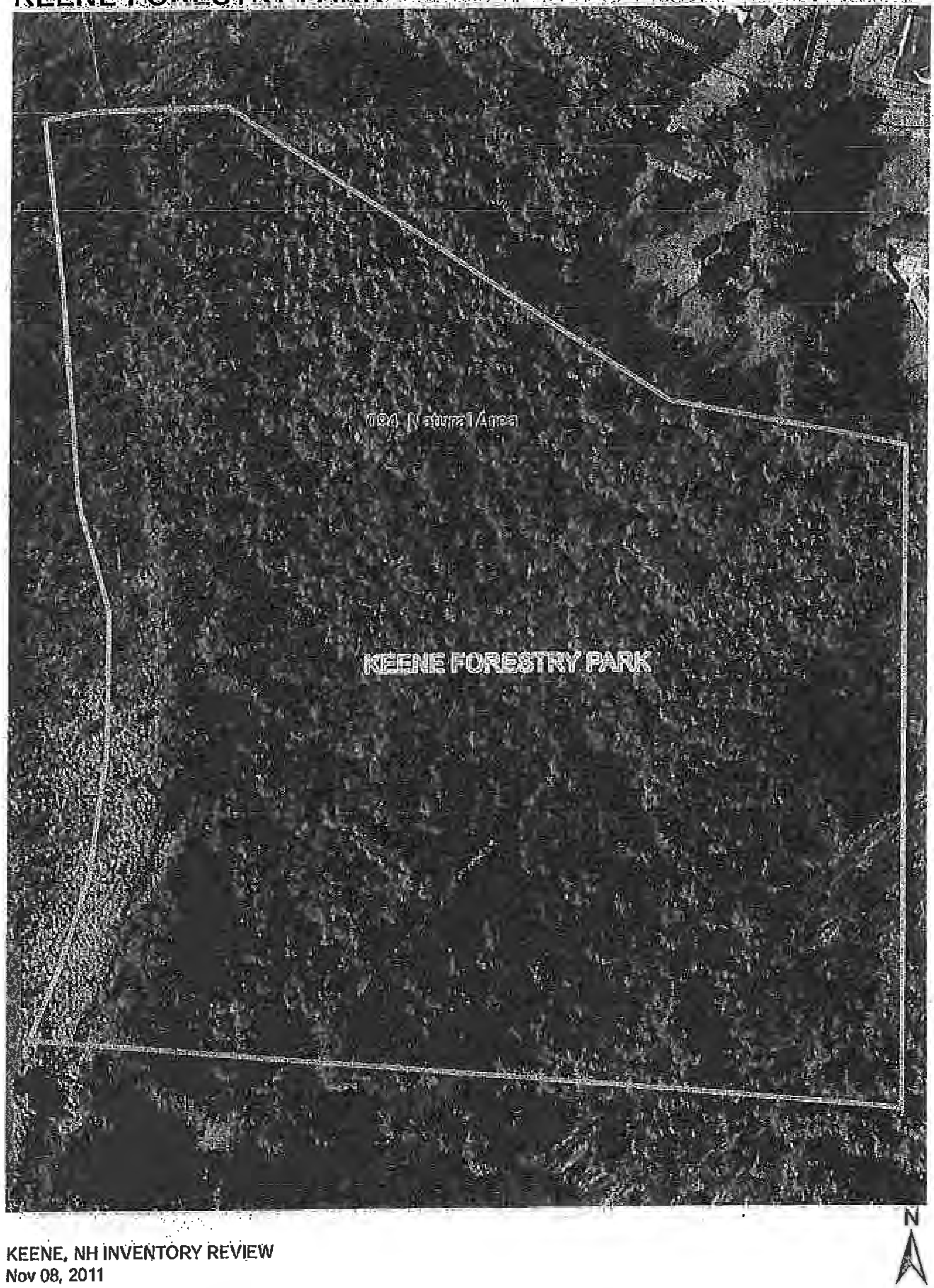
Ann (Shedd) MD

Ann Shedd, MD
59 Greenwood Avenue
Keene, NH 03431

ATTACHMENTS: Submitted directly to Dept of Transportation

1. Map of Keene Forestry Park, from City of Keene Parks and Recreation Dept
2. Nowak et al, Air Pollution removal by urban trees and shrubs in the US, *Urban Forestry and Urban Greening,* 4(2006) 115-123
3. Nowak et al: Modeled PM2.5 removal by trees in ten US cities and associated health effects, *Environmental Pollution* 178 (2013) 395-402
4. Introduction to "Research Needs Associated with Particulate Emissions at Airports" (onlinepubs.trb.org/onlinepubs/acrp/acrp_rpt_006.pdf).
5. Nowak et al, Carbon storage and sequestration by trees in urban and community areas of the US, *Environmental Pollution* 178 (2013) 229-236
6. Map of Keene's aquifer, from the 2010 Keene Comprehensive Master Plan
7. Photograph (Ann Shedd, May 2014) showing one of several areas around Wetland #3 with Sept 2013 Wetland Delineation flagging well inside previous flagging (unknown date)
8. Photograph (Ann Shedd, May 2014) showing one of several areas around Wetland #3 with standing water beyond Sept 2013 Wetland Delineation flagging

# KEENE FORESTRY PARK




KEENE, NH INVENTORY REVIEW
Nov 08, 2011

| | |
|---|---|
| Park Name | KEENE FORESTRY PARK |
| Ownership | CITY OF KEENE |
| Class | PARK |
| Address | |
| Inventory Date | 14-Jul |
| D&A | 2 |
| Drnk. Fountains | |
| Seating | |
| BBQ Grills | |
| Dog Station | |
| Security Lighting | |
| Bike Parking | |
| Restrooms | |
| Shade | |
| Connect to Trails | |
| Park Access | 2 |
| Parking | 2 |
| Seasonal Plant | |
| Ornamental | |
| Picnic Tables | |
| Other | |
| Comments | corrected parcel but verify components and modifiers |
| GIS Acres | 18 |
| GISID | P024 |

| GISID | Comp | N | C | QTY | Lights | Shade | Comments |
|---|---|---|---|---|---|---|---|
| 94 | Natural Area | 2 | 2 | 1 | | | |

Available online at www.sciencedirect.com
SCIENCE DIRECT
ELSEVIER
Urban Forestry & Urban Greening 4 (2006) 115–123
URBAN FORESTRY & URBAN GREENING
www.elsevier.de/ufug

# Air pollution removal by urban trees and shrubs in the United States

David J. Nowak*, Daniel E. Crane, Jack C. Stevens

*USDA Forest Service, Northeastern Research Station, 5 Moon Library, SUNY-ESF, Syracuse, NY 13210 USA*

## Abstract

A modeling study using hourly meteorological and pollution concentration data from across the coterminous United States demonstrates that urban trees remove large amounts of air pollution that consequently improve urban air quality. Pollution removal ($O_3$, $PM_{10}$, $NO_2$, $SO_2$, CO) varied among cities with total annual air pollution removal by US urban trees estimated at 711,000 metric tons ($3.8 billion value). Pollution removal is only one of various ways that urban trees affect air quality. Integrated studies of tree effects on air pollution reveal that management of urban tree canopy cover could be a viable strategy to improve air quality and help meet clean air standards.
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*Keywords:* Air quality; Urban forests; Urban forestry; Environmental quality

## 1. Introduction

Air pollution is a major environmental concern in most major cities across the world. An important focus of research has been on the role of urban vegetation in the formation and degradation of air pollutants in cities. Through the emission of volatile organic compounds (VOC), urban trees can contribute to the formation of ozone ($O_3$) (Chameides et al., 1988). However, more integrative studies are revealing that urban trees, particularly low VOC emitting species, can be a viable strategy to help reduce urban ozone levels (Cardelino and Chameides, 1990; Taha, 1996; Nowak et al., 2000), particularly through tree functions that reduce air temperatures (transpiration), remove air pollutants (dry deposition to plant surfaces), and reduce building energy and consequent power plant emissions (e.g., temperature reductions; tree shade). One study (Nowak et al., 2000) has concluded that for the US northeast coast, the physical effects of urban trees were more important than the chemical effects in terms of affecting ozone concentrations.

Nationally, urban trees and shrubs (hereafter referred to collectively as "trees") offer the ability to remove significant amounts of air pollutants and consequently improve environmental quality and human health. Trees remove gaseous air pollution primarily by uptake via leaf stomata, though some gases are removed by the plant surface. Once inside the leaf, gases diffuse into intercellular spaces and may be absorbed by water films to form acids or react with inner-leaf surfaces (Smith, 1990). Trees also remove pollution by intercepting airborne particles. Some particles can be absorbed into the tree, though most particles that are intercepted are retained on the plant surface. The intercepted particle often is resuspended to the atmosphere, washed off by rain, or dropped to the ground with leaf and twig fall. Consequently, vegetation is only a temporary retention site for many atmospheric particles.

To investigate the magnitude of air pollution removal by urban trees throughout the lower 48 United States, computer modeling of air pollution removal of carbon

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doi:10.1016/j.ufug.2006.01.007

monoxide (CO), nitrogen dioxide ($NO_2$), ozone, particulate matter less than 10 µm ($PM_{10}$) and sulfur dioxide ($SO_2$) was performed for 55 US cities and for the entire nation based on meteorological, pollution concentration, and urban tree cover data. Due to the need for various assumptions within the model, the model provides a first-order estimate of the magnitude of pollution removal by urban trees.

## Methods

For each city, the downward pollutant flux ($F$; in $g\,m^{-2}s^{-1}$) was calculated as the product of the deposition velocity ($V_d$; in $m\,s^{-1}$) and the pollutant concentration ($C$; in $g\,m^{-3}$) ($F = V_dC$). Deposition velocity was calculated as the inverse of the sum of the aerodynamic ($R_a$), quasi-laminar boundary layer ($R_b$) and canopy ($R_c$) resistances (Baldocchi et al., 1987). Hourly estimates of $R_a$ and $R_b$ were calculated using standard resistance formulas (Killus et al., 1984; Pederson et al., 1995; Nowak et al., 1998) and hourly weather data from nearby airports for 1994. $R_a$ and $R_b$ effects were relatively small compared to $R_c$ effects.

Hourly canopy resistance values for $O_3$, $SO_2$, and $NO_2$ were calculated based on a modified hybrid of big-leaf and multilayer canopy deposition models (Baldocchi et al., 1987; Baldocchi, 1988). Canopy resistance ($R_c$) has three components: stomatal resistance ($r_s$), mesophyll resistance ($r_m$), and cuticular resistance ($r_t$), such that: $1/R_c = 1/(r_s+r_m)+1/r_t$. Mesophyll resistance was set to zero $s\,m^{-1}$ for $SO_2$ (Wesely, 1989) and 10 $s\,m^{-1}$ for $O_3$ (Hosker and Lindberg, 1982). Mesophyll resistance was set to 100 $s\,m^{-1}$ for $NO_2$ to account for the difference between transport of water and $NO_2$ in the leaf interior, and to bring the computed deposition velocities in the range typically exhibited for $NO_2$ (Lovett, 1994). Base cuticular resistances were set at 8000 $s\,m^{-1}$ for $SO_2$, 10,000 $s\,m^{-1}$ for $O_3$, and 20,000 $s\,m^{-1}$ for $NO_2$ to account for the typical variation in $r_t$ exhibited among the pollutants (Lovett, 1994).

As removal of CO and particulate matter by vegetation are not directly related to photosynthesis/transpiration, $R_c$ for CO was set to a constant for in-leaf season (50,000 $s\,m^{-1}$) and leaf-off season (1,000,000 $s\,m^{-1}$) (Bidwell and Fraser, 1972). For particles, the median deposition velocity (Lovett, 1994) was set to 0.064 $m\,s^{-1}$ based on 50-percent resuspension rate (Zinke, 1967). The base Vd was adjusted according to in-leaf vs. leaf-off season parameters. To limit deposition estimates to periods of dry deposition, deposition velocities were set to zero during periods of precipitation.

Each city was assumed to have a single-sided leaf area index within the canopy covered area of 6 and to be 10% coniferous (Nowak, 1994). Leaf area index value is total leaf area ($m^2$: trees and large shrubs [minimum 1 in stem diameter]) divided by total canopy cover in city ($m^2$) and includes layering of canopies. Regional leaf-on and leaf-off dates were used to account for seasonal leaf area variation. Total tree canopy cover in each city was based on aerial photograph sampling (Nowak et al., 1996) or advanced very high resolution radiometer data (Dwyer et al., 2000; Nowak et al., 2001).

Hourly pollution concentration data (1994) from each city were obtained from the US Environmental Protection Agency (EPA). Missing hourly meteorological or pollution-concentration data were estimated using the monthly average for the specific hour. In some locations, an entire month of pollution-concentration data may be missing and are estimated based on interpolations from existing data. For example, $O_3$ concentrations may not be measured during winter months and existing $O_3$ concentration data are extrapolated to missing months based on the average national $O_3$ concentration monthly pattern. Data from 1994 were used due to available data sets with cloud cover information. To estimate percent air quality improvement due to dry deposition (Nowak et al., 2000), hourly boundary heights were used in conjunction with local deposition velocities for select cities with boundary layer height data. Daily morning and afternoon mixing heights from nearby stations were interpolated to produce hourly values using the EPA's PCRAMMIT program (US EPA, 1995). Minimum boundary-layer heights were set to 150 m during the night and 250 m during the day based on estimated minimum boundary-layer heights in cities. Hourly mixing heights (m) were used in conjunction with pollution concentrations ($\mu g\,m^{-3}$) to calculate the amount of pollution within the mixing layer ($\mu g\,m^{-2}$). This extrapolation from ground-layer concentration to total pollution within the boundary layer assumes a well-mixed boundary layer, which is common in the daytime (unstable conditions) (Colbeck and Harrison, 1985). Hourly percent air quality improvement was calculated as grams removed/(grams removed + grams in atmosphere), where grams in atmosphere = measured concentration ($g\,m^{-3}$) × boundary layer height (m) × city area ($m^2$).

To estimate pollution removal by all urban trees in the United States, national pollution concentration data (all EPA monitors) were combined with standardized local or regional pollution removal rates. Pollution removal rates ($g\,m^{-2}$ of tree cover) standardized to the average pollutant concentration in the city ($g\,m^{-2}$ per ppm or per $\mu g\,m^{-3}$). As flux rates are directly proportional to pollutant concentrations, standardized removal rates are used to account for concentration differences among urban areas.

For all urban areas in the United States outside of the 55 analyzed cities, local pollution monitoring data were used to calculate the average pollution concentration in the urban area for each pollutant. Urban area boundaries are based on 1990 census definitions of urbanized areas (areas with population density $\geq$ 1000 people $mi^{-2}$) and urban places (incorporated or unincorporated (census-defined) places with a population $\geq$ 2500) outside of urbanized areas. If pollutant monitors did not exist within the urban area, minimum state pollution concentration data were assigned to the urban area. Likewise, standardized pollution removal rates were assigned to each urban area based on data from the closest analyzed city within the same climate zone. All urban areas within a state were assigned to the dominant climate zone (cool temperate, Desert, Mediterranean, steppe, tropical, tundra, warm temperate) in the state, except for California and Texas where urban areas were individually assigned to one of multiple state climate zones.

For each urban area exclusive of the 55 analyzed cities, standardized pollution removal rates were multiplied by average pollutant concentration and total amount of tree cover to calculate total pollution removal for each pollutant in every urban area. Urban area pollution removal totals were combined to estimate the national total. Pollution removal value was estimated using national median externality values (Murray et al., 1994). Values were based on the median monetized dollar per ton externality values used in energy-decision-making from various studies. These values, in dollars per metric ton (t) are: $NO_2$ = \$6752 $t^{-1}$, $PM_{10}$ = \$4508 $t^{-1}$, $SO_2$ = \$1653 $t^{-1}$, and CO = \$959 $t^{-1}$. Externality values for $O_3$ were set to equal the value for $NO_2$. Externality values can be considered the estimated cost of pollution to society that is not accounted for in the market price of the goods or services that produced the pollution.

## Results and discussion

Total pollution removal and value varied among the cities from 11,100 t $a^{-1}$ (\$60.7 million $a^{-1}$) in Jacksonville, FL to 22 t $a^{-1}$ (\$116,000 $a^{-1}$) in Bridgeport, CT (Table 1). Pollution removal values per unit canopy cover varied from 23.1 g $m^{-2}$ $a^{-1}$ in Los Angeles, CA to 6.2 g $m^{-2}$ $a^{-1}$ in Minneapolis, MN. The median pollution removal value per unit canopy cover was 10.8 g $m^{-2}$ $a^{-1}$.

Pollution removal values for each pollutant will vary among cities based on the amount of tree cover (increased tree cover leading to greater total removal), pollution concentration (increased concentration leading to greater downward flux and total removal), length of in-leaf season (increased growing season length leading to greater total removal), amount of precipitation (increased precipitation leading to reduced total removal via dry deposition), and other meteorological variables that affect tree transpiration and deposition velocities (factors leading to increased deposition velocities would lead to greater downward flux and total removal). All of these factors combine to affect total pollution removal and the standard pollution removal rate per unit tree cover.

Jacksonville's urban forest had the largest total removal, but had below median value of pollution removal per unit tree cover. Jacksonville's high total pollution removal value was due to its large city size (1965 $km^2$) and relatively high estimated percent tree cover within the city (53%). Los Angeles had the highest pollution removal values per unit tree cover due to its relatively long in-leaf season, relatively low precipitation, and relatively high pollutant concentrations and deposition velocities. Minneapolis had the lowest pollution removal values per unit tree cover due, in part, to its relatively short in-leaf season.

Average leaf-on daytime dry deposition velocities varied among the cities ranging from 0.44 to 0.29 cm $s^{-1}$ for $NO_2$, 0.40 to 0.71 cm $s^{-1}$ for $O_3$, and 0.38 to 0.69 cm $s^{-1}$ for $SO_2$. Deposition velocities did not vary for CO and $PM_{10}$ as deposition rates for these pollutants were not related to transpiration rates, but rates did vary based on leaf-off and leaf-on seasons. The deposition velocities for CO and $PM_{10}$ were based on literature averages and assumed to be constant. The highest deposition velocities occurred in San Jose, CA; the lowest in Phoenix, AZ.

Though urban trees remove tons of air pollutants annually, average percent air quality improvement in cities during the daytime of the vegetation in-leaf season were typically less than 1 percent (Table 2) and varied among pollutants based on local meteorological and pollution concentration conditions. Percent air quality improvement was typically greatest for particulate matter, ozone, and sulfur dioxide. Air quality improvement increases with increased percent tree cover and decreased mixing-layer heights. In urban areas with 100% tree cover (i.e., contiguous forest stands), average air quality improvements during the daytime of the in-leaf season were around two percent for particulate matter, ozone, and sulfur dioxide. In some cities, short-term air quality improvements (one hour) in areas with 100% tree cover are estimated to be as high as 16% for ozone and sulfur dioxide, 9% for nitrogen dioxide, 8% for particulate matter, and 0.03% for carbon monoxide (Table 2).

These estimates of air quality improvement due to pollution removal likely underestimate the total effect of the forest on reducing ground-level pollutants because they do not account for the effect of the forest canopy in preventing concentrations of upper air pollution from reaching ground-level air space. Measured differences in

**Table 2.** Estimated percent air quality improvement in selected US cities due to air pollution removal by urban trees

| City | %tree cover | % air quality improvement | | | | |
|---|---|---|---|---|---|---|
| | | CO | $NO_2$ | $O_3$ | $PM_{10}$ | $SO_2$ |
| Atlanta, GA | 32.9 | 0.002 (0.001–0.009) | 0.5 (0.1–2.5) | 0.7 (0.1–4.4) | 0.7 (0.3–2.8) | 0.7 (0.1–4.3) |
| Boston, MA | 21.2 | 0.002 (0.000–0.006) | 0.4 (0.0–1.8) | 0.6 (0.1–3.4) | 0.6 (0.1–1.8) | 0.5 (0.1–3.4) |
| Dallas, TX | 28.0 | 0.002 (0.001–0.008) | 0.4 (0.1–2.2) | 0.6 (0.1–3.9) | 0.6 (0.2–2.4) | 0.6 (0.1–3.8) |
| Denver, CO | 26.0 | 0.001 (0.000–0.007) | 0.2 (0.0–1.5) | 0.3 (0.0–2.1) | 0.4 (0.1–2.2) | 0.3 (0.0–2.0) |
| Milwaukee, WI | 19.1 | 0.001 (0.000–0.005) | 0.3 (0.0–1.5) | 0.4 (0.1–2.7) | 0.4 (0.1–1.6) | 0.4 (0.0–2.7) |
| New York, NY | 16.6 | 0.001 (0.000–0.005) | 0.3 (0.0–1.4) | 0.4 (0.1–2.6) | 0.5 (0.1–1.4) | 0.4 (0.1–2.6) |
| Portland, OR | 42.0 | 0.003 (0.001–0.012) | 0.6 (0.1–2.7) | 0.8 (0.1–3.7) | 1.0 (0.3–3.5) | 0.7 (0.1–4.0) |
| San Diego, CA | 8.6 | 0.001 (0.000–0.002) | 0.2 (0.0–0.7) | 0.3 (0.0–1.4) | 0.3 (0.1–0.7) | 0.3 (0.0–1.4) |
| Tampa, FL | 9.6 | 0.001 (0.000–0.003) | 0.2 (0.0–0.8) | 0.2 (0.0–1.4) | 0.2 (0.1–0.8) | 0.2 (0.0–1.4) |
| Tucson, AZ | 13.7 | 0.001 (0.000–0.004) | 0.1 (0.0–1.0) | 0.1 (0.0–1.7) | 0.2 (0.1–1.2) | 0.1 (0.0–1.7) |
| Washington, DC | 31.1 | 0.002 (0.001–0.009) | 0.4 (0.2–2.3) | 0.6 (0.1–3.9) | 0.7 (0.2–2.6) | 0.6 (0.1–3.9) |

Estimates are given for actual tree cover conditions in city for ozone ($O_3$), particulate matter less than 10 μm ($PM_{10}$), nitrogen dioxide ($NO_2$), sulfur dioxide ($SO_2$), and carbon monoxide (CO) based on local boundary layer height and pollution removal estimates. Bounds of total tree removal of $O_3$, $NO_2$, $SO_2$, and $PM_{10}$ were estimated using the typical range of published in-leaf dry deposition velocities (Lovett, 1994)

$O_3$ concentration between above- and below-forest canopies in California's San Bernardino Mountains have exceeded 50 ppb (40-percent improvement) (Bytnerowicz et al., 1999). Under normal daytime conditions, atmospheric turbulence mixes the atmosphere such that pollutant concentrations are relatively consistent with height (Colbeck and Harrison, 1985). Forest canopies can limit the mixing of upper air with ground-level air, leading to significant below-canopy air quality improvements. However, where there are numerous pollutant sources below the canopy (e.g., automobiles), the forest canopy could have the inverse effect by minimizing the dispersion of the pollutants away at ground level.

The greatest effect of urban trees on ozone, sulfur dioxide, and nitrogen dioxide is during the daytime of the in-leaf season when trees are transpiring water. Particulate matter removal occurs both day and night and throughout the year as particles are intercepted by leaf and bark surfaces. Carbon monoxide removal also occurs both day and night of the in-leaf season, but at much lower rates than for the other pollutants.

Urban areas are estimated to occupy 3.5% of lower 48 states with an average canopy cover of 27%. Urban tree cover varies by region within the United States with cities developed in forest areas averaging 34.4% tree cover, cities in grassland areas: 17.8%, and cities in deserts: 9.3% (Dwyer et al., 2000; Nowak et al., 2001). Total pollution air removal (5 pollutants) by urban trees in coterminous United States is estimated at 711,000 t, with an annual value of $3.8 billion (Table 3).

Though the estimates given in this paper are only for a 1-year period (1994), analysis of changes in meteorology and pollution concentration on pollution removal by urban trees over a 5-year period in Chicago (1991–1995) reveals that annual removal estimates were within 10% of the 5-year average removal rate. Estimates of pollution removal may be conservative as some of the deposition-modeling algorithms are based on homogenous canopies. As part of the urban tree canopy is heterogeneous with small patches or individual trees, this mixed canopy effect would tend to increase pollutant deposition. Also, aerodynamic resistance estimates may be conservative and lead to a slight underestimate of pollution deposition.

Though the average percent air quality improvement due to trees is relatively low (< 1%), the improvement is for multiple pollutants and the actual magnitude of pollution removal can be significant (typically hundreds to thousands of metric tons of pollutants per city per

Table 3. Air pollution removal and value for all urban trees in the coterminous United States

| Pollutant | Removal (t) | Value ($ × $10^6$) |
|---|---|---|
| $O_3$ | 305,100 | 2,060 |
| | (75,000–390,200) | (506–2635) |
| $PM_{10}$ | 214,900 | 969 |
| | (84,000–335,800) | (378–1514) |
| $NO_2$ | 97,800 | 660 |
| | (42,800–119,100) | (289–804) |
| $SO_2$ | 70,900 | 117 |
| | (32,200–111,100) | (53–184) |
| CO | 22,600 | 22 |
| | na | Na |
| Total | 711,300 | 3828 |
| | (256,600–978,800) | (1,249–5158) |

Estimates are given for ozone ($O_3$), particulate matter less than 10 µm ($PM_{10}$), nitrogen dioxide ($NO_2$), sulfur dioxide ($SO_2$), and carbon monoxide (CO). The monetary value of pollution removal by trees is estimated using the median externality values for the United States for each pollutant (Murray et al., 1994). Externality values for $O_3$ were set to equal the value for $NO_2$. Bounds of total tree removal of $O_3$, $NO_2$, $SO_2$, and $PM_{10}$ were estimated using the typical range of published in-leaf dry deposition velocities (Lovett, 1994).

year). Percent air quality improvement estimates are likely conservative and can be increased through programs to increase canopy cover within cities. Air pollution removal is also only one aspect of how urban trees affect air quality. Ozone studies that integrate temperature, deposition and emission effects of trees are revealing that urban trees can have significant effects on reducing ozone concentrations (Cardelino and Chameides, 1990; Taha, 1996; Nowak et al., 2000). Based in part on these findings, the US Environmental Protection Agency has introduced urban tree cover as a potential emerging measure to help meet air quality standards (US EPA, 2004). So even though the percent air quality improvement from pollution removal by trees may be relatively small, the total effect of trees on air pollution can produce impacts that are significant enough to warrant consideration of tree cover management as a means to improve air quality.

## Conclusion

Through pollution removal and other tree functions (e.g., air temperature reductions), urban trees can help improve air quality for many different air pollutants in cities, and consequently can help improve human health. While the existing percent air quality improvements due to pollution removal by urban trees are modest, they can be improved by increasing urban tree canopy cover. The combined total effects of trees on air pollutants are significant enough that urban tree management could provide a viable means to improve air quality and help meet clean air standards in the United States.

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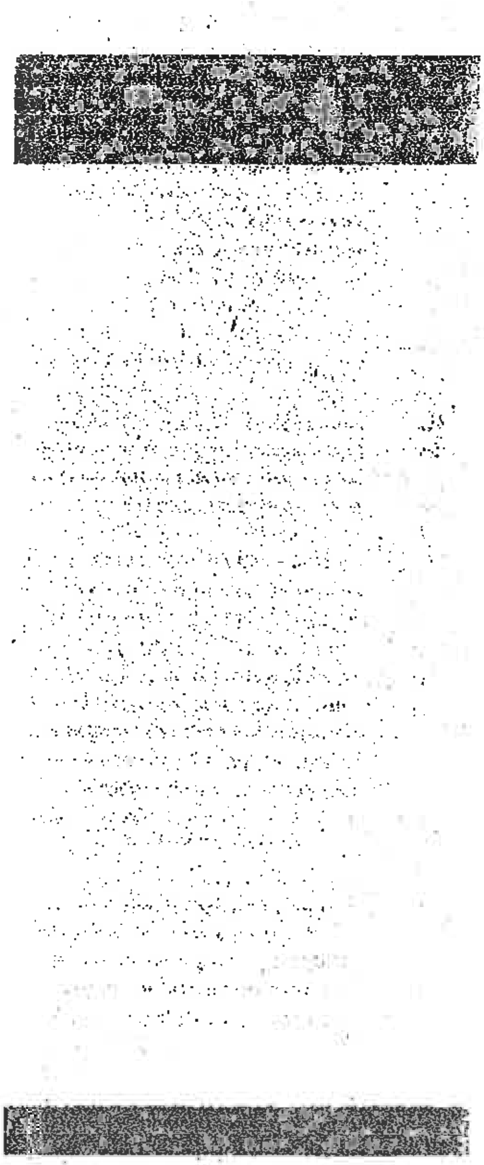

## Research Needs Associated with Particulate Emissions at Airports

TRANSPORTATION RESEARCH BOARD

CHAPTER 2

# Background

The Clean Air Act requires airports to demonstrate com-
pliance with PM emission standards for current operations as well as for expansion and construction projects. Currently irports must meet these requirements using very limited lata on PM emissions from aircraft engines and no data on 'M emissions from auxiliary power units (APUs). Data on other sources vary in quality and availability, and only limited lata are available on ambient PM around airports.

Aviation engine PM data are rapidly evolving and with this volution there is an urgent need to consolidate the work lone in the past with the most recent state-of-the-art measurements. The scientific community's understanding of the ature of aircraft-related PM emissions is hindered since current data remain incomplete for large fractions of common ngines operating in the domestic and global fleets. While here are no data available on APU PM emissions, APUs are ssentially small jet engines that consume much less jet fuel nd consequently emit much less than aircraft main engines, ven in the airport vicinity. Their emissions are believed to be imilar in composition to main engine emissions but this is et to be determined.

The need to fill existing data gaps has been identified and nitial steps taken in projects recently funded by FAA, NASA, nd Transport Canada in their Partnership for AiR Transportation Noise and Emissions Reduction (PARTNER) Center of Excellence. Quite a bit of data have been acquired, specially in the last 3 years, on both military engines—much nder DOD's Strategic Environmental Research and Development Program (SERDP) sponsorship—and on commercial-type wide-body transports and regional jets. Many gaps remain, however. The current state of available data is described n this report. From this, gaps in the current knowledge base re identified. Understanding the gaps guided the development of *project statements* for future research.

*ACRP Report 6* presents the project results. A survey of 80 airports was conducted, ranging from large hubs to small general aviation airports, inquiring about the significance of PM emissions at that airport. Interviews were conducted with airport operators and researchers who have specific knowledge about PM emissions at airports. The team also conducted a literature review of available information and ongoing research about PM emissions at airports.

Based on the findings from the survey, the interviews, the literature review, and the professional knowledge of the team, the researchers prepared an assessment of the current state of knowledge of aviation PM emissions. This final report assesses research needs relative to PM emissions and presents problem statements for future research to meet the most critical needs that would be of significant benefit to airport operators.

Chapter 3 of this report presents a primer on PM emissions from aviation to provide a baseline of information for readers who may be unfamiliar with PM emissions generally and issues faced by the aviation community specifically. Chapter 4 summarizes the findings of the PM survey of airports and interviews with airport operators and PM researchers. Chapter 5 describes current knowledge and gaps regarding PM emissions from aircraft engines. Chapter 6 describes the current state of knowledge concerning other airport emission sources and Chapter 7 summarizes research needs. Chapter 8 includes a prioritized research agenda and problem statements for projects to address airports' highest priorities. Chapter 9 includes the literature review and the project bibliography. Appendix A includes a list of airports receiving the survey, a copy of the survey, and a summary of the survey responses. Appendix B includes notes recorded during the interviews. Appendix C presents a summary of hazardous air pollutants for reference. A glossary of key terms is also included.

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# Modeled $PM_{2.5}$ removal by trees in ten U.S. cities and associated health effects

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ABSTRACT

Urban particulate air pollution is a serious health issue. Trees within cities can remove fine particles from the atmosphere and consequently improve air quality and human health. Tree effects on $PM_{2.5}$ concentrations and human health are modeled for 10 U.S. cities. The total amount of $PM_{2.5}$ removed annually by trees varied from 4.7 tonnes in Syracuse to 64.5 tonnes in Atlanta, with annual values varying from \$1.1 million in Syracuse to \$60.1 million in New York City. Most of these values were from the effects of reducing human mortality. Mortality reductions were typically around 1 person $yr^{-1}$ per city, but were as high as 7.6 people $yr^{-1}$ in New York City. Average annual percent air quality improvement ranged between 0.05% in San Francisco and 0.24% in Atlanta. Understanding the impact of urban trees on air quality can lead to improved urban forest management strategies to sustain human health in cities.

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## 1. Introduction

Fine particulate matter less than 2.5 microns ($PM_{2.5}$) is associated with significant health effects that include premature mortality, pulmonary inflammation, accelerated atherosclerosis, and altered cardiac functions (e.g., Pope et al., 2004). A 10 μg $m^{-3}$ increase in fine particulate matter has been associated with an approximately 4%, 6%, and 8% increased risk in all-cause, cardiopulmonary and lung cancer mortality, respectively (Pope et al., 2002). The regulation of these pollutants by the U.S. Environmental Protection Agency (U.S. EPA) has resulted in significant improvements in air quality over the last decade with reductions in monitored $PM_{2.5}$ from 2000 to 2007 associated with 22 000–60 000 net avoided premature mortalities in the United States (Fann and Risley, 2011).

Trees are often a major element of the city landscape with urban tree cover in the United States averaging 35.0% (Nowak and Greenfield, 2012a). Trees directly affect particulate matter in the atmosphere by removing particles (e.g., Beckett et al., 2000a; Freer-Smith et al., 2004) and emitting particles (e.g., pollen) or through resuspension of particles captured on the plant surface. Some captured particles can be absorbed into the tree, though most particles that are intercepted are retained on the plant surface. The intercepted particle often is resuspended to the atmosphere, washed off by rain, or dropped to the ground with leaf and twig fall. Consequently, vegetation is only a temporary retention site for many atmospheric particles. Trees can also affect particulate matter concentration by altering air temperatures, emitting volatile organic compounds and altering energy use (e.g., tree shade on building, altering wind speeds, cooling air temperatures) and consequent emissions from power plants (e.g., Heisler, 1986; Smith, 1990; Beckett et al., 1998). At the local scale, interior parts of forest patches within urban areas can have substantially lower concentrations of particulate matter than forest edges (Cavanagh et al., 2009).

To date, most research related to urban trees and particulate matter has focused on removal of particulate matter less than 10 microns ($PM_{10}$) by trees. Increasing total tree cover in West Midlands, UK from 3.7% to 16.5% is estimated to reduce average primary $PM_{10}$ concentrations by 10% from 2.3 to 2.1 μg $m^{-3}$ (removing 110 tonnes per year); increasing tree cover from 3.6% to 8% in Glasgow, UK is estimated to reduce $PM_{10}$ concentrations by 2%, (removing 4 tonnes per year) (McDonald et al., 2007). In the Greater London area (UK), urban tree canopies are estimated to remove between 852 and 2121 tonnes of $PM_{10}$ annually, which equates to 0.7%–1.4% $PM_{10}$ air quality improvement (Tallis et al., 2011). A 10 × 10 km grid in London with 25% tree cover was estimated to remove 90.4 tonnes of $PM_{10}$ per year, which equated to the avoidance of 2 deaths and 2

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hospital emissions per year (Tiwary et al., 2009). $PM_{10}$ removal by urban trees in the United States has been estimated at 214 900 tonnes per year (Nowak et al., 2006a).

Various studies to date have investigated the removal rate and resuspension of $PM_{2.5}$ by trees (e.g., Beckett et al., 2000b; Freer-Smith et al., 2004, 2005; Pullman, 2009), but none have estimated the overall impact of the trees and forests in a city on $PM_{2.5}$ concentrations. The objective of this paper is to estimate, on an hourly basis over the course of a year, the amount of $PM_{2.5}$ removal and resuspension by trees within 10 U.S. cities and its effect on $PM_{2.5}$ concentrations, including the associated values and impact on human health.

## 2. Methods

To estimate the effects and associated values of $PM_{2.5}$ removal by urban trees in 10 cities (Table 1), four types of analyses were conducted that estimated: 1) the total leaf area in the city on a daily basis, 2) the hourly flux and resuspension of $PM_{2.5}$ to and from the leaves, 3) the effects of hourly $PM_{2.5}$ removal by trees on $PM_{2.5}$ concentration in the atmosphere, and 4) the health incidence impacts and monetary value of the change in $PM_{2.5}$ concentration using information from the U.S. EPA Environmental Benefits Mapping and Analysis Program (BenMAP) model (U.S. EPA, 2012a).

### 2.1. City tree population parameters

To determine the leaf surface area within the 10 U.S. cities, field data on trees were measured within randomly selected 0.04 ha plots and analyzed using the i-Tree Eco model (Table 1; Nowak et al., 2008). The model estimated the total leaf area index per unit of tree cover (LAI = one-sided leaf area in crown divided by projected crown area on the ground; i.e., the number of layers of leaves within the crown) and percent of the tree population that is evergreen. Tree cover within each city was estimated by photo interpreting random points throughout each city with recent imagery (Table 1; Nowak and Greenfield, 2012b). Total city leaf area was estimated by multiplying city tree cover ($m^2$) by city LAI per unit of tree cover ($m^2\ m^{-2}$). Leaf area index values were combined with percent evergreen information and local leaf on and leaf off dates to estimate total daily leaf surface area in each city.

### 2.2. $PM_{2.5}$ removal by trees

Hourly pollution removal or flux ($F$ in $\mu g\ m^{-2}\ hr^{-1}$) can be estimated as:

$$F = V_d \times C \tag{1}$$

**Table 1**
Number of field plots and tree cover estimates in cities.

| City | Plots | | | Tree cover (%)[b] | Cover year[c] |
|---|---|---|---|---|---|
| | # | #km$^{-2}$ | Year[a] | | |
| Atlanta, GA[d] | 205 | 0.6 | 1997 | 52.1 | 2009 |
| Baltimore, MD[d] | 195 | 0.9 | 2009 | 28.5 | 2005 |
| Boston, MA[d] | 217 | 1.5 | 1996 | 27.9 | 2008 |
| Chicago, IL[e] | 745 | 1.2 | 2007 | 18.0 | 2009 |
| Los Angeles, CA[f] | 348 | 0.3 | 2007–2008 | 20.6 | 2009 |
| Minneapolis, MN[g] | 110 | 0.7 | 2004 | 34.1 | 2008 |
| New York, NY[h] | 206 | 0.3 | 1996 | 19.7 | 2009 |
| Philadelphia, PA[i] | 210 | 0.6 | 1996 | 20.8 | 2010 |
| San Francisco, CA[j] | 194 | 1.6 | 2004 | 16.0 | 2011 |
| Syracuse, NY[d] | 198 | 3.0 | 2009 | 26.9 | 2009 |

#Number of plots.
[a] Year of plot field data collection.
[b] Cover estimates from photo-interpretation (Nowak and Greenfield, 2012b). Philadelphia and San Francisco are unpublished estimates, U.S. Forest Service, Syracuse, NY.
[c] Year of imagery for cover estimates.
[d] Unpublished data from U.S. Forest Service, Syracuse, NY.
[e] Nowak et al., 2010.
[f] Nowak et al., 2011.
[g] Nowak et al., 2006b.
[h] Nowak et al., 2007a.
[i] Nowak et al., 2007b.
[j] Nowak et al., 2007c.

where $V_d$ is the deposition velocity of the pollutant to the leaf surface ($m\ h^{-1}$) and $C$ is pollutant concentration ($\mu g\ m^{-3}$) (e.g., Hicks et al., 1989). Daily (24-h) pollution concentrations of $PM_{2.5}$ in each city were obtained from U.S. EPA monitors for the year of 2010. If more than one monitor existed, the daily values were averaged for each day to produce a city average value. The average daily value was used to represent the hourly concentration values throughout the day.

Deposition velocities of $PM_{2.5}$ to trees were estimated from the literature and varied with wind speed (Beckett et al., 2000b; Freer-Smith et al., 2004; Pullman, 2009). These papers measured deposition velocities to tree leaves from 17 tree species under wind speeds of 1, 3, 6, 8, 9 and 10 m $s^{-1}$. For each wind speed, the median deposition velocities from the measured deposition velocities was used to estimate the $V_d$ for that wind speed per unit leaf area (Table 2). The standard error of the estimates among the species was used to estimate a potential range of values of deposition velocities. The 95 percent confidence interval of median deposition velocity per wind speed was used to estimate a maximum deposition for the wind speed. As 95 percent confidence interval for the lower range of deposition velocities produced negative deposition velocities, the minimum average $V_d$ from any species was used to represent the minimum $V_d$ for the wind speed. To estimate the $V_d$ for wind speeds between 1 and 10 m $s^{-1}$ that did not have a measured $V_d$, values were interpolated between the closest measured values. For wind speeds above 10 m $s^{-1}$, the $V_d$ for 10 m $s^{-1}$ was used; for a wind speed of 0 m $s^{-1}$, the $V_d$ was assumed to be 0 m $s^{-1}$ (Table 3).

Resuspension of $PM_{2.5}$ from trees was estimated from Pullman (2009) and varied with wind speed. This paper measured percent resuspension of $PM_{2.5}$ from tree leaves of three tree species under wind speeds of 6.5, 10 and 13 m $s^{-1}$. The average percent resuspension for the trees species and wind speed was calculated (Table 3). As the percent resuspension for the wind speed of 6.5 m $s^{-1}$ was 9.5%, a value of 9% was assumed for a wind speed of 6 m $s^{-1}$ and 10% for 7 m $s^{-1}$. The percent resuspension for a wind speed of 0 m $s^{-1}$ was assumed to be 0%. To estimate the percent resuspension for wind speeds between 0 and 13 m $s^{-1}$ that did not have measured resuspension rates, values were interpolated from the closest measured values (or assumed value at wind speed of 0 m $s^{-1}$). For wind speeds above 13 m $s^{-1}$, the percent resuspension rate for 13 m $s^{-1}$ was used (Table 3).

To calculate pollution removal, local city weather data from the National Climatic Data Center were used to obtain hourly wind speed and precipitation data. Hourly flux values to trees in the city (Eq. (1); $\mu g\ m^{-2}\ h^{-1}$) were multiplied by total leaf surface area ($m^2$) with hourly $V_d$ based on local wind speed (Table 3). Flux values were accumulated hourly with a percent of the total accumulated $PM_{2.5}$ over the current and previous hours resuspended back to the atmosphere hourly based on local wind speed. $PM_{2.5}$ was accumulated upon leaves and resuspended from leaves

**Table 2**
Summary of average deposition velocities (cm $s^{-1}$) of $PM_{2.5}$ by wind speed from the literature per unit leaf area.

| Species | Wind speed (m $s^{-1}$) | | | | |
|---|---|---|---|---|---|
| | 1 | 3 | 6 | 8.5[a] | 10 |
| *Quercus petraea*[b] | | 0.831 | 1.757 | 3.134 | |
| *Alnus glutinosa*[b] | | 0.125 | 0.173 | 0.798 | |
| *Fraxinus excelsior*[b] | | 0.178 | 0.383 | 0.725 | |
| *Acer pseudoplatanus*[b] | | 0.042 | 0.197 | 0.344 | |
| *Pseudotsuga menziesii*[b] | | 1.269 | 1.604 | 6.04 | |
| *Eucalyptus globulus*[b] | | 0.018 | 0.029 | 0.082 | |
| *Ficus nitida*[b] | | 0.041 | 0.098 | 0.234 | |
| *Pinus nigra*[c] | 0.13 | 1.15 | | 19.24 | 28.05 |
| *Cupressocyparis x leylandii*[c] | 0.08 | 0.76 | | 8.24 | 12.2 |
| *Acer campestre*[c] | 0.03 | 0.08 | | 0.46 | 0.57 |
| *Sorbus intermedia*[c] | 0.04 | 0.39 | | 1.82 | 2.11 |
| *Populus deltoides*[c] | 0.03 | 0.12 | | 1.05 | 1.18 |
| *Pinus strobus*[d] | 0.0108 | | | | |
| *Tsuga canadensis*[d] | 0.0193 | | | | |
| *Tsuga japonica*[d] | 0.0058 | | | | |
| *Picea abies*[d] | 0.0189 | | | | |
| *Picea abies*[e] | 0.038 | | | | |
| Median | 0.030 | 0.152 | 0.197 | 0.924 | 2.110 |
| SE[f] | 0.012 | 0.133 | 0.281 | 1.610 | 5.257 |
| Maximum[g] | 0.057 | 0.442 | 0.862 | 5.063 | 14.542 |
| Minimum[h] | 0.006 | 0.018 | 0.029 | 0.082 | 0.570 |

[a] Combination of 8 and 9 m $s^{-1}$ wind speeds.
[b] From Freer-Smith et al. (2004).
[c] From Beckett et al. (2000b).
[d] From Pullman (2009). Included particles up to 3.0 μm in diameter.
[e] From Pullman (2009). Based on maximum and minimum of reported range. Included particles up to 3.8 μm in diameter.
[f] Standard error.
[g] Based on 95 percent confidence interval above median value.
[h] Based on lowest recorded value for any species.

Table 3
Deposition velocities and percent resuspension by wind speed per unit leaf area.

| Wind speed ($m\ s^{-1}$) | Deposition velocity ($V_d$) | | | Resuspension (%) |
|---|---|---|---|---|
| | Average ($cm\ s^{-1}$) | Minimum ($cm\ s^{-1}$) | Maximum ($cm\ s^{-1}$) | |
| 0 | 0.00 | 0.000 | 0.000 | 0 |
| 1 | 0.03 | 0.006 | 0.042 | 1.5 |
| 2 | 0.09 | 0.012 | 0.163 | 3 |
| 3 | 0.15 | 0.018 | 0.285 | 4.5 |
| 4 | 0.17 | 0.022 | 0.349 | 6 |
| 5 | 0.19 | 0.025 | 0.414 | 7.5 |
| 6 | 0.20 | 0.029 | 0.478 | 9 |
| 7 | 0.56 | 0.056 | 1.506 | 10 |
| 8 | 0.92 | 0.082 | 2.534 | 11 |
| 9 | 0.92 | 0.082 | 2.534 | 12 |
| 10 | 2.11 | 0.570 | 7.367 | 13 |
| 11 | 2.11 | 0.570 | 7.367 | 16 |
| 12 | 2.11 | 0.570 | 7.367 | 20 |
| 13 | 2.11 | 0.570 | 7.367 | 23 |

during non-precipitation periods. During precipitation events, the accumulated $PM_{2.5}$ was assumed to be washed off to the ground surface depending upon the magnitude of the precipitation event (Pe in mm). As leaves capture about 0.2 mm of precipitation (Wang et al., 2008) before runoff from the leaf, the total precipitation storage capacity (Ps in mm) of the canopy was calculated as 0.2 × LAI. If Pe was greater than Ps, then all particles were assumed to be removed from the leaves and resuspension dropped to zero. When the Pe was less than Ps, no particles were removed from the leaves as there was no runoff from the leaves. After the rain stopped, $PM_{2.5}$ began accumulating on and resuspending from leaves again. Water on the leaves after rain events was reduced hourly based on evaporation rates calculated from meteorological conditions. The annual flux to tree leaves was estimated as the total $PM_{2.5}$ washed off leaves during the year plus the amount remaining on leaves at the end of the year.

### 2.3. Change in $PM_{2.5}$ concentration

To estimate percent air quality improvement due to dry deposition (Nowak et al., 2000), hourly boundary layer heights were used in conjunction with local hourly fluxes and resuspension rates in each city. Daily morning and afternoon mixing heights were calculated using the EPA's mixing height program (U.S. EPA, 1981) with upper air data from the nearest radiosonde station. These mixing heights were then interpolated to produce hourly boundary layer height values using the EPA's PCRAMMIT program (U.S. EPA, 1995). Minimum boundary-layer heights were set to 150 m during the night and 250 m during the day based on estimated minimum boundary-layer heights in cities. Hourly mixing heights (m) were used in conjunction with pollution concentrations ($\mu g\ m^{-3}$) to calculate the amount of pollution within the mixing layer ($\mu g\ m^{-2}$). This extrapolation from ground-layer concentration to total pollution within the boundary layer assumes a well-mixed boundary layer, which is common in the daytime (unstable conditions) (Colbeck and Harrison, 1985). Hourly change in $PM_{2.5}$ concentration was calculated as:

$$\Delta C = \Delta P_t/(BL \times CA) \quad (2)$$

where $\Delta C$ = change in $PM_{2.5}$ concentration ($\mu g\ m^{-3}$), $\Delta P_t$ = change in $PM_{2.5}$ mass ($\mu g$) due to the net of effect of $PM_{2.5}$ removal (flux) and resuspension from leaves, BL = boundary layer height (m) and CA = city area ($m^2$). Percent air quality improvement was calculated as:

$$\%\Delta = \Delta P_t/(\Delta P_t + P_a) \quad (3)$$

where $P_a$ = $PM_{2.5}$ mass in the atmosphere ($\mu g$), which equals measured concentration ($\mu g\ m^{-3}$) × BL × CA.

### 2.4. Health incidence effects and monetary value of $PM_{2.5}$ removal

For the 10 U.S. cities, the U.S. EPA's BenMAP program was used to estimate the incidence of adverse health effects (i.e., mortality and morbidity) and associated monetary value that result from changes in $PM_{2.5}$ concentrations. BenMAP is a Windows-based computer program that uses Geographic Information System (GIS) based data to estimate the health impacts and economic value when populations experience changes in air quality (U.S. EPA, 2012a). The model uses air quality grids to determine the change in pollution concentration, concentration-response functions to estimate the change in adverse health effects, and valuation functions to calculate the associated economic value (Table 4). BenMAP was used to obtain incidence and value results for each county within which the 10 cities reside.

The air quality grids used for this analysis were for baseline (2000) and control (2006) years that had the greatest change in pollution concentration based on national pollution trends (http://www.epa.gov/airtrends/index.html). The pollution concentration for the grids was interpolated from existing pollution data sets from EPA pollutant monitors using Voronoi neighborhood averaging.

Several functions were used to estimate incidence and value for the following common health effects of $PM_{2.5}$: acute bronchitis, acute myocardial infarction, acute respiratory symptoms, asthma exacerbation, chronic bronchitis, emergency room visits, hospital admissions – cardiovascular or respiratory, lower respiratory symptoms, mortality, upper respiratory symptoms, and work loss days. The concentration-response functions that were used for the $PM_{2.5}$ analysis (Table 4) have several inputs including air quality metrics (e.g., 24-h mean) and age of the population (e.g., 18–64 years old, 65–99 years old).

The model was run using population statistics from the U.S. Census 2010 county dataset using an economic forecasting model described in the BenMAP user manual (Abt Associates, 2010). BenMAP configures Census block populations into grid cell level data and the calculation is at grid cell level. BenMap data were then aggregated to the county level. The health effects categories potentially had multiple estimates corresponding to different air quality metrics and age groups. Different age groups were represented because the concentration-response functions are age specific and incidence rate can vary across different age groups. Multiple estimates were pooled by either averaging the estimates using the random/fixed effects method or summing the estimates depending on which process was appropriate. In the end, a final estimate was produced to cover all possible metrics and age groups within a health category. For example, equations for 0–17, 18–64, and 65–99 age groups were summed to produce an estimate for 0–99 age group. More details on the BenMAP model are found in the literature (Davidson et al., 2007; Abt Associates, 2010; U.S. EPA, 2012a).

To estimate each individual health category incidence and dollar value effect at the city scale, the county estimates were divided by the county population by age group and change in pollution concentration to produce an estimate of number of incidences or dollar value per person per age group per change in $\mu g\ m^{-3}$, similar to the procedure used in U.S. EPA (2012b). This value was then multiplied by the city population per age group and change in $PM_{2.5}$ concentration due to trees in the city to estimate the tree effects on incidence and value for each health category. The dollar values for all health categories were summed to determine the total value of $PM_{2.5}$ effects from trees in each city.

## 3. Results

Total amount of $PM_{2.5}$ removal annually by trees varied from 4.7 tonnes in Syracuse to 64.5 tonnes in Atlanta, with values varying from \$1.1 million in Syracuse to \$60.1 million in New York City (Table 5). Most of these values were dominated by the effects of reducing human mortality (Table 6). The average value per mortality incidence was \$7.8 million. Mortality reductions were typically around 1 person $yr^{-1}$ per city, but were as high as 7.6 people $yr^{-1}$ in New York City. The net removal amounts per square meter of canopy cover varied from 0.13 g $m^{-2}$ $yr^{-1}$ in Los Angeles to 0.36 g $m^{-2}$ $yr^{-1}$ in Atlanta. The average annual percent air quality improvement ranged between 0.05% in San Francisco and 0.24% in Atlanta (Table 5).

The average health benefits value per hectare of tree cover was about \$1 600, but varied from \$500 in Atlanta and Minneapolis to \$3800 in New York (Table 5). The value per tonne of $PM_{2.5}$ averaged \$682 000, but varied from \$142 000 in Atlanta to \$1 610 000 in New York. The health benefits value per reduction of 1 $\mu g\ m^{-3}$ also varied from \$122 million in Syracuse to \$6.2 billion in New York, with an overall average of \$1.6 billion.

The interactions among variable $V_d$, resuspension, and precipitation can be seen in an hourly graph of total accumulation by tree canopies, in which removal of $PM_{2.5}$ by trees occurs during precipitation events when particles on leaves are washed off and transferred to the soil. Total accumulation stabilizes around 3500 $\mu g\ m^{-2}$ of tree cover among the cities with variations up (net removal) and down (net resuspension) hourly (Fig. 1). Average hourly cumulative flux in the cities ranged between 2100 $\mu g\ m^{-2}$ of tree cover in Philadelphia to 5700 $\mu g\ m^{-2}$ of tree cover in San Francisco. Average reduction in $PM_{2.5}$ concentrations ranged between 0.006 $\mu g\ m^{-3}$ in Philadelphia and San Francisco to 0.03 $\mu g\ m^{-3}$ in Atlanta (Table 5). Of all the particles intercepted by leaves, on average 34.0 percent were resuspended, with percent resuspension varying from 26.7 percent in Syracuse to 42.6 percent in San Francisco.

**Table 4**
Concentration-response functions used for $PM_{2.5}$ analyses. Daily 24-h mean concentrations data were aggregated by seasonal metric. Valuation procedure for health effects are also noted.

| Health effect | Concentration response function reference | Seasonal metric | Start age | End age |
|---|---|---|---|---|
| Acute Bronchitis[a] | Dockery et al., 1996 | Quarterly | 8 | 12 |
| *Acute myocardial infarction*[b] | | | | |
| Acute myocardial infarction, nonfatal | Peters et al., 2001 | Annual | 18 | 99 |
| | Pope et al., 2006 | Annual | 0 | 99 |
| | Sullivan et al., 2005 | Annual | 0 | 99 |
| | Zanobetti and Schwartz, 2006 | Annual | 0 | 99 |
| | Zanobetti et al., 2009 | Annual | 0 | 99 |
| *Acute respiratory symptoms*[a] | | | | |
| Minor restricted activity days | Ostro and Rothschild, 1989 | Annual | 18 | 64 |
| *Asthma exacerbation*[a] | | | | |
| Asthma exacerbation, cough | Mar et al., 2004 | Annual | 6 | 18 |
| Asthma exacerbation, shortness of breath | Mar et al., 2004 | Annual | 6 | 18 |
| Asthma exacerbation, wheeze | Ostro et al., 2001 | Annual | 6 | 18 |
| Chronic bronchitis[a,b] | Abbey et al., 1995 | Quarterly | 27 | 99 |
| *Emergency room visits, respiratory*[b] | | | | |
| Emergency room visits, asthma | Mar et al., 2010 | Annual | 0 | 99 |
| | Norris et al., 1999 | Annual | 0 | 17 |
| | Slaughter et al., 2005 | Annual | 0 | 99 |
| *Hospital admissions, cardiovascular*[b] | | | | |
| HA, all cardiovascular (less myocardial infarctions) | Bell et al., 2008 | Annual | 65 | 99 |
| | Moolgavkar, 2000 | Annual | 18 | 64 |
| | Moolgavkar, 2003 | Annual | 65 | 99 |
| | Peng et al., 2008 | Annual | 65 | 99 |
| | Peng et al., 2009 | Annual | 65 | 99 |
| | Zanobetti et al., 2009 | Annual | 65 | 99 |
| *Hospital admissions, respiratory*[b] | | | | |
| HA, all respiratory | Zanobetti et al., 2009 | Annual | 65 | 99 |
| Lower respiratory symptoms[a] | Schwartz and Neas, 2000 | Annual | 7 | 14 |
| *Mortality*[c] | | | | |
| Mortality, all cause | Laden et al., 2006 | Quarterly | 25 | 99 |
| | Woodruff et al., 1997 | Quarterly | 0 | 1 |
| | Woodruff et al., 2006 | Quarterly | 0 | 1 |
| Upper respiratory symptoms[a] | Pope et al., 1991 | Quarterly | 9 | 11 |
| Work loss days[d] | Ostro, 1987 | Annual | 18 | 64 |

Valuation procedure (U.S. EPA, 2012a).
[a] Willingness to pay.
[b] Cost of illness.
[c] Value of statistical life.
[d] Median daily wage.

## 4. Discussion

The removal of $PM_{2.5}$ by urban trees is substantially lower than for $PM_{10}$ (Nowak et al., 2006a), but the health implications and values are much higher. The value of $PM_{2.5}$ removal in the cities ranged from \$1.1 million $yr^{-1}$ (Syracuse) to 60.1 million $yr^{-1}$ (New York). The annual values per tonne removed ranged between \$142 000 (Atlanta) and \$1.6 million (New York). These values are substantially higher than value estimates for $PM_{10}$ (\$4500 $t^{-1}$), which are based on median national externality values (Murray et al., 1994). Most of this $PM_{2.5}$ removal value is derived from the reduction in human mortality due to reduced $PM_{2.5}$ concentrations. Reduction in human mortality ranged from 1 person per 365 000 people in Atlanta to 1 person per 1.35 million people in San Francisco (average = 1 person per 990 000 people). Overall, the greatest effect of trees on reducing health impacts of $PM_{2.5}$ occurred in New York due to its relatively large human population and moderately high removal rate and reduction in concentration. The greatest

**Table 5**
Estimated removal of $PM_{2.5}$ by trees and associated value in several U.S. cities.

| City | Total (t $yr^{-1}$) | Range (t $yr^{-1}$) | Value (\$ $yr^{-1}$) | Effect[a]: $m^{-2}$ $yr^{-1}$ (g) | Effect[a]: $m^{-2}$ $yr^{-1}$ (\$) | ΔC[b] (μg $m^{-3}$) | AQ[c] (%) |
|---|---|---|---|---|---|---|---|
| Atlanta, GA | 64.5 | (8.5–140.4) | 9 170 000 | 0.36 | 0.05 | 0.030 | 0.24 |
| Baltimore, MD | 14.0 | (1.8–29.5) | 7 780 000 | 0.24 | 0.13 | 0.010 | 0.09 |
| Boston, MA | 12.7 | (2.0–35.6) | 9 360 000 | 0.32 | 0.23 | 0.020 | 0.19 |
| Chicago, IL | 27.7 | (4.0–68.1) | 25 860 000 | 0.26 | 0.24 | 0.011 | 0.09 |
| Los Angeles, CA | 32.2 | (4.2–70.3) | 23 650 000 | 0.13 | 0.09 | 0.009 | 0.07 |
| Minneapolis, MN | 12.0 | (1.6–28.2) | 2 610 000 | 0.23 | 0.05 | 0.010 | 0.08 |
| New York, NY | 37.4 | (5.1–97.2) | 60 130 000 | 0.24 | 0.38 | 0.010 | 0.09 |
| Philadelphia, PA | 12.3 | (1.6–28.1) | 9 880 000 | 0.17 | 0.14 | 0.006 | 0.08 |
| San Francisco, CA | 5.5 | (0.8–14.4) | 4 720 000 | 0.29 | 0.25 | 0.006 | 0.05 |
| Syracuse, NY | 4.7 | (0.6–10.8) | 1 100 000 | 0.27 | 0.06 | 0.009 | 0.10 |

[a] Average effects per square meter of tree cover per year: removal in grams and dollar value.
[b] Average annual reduction in hourly concentration.
[c] Average percent air quality improvement.

Table 6
Reduction in number of incidences and associated dollar value for various health effects due to $PM_{2.5}$ reduction from trees.

| Health effect[a] | No. | Value | No. | Value | No. | Value | No. | Value | No. | Value |
|---|---|---|---|---|---|---|---|---|---|---|
| | Atlanta, GA | | Baltimore, MD | | Boston, MA | | Chicago, IL | | Los Angeles, CA | |
| Acute bronchitis | 0.6 | 60 | 0.4 | 30 | 0.5 | 50 | 1.8 | 160 | 2.1 | 180 |
| Acute myocardial infarction | 0.3 | 26 300 | 0.2 | 14 600 | 0.3 | 28 400 | 0.9 | 78 800 | 0.6 | 49 300 |
| Acute respiratory symptoms | 488.7 | 47 900 | 240.9 | 23 600 | 502.5 | 49 200 | 1125.2 | 110 300 | 1263.6 | 123 900 |
| Asthma exacerbation | 243.8 | 19 800 | 138.3 | 11 200 | 243.0 | 19 800 | 770.0 | 62 600 | 936.4 | 76 100 |
| Chronic bronchitis | 0.4 | 104 000 | 0.2 | 53 000 | 0.3 | 96 000 | 0.9 | 247 000 | 1.0 | 285 000 |
| Emergency room visits | 0.4 | 180 | 0.9 | 390 | 0.4 | 190 | 1.2 | 510 | 1.1 | 470 |
| Hospital admissions, cardiovascular | 0.2 | 7700 | 0.2 | 6200 | 0.2 | 6300 | 0.5 | 17 400 | 0.3 | 12 700 |
| Hospital admissions, respiratory | 0.1 | 4400 | 0.1 | 2300 | 0.1 | 4600 | 0.4 | 13 800 | 0.3 | 9000 |
| Lower respiratory symptoms | 7.2 | 400 | 4.4 | 200 | 6.5 | 300 | 22.9 | 1200 | 25.5 | 1300 |
| Mortality | 1.2 | 8 940 000 | 1.0 | 7 670 000 | 1.2 | 9 140 000 | 3.2 | 25 300 000 | 3.0 | 23 000 000 |
| Upper respiratory symptoms | 6.4 | 300 | 3.7 | 200 | 5.2 | 200 | 18.3 | 800 | 21.0 | 900 |
| Work loss days | 84.8 | 16 300 | 40.8 | 6000 | 87.5 | 15 300 | 192.1 | 35 000 | 217.4 | 37 000 |
| Total | na | 9 170 000 | na | 7 780 000 | na | 9 360 000 | na | 25 900 000 | na | 23 600 000 |
| | Minneapolis, MN | | New York, NY | | Philadelphia, PA | | San Francisco, CA | | Syracuse, NY | |
| Acute bronchitis | 0.2 | 20 | 4.5 | 400 | 0.5 | 50 | 0.2 | 20 | 0.1 | 10 |
| Acute myocardial infarction | 0.1 | 5800 | 1.4 | 129 300 | 0.2 | 22 400 | 0.1 | 7400 | 0.0 | 2400 |
| Acute respiratory symptoms | 146.8 | 14 400 | 2930.9 | 287 300 | 313.8 | 30 800 | 207.3 | 20 300 | 49.5 | 4900 |
| Asthma exacerbation | 80.9 | 6600 | 1919.3 | 156 000 | 205.8 | 16 700 | 77.2 | 6300 | 37.7 | 3100 |
| Chronic bronchitis | 0.1 | 29 400 | 2.4 | 682 000 | 0.3 | 71 500 | 0.2 | 51 600 | 0.0 | 9600 |
| Emergency room visits | 0.1 | 40 | 8.0 | 3300 | 0.4 | 160 | 0.1 | 30 | 0.0 | 20 |
| Hospital admissions, cardiovascular | 0.0 | 1200 | 1.2 | 46 200 | 0.1 | 5400 | 0.1 | 2000 | 0.0 | 500 |
| Hospital admissions, respiratory | 0.0 | 600 | 0.7 | 22 700 | 0.1 | 3000 | 0.0 | 1500 | 0.0 | 300 |
| Lower respiratory symptoms | 2.2 | 100 | 55.7 | 2900 | 6.1 | 300 | 2.0 | 100 | 1.0 | 50 |
| Mortality | 0.3 | 2 550 000 | 7.6 | 58 700 000 | 1.2 | 9 720 000 | 0.6 | 4 620 000 | 0.1 | 1 080 000 |
| Upper respiratory symptoms | 1.9 | 100 | 45.0 | 2000 | 5.1 | 200 | 1.7 | 100 | 0.8 | 40 |
| Work loss days | 25.0 | 4800 | 504.0 | 92 100 | 53.7 | 8500 | 36.0 | 7900 | 8.3 | 1400 |
| Total | na | 2 610 000 | na | 60 100 000 | na | 9 880 000 | na | 4 720 000 | na | 1 100 000 |

[a] Incidence values of 0.0 indicate a value of less than 0.05.

overall removal by trees was in Atlanta due to its relatively high percent tree cover and $PM_{2.5}$ concentrations (12.6 $\mu g\ m^{-3}$).

The net removal rates per square meter of tree cover varied among cities between 0.36 $g\ m^{-2}\ yr^{-1}$ (Atlanta) and 0.13 $g\ m^{-2}\ yr^{-1}$ (Los Angeles), with Los Angeles having the highest $PM_{2.5}$ concentrations (13.8 $\mu g\ m^{-3}$), but the lowest amount (392 $mm\ yr^{-1}$) and frequency of rainfall (247 $h\ yr^{-1}$). The average amount and frequency of precipitation among the cities were 644 $mm\ yr^{-1}$ and 394 $h\ yr^{-1}$ respectively. On average, about 24 $g\ m^{-2}\ yr^{-1}$ of $PM_{2.5}$ removal equated to 1 $\mu g\ m^{-3}$ reduction in $PM_{2.5}$ concentrations, but results varied from 12 $g\ m^{-2}\ yr^{-1}$ in Atlanta to 45 $g\ m^{-2}\ yr^{-1}$ in San Francisco.

Removal rates per unit canopy and effects on local $PM_{2.5}$ concentration varies among cities based on amount of tree cover — increased cover increases removal, pollution concentration — increased concentration increases removal, length of growing season and percent evergreen leaf area — longer growing season increases removal by deciduous species, and meteorological conditions. The meteorological conditions (precipitation, wind speed and boundary layer heights) interact to affect $PM_{2.5}$ removal and concentrations. Increased precipitation tends to increase tree removal via the washing of particles from the leaf surfaces. The low removal rate in Los Angeles is likely due, in part, to limited precipitation. Wind speeds affect resuspension and boundary layer heights. Greater resuspension reduces the overall removal rate by trees; increased boundary layer heights reduce the overall percent impact of trees on pollutant concentrations, but also reduce $PM_{2.5}$ concentrations. Maximum percent air quality improvements tended to occur under windy conditions (increased $V_d$) with low boundary layer heights (increased impact of removal on pollutant concentration) and relatively clean leaves (low amount of particles to be resuspended).

When resuspension is greater than the removal rate, trees can increase local concentrations due to previously deposited particles reentering the atmosphere (Fig. 1). Although $PM_{2.5}$ removal by trees in the analyzed cities lead to reduced overall particulate concentrations, it is possible that even though trees remove particulate matter, they could increase overall particulate concentrations. This overall increase in concentrations could occur depending upon the meteorological conditions when particles are deposited and resuspended. If particulate removal occurs under high boundary layer conditions, but resuspension occurs mostly under low boundary layer conditions, the amount of removal would cause a lower reduction in concentrations than the increased concentration effect due to resuspension. Thus timing of removal relative to boundary layer heights has a substantial impact on overall concentration changes. Overall impacts and dollar values also varied based on population density and composition, along with the tree effects on concentration.

Though there are various limitations to these estimates, the results indicate a first-order approximation of the magnitude of tree effects on $PM_{2.5}$ concentrations. Limitations of the analysis include: a) assumption that all particles are removed from leaves by precipitation events that cover the entire leaf area as some particles may remain on leaves or some particles may be removed in light rain events (Pe < Ps), b) there is no assumed interaction with water on leaves after precipitation events, c) some precipitation events may be in the form of snow, which may limit removal; however these events are relatively infrequent and limited to only evergreen trees removal that accounts for only about 18% of the total leaf area among the cities, d) measured deposition velocities used to calculate the average $V_d$ are based on varying particle sizes with some particles greater than 2.5 μm (up to 3.8 μm) and particle size affects the deposition velocity (e.g., Gallagher et al., 1997) — it is assumed the measured deposition velocities represent the average for the particle distribution in the atmosphere, e) wind speeds and therefore $V_d$ and resuspension can vary locally, though an average wind speed is used to represent the entire city, f) tree volatile

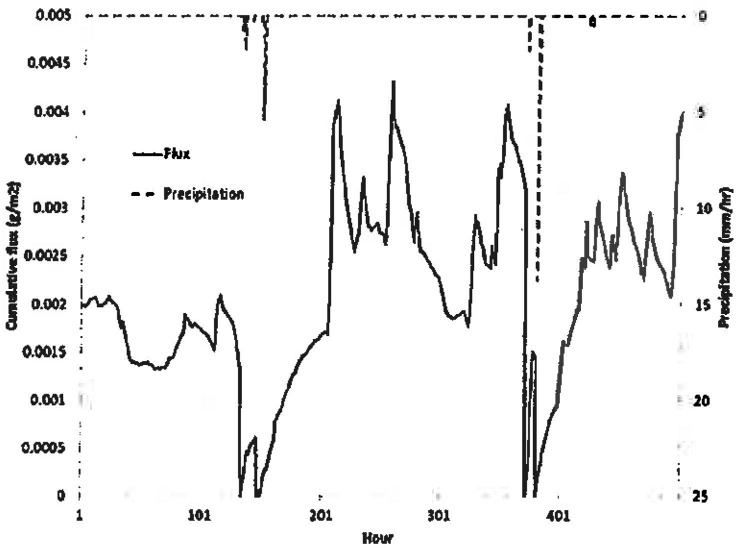


Fig. 1. Cumulative hourly flux of $PM_{2.5}$ per square meter of tree cover in New York City starting at 1 am on July 8, 2010. Increasing flux values indicate hourly removal, decreasing values indicate a net resuspension. Precipitation periods could remove particles from leaves and transport them to the ground. This transported amount was calculated as a net removal from trees.

organic compound emissions and their potential contribution to $PM_{2.5}$ concentrations are not considered (e.g., Hodan and Barnard., 2004), g) $V_d$ is assumed equal for all leaves within a tree canopy; however interior leaves are likely to have lower wind speeds and therefore lower $V_d$ and resuspension rates, but most leaf surface area is not within the interior of the tree canopy, h) rainfall intensity is not considered and may affect washoff rates; i) use of 24-h average concentration data to estimate the hourly concentrations during the day as concentrations will vary locally (e.g., likely higher concentrations near roadways) and temporally, and j) the boundary layer is assumed to be well-mixed (unstable), which will likely lead to conservative estimates of concentration reductions during stable conditions. Future research and more detailed modeling may help overcome these current limitations.

Despite the limitations, there are advantages to these modeling estimates, which include: a) use of locally measured tree, weather and pollution data to assess $PM_{2.5}$ effects, b) use of measured $V_d$ and resuspension rates to estimate removal and resuspension, and c) interaction of $V_d$ and resuspension with local hourly wind speeds. The interactions and variations of $PM_{2.5}$ removal and resuspension with wind speed (Fig. 1) illustrate how the $PM_{2.5}$ flux can vary hourly, yielding positive and negative concentration changes throughout a day. Average wind speed in the cities was 3.7 m $s^{-1}$ with a maximum speed of 20.6 m $s^{-1}$. The average deposition velocity to tree canopies was 0.65 cm $s^{-1}$, which is above the typical range listed for particles less than 2 μm (<0.5 cm $s^{-1}$; Lovett, 1994). However, the average $V_d$ estimate for $PM_{2.5}$ (0.65 cm $s^{-1}$) does not include resuspension, which considering a 34 percent average resuspension rate, would lower the $V_d$ estimate to about 0.43 cm $s^{-1}$.

In this simulation, the movement of the particles from the tree leaves to the soil environment occurs via precipitation. The greater the amount of particles on a leaf just prior to a precipitation event, the greater the overall effect of the trees on removal of $PM_{2.5}$ from the atmosphere. Between rainfall events, the amount of particles retained on tree canopies averages 3500 μg $m^{-2}$, but fluctuates through time based on wind speed. Frequent rainfall would likely maximize tree effectiveness on removing particles from the atmosphere and transferring them to the soil environment. However, not all particles will be resuspended or washed off with precipitation, some particle will adhere to waxy leaf surfaces and be transferred to the soil via leaf drop and leaf decomposition (e.g., Joureava et al., 2002).

This citywide modeling focuses on broad-scale estimates of tree effects on $PM_{2.5}$. Local-scale effects likely differ depending upon vegetation designs. At the local scale, $PM_{2.5}$ concentrations can be increased if trees: a) trap the particles beneath tree canopies near emission sources (e.g., along road ways, Gromke and Ruck (2009)), b) limit dispersion by reducing wind speeds (e.g., Vos et al., 2012) and/or c) lower boundary layer heights by reducing wind speeds (e.g., Nowak et al., 2000). Under stable atmospheric conditions (limited mixing), particle removal by trees could lead to increased reductions in pollution concentrations at the ground level. In addition, if some local sources of $PM_{2.5}$ come from wind-borne soils, tree cover can reduce these particles by reducing wind speeds. Large stands of trees can also reduce pollutant concentrations in the interior of the stand due to increased distance from emission sources and increased dry deposition (e.g., Dasch, 1987; Cavanagh et al., 2009). Thus, local scale design with trees and forests are important for reducing local scale $PM_{2.5}$ concentrations. More research is needed on these local scale issues as local scale designs with trees need to consider vegetation configuration and source–sink relationships to maximize tree effects on reducing $PM_{2.5}$ concentrations and minimizing human exposure to $PM_{2.5}$.

In addition to $PM_{2.5}$ removal, tree also remove other air pollutants (e.g., ozone, sulfur dioxide, nitrogen dioxide; Nowak et al., 2006a) and emit volatile organic compounds that can contribute to ozone formation (e.g., Chameides et al., 1988). Managers need to understand the magnitude of tree effects on air pollution to better manage urban vegetation to improve air quality. To aid in assisting urban forest planners and managers, a free model (i-Tree: www.itreetools.org) has been developed to aid cities in quantifying pollution removal by trees and other environmental services. Improving air quality with vegetation in cities can lead to improved human health and substantial health care savings.

## 5. Conclusions

Modeling of broad-scale effects of pollution removal by trees on $PM_{2.5}$ concentrations and human health reveal that trees can produce substantial health improvements and values in cities. More research is needed to improve these estimates and on local scale effects of vegetation designs. These local scale effects include potentially increasing local concentrations due to limiting pollution dispersion or reducing concentrations through enhanced deposition and reducing the production of particulate matter. Urban forest designs that consider source–sink relationships of $PM_{2.5}$ and other pollutants can be developed to reduce $PM_{2.5}$ concentrations and minimize human exposure to $PM_{2.5}$ in cities across the globe.

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# ACRP

REPORT 6

AIRPORT
COOPERATIVE
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# Research Needs Associated with Particulate Emissions at Airports

TRANSPORTATION RESEARCH BOARD
*OF THE NATIONAL ACADEMIES*

# CHAPTER 2

# Background

The Clean Air Act requires airports to demonstrate compliance with PM emission standards for current operations as well as for expansion and construction projects. Currently airports must meet these requirements using very limited data on PM emissions from aircraft engines and no data on PM emissions from auxiliary power units (APUs). Data on other sources vary in quality and availability, and only limited data are available on ambient PM around airports.

Aviation engine PM data are rapidly evolving and with this evolution there is an urgent need to consolidate the work done in the past with the most recent state-of-the-art measurements. The scientific community's understanding of the nature of aircraft-related PM emissions is hindered since current data remain incomplete for large fractions of common engines operating in the domestic and global fleets. While there are no data available on APU PM emissions, APUs are essentially small jet engines that consume much less jet fuel and consequently emit much less than aircraft main engines, even in the airport vicinity. Their emissions are believed to be similar in composition to main engine emissions but this is yet to be determined.

The need to fill existing data gaps has been identified and initial steps taken in projects recently funded by FAA, NASA, and Transport Canada in their Partnership for AiR Transportation Noise and Emissions Reduction (PARTNER) Center of Excellence. Quite a bit of data have been acquired, especially in the last 3 years, on both military engines—much under DOD's Strategic Environmental Research and Development Program (SERDP) sponsorship—and on commercial-type wide-body transports and regional jets. Many gaps remain, however. The current state of available data is described in this report. From this, gaps in the current knowledge base are identified. Understanding the gaps guided the development of *project statements* for future research.

*ACRP Report 6* presents the project results. A survey of 80 airports was conducted, ranging from large hubs to small general aviation airports, inquiring about the significance of PM emissions at that airport. Interviews were conducted with airport operators and researchers who have specific knowledge about PM emissions at airports. The team also conducted a literature review of available information and ongoing research about PM emissions at airports.

Based on the findings from the survey, the interviews, the literature review, and the professional knowledge of the team, the researchers prepared an assessment of the current state of knowledge of aviation PM emissions. This final report assesses research needs relative to PM emissions and presents problem statements for future research to meet the most critical needs that would be of significant benefit to airport operators.

Chapter 3 of this report presents a primer on PM emissions from aviation to provide a baseline of information for readers who may be unfamiliar with PM emissions generally and issues faced by the aviation community specifically. Chapter 4 summarizes the findings of the PM survey of airports and interviews with airport operators and PM researchers. Chapter 5 describes current knowledge and gaps regarding PM emissions from aircraft engines. Chapter 6 describes the current state of knowledge concerning other airport emission sources and Chapter 7 summarizes research needs. Chapter 8 includes a prioritized research agenda and problem statements for projects to address airports' highest priorities. Chapter 9 includes the literature review and the project bibliography. Appendix A includes a list of airports receiving the survey, a copy of the survey, and a summary of the survey responses. Appendix B includes notes recorded during the interviews. Appendix C presents a summary of hazardous air pollutants for reference. A glossary of key terms is also included.

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# Carbon storage and sequestration by trees in urban and community areas of the United States

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ABSTRACT

Carbon storage and sequestration by urban trees in the United States was quantified to assess the magnitude and role of urban forests in relation to climate change. Urban tree field data from 28 cities and 6 states were used to determine the average carbon density per unit of tree cover. These data were applied to statewide urban tree cover measurements to determine total urban forest carbon storage and annual sequestration by state and nationally. Urban whole tree carbon storage densities average 7.69 kg C $m^{-2}$ of tree cover and sequestration densities average 0.28 kg C $m^{-2}$ of tree cover per year. Total tree carbon storage in U.S. urban areas (c. 2005) is estimated at 643 million tonnes ($50.5 billion value; 95% CI = 597 million and 690 million tonnes) and annual sequestration is estimated at 25.6 million tonnes ($2.0 billion value; 95% CI = 23.7 million to 27.4 million tonnes).

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## 1. Introduction

Urban trees and forests affect climate change, but are often disregarded because their ecosystem services are not well-understood or quantified. Trees act as a sink for carbon dioxide ($CO_2$) by fixing carbon during photosynthesis and storing carbon as biomass. The net long-term $CO_2$ source/sink dynamics of forests change through time as trees grow, die, and decay. Human influences on forests (e.g., management) can further affect $CO_2$ source/sink dynamics of forests through such factors as fossil fuel emissions and harvesting/utilization of biomass (Nowak et al., 2002). Trees in urban areas (i.e., urban forests) currently store carbon, which can be emitted back to the atmosphere after tree death, and sequester carbon as they grow. Urban trees also influence air temperatures and building energy use, and consequently alter carbon emissions from numerous urban sources (e.g., power plants) (Nowak, 1993). Thus, urban trees influence local climate, carbon cycles, energy use and climate change (e.g., Abdollahi et al., 2000; Wilby and Perry, 2006; Gill et al., 2007; Nowak, 2010; Lal and Augustine, 2012).

Urban areas in the conterminous United States have increased from 2.5% of the U.S. land area (19.5 million ha) in 1990 to 3.1% (24.0 million ha) in 2000, an increase in area the size of Vermont and New Hampshire combined (Nowak et al., 2005). If the growth patterns of the 1990s continue, urban land is projected to reach 8.1% by 2050, an increase greater than the area of Montana (Nowak and Walton, 2005). Within these urban areas, tree cover (circa 2005) is estimated at 35.0% (Nowak and Greenfield, 2012b).

Given the growing expanse of urban areas, trees within these areas have the potential to store and annually sequester substantial amounts of carbon. Understanding this national carbon effect can aid in preparing annual inventories of greenhouse gas (GHG) emissions and sinks (U.S. EPA, 2010; Heath et al., 2011). Numerous cities in the United States have analyzed carbon storage and sequestration of the trees and forests among various land-use types using the i-Tree methodology (www.itreetools.org) (Table 1) or other methods (Hutyra et al., 2011; Raciti et al., 2012). In addition, cities outside the United States have also analyzed carbon storage by urban vegetation (e.g., Brack, 2002; Jo, 2002; Chaparro and Terradas, 2009; Zhao et al., 2010; Davies et al., 2011; Strohbach and Haase, 2012).

In the past, city analyses of carbon storage and sequestration have been extrapolated to national estimates using limited data. The first estimate of national carbon storage by urban trees (between 350 and 750 million tonnes; Nowak, 1993) was based on an extrapolation of carbon data from one city (Oakland, CA) and tree cover data from various U.S. cities (e.g., Nowak et al., 1996). A later assessment, which included data from a second city (Chicago, IL), estimated national carbon storage by urban trees between 600 and

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**Table 1**
City and state data used for carbon estimates. Plot size = 0.04 ha unless noted otherwise.

| City/State | Year | No. plots | Data collection group | Reference |
|---|---|---|---|---|
| Arlington, TX[a] | 2009 | 233 | City of Arlington | |
| Atlanta, GA[a] | 1997 | 205 | ACRT, Inc. | |
| Baltimore, MD[a] | 2009 | 195 | US Forest Service (USFS) | |
| Boston, MA[a] | 1996 | 217 | ACRT, Inc. | |
| Casper, WY | 2006 | 234 | City of Casper | Nowak et al., 2006c |
| Chicago, IL | 2007 | 745 | City of Chicago, Chicago Park District, USFS | Nowak et al., 2010b |
| Freehold, NJ[a] | 1998 | 144 | NJ Dept. Env. Protection | |
| Gainesville, FL | 2007 | 93 | Univ. Florida, USFS | Escobedo et al., 2009 |
| Golden, CO[a] | 2007 | 115 | Inst. of Environmental Solutions | |
| Hartford, CT[a] | 2007 | 200 | Knox Parks Foundation | |
| Jersey City, NJ[a] | 1998 | 220 | NJ Dept. Env. Protection | |
| Lincoln, NE[a] | 2008/09 | 178 | Nebraska Forest Service | |
| Los Angeles, CA | 2007/08 | 348 | USFS, Univ. Cal., Riverside | Nowak et al., 2011 |
| Milwaukee, WI[a] | 2008 | 216 | City of Milwaukee | |
| Minneapolis, MN | 2004 | 110 | Davey Resource Group | Nowak et al., 2006a |
| Moorestown, NJ[a] | 2000 | 206 | NJ Dept. Env. Protection | |
| Morgantown, WV | 2004 | 136 | West Virginia University | Nowak et al., 2012c |
| New York, NY | 1996 | 206 | ACRT, Inc. | Nowak et al., 2007d |
| Oakland, CA[b] | 1989 | 1350 | USFS | Nowak, 1991 |
| Omaha, NE[a] | 2008/09 | 189 | Nebraska Forest Service | |
| Philadelphia, PA | 1996 | 210 | ACRT, Inc. | Nowak et al., 2007b |
| Roanoke, VA[a] | 2010 | 160 | Virginia Tech | |
| Sacramento, CA[a] | 2007 | 300 | Sacramento Tree Foundation | |
| San Francisco, CA | 2004 | 194 | San Francisco Dept. of the Environment | Nowak et al., 2007c |
| Scranton, PA | 2006 | 182 | Northeast PA Urban Forestry Program, Keystone College, Penn State Extension, PA Dept. of Conservation and Natural Resources | Nowak et al., 2010a |
| Syracuse, NY[a] | 2009 | 198 | USFS | |
| Washington, DC | 2004 | 201 | Casey Trees, University of Maryland, National Park Service | Nowak et al., 2006b |
| Woodbridge, NJ[a] | 2000 | 215 | NJ Department of Environmental Protection | |
| Indiana[c] | 2002 | 32 | State Forestry personnel, USFS | Nowak et al., 2007a |
| Kansas[c] | 2008/09 | 188 | State Forestry personnel | Nowak et al., 2012b |
| Nebraska[c] | 2008/09 | 200 | State Forestry personnel | Nowak et al., 2012b |
| North Dakota[c] | 2008/09 | 299 | State Forestry personnel | Nowak et al., 2012b |
| South Dakota[c] | 2008/09 | 200 | State Forestry personnel | Nowak et al., 2012b |
| Tennessee[c] | 2005–09 | 255 | State Forestry personnel, USFS | Nowak et al., 2012a |

[a] Unpublished data.
[b] Variable plot size.
[c] 0.067 ha plot size.

900 million tonnes (Nowak, 1994). The most recent analysis, which used data from 10 cities and urban tree cover estimates (Nowak et al., 2001) derived from 1991 Advanced Very High Resolution Radiometer (AVHRR) data, estimated national carbon storage by urban forests at 700 million tonnes (range: 335 million–980 million tonnes) (Nowak and Crane, 2002). Above and below ground biomass in all forestland across the United States, which includes forest stands within urban areas, stored approximately 20.2 billion tonnes of carbon in 2008 (Heath et al., 2011).

The purpose of this paper is to update the national urban tree carbon storage and sequestration estimates using urban field data from 28 cities and 6 states and newer estimates of urban land area and urban tree cover. This new assessment produces more refined statistical estimates of the uncertainty of the national estimates and investigates the overlap between urban carbon estimates and U.S. forestland carbon estimates. These carbon storage and sequestration estimates provide better, more up-to-date information for national carbon estimates (e.g., IPCC, 2006) and can be used to help assess the actual and potential role of urban forests in reducing atmospheric $CO_2$.

## 2. Materials and methods

The methods of this study used: (a) field data and model analyses from several cities and states to estimate total carbon storage and sequestration in these areas, (b) photo-interpretation of tree cover in these areas to determine carbon densities per unit of tree cover, and (c) photo-interpretation of tree cover in urban and community areas in each U.S. state to estimate statewide urban forest carbon values. As forest values from the national Forest Inventory and Analysis (FIA) program (hereby referred to as "forestland") overlap with urban estimates (because there are forest stands within urban areas), analysis of forestland plots within urban areas was conducted to determine the overlap between national forestland carbon estimates and national urban forest carbon estimates.

The definition of urban is based on population density using the U.S. Census Bureau's (2007) definition: all territory, population, and housing units located within urbanized areas or urban clusters. The definition of community, which includes cities, is based on jurisdictional or political boundaries delimited by U.S. Census Bureau definitions of incorporated or designated places (U.S. Census Bureau, 2007). Community areas may include all, some, or no urban land within their boundaries, but city areas are often dominated by urban land. As urban land encompasses the more heavily populated areas (population density-based definition) and community land has varying amounts of urban land that are recognized by their geopolitical boundaries (political definition), the category of "urban/community" was created to classify the union of these two geographically overlapping definitions where most people live. Urban land in 2000 occupied 3.1% (24.0 million ha) of the conterminous United States (Nowak et al., 2005), while urban/community land occupied 5.3% (40.4 million ha) (Nowak and Greenfield, 2012b).

Forestlands at the national scale, as defined by the U.S. Department of Agriculture (USDA) Forest Service Forest Inventory and Analysis (FIA) program, are areas at least 0.4 ha (1 ac) in size, at least 36.6 m (120 feet) wide, and at least 10% stocked. To be measured as "forestland", plots must also not be affected by a land use that prevents normal tree regeneration and succession such as mowing, intensive grazing, or recreational activities (USDA Forest Service, 2010). Forestlands are estimated to cover 304 million ha in the United States (Smith et al., 2009). These forestlands include some areas that fall within urban and community areas.

### 2.1. Field data

Field data were used to determine the entire urban forest structure (e.g., tree species composition and number of trees on all land uses) for 28 U.S. cities and urban areas in 6 states (Table 1). These cities were sampled based on methods developed by the USDA Forest Service for various urban forest research projects (e.g., Nowak et al., 2008) and national urban forest monitoring (Cumming et al., 2008). Data collection was based on random sampling of 0.04 ha (1/10 ac) plots (in cities) or 0.067 ha (four 1/24 ac sub-plots) plots (in urban areas of states) and analyzed using the i-Tree Eco (formerly Urban Forest Effects (UFORE)) model (Nowak et al., 2008). The state plots were based on FIA plot design and data were collected as part of pilot projects testing FIA data collection in urban areas (Cumming et al., 2008). The number of plots collected varied by location (Table 1) with data collection including tree species, stem diameter at 1.37 m above the ground (DBH), tree and crown height, crown width, crown light exposure, and canopy condition. For each tree sampled, carbon storage and annual sequestration were estimated using biomass and growth equations. To aid in national estimates of carbon storage and sequestration, the carbon data are standardized per unit of tree cover.

### 2.2. Biomass equations

Biomass for each measured tree (minimum tree size = 2.54 cm dbh) was calculated using allometric equations and conversion factors from the literature to estimate whole tree dry weight biomass and carbon (see Nowak, 1994; Nowak et al., 2008). These equations are based on forest-grown trees, but as open-grown, maintained trees tend to have less above-ground biomass than predicted by forest-derived biomass equations for trees of the same DBH, biomass results for open-grown urban trees were multiplied by a factor 0.8 (Nowak, 1994). No adjustment was made for trees found in more natural stand conditions (e.g., on vacant lands or in forest preserves). If no allometric equation could be found for an individual species, the average of results from equations of the same genus was used. If no genus equations were found, the average of results from all broadleaf or conifer equations was used.

The carbon estimates yield a standard error of the estimate based on sampling error, rather than error of estimation. Estimation error is unknown and likely larger than the reported sampling error. Estimation error includes the uncertainty of using biomass equations and conversion factors, which may be large, as well as measurement error, which is typically small.

To estimate monetary value associated with urban tree carbon storage and sequestration, carbon values are multiplied by \$78.5 per tonne of carbon (range = \$17.2–128.7 $tC^{-1}$) based on the estimated social costs of carbon for 2010 with a 3% discount rate (Interagency Working Group, 2010).

### 2.3. Urban Tree growth and carbon sequestration

Measured tree growth rates for street (Frelich, 1992; Fleming, 1988; Nowak, 1994), park (deVries, 1987), and forest (Smith and Shifley, 1984) trees were standardized to length of growing season and adjusted for site competition and tree condition. The measured tree growth rates were standardized to 153 frost free days based on: Standardized growth (SG) = measured growth rate × (153 ÷ number of frost free days of measurement) (Nowak et al., 2008). The 153 days was used as the reference length as this was the minimum length of the growing season from the measured data.

Standardized growth rates of trees of the same species or genera were then compared to determine the average difference between standardized street tree growth and standardized park and forest growth rates. Park growth averaged 1.78 times less than street tree growth, and forest growth averaged 2.29 times less than street tree growth. Crown light exposure (CLE) measurements (number of sides and/or top of tree exposed to sunlight) of 0–1 were used to represent forest growth conditions; 2–3 for park conditions; and 4–5 for open-grown (street tree) conditions. Local tree base growth rate (BG) was then calculated as the average standardized growth rate for open-grown trees (0.83 cm $year^{-1}$) × number of frost free days ÷ 153. CLE adjusted growth rate was: BG ÷ 2.26 for CLE 0–1; BG ÷ 1.78 for CLE 2–3; and BG ÷ 1 for CLE 4–5 (Nowak et al., 2008).

The CLE adjusted growth rate was then adjusted based on tree condition to determine the final growth rate. For trees in fair to excellent condition, base growth rates are multiplied by 1 (no adjustment), for trees in poor condition (26–50% dieback) growth rates are multiplied by 0.62, critical trees (51–75% dieback) by 0.37, dying trees (76–99% dieback) by 0.13 and dead trees (100% dieback) by 0 (Nowak et al., 2008). Adjustment factors are based on percent crown dieback and the assumption that less than 25% crown dieback has a limited effect on growth rates. The difference in estimates of carbon storage between year x and year (x + 1) is the gross amount of carbon sequestered annually.

Tree death leads to the eventual release of stored carbon. To estimate the net amount of carbon sequestered by the urban trees, carbon emissions due to decomposition of dead trees were calculated based on methods detailed in Nowak and Crane (2002). To estimate the net carbon sequestration rate, the amount of carbon sequestered due to tree growth was reduced by the estimated amount of carbon lost due to tree mortality and decay.

### 2.4. Tree cover estimates

Tree cover within each sample city was assessed using either photo-interpretation or ground plot measurements of tree cover. Tree cover in urban areas and "urban/community" areas in each state was assessed using photo-interpretation of aerial images circa 2005 (Nowak and Greenfield, 2012b).

### 2.5. State and national level estimates

Carbon and tree cover data for individual cities and states were used to calculate the total carbon storage and sequestration values standardized to per unit tree cover (kg C $m^{-2}$; Table 2). The carbon storage standardized values were pooled to determine a national average standardized value and associated standard error. The average standardized value was multiplied by tree cover and associated standard error in urban and urban/community areas in each state (Nowak and Greenfield, 2012b) to estimate state and national totals for carbon storage. As tree growth and thus carbon sequestration can vary by length of growing season, the standardized sequestration values for each sampled city/state were divided by its length of growing season (number of days) to determine the average sequestration per day per unit of tree cover. This average value was multiplied by the average length of growing season and tree cover for each state to estimate state and national totals for annual carbon sequestration.

### 2.6. Overlap with forest estimates

As national forestland (FIA) data contains data from forest stands in urban areas, and the national urban forest data contains data from forest stands in urban areas, there is an overlap between the two estimates. This overlap leads to double-counting carbon when combining the two estimates for national scale analyses. To estimate the amount of overlap between urban forest and forestland estimates, urban boundaries were overlaid on national FIA plot locations using a geographic information system. Each FIA plot was classified as to whether the plot was 100% forested, partially forested (data were collected only on forested portions of the 4 sub-plots) or 100% non-forest (no data collected).

To estimate the number of FIA plots where data were collected in urban areas within a state, 100% of forested plots were assumed to be sampled, non-forest plots were assumed to be not sampled by field crews, and the number of partial forest plots sampled was estimated as number of partial plots times the average percent urban tree cover in the state (e.g., if tree cover was 50%, then half of the partial forest plots were assumed to be measured). The number of FIA plots measured in urban areas was contrasted with the total number of FIA plots measured in each state to determine the proportion of FIA plots sampled in urban areas.

## 3. Results

Average carbon storage per square meter of tree cover varies by sampled city and state (Table 2), with overall carbon storage averaging 7.69 kg C $m^{-2}$ (SE = 1.36), gross carbon sequestration rate averaging 0.277 kg C $m^{-2}$ $year^{-1}$ (SE = 0.045), and net carbon sequestration rate averaging 0.205 kg C $m^{-2}$ $year^{-1}$ (SE = 0.041). The net sequestration rate averages 74% of the gross sequestration rate. Total carbon storage and sequestration rates in urban and urban/community areas also varied among the United States (Table 3) with total urban tree carbon storage estimated as 643 million tonnes (SE = 23.8 million; value = \$50.5 billion) and total urban/community tree carbon storage estimated as 1.36 billion tonnes (SE = 57.0 million; value = \$106.9 billion). Annual gross carbon sequestration is 25.6 million tonnes $year^{-1}$ (SE = 1.0 million; value = \$2.0 billion) in urban areas and 50.3 million tonnes $year^{-1}$ in urban/community areas (SE = 1.8 million; value = \$4.0 billion). Annual net carbon sequestration is 18.9 million tonnes $year^{-1}$ (SE = 862,000; value = \$1.5 billion) in urban and 37.2 million tonnes $year^{-1}$ in urban/community areas (SE = 1.7 million; value = \$2.9 billion). However, it should be noted that Alaska contains 17% of the total U.S. urban/community area due to its relatively large community boundaries. If urban/community estimates focus on the conterminous United States, the carbon storage, annual gross sequestration and annual net sequestration estimates drop to 1.1 billion, 44.7 million, and 33.1 million tonnes, respectively (Table 3).

In terms of national overlap between conterminous U.S. forestland estimates and urban forest estimates, 13.7% of urban land, or about 38.6% of all urban tree cover, is measured by the U.S. forest inventory plots. From the national forest plot perspective, about 1.5% of all forestland plots are in urban areas in the

Table 2
Standardized carbon storage and sequestration estimates per unit of tree cover and percent tree cover in measured cities and states.

| City/State | Storage | | Gross sequestration | | Net sequestration | | Tree cover | |
|---|---|---|---|---|---|---|---|---|
| | kg C m$^{-2}$ | SE | kg C m$^{-2}$ year$^{-1}$ | SE | kg C m$^{-2}$ year$^{-1}$ | SE | % | SE |
| Arlington, TX | 6.37 | 0.73 | 0.288 | 0.028 | 0.262 | 0.025 | 22.5 | 0.3 |
| Atlanta, GA | 6.63 | 0.54 | 0.229 | 0.017 | 0.175 | 0.025 | 53.9 | 1.6 |
| Baltimore, MD | 8.76 | 1.09 | 0.282 | 0.036 | 0.168 | 0.032 | 28.5 | 1.0 |
| Boston, MA | 7.02 | 0.96 | 0.231 | 0.025 | 0.168 | 0.023 | 28.9 | 1.5 |
| Casper, WY | 6.97 | 1.50 | 0.221 | 0.039 | 0.119 | 0.038 | 8.9 | 1.0 |
| Chicago, IL | 6.03 | 0.64 | 0.212 | 0.021 | 0.149 | 0.018 | 18.0 | 1.2 |
| Freehold, NJ | 11.50 | 1.78 | 0.314 | 0.045 | 0.201 | 0.050 | 31.2 | 3.3 |
| Gainesville, FL | 6.33 | 0.99 | 0.220 | 0.032 | 0.160 | 0.025 | 50.6 | 3.1 |
| Golden, CO | 5.88 | 1.33 | 0.228 | 0.045 | 0.181 | 0.038 | 11.4 | 1.5 |
| Hartford, CT | 10.89 | 1.62 | 0.329 | 0.046 | 0.186 | 0.051 | 26.2 | 2.0 |
| Jersey City, NJ | 4.37 | 0.88 | 0.183 | 0.034 | 0.132 | 0.035 | 11.5 | 1.7 |
| Lincoln, NE | 10.64 | 1.74 | 0.409 | 0.063 | 0.351 | 0.055 | 14.4 | 1.6 |
| Los Angeles, CA | 4.59 | 0.51 | 0.176 | 0.017 | 0.107 | 0.015 | 20.6 | 1.3 |
| Milwaukee, WI | 7.26 | 1.18 | 0.260 | 0.033 | 0.178 | 0.027 | 21.6 | 1.6 |
| Minneapolis, MN | 4.41 | 0.74 | 0.157 | 0.023 | 0.081 | 0.045 | 34.1 | 1.6 |
| Moorestown, NJ | 9.95 | 0.93 | 0.320 | 0.030 | 0.241 | 0.028 | 28.0 | 1.6 |
| Morgantown, WV | 9.52 | 1.16 | 0.297 | 0.037 | 0.231 | 0.026 | 39.6 | 2.2 |
| New York, NY | 7.33 | 1.01 | 0.230 | 0.029 | 0.124 | 0.028 | 20.9 | 1.3 |
| Oakland, CA | 5.24 | 0.19 | na | na | na | na | 21.0 | 0.2 |
| Omaha, NE | 14.14 | 2.29 | 0.513 | 0.081 | 0.401 | 0.066 | 14.8 | 1.6 |
| Philadelphia, PA | 6.77 | 0.90 | 0.206 | 0.027 | 0.151 | 0.023 | 20.8 | 1.8 |
| Roanoke, VA | 9.20 | 1.33 | 0.399 | 0.058 | 0.268 | 0.053 | 31.7 | 3.3 |
| Sacramento, CA | 7.82 | 1.57 | 0.377 | 0.064 | 0.327 | 0.055 | 13.2 | 1.7 |
| San Francisco, CA | 9.18 | 2.25 | 0.241 | 0.050 | 0.221 | 0.046 | 16.0 | 2.6 |
| Scranton, PA | 9.24 | 1.28 | 0.399 | 0.052 | 0.296 | 0.043 | 22.0 | 1.9 |
| Syracuse, NY | 8.59 | 1.04 | 0.285 | 0.030 | 0.202 | 0.039 | 26.9 | 1.3 |
| Washington, DC[a] | 8.52 | 1.04 | 0.263 | 0.030 | 0.209 | 0.026 | 35.0 | 2.0 |
| Woodbridge, NJ | 8.19 | 0.82 | 0.285 | 0.028 | 0.208 | 0.029 | 29.5 | 1.7 |
| Indiana | 8.80 | 2.68 | 0.292 | 0.077 | 0.270 | 0.071 | 20.1 | 3.2 |
| Kansas | 7.42 | 1.30 | 0.284 | 0.048 | 0.221 | 0.040 | 14.0 | 1.6 |
| Nebraska | 6.67 | 1.86 | 0.269 | 0.074 | 0.227 | 0.063 | 15.0 | 3.6 |
| North Dakota | 7.78 | 2.47 | 0.282 | 0.079 | 0.134 | 0.079 | 2.7 | 0.6 |
| South Dakota | 3.14 | 0.66 | 0.128 | 0.026 | 0.111 | 0.022 | 16.5 | 2.2 |
| Tennessee | 6.47 | 0.50 | 0.340 | 0.021 | 0.304 | 0.020 | 37.7 | 0.8 |

na — not analyzed.
[a] Tree cover estimated based on high resolution tree cover map of city with an estimated standard error of 2 percent.

conterminous U.S. (9.3 million ha) (Table 4). Carbon storage that is accounted for in both the national forestland and urban forest estimates ranges from 247 million tonnes using the 38.6% urban overlap estimate to 303 million tonnes using the 1.5% national forestland overlap estimate.

## 4. Discussion

Trees and forests in U.S. urban areas (circa 2005) store 643 million tonnes of carbon (639 million tonnes of carbon in the conterminous U.S.). This new estimate is within range of past estimates for the conterminous U.S. (circa 1990 estimate = 700 million tonnes; Nowak and Crane, 2002), but due to the new data, the current estimate has a reduced bound of error. The 95% confidence interval (CI) for the current carbon storage estimate is between 597 million and 690 million tonnes. However, this bound of estimate is conservative as the error estimate is based on sampling error, and does not include estimation error. If community land is combined with the urban land, the total estimate rises to 1.36 billion tonnes with a 95% CI between 1.25 and 1.47 billion tonnes. The relative standard error (SE/total) for carbon storage in urban areas varied among the states from 0.18 to 0.37. Most of this variation is due to differences in SE of tree cover estimates as states had variable sample sizes in estimating tree cover.

Given the potential available space (pervious land) in urban areas of 74.5% or 17.7 million ha (Nowak and Greenfield, 2012b), carbon storage could increase in the United States. However, given the limitations to tree growth and establishment in urban areas imposed by humans (e.g., mowing) and nature (e.g., lack of precipitation), increasing carbon storage in urban areas is not likely without a major effort to change current conditions (both social and physical). As tree cover in urban areas in the United States is on the decline (Nowak and Greenfield, 2012a), carbon storage in urban areas are also likely on the decline. Long-term monitoring of urban forests is needed to better understand rates of changes in urban areas and provide better estimates of long-term carbon trends.

Carbon storage by trees in forestlands nationally was 20.2 billion tonnes in 2008 (Heath et al., 2011). Given the overlap between urban and U.S. forestland estimates for above and below-ground carbon in trees, total U.S. tree carbon storage including urban and forestland areas is estimated at 20.6 billion tonnes. Carbon storage by urban trees nationally is about 3.2% of the estimated carbon stored in U.S. forestland and urban forest trees combined.

Urban tree carbon storage and sequestration in a state is a function of the total amount of urban tree cover. Generally, states in forested regions have higher percent urban tree cover than urban areas in grassland or desert regions (Nowak et al., 2001; Nowak and Greenfield, 2012b). Thus forested regions will typically have the greatest urban forest carbon densities per unit land area. Carbon density per unit of tree cover range from 3.1 to 14.1 kg C m$^{-2}$ and have less variation than carbon estimates per unit of land cover. The carbon per unit of tree cover varies among cities based on variations in tree density, tree size distributions, and species composition.

The estimated rate of carbon storage per square meter of tree cover has decreased from 9.25 kg C m$^{-2}$ (Nowak and Crane, 2002) to 7.69 kg C m$^{-2}$. This reduction is due to an increased availability of data and better tree cover estimates derived from photo-

**Table 3**
Estimated carbon storage (tonnes), annual sequestration (tonnes $yr^{-1}$) and sequestration rate in urban and urban/community areas by state. Net sequestration estimates equal 74% of gross sequestration.

| State | Storage ($\times10^6$) | | | | Gross sequestration ($\times10^3$) | | | | Rate[b] |
|---|---|---|---|---|---|---|---|---|---|
| | Urban | SE | UC[a] | SE | Urban | SE | UC[a] | SE | |
| Alabama (AL) | 18.7 | 3.6 | 53.9 | 9.8 | 836 | 148 | 2406 | 402 | 0.343 |
| Arizona (AZ) | 5.5 | 1.4 | 21.3 | 4.3 | 253 | 64 | 981 | 185 | 0.354 |
| Arkansas (AR) | 7.7 | 1.6 | 20.0 | 3.9 | 331 | 66 | 858 | 154 | 0.331 |
| California (CA) | 31.4 | 6.0 | 66.9 | 12.3 | 1591 | 283 | 3386 | 571 | 0.389 |
| Colorado (CO) | 4.4 | 1.2 | 10.0 | 2.3 | 112 | 30 | 257 | 55 | 0.197 |
| Connecticut (CT) | 23.3 | 4.3 | 26.0 | 4.8 | 724 | 123 | 806 | 136 | 0.239 |
| Delaware (DE) | 2.3 | 0.5 | 2.4 | 0.5 | 99 | 21 | 106 | 22 | 0.335 |
| Florida (FL) | 42.9 | 8.0 | 62.6 | 11.4 | 2650 | 455 | 3864 | 649 | 0.475 |
| Georgia (GA) | 38.5 | 7.1 | 60.0 | 10.9 | 1770 | 299 | 2759 | 458 | 0.353 |
| Idaho (ID) | 1.1 | 0.3 | 1.4 | 0.5 | 25 | 8 | 33 | 11 | 0.184 |
| Illinois (IL) | 18.7 | 3.7 | 24.4 | 4.7 | 688 | 128 | 896 | 161 | 0.283 |
| Indiana (IN) | 9.7 | 2.2 | 13.7 | 2.9 | 317 | 67 | 447 | 88 | 0.250 |
| Iowa (IA) | 3.8 | 1.0 | 7.7 | 1.8 | 117 | 28 | 240 | 52 | 0.240 |
| Kansas (KS) | 4.8 | 1.1 | 7.3 | 1.8 | 176 | 40 | 270 | 62 | 0.283 |
| Kentucky (KY) | 6.5 | 1.6 | 9.0 | 2.0 | 241 | 55 | 334 | 72 | 0.286 |
| Louisiana (LA) | 10.6 | 2.2 | 20.4 | 4.0 | 544 | 109 | 1052 | 191 | 0.397 |
| Maine (ME) | 3.8 | 0.8 | 13.6 | 2.7 | 109 | 20 | 390 | 71 | 0.221 |
| Maryland (MD) | 11.9 | 2.5 | 15.6 | 3.1 | 497 | 98 | 655 | 123 | 0.323 |
| Massachusetts (MA) | 35.9 | 6.6 | 41.1 | 7.5 | 1187 | 199 | 1359 | 227 | 0.254 |
| Michigan (MI) | 22.9 | 4.5 | 28.9 | 5.5 | 654 | 118 | 826 | 146 | 0.220 |
| Minnesota (MN) | 9.3 | 2.0 | 27.7 | 5.3 | 275 | 55 | 825 | 145 | 0.229 |
| Mississippi (MI) | 7.4 | 1.6 | 20.6 | 4.0 | 333 | 67 | 922 | 164 | 0.344 |
| Missouri (MS) | 11.2 | 2.4 | 20.2 | 4.0 | 417 | 83 | 750 | 138 | 0.285 |
| Montana (MT) | 0.5 | 0.2 | 21.5 | 4.2 | 11 | 4 | 514 | 94 | 0.184 |
| Nebraska (NE) | 1.6 | 0.4 | 2.2 | 0.7 | 51 | 13 | 68 | 20 | 0.238 |
| Nevada (NV) | 1.3 | 0.4 | 5.8 | 1.5 | 35 | 11 | 155 | 39 | 0.207 |
| New Hampshire (NH) | 7.1 | 1.4 | 12.2 | 2.3 | 202 | 36 | 344 | 61 | 0.217 |
| New Jersey (NJ) | 28.0 | 5.3 | 34.8 | 6.4 | 1069 | 186 | 1328 | 227 | 0.294 |
| New Mexico (NM) | 1.8 | 0.6 | 4.9 | 1.3 | 62 | 19 | 166 | 44 | 0.263 |
| New York (NY) | 32.1 | 6.0 | 43.2 | 7.9 | 1005 | 175 | 1350 | 229 | 0.240 |
| North Carolina (NC) | 34.0 | 6.3 | 51.0 | 9.3 | 1378 | 236 | 2067 | 346 | 0.312 |
| North Dakota (ND) | 0.4 | 0.1 | 1.6 | 0.5 | 12 | 4 | 46 | 14 | 0.223 |
| Ohio (OH) | 22.9 | 4.5 | 32.3 | 6.1 | 739 | 134 | 1038 | 182 | 0.248 |
| Oklahoma (OK) | 4.3 | 1.1 | 29.1 | 5.5 | 187 | 46 | 1256 | 221 | 0.332 |
| Oregon (OR) | 8.1 | 1.8 | 10.8 | 2.3 | 255 | 52 | 339 | 67 | 0.242 |
| Pennsylvania (PA) | 28.7 | 5.5 | 45.4 | 8.4 | 911 | 161 | 1438 | 245 | 0.244 |
| Rhode Island (RI) | 4.1 | 0.8 | 4.2 | 0.8 | 139 | 26 | 140 | 27 | 0.258 |
| South Carolina (SC) | 17.3 | 3.4 | 27.1 | 5.1 | 760 | 138 | 1190 | 206 | 0.338 |
| South Dakota (SD) | 0.7 | 0.2 | 1.8 | 0.6 | 21 | 5 | 56 | 17 | 0.236 |
| Tennessee (TN) | 18.9 | 3.7 | 38.2 | 7.1 | 744 | 136 | 1508 | 259 | 0.303 |
| Texas (TX) | 45.2 | 8.4 | 81.4 | 14.8 | 2165 | 370 | 3897 | 650 | 0.368 |
| Utah (UT) | 2.1 | 0.6 | 7.5 | 1.8 | 58 | 17 | 210 | 47 | 0.215 |
| Vermont (VT) | 1.5 | 0.3 | 2.8 | 0.6 | 42 | 8 | 77 | 15 | 0.213 |
| Virginia (VA) | 16.6 | 3.3 | 30.9 | 5.8 | 632 | 117 | 1174 | 204 | 0.293 |
| Washington (WA) | 13.8 | 2.8 | 23.8 | 4.6 | 463 | 89 | 799 | 143 | 0.258 |
| West Virginia (WV) | 5.1 | 1.1 | 12.0 | 2.3 | 161 | 31 | 376 | 68 | 0.241 |
| Wisconsin (WI) | 9.4 | 2.1 | 19.2 | 3.8 | 275 | 57 | 562 | 102 | 0.225 |
| Wyoming (WY) | 0.3 | 0.1 | 7.4 | 1.7 | 7 | 3 | 175 | 39 | 0.182 |
| US48[c] | 638.8 | 23.8 | 1126.1 | 38.9 | 25,347 | 955 | 44,711 | 1563 | 0.305 |
| Alaska | 2.0 | 0.4 | 225.8 | 41.7 | 44 | 7 | 4945 | 840 | 0.168 |
| Hawaii | 2.2 | 0.4 | 9.0 | 1.6 | 167 | 28 | 682 | 112 | 0.581 |
| US50[d] | 643.2 | 23.8 | 1361.2 | 57.0 | 25,559 | 956 | 50,338 | 1778 | 0.306 |

[a] Urban/community land.
[b] Estimated carbon sequestration rate (kg C $m^{-2}$ of tree cover $year^{-1}$) based on average rate from sample adjusted based on the ratio of the average length of growing season in each state to sample average length of growing season.
[c] Conterminous United States.
[d] 50 states.

interpretation. Storage rates per square meter of tree cover in urban areas (7.69 kg C $m^{-2}$) are slightly larger than those found within forestlands (7.24 kg C $m^{-2}$) (Heath et al., 2011). However, this forestland estimate assumes 100% tree cover, which is likely leading to an underestimate of carbon storage per unit of tree cover.

Carbon density rates in this study vary substantially among cities/states from 3.14 to 14.1 kg C $m^{-2}$ cover. This wide range in values illustrates the importance of local forest structure on carbon densities and the need for more local data to refine estimates. This range in values has been illustrated in other studies as well. In the Seattle, WA region, above-ground live carbon storage has been estimated at 8.9 kg C $m^{-2}$ with 57% tree cover, which equates to 15.6 kg C $m^{-2}$ of tree cover. These regional values are greater than the urban estimates in our study as the regional values include significant amounts of peri-urban forest stands. When focused on the urban lands, estimates were 0.2 kg C $m^{-2}$ in heavy urban land uses (6% tree cover; or 3.3 kg C $m^{-2}$ of tree cover); 1.5 kg C $m^{-2}$ in medium urban land uses (21% tree cover; or 7.1 kg C $m^{-2}$ of tree cover); and 3.6 kg C $m^{-2}$ in low urban land uses (31% tree cover; or 11.6 kg C $m^{-2}$ of tree cover) (Hutyra et al., 2011). Storage values in our study are comparable to the medium urban land uses in the Seattle region.

Table 4
Statistics on U.S. forestland plots within urban areas by state.

| State | Forest plots[a] | Urban plots[b] | Partial forest (%)[c] | 100% forest (%)[c] | Urban forest plots[d] | Urban forest (%)[e] | Forest in urban (%)[f] |
|---|---|---|---|---|---|---|---|
| AL | 3614 | 177 | 16.9 | 10.7 | 35 | 19.7 | 1.0 |
| AR | 2804 | 97 | 17.5 | 6.2 | 13 | 13.7 | 0.5 |
| AZ[g] | 2373 | 159 | 44.7 | 1.9 | 15 | 9.2 | 0.6 |
| CA[g] | 4064 | 765 | 3.5 | 0.8 | 11 | 1.5 | 0.3 |
| CO[g] | 2312 | 107 | 50.5 | 0.9 | 10 | 9.7 | 0.4 |
| CT | 283 | 181 | 27.6 | 15.5 | 61 | 33.8 | 21.6 |
| DE | 57 | 28 | 10.7 | 3.6 | 2 | 7.6 | 3.8 |
| FL | 2497 | 679 | 11.0 | 5.4 | 63 | 9.3 | 2.5 |
| GA | 3849 | 419 | 26.3 | 9.3 | 96 | 23.0 | 2.5 |
| IA | 269 | 96 | 8.3 | 3.1 | 5 | 5.1 | 1.8 |
| ID[g] | 2010 | 22 | 81.8 | 0.0 | 2 | 10.6 | 0.1 |
| IL | 472 | 385 | 7.0 | 3.6 | 21 | 5.5 | 4.5 |
| IN | 543 | 245 | 8.2 | 2.9 | 11 | 4.7 | 2.1 |
| KS | 157 | 94 | 8.5 | 0.0 | 2 | 2.4 | 1.4 |
| KY | 1933 | 131 | 13.0 | 6.9 | 14 | 10.4 | 0.7 |
| LA | 2110 | 189 | 14.3 | 5.8 | 20 | 10.4 | 0.9 |
| MA | 488 | 302 | 28.1 | 16.9 | 106 | 35.0 | 21.7 |
| MD | 338 | 194 | 22.7 | 13.4 | 40 | 20.9 | 12.0 |
| ME | 3027 | 37 | 54.1 | 2.7 | 12 | 31.9 | 0.4 |
| MI | 2897 | 365 | 11.5 | 4.7 | 32 | 8.6 | 1.1 |
| MN | 2224 | 163 | 11.7 | 0.6 | 7 | 4.2 | 0.3 |
| MO | 2068 | 191 | 11.0 | 4.2 | 15 | 7.6 | 0.7 |
| MS | 3004 | 96 | 29.2 | 6.2 | 17 | 18.2 | 0.6 |
| MT[g] | 2805 | 21 | 76.2 | 0.0 | 1 | 6.9 | 0.1 |
| NC | 2912 | 398 | 26.6 | 7.5 | 81 | 20.4 | 2.8 |
| ND | 70 | 17 | 0.0 | 0.0 | 0 | 0.0 | 0.0 |
| NE | 132 | 51 | 2.0 | 0.0 | 0 | 0.4 | 0.1 |
| NH | 847 | 65 | 43.1 | 20.0 | 31 | 47.6 | 3.7 |
| NJ | 308 | 306 | 19.9 | 8.5 | 57 | 18.5 | 18.4 |
| NM[h] | 1308 | 81 | na | na | 4 | 12.0 | 0.7 |
| NV[g] | 339 | 14 | 0.0 | 0.0 | 0 | 0.0 | 0.0 |
| NY | 2932 | 422 | 21.1 | 8.3 | 72 | 17.0 | 2.4 |
| OH | 1138 | 424 | 20.8 | 6.6 | 54 | 12.6 | 4.7 |
| OK | 902 | 42 | 19.0 | 4.8 | 4 | 8.4 | 0.4 |
| OR[g] | 2890 | 110 | 20.0 | 2.7 | 12 | 10.7 | 0.4 |
| PA | 2548 | 456 | 20.2 | 5.5 | 56 | 12.3 | 2.2 |
| RI | 62 | 44 | 34.1 | 4.5 | 10 | 23.0 | 16.3 |
| SC | 2036 | 207 | 23.7 | 11.1 | 46 | 22.3 | 2.3 |
| SD | 238 | 17 | 0.0 | 5.9 | 1 | 5.9 | 0.4 |
| TN | 2211 | 257 | 66.9 | 10.5 | 94 | 36.7 | 4.3 |
| TX | 4839 | 541 | 10.0 | 5.9 | 49 | 9.1 | 1.0 |
| UT[g] | 2215 | 74 | 44.6 | 0.0 | 5 | 6.7 | 0.2 |
| VA | 2569 | 262 | 17.9 | 6.9 | 34 | 13.1 | 1.3 |
| VT | 757 | 18 | 16.7 | 11.1 | 4 | 19.9 | 0.5 |
| WA[g] | 1531 | 191 | 53.9 | 1.6 | 37 | 19.3 | 2.4 |
| WI | 2303 | 192 | 12.0 | 1.6 | 10 | 5.1 | 0.4 |
| WV | 1957 | 69 | 30.4 | 8.7 | 16 | 23.0 | 0.8 |
| WY[h] | 789 | 20 | na | na | 1 | 9.0 | 0.2 |
| US[i] | 84,031 | 9421 | 19.9 | 6.1 | 1289 | 13.8 | 1.5 |

[a] Estimated number of forested plots.
[b] Total plots laid in urban areas.
[c] Percent of urban plots.
[d] Estimated number of urban plots that were measured.
[e] Percent of urban plots laid that are forested (urban forest plots/urban plots).
[f] Percent of forest plots within urban areas (urban forest plots/forest plots).
[g] Not all plots sampled to date. Numbers given are for plots with completed data collection. On average, about 76% of the plots have been measured in these western states.
[h] No plot data collected to date. Numbers given are based on all state plots (unsampled). Estimate of urban plots that will have data collection (<0.1% of all plots) assume that urban plots are partially forested proportional to urban tree cover in state.
[i] Conterminous United States.

In three cities in middle Korea: Chuncheon, Kangleung, and Seoul, mean carbon storage by woody plants ranged from 0.47 to 0.72 kg C $m^{-2}$ for urban lands (Jo, 2002), which equates to 3.85–5.58 kg C $m^{-2}$ of tree cover. Annual carbon sequestration values in these urban areas ranged from 0.41 to 0.62 kg C $m^{-2}$ of tree cover $year^{-1}$. Values in more natural land uses in Korea ranged from 2.6 to 5.87 kg C $m^{-2}$ of tree cover for carbon storage and 0.16–0.39 kg C $m^{-2}$ of tree cover $year^{-1}$ for sequestration assuming 100% tree cover in these areas. The storage values are slightly lower than the U.S. urban average likely due to differences in forest structure. Annual sequestration rate per unit of tree cover are higher likely due to higher growth rates compared to the U.S. average.

In Leipzig, Germany, carbon storage averaged 6.82 kg C $m^{-2}$ of tree cover, but varied from 0.68 kg C $m^{-2}$ of tree cover in afforestation areas to 9.85 kg C $m^{-2}$ of tree cover in riparian forests (Strohbach and Haase, 2012). In Barcelona, Spain, carbon storage averaged 4.45 kg C $m^{-2}$ of tree cover, but varied from 1.53 kg C $m^{-2}$ of tree cover in commercial/industrial areas to 9.67 kg C $m^{-2}$ of tree cover in institutional areas (Chaparro and Terradas, 2009). In Hangzhou, China, carbon storage averaged 4.28 kg C $m^{-2}$ of tree cover (Zhao et al., 2010). Within urban areas of the Boston metropolitan area, above-ground carbon storage (live trees, dbh > 5 cm) was estimated at 10.6 kg C $m^{-2}$ of tree cover (Raciti et al., 2012). This value is higher than the national average, but within the range from other U.S. cities (Table 2).

Carbon density rates in this national study (maximum rate of 14.1 kg C $m^{-2}$ cover) are substantially lower than the maximum above-ground carbon density for all vegetation in treed areas in Leicester, England (28.1–28.9 kg C $m^{-2}$) (Davies et al., 2011) and estimates for total carbon within human settlements (23–42 kg C $m^{-2}$) (Churkina et al., 2010). The human settlement estimates are higher because they account for all carbon (e.g., vegetation, buildings); the Leicester tree estimate could be higher due to increased tree densities (Davies, pers. comm., 2012).

Total annual urban gross carbon sequestration is estimated at 25.6 million tonnes $year^{-1}$ (95% CI = 23.7 million–27.4 million tonnes). Total annual urban net carbon sequestration is estimated at 18.9 million tonnes $year^{-1}$ (95% CI = 17.2 million–20.6 million tonnes). Urban tree carbon sequestration rates per square meter of tree cover (0.28 kg C $m^{-2}$ $year^{-1}$) from the sampled cities and states fall within range of estimated sequestration rates for the first 15 years of afforestation of crop and pasture land (0.18–0.43 kg C $m^{-2}$ $year^{-1}$) (Lewandrowski et al., 2004). The national average gross sequestration rate per square meter of tree cover is estimated at 0.306 kg C $m^{-2}$ $year^{-1}$, but varies among the states from 0.168 to 0.581 kg C $m^{-2}$ $year^{-1}$ based on length of growing season (Table 3). The net sequestration is estimated at 0.226 kg C $m^{-2}$ $year^{-1}$. Sequestration rates will vary locally based on tree sizes, tree health, and growth rates associated with species and site conditions. Net annual carbon sequestration is positive for growing forests, but sequestration rates will diminish through time as the forest matures. The sequestration will become negative during periods of forest decline and/or loss when carbon emissions from dead trees (e.g., decomposition, fire) exceed carbon uptake by live trees.

The carbon estimates are based on available data from select cities and states, not a random sample of urban areas. However, the standardization of carbon values per unit tree cover allows these standard values to be applied to actual tree cover within an area to provide a reasonable estimate of carbon storage and sequestration. The estimates are reasonable as they are based on, and therefore account for, local tree cover values and local growth rates. State level results would vary from the given estimates if tree diameter distribution, tree density, and to a lesser extent, species composition, varied from the national average per unit of tree cover. Local and national estimates can be improved through field data collection to estimate local forest structure and carbon storage and sequestration.

In addition to direct carbon storage and sequestration reported in this paper, urban trees can also affect carbon emissions in urban areas. Planting trees in energy-conserving locations around buildings (e.g., Heisler, 1986) can reduce building energy use and consequently emissions from power plants. Transpirational cooling and changes in albedo due to trees alters urban microclimates that can also reduce carbon emissions from cities (e.g., reduced evaporative emissions with lower air temperatures). Additionally, urban tree management practices need to be considered when estimating the net effects of urban trees on atmospheric $CO_2$ as various maintenance activities emit carbon back to the atmosphere via fossil-fuel combustion (e.g., from chain saws, trucks, chippers) (Nowak et al., 2002). As urban areas produce substantial emissions of carbon, tree effects on carbon emissions through altering of microclimates, albedo, energy use, and maintenance emissions need to be incorporated with tree storage and sequestration estimates to develop a more complete assessment of the role of urban forests on climate change.

Urban soils are estimated to store approximately 1.9 billion tonnes of carbon in the United States (Pouyat et al., 2006), three times more than urban trees. More research is needed on the cumulative effects of trees, soils and their management in urban areas (e.g., Pataki et al., 2006) though carbon estimates for urban ecosystems are improving through time as new data become available. Monitoring of urban and other non-forest areas will help improve carbon estimates in urban and other traditionally non-forested landscapes. A better understanding and accounting of urban ecosystems can be used to develop management plans and national policies that can significantly improve environmental quality and human health across the nation.

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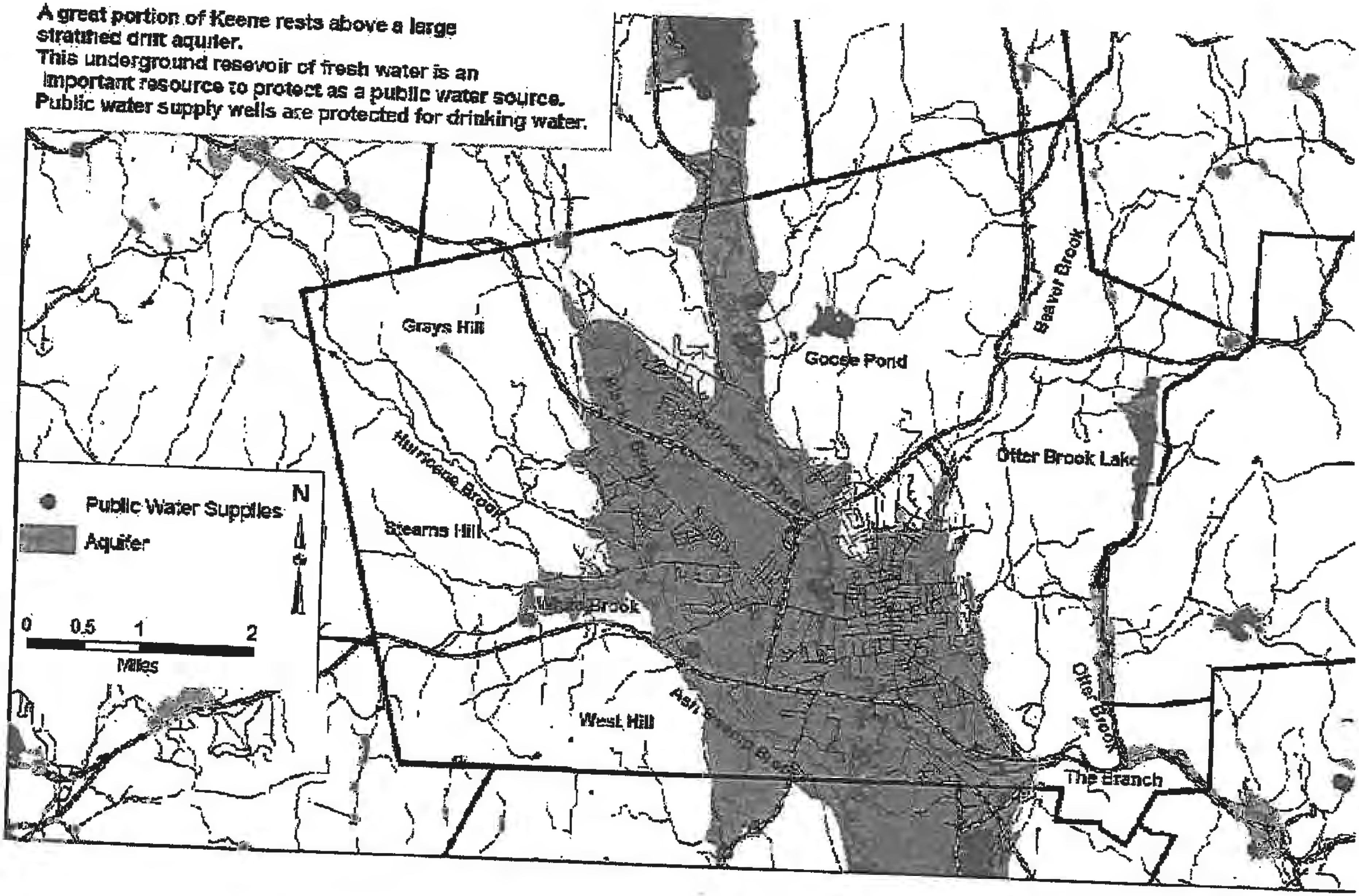
A great portion of Keene rests above a large stratified drift aquifer.
This underground resevoir of fresh water is an important resource to protect as a public water source.
Public water supply wells are protected for drinking water.
Public Water Supplies
Aquifer
N
0
0.5
1
2
Miles
Grays Hill
Goose Pond
Beaver Brook
Otter Brook Lake
Hurricane Brook
Stearns Hill
West Hill
Otter Brook
The Branch

Photograph by A. Shedd,
5/2014

photograph by A.Sledd, 5/2014

Previous Flagging

Sept. 2013 Flagging

USFS - Climate Change Resource Ctr.
www.fs.fed.us/ccrc



# Rate of tree carbon accumulation increases continuously with tree size

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**Forests are major components of the global carbon cycle, providing substantial feedback to atmospheric greenhouse gas concentrations[1]. Our ability to understand and predict changes in the forest carbon cycle—particularly net primary productivity and carbon storage—increasingly relies on models that represent biological processes across several scales of biological organization, from tree leaves to forest stands[2,3]. Yet, despite advances in our understanding of productivity at the scales of leaves and stands, no consensus exists about the nature of productivity at the scale of the individual tree[4,5,6,7], in part because we lack a broad empirical assessment of whether rates of absolute tree mass growth (and thus carbon accumulation) decrease, remain constant, or increase as trees increase in size and age. Here we present a global analysis of 403 tropical and temperate tree species, showing that for most species mass growth rate increases continuously with tree size. Thus, large, old trees do not act simply as senescent carbon reservoirs but actively fix large amounts of carbon compared to smaller trees; at the extreme, a single big tree can add the same amount of carbon to the forest within a year as is contained in an entire mid-sized tree. The apparent paradoxes of individual tree growth increasing with tree size despite declining leaf-level[8,9,10] and stand-level[10] productivity can be explained, respectively, by increases in a tree's total leaf area that outpace declines in productivity per unit of leaf area and, among other factors, age-related reductions in population density. Our results resolve conflicting assumptions about the nature of tree growth, inform efforts to undertand and model forest carbon dynamics, and have additional implications for theories of resource allocation[11] and plant senescence[12].**

C&S AVIATION
services

Joseph N Briggs
VP Aviation
C&S Wholesale Grocers Inc.
7 Corporate Drive
Keene, New Hampshire 03431
May 23, 2014

Mayor Kendall Lane
Keene City Hall
3 Washington Street
Keene, New Hampshire 03431

James P. Duffy, Chair
Municipal Services, Facilities and Infrastructure Committee
Keene City Hall
3 Washington Street
Keene, New Hampshire 03431

Ed Mattern, Airport Director
Dillant Hopkins Airport
80 Airport Road
Keene, New Hampshire 03431

RE: Safety Improvements for Dillant Hopkins Airport

Gentlemen:

Thank you for this opportunity to present comments on the potential environmental impacts associated with the proposed safety improvement project at Dillant-Hopkins Airport. I am the Vice President of Aviation for C&S and I am responsible for all airport activities for C&S.

First and foremost, C&S is pleased that the City of Keene is addressing this important safety issue relating to the operation of the airport and hopes that a reasonable accommodation can be reached that satisfies in a practical way the concerns of the affected neighbors but, at the same time, resolves the significant safety issues that have been raised by the Federal Aviation Administration for Runway 02/20.

As the City of Keene is well aware, Dillant-Hopkins is an integral part of the operations of C&S. We currently own two jets that are housed at the airport. Last year, we flew in and out of the Keene airport approximately 400 times.

The other significant consideration for the City is how important that the airport is to both current businesses and attracting new businesses to Keene. While we understand that C&S is the largest user of the airport, we know that other businesses use the airport both for its own employees and also for vendors who come to Keene from distant locations. A fully functioning airport is important to the economic vitality of the City.

We are especially concerned with the safety implications of the current situation at Dillant-Hopkins. Our jets require a minimum runway length of just over 6000 feet in average weather conditions. Inclement weather dictates longer runway availability. The current runway length for 02/20 is 6300 feet.

The significant tree growth at the north end of the airport has become an increasing safety issue for aircraft landing from that direction. Consequently, C&S firmly supports the plan to eliminate the tree growth that limits access to the airport from that direction.

Having said that, C&S recognizes that the plan to cut a large number of trees affects the Edgewood neighborhood. Because of that concern, C&S engaged an arborist to review the Stantec report and evaluate whether there was some other option that has less of an impact on the neighborhood but, at the same time, achieves the objective of improving the safety on that runway. One option that was mentioned at the committee meeting was "topping" the trees to a level that met the safety requirements imposed by the FAA but kept the trees standing.

Unfortunately, he concluded that "topping" the trees was simply not feasible for most of the trees that are proposed to be cut. This is especially true of the tallest pine trees. The arborist did strongly encourage cutting only those trees in the buffer area between the neighborhood and the airport itself that were already too tall or would likely need to be cut in the next several years. This would preserve to the maximum extent possible both a visual and sound barrier between the airport and the neighborhood.

After careful consideration, C&S believes that the proposal by Stantec Consulting Services, Inc. to cut limited trees and thereafter develop and implement a forestry management plan to maintain a lower tree canopy will accommodate the needs of the airport traffic and address the reasonable concerns of the neighborhood.

Thank you for the opportunity to present our position on this important matter.

Sincerely,

Joseph Briggs

CC: John MacLean, City Manager

Dear Mr. Cohen and Mr. Mattern,

This letter is submitted 23 May 2014 as public comment on the "Final Draft Environmental Assessment" (EA) (See Endnote 1) compiled by the City of Keene and by Stantec Consulting Services Inc. on the topic of the proposed removal of trees affecting Runway 20 protected airspace at Dillant-Hopkins Airport. Stated purposes of the EA (per Keene Public Notice) include "to inform regulatory agencies and the public of the likely environmental consequences" and to provide "the New Hampshire Department of Transportation (NHDOT) with the information necessary to determine whether impacts associated with the proposed project have the potential to contribute to cumulative impacts to the environment."

Unfortunately, the EA omits major topics related to the environmental impact of the proposed removal of trees. Electronic searches of the EA for "carbon dioxide" or "carbon sequestration" or "greenhouse gas" or "climate change" or "global warming" yield no hits. The NHDOT needs more information than is contained in the EA in order to evaluate fully the proposed removal of trees as part of societal trends leading to climate change contributing to cumulative impacts to the environment.

Carbon dioxide emissions to the atmosphere endure for many years. Trees and forests are of great importance for dealing with those emissions. The 2014 National Climate Assessment (NCA3) states that "U.S. forests and associated wood products currently absorb and store the equivalent of about 16% of all carbon dioxide (CO2) emitted by fossil fuel burning in the U.S. each year."(2)

The planetary environmental consequences of removing acres of mature trees near Runway 20 as well as the local manifestations of those consequences must be included in any full analysis of this project. NCA3 states that "Of the carbon dioxide emitted from human activities in a year, about half is removed from the atmosphere by natural processes within a century, but around 20% continues to circulate and to affect atmospheric concentrations for thousands of years. Stabilizing or reducing atmospheric carbon dioxide concentrations, therefore, requires very deep reductions in future emissions – ultimately approaching zero – to compensate for past emissions that are still circulating in the Earth system. Avoiding future emissions, or capturing and storing them in stable geological storage, would prevent carbon dioxide from entering the atmosphere, and would have very long-lasting effects on atmospheric concentrations."(3)

Flooding due to increased frequency of very heavy precipitation events is one example of potential cumulative impacts to the environment resulting from societal trends leading to climate change, including the proposed removal of trees at Dillant-Hopkins Airport. The amount of precipitation falling in very heavy events from 1958 to 2012 in the Northeastern U.S. has increased by 71 percent.(4) There is good documentation of increased flooding in Keene and surrounding areas during recent years.

We request that the NHDOT make note of the perspectives of the Intergovernmental Panel on Climate Change (IPCC) as expressed in its recent document "Summary for Policymakers," specifically that "Effective mitigation will not be achieved if individual agents advance their own interests independently. Climate change has the characteristics of a collective action problem at the global scale, because most greenhouse gases (GHGs) accumulate over time and mix globally, and emissions by any agent (e. g., individual, community, company, country) affect other agents. International cooperation is therefore required to effectively mitigate GHG emissions and address other climate change issues."(5)

We further request that the NHDOT require the preparation of an Environmental Impact Statement (EIS) in order to fully analyze the proposed projects and associated cumulative impacts to the environment related to tree removal near Runway 20 at Dillant-Hopkins Airport, including factors and trends in global warming, greenhouse gas accumulation, and climate change.

Thank you for your attention.

James Gardner
Dorothy Bauer
27 Birch Street
Keene, NH 03431

Endnotes

(1) Available at http://www.ci.keene.nh.us/sites/default/files/draft_ea_rpt_3-31-2014.pdf

(2) Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program, 841 pp. doi:10.7930/J0Z31WJ2, p.176; available at http://nca2014.globalchange.gov/system/files_force/downloads/low/NCA3_Climate_Change_Impacts_in_the_United%20States_LowRes.pdf?download=1

(3) *Ibid.*, pp. 650, 651.

(4) *Ibid.*, Figure 2.18, p. 37.

(5) IPCC, 2014: Summary for Policymakers, In: Climate Change 2014, Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, p. 5; available at http://report.mitigation2014.org/spm/ipcc_wg3_ar5_summary-for-policymakers_approved.pdf

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MAY 2 3 2014
NH AERONAUTICS

May 20, 2014

To: New Hampshire Department of Transportation

The City of Keene and Dillant-Hopkins Airport plan to cut hundreds of trees in the forest between the Edgewood Neighborhood and the Airport. The FAA has determined that the trees invade the airspace necessary for planes to land safely.

This elimination of the forest will have disastrous effect on the Edgewood neighborhood. It will increase air and noise pollution, result in decreased property values, harm the surrounding environment and leave a citizenry of about 200 taxpayers feeling betrayed by their own city government.

Instead of a lovely forest, we will have a gaping hole with a view of an industrial area - the terminal building, runways, planes, and open space beyond for more than a mile.

We have not seen any plans or studies showing alternative ways of providing safe landings for planes. What we have heard is the cost of $23 million which is too expensive, to lengthen the runway. Show us the study. Or is this just an estimate? We've heard that planes approaching the runway at a 4 degree angle instead of a 3 degree angle would solve the problem. Is this true?

We are for the utmost safety of pilots and their passengers. Destroying a forest and neighborhood is not the way to ensure it. There has to be a better way.

Peter Weinert

Peter Weinert
7 Riverton St.
Keene, NH

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MAY 2 1 2014

NH AERONAUTICS

Public Comment
Airport Obstruction Removal

The city of Keene, citing the FAA, has found that the trees at the north end of the airport are too tall. Those trees are endangering the lives of pilots and whom they are carrying. In the sixties when the land was given to the city, the city was charged with maintaining the area as a pedestrian park, which also meant managing the forest so that it did not become a safety problem.

The city never paid any attention to the area. In fact at one point it allowed the fire department to build a training area in the park. The training area has not been used for all of fifteen years yet it remains, the thirty foot tower, the false roof and the gas tanks are still in place. None of this is a problem until a child disregards the signs, climbs and falls.

Now because of city negligence, some of the trees in the neighborhood and in the forest are too tall and are interfering with safe access to the runway from the north end. Some may remember what the city did in the Nineties at the south end of the runway to establish an instrument landing facility. A huge area was clear cut and private property was taken by Eminent Domain. The airport still did not pay for itself. Keene taxpayers aid the airport to the tune of excess of thirty thousand dollars annually.

A simple solution to this problem that is at no cost monetarily nor environmentally was presented to MSFI Committee in April by a pilot who said by simply changing the angle of descent on the north end of the airport from three degrees to four degrees the trees are no longer a problem.

James T. Dunn
One Riverton Street
Keene, New Hampshire 03431

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MAY 2 1 2014

NH AERONAUTICS

Public Comment
Airport Obstruction Removal

The city of Keene owns an airport at the southern end of the city in the town of Swanzey. Between the airport and the residential area that is just beyond the Catholic Cemetery, called Edgewood, is a forest. Actually it is a city park, with hiking trails that are used year around by walkers, hikers, skiers and snowshoers. The forest park was deeded to the city in the sixties as a buffer between the two areas. The city was to manage the area, which includes a glacier- created bog and a rather large wetland. The city was negligent in actually managing the area. As a result, draconian measures are under way.

We knew, when we bought our 1912 Craftsman-style house in Edgewood, twenty years ago, that the airport was nearby. It was never a problem, a few flights a day, coming or going. Not a problem. In the 1990's the south end of the airport was cleared and an instrument landing guidance system was installed. Although that end of the runway still looks like a scar, very little changed. Much is in the process of changing now.

From early in the twentieth century until the sixties, the area they are now planning to cut was a tree farm used to help reforest the state. The white pines were sought after and purchased by many communities around the state.

Now, as the city never complied with the original agreement, the trees are suddenly a cause for concern as they might present a problem for pilots when landing. This is especially true for student pilots. As a result the city and the FFA intend to use "best practices" to annihilate over six hundred trees.

The study done by Stantec, the planning consultant firm hired by the City, has found there is 'no substantial environmental impact' with this project. That presents a question in my mind: how do you cut down more than six hundred trees from a twelve+ acre site without having an environmental impact, best practices or no.

James T Dunn

James T Dunn
1 Riverton St
Keene, New Hampshire 03431

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MAY 2 2 2014

NH AERONAUTICS

May 19, 2014

Carol Niewola

Department of Transportation

P.O. Box 483

Concord, NH 03302

Dear Ms. Niewola:

Being one of the households faced with avigation easements and the downgrading of my neighborhood, I would like to state I wouldn't want to see the airports abilities damaged nor do I want to see the many trees that define our neighborhood cut down. My wife and I bought our home 9 years ago because of the neighborhood and have told people we never regretted the purchase for one day, that is until now. We never would have purchased the home if it had an avigation easement attached to the deed. We have included an Avigation Easement Language sample provided by Stantec and a copy of the suggested template for an Avigation Easement, titled "Surface and Overhead Avigation Easement" found on the FAA Central Region, Airport Division web site.

One approach that wasn't considered on the DEA by the Stantec report would be to use alternative 3.2.3 in the DEA report that moves the northern threshold south and would leave 4613 ft. of runway, leaving 387 ft. to be constructed.

I have been told 300 ft. of runway was abandoned in a prior project if so less than 100 ft. of new runway would have to be added to have the 5000 ft. of runway needed as per FFA regulations for the aircraft using the airport and would not affect the General Aviation designation of the airport . This idea was brought up at the April 5th 2013 ad hoc meeting and was dismissed because of permit and wetland issues. The DEA on page 4.14 shows that permits will be needed to do work on the runway safety area in the wetlands on west side of the southern end of runway 2/20.

As stated in the DEA report by Stantec and by Mr. Mattern at the April 5th 2013 ad hoc meeting the airport has no plans to bring in larger planes. Mr. Mattern also stated 80% of air traffic used the southern approach. This would add 387 ft. for aircraft using the southern approach. This would not require avigation easements or the cutting of a large number of trees on private property or the Keene Forestry Park.

I know money is usually the deciding factor in any project, the DEA says that alternative 3.2.3 is approximately $450.000 not including the avigation easements or the removal of trees on private property and I know this idea would add some cost to the project The city's tax revenues would be affected by the reduced value of property in the Edgewood neighborhood and more so on the homes affected by the easements.

I looked up reduction of property values due to avigation easements and found no set answer as each parcel is unique but found an estimate of 10.1 to 27.4 % for a national average. This will go forever or until the airport is closed. Going with Alternative 2 may prove to be more costly to the City of Keene and the city residents in the long hall. All tax payers of Keene will be affected as they will have to make up the lost revenue brought on by the reduction of our property values. I also found that some mortgages have a clause that cancel's them if there property value decreases.

Please review Appendix C. of the Stantec DEA:

In July of 1969 the Keene Forestry Association deeded land to the Edgewood Civic Association. The Edgewood Civic Association deeded land to the City of Keene in the same month and year, July, 1969 which also included the property deeded to them from Keene Forestry Association. The deed was amended on March 18, 1983 to allow the removal of trees hazardous to air navigation. The deed contained certain restriction on the land use including the following.

"Such premises shall be maintained in a natural wooded state substantially in the same condition in which the premises are on the date of the deed".

The City of Keene Airport has been negligent in following through with the language of the deed and if the land had been managed as per the deed there would be no problem with the trees now.

I find it hard to have confidence in the Stantec DEA as they missed the aquifer under the airport and made the ridiculous statement that the forest would regrow in 2 or 3 years.

It is very difficult to have any faith in this process as we have been told numerous things and promises by both the airport manager and Stantec rep. that have not been true. There has been no consideration for the neighborhood, it's as we don't exist or just a painful thorn in their side.

In closing I would like to quote the Russian proverb printed on the City of Keene Comprehensive Master Plan for neighborhoods" DON'T BUY THE HOUSE BUY THE NEIGHBORHOOD"

Dwight Anderson 103 Greenwood Ave. Keene, NH

Dwight Anderson

Leanne Anderson 103 Greenwood Ave. Keene, NH

Leanne Anderson

603-352-0534

from Stantec

**SAMPLE AVIGATION EASEMENT LANGUAGE**

**The easement and right of way shall be defined to include the following:**

> **The airspace above the Grantor's property to an infinite height above the approach surface of said Grantor's property as fully described. (Attach plan and insert surface description.)**
>
> **Together with the right to cause in all airspace above the surface of the portion of the Grantor's property to be conveyed to the Grantee such noise, vibrations, fumes, dust, fuel particles, and all other effects that may be caused by the operation of aircraft landing at, or taking off from, or operating at or on said airport; and Grantor does hereby fully waive, remise and release any right or cause of action which they may now have or which they may have in the future against Grantee, its successors and assigns, due to such noise, vibrations, fumes, dust, fuel particles, and all other effects that may be caused or may have been caused by the operation of aircraft landing at, or taking off from, or operating at or on said airport.**
>
> **The easement and right of way hereby granted includes the continuing right in the Grantee to prevent the erection or growth upon Grantor's property of any building, structure, tree or other object, extending into the airspace above the aforesaid imaginary surface or any tree that is within 15 feet of the aforesaid imaginary surface, and to remove trees that extend into the aforesaid imaginary surfaces or to remove or top trees that are within (15) feet below the imaginary surfaces, or at the sole option of the Grantee, as an alternative, to mark and light as obstruction(s) to air navigation, any such building, structure, tree, or other objects now upon, or which in the future may be upon said property, together with the right of ingress to and egress from, and passage over Grantor's property for the above purposes;**
>
> **The Grantee will give 14 days notice before entering the Grantor's property. Any damages incurred by entering the Grantor's property or performing the necessary work will be restored to pre-project conditions including, but not necessarily limited to, restoration of turf areas, landscaping, pavements, curbs, and structures.**

**Suggested Template for Avigation Easements**
We have provided this sample Avigation Easement language to assist Sponsors with the preparation of an agreement for their specific location and situation. We recommend Sponsors furnish this sample language to their attorney tasked with preparing the actual Avigation Easement.
**Limitations of Use**
The FAA's provision of this sample language serves as a starting point for the Sponsor for preparing their customized avigation easement. Sponsors must not construe provision of this sample document as being complete and legally sufficient. Sponsors are solely responsible for verifying the legal status of all contractual matters, including establishment of avigation easements.

# SURFACE AND OVERHEAD AVIGATION EASEMENT

**WHEREAS**, (Property Owner), hereinafter called the Grantors are the fee owners of the following specifically described parcel of land situated in (City, County & State):

(Metes & bounds description of easement parcel)

hereinafter called "Grantors' property" and outlined on an attached Exhibit A map.

**NOW, THEREFORE**, in consideration of the sum of $____________ and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, the Grantors, for themselves, their heirs, administrators, executors, successors and assigns do hereby grant the following appurtenant rights and benefits to the (Name of Airport) hereinafter called the "Grantee" for the use and benefit of the public.

The appurtenant rights and benefits include the uses, rights and restrictions described as follows:

The unobstructed use and passage of all types of aircraft in and through the airspace at any height or altitude above the surface of the land.

The right of said aircraft to cause noise, vibrations, fumes, deposits of dust, fuel particles (incidental to the normal operation of aircraft); fear, interference with sleep or communication, and any other effects associated with the normal operation of aircraft taking off, landing or operating in the vicinity of (Airport).

As used herein, the term "aircraft" shall mean any and all types of aircraft, whether now in existence or hereafter manufactured and developed, to include jet, propeller-driven, civil, military or commercial aircraft; helicopters, regardless of existing or future noise levels, for the purpose of transporting persons or property through the air, by whoever owned or operated.

In granting this easement, the Grantors agree to make no modifications to the following "accepted" existing structures lying within the bounds of the easement area of the Grantors' property.

(Example: 20' x 25' utility shed, see attached Exhibit A map)

The Grantors agree that during the life of this easement, they will not construct, erect, suffer to permit or allow any structure or trees on the surface of the burdened property. The Grantors may not permit any places of public assembly or gatherings within the easement area. (Examples: churches, schools, day care facilities, hospitals, restaurants, stadiums, office buildings, etc.) The Grantors are permitted to continue to grow and harvest crops or graze livestock in the easement area

The Grantors agree to keep the easement area free of the following: structures (permanent or temporary) that might create glare or contain misleading lights; residences, fuel handling and storage facilities and smoke generating activities and creation of any means of electrical interference that could effect the movement of aircraft over the easement area.

Grantors agree to waive all damages and claims for damages caused or alleged to be caused by the Grantors violation of any aspect of this easement document. The (Airport) has a perpetual right of ingress/egress in the easement area and the right to remove any new structure or vegetation that is not specifically mentioned above as "accepted."

TO HAVE AND TO HOLD said easement and right of way, and all rights appertaining thereto unto the Grantee, its successors, and assigns, until said (Airport) shall be abandoned and shall cease to be used for public airport purposes. It is understood and agreed that all provisions herein shall run with the land and shall be binding upon the Grantors, their heirs, administrators, executors, successors and assigns until such time that the easement is extinguished.

IN WITNESS WHEREOF, the grantors have hereunto set their hands and seals this ____________ day of __________________, 20_____. (Local recordation and subordination practices must also be met. If subordination is necessary in which case the mortgagee must join in the agreement, a statement must be made to assure that the mortgage is subordinate to the Easement and the Easement recording superior and prior to lien in said mortgage without consideration of the date of the mortgage instrument)

____________________

____________________(SEAL)

Grantor(s)

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MAY 2 0 2014

NH AERONAUTICS

To: Federal Aviation Administration, NH Department of Transportation
Re: Public Comment on Environmental Assessment for Keene Dillant-Hopkins Airport

There are several comments that I would like to make regarding the Environmental Assessment (EA) recently presented to Keene's MSFI Committee by Stantec Corporation, regarding the Keene Airport "Runway Obstruction" project.

Central to Option 2, as recommended by the Stantec Corporation, are **32 Avigation Easements.** These easements will be needed from private property owners in the adjoining neighborhood (Edgewood), in order to cut a large number of mature pine trees. On multiple occasions in the past several months, requests have been made for Stantec to specify the language in the easements. However, only a generic example of such an easement has been provided, one which in broad terms removes rights of the property owner **far in excess what is needed to cut trees.** To quote from paragraph two of the sample easement:

> *Together with the right to cause in all airspace above the surface of the portion of the Grantor's property to be conveyed to the Grantee such noise, vibrations, fumes, dust, fuel particles, and all other effects that may be caused by the operation of aircraft landing at, or taking off from, or operating at or on said airport; and Grantor does hereby fully waive, remise and release any right or cause of action which they may now have or which they may have in the future against Grantee, its successors and assigns, due to such noise, vibrations, fumes, dust, fuel particles, and all other effects that may be caused or may have been caused by the operation of aircraft landing at, or taking off from, or operating at or on said airport.*

Why, if this project is about cutting trees, is there a paragraph releasing the airport from all responsibility related to "noise, vibrations, fumes, dust, fuel particles and all other effects?" This type of language is completely unrelated to the project at hand and should be omitted.

Secondly, the cost of option 2 in the EA is in error, because it does not include the cost of obtaining easements, or the cost of using eminent domain laws in the (likely) event of property owners not signing easements. Also, it does not include lost revenue that the city of Keene will experience as a result of reduced property valuations, once easements have been placed on nearly half of the neighborhood properties. This lost revenue will continue, year after year, making this option expensive indeed. For example, the neighborhood now contributes almost $500,000 in taxes to the city. If the placement of easements reduces the value of properties by 10%, the city will lose $50,000/year, in perpetuity.

Thirdly, Stantec Corporation has declined to perform noise or air quality studies, despite the request of affected property owners. How will we be able to quantify the change in air quality and noise pollution after the tree cutting, if no studies are done now? Of course, once people have signed away their rights regarding "noise, vibrations, fumes, dust, fuel particles and all other effects" it will not matter...and if such language remains in the easements, documenting the amount of such effects would likely make the easements more expensive to obtain (perhaps this why the city, airport and Stantec Corporation do not wish to perform them).

Fourth, there is uncertainty regarding the 1983 addendum that Philip Mangones approved to the original deed transferring the Edgewood Civic Association parcel to the city. In particular, we've been advised that if membership in the Association is not a requirement of living in the neighborhood (and it is not), that Mr. Mangones might not have had, in his position of President of the Association, the power to alter the original conditions of the property transfer.

Fifth, the boundaries of the Civic Association parcel have never been made clear vis a vis a second parcel, the Keene Forestry Park. Why is this information not available?

It was clear from comments made by a local pilot at the presentation of the EA to Keene's MSFI Committee that **another possible option** exists. This option is as follows: change the glide slope approach to the airport (on the Edgewood neighborhood end of the runway) from 3% to 4%, and move the landing threshold 200 – 300 feet. This altered glide slope is currently used in many airports (most of them much larger and busier than Keene). This, in conjunction with the minor modification of the landing threshold, would still leave 6000+ feet of runway, and would result in much less environmental impact, and less cost. Fewer easements, if any, would be needed, and fewer trees would need to be cut. Why has this option not been considered?

Finally, it must be noted that the Keene Airport tree-cutting project, like the four million dollar runway resurfacing project currently in progress, anticipates future growth at the Keene Airport. Is this really likely in the slow-growth Monadnock region, particularly in an approaching era of expensive fuel, advanced telecommunication capability, and increasing recognition of the detrimental effects of **all** air traffic on climate change? The trees, or other vegetation, will grow back (though large trees sequester more carbon than smaller vegetation (Nature **507**, 90-93, 06 March 2014). However, Option 2, as outlined in the Stantec's EA, maximizes the damage to the environment and private properties, without adequate on-site study and consideration of less extreme solutions.

Sincerely,
Mark Meess

Mark C. Meess

59 Greenwood Ave
Keene, NH 03431

**Karen Honeycutt**
**71 Greenwood Ave.**
**North Swanzey, NH  03431**
**(603) 352-6103**
**khoneycutt@keene.edu**

Tuesday, May 20, 2014

Carol Niewola
Department of Transportation
PO Box 483
Concord, NH  03302

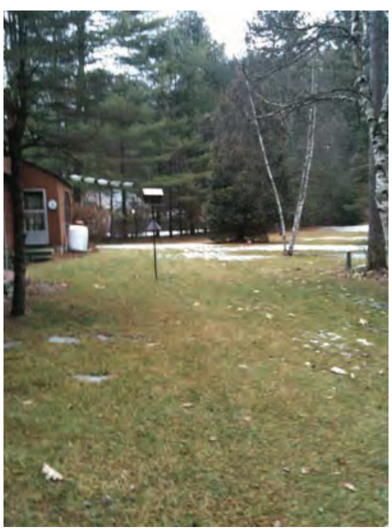
Dear Ms. Niewola:

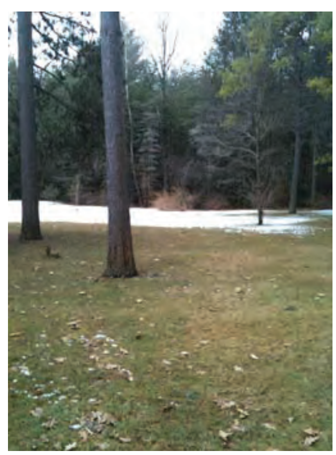
I am writing about the tree-cutting project that the Keene Airport wants to do in my neighborhood, the Edgewood neighborhood in Keene/North Swanzey.

To place my concerns into context, I am including several photos that show my current back yard – ***THE BACK YARD THAT IS THE MAIN REASON I BOUGHT THIS HOUSE 2 YEARS AGO.***

The picture above right is the view from my kitchen window.  Every morning I go downstairs and the first thing I do is open the curtains on that window; I never fail to be calmed by the view.

The pictures below are of my back yard, moving left to right from just outside a back door ...






As you can see, my view is *wonderful* -- it basically is a small forest (and the surrounding area is also full of beautiful trees).  My lot is THE biggest reason I bought this house.  For me, this was a huge decision; I already had a house in Keene that I didn't want to sell, so I had to find renters for it, and of course I had to qualify for financing and all the rest of the usual things you go through to buy a house.  The house was WAY bigger than I needed (I live by myself, and the house has 5 bedrooms!), but I bought it ***because of the lot and the neighborhood.***

To find out AFTER buying the house that the airport wants to cut down a huge number of the trees in the neighborhood and on my property was a shock, to say the least. The seller had lived in the neighborhood for literally decades (my house was his family house, and he had another house a block away in the same neighborhood), and had a real estate business there, and was active in local politics – yet he neglected to mention what was going on (despite the fact that he KNEW I was buying the house ONLY because it was on THIS lot – take away the lot and I would not have bought it, simple as that).

The Edgewood neighborhood was established many decades ago (my house was built around 1960) and is now one of the nicest areas in Keene/Swanzey. Friends who come to visit always comment on the neighborhood – the houses are all different (no cookie-cutter division here) but they are all well-kept-up and beautiful. The neighborhood has informal get-togethers every year; this is a well-established, wonderful neighborhood that I would bet most of us chose because of its beautiful setting.

The Airport management has been arrogant and dismissive of neighborhood concerns. One publicly stated that people living in the area didn't care about pilot safety and instead were just worried about a few trees; others complain that the Airport has to spend money on useless studies just to appease homeowners. The irony there is, the "independent" company hired to come up with options utlimately decided on the one option that the Airport wanted all along. That is highly suspicious in and of itself; it is very clear that no other options were seriously considered, and to pretend otherwise is ludicrous.

I am flabbergasted that Edgewood homeowners are being ignored. I spent more than a quarter-million dollars on my house, and the Airport wants to take away THE reason I bought it – which to me takes away all of its value (literally -- I absolutely would not have bought it if the view was of the AIRPORT instead of all the trees!). The Airport -- which benefits only a few people in this area, although they would like to think differently -- wants to fundamentally change the nature of this beautiful neighborhood. **They are so cavalier with *other people's property!***

As we wrote on a petition, "I ... oppose the City of Keene's proposed tree cutting in the forest between the Keene Airport and the Edgewood neighborhood. Removing the trees will significantly impact our quality of life, reduce our property values and, will potentially negate our rights as residents. We urge the City of Keene, the Federal Aviation Administration (FAA), the New Hampshire DOT, and the Keene Airport Commission to consider other alternatives. To reiterate, we want pilots to be safe; destroying a neighborhood is not the best way to do it!"

Sincerely,

Karen Honeycutt

RECEIVED

MAY 2 1 2014

NH AERONAUTICS

Edgewood Neighborhood Association
1 Riverton St
Keene, NH 03431

Carol Niewola
NH Dept of Transportation
PO Box 483
Concord, NH 03302

May 20, 2014

Dear Ms Niewola:

Enclosed are signed petitions submitted in objection to the proposed tree cutting by the City of Keene / Dillant-Hopkins Airport.

Thank you for your consideration,

Brenda Dunn, corresponding secretary

# Edgewood Neighborhood Association



## PETITION

the undersigned, oppose the City of Keene's proposed tree cutting in the forest between the Keene Airport and the Edgewood neighborhood. Removing the trees will significantly impact our quality of life, reduce our property values and, will potentially negate our rights as residents.

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Name Address Keene, NH 03431

Dominic Tzalli 109 Greenwood Avenue

Signature Address

I affirm the ~~above~~ attached signatures are all residents of the Edgewood neighborhood. Their signatures were obtained based on their own free will and accord.

Name Dominic Tzalli Date May 29 2014

Notary Public: Susan H Silver

My Commission Expires

SUSAN H. SILVER, Notary Public
My Commission Expires January 16, 2018

NOTARY PUBLIC
NEW HAMPSHIRE

# Edgewood Neighborhood Association

# PETITION

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**We urge the City of Keene, the Federal Aviation Administration (FAA), the New Hampshire DOT and the Keene Airport Commission to consider other alternatives. To reiterate, we want pilots to be safe; destroying a neighborhood is not the best way to do it!**

| Name | Address | Keene, NH 03431 |
|---|---|---|
| 1. Lee Kendall | 46 Lynwood Ave | |
| 2. Helen Kendall | " | |
| 3. [illegible] | 108 Greenwood Ave | |
| 4. Lynda D Elkins | 108 Greenwood Ave | |
| 5. Sandra Carlson | 114 Greenwood Ave | |
| 6. Al Ross | 114 Greenwood Ave | |
| 7. John W. Kearns | [illegible] 36 Lynwood Ave | |
| 8. Cheryl Kirwin | 36 Lynwood Ave | |
| 9. [illegible] | 39 Lynwood Ave | |
| 10. [illegible] | 10 Leawood Ave. | |
| 11. Josh MacLellan | 10 Leawood ave | |
| 12. [illegible] | 14 Leawood Ave | |
| 13. Justin Hutchings | 14 Leawood Ave | |
| 14. Andrea MacMurray | 7 Leawood Avenue | |
| 15. Linda J. Rajaniemi | 132 Greenwood Ave. | |
| 16. [illegible] | 11 Rte 32 | |



DT / SF

# Edgewood Neighborhood Association

## PETITION (Continued)

17. [signature] 11 Old Homestead Hwy
18. 
19. 
20. 
21. 
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30. 

I affirm the above signatures are all residents of the Edgewood neighborhood. Their signatures were obtained based on their own free will and accord.

SE/DT

Name____________________ Date__________

Notary Public: ____________________

My Commission Expires: ____________________

# Edgewood Neighborhood Association

# PETITION

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| Name | Address | Keene, NH 03431 |
|---|---|---|
| 1. Jane Jacobs | 115 Greenwood Ave. | |
| 2. [illegible] | 115 Greenwood Ave | |
| 3. [illegible] | 123 Greenwood Ave. | |
| 4. [illegible] | 123 Greenwood Ave. | |
| 5. Frank J. Murphy | 119 Greenwood Avenue | |
| 6. [illegible] Darrell | 30 LYNWOOD AVENUE | |
| 7. [illegible] | 30 LYNWOOD AVENUE | |
| 8. [illegible] | 103 Greenwood Ave. | |
| 9. Jeanne Anderson | 103 Greenwood Ave. | |
| 10. [illegible] LOUISE | 27 OLD EDGEWOOD HAMESTEAD HWY. | |
| 11. Gloria Kearney | 134 GREENWOOD AVE | |
| 12. [illegible] Kearney | 134 GREENWOOD AVE | |
| 13. [illegible] Dallimore | 129 Greenwood Ave | |
| 14. Dominic Tralli | 109 Greenwood Ave. | |
| 15. Rhonda Capparo Tralli | 109 GREENWOOD AVE. | |
| 16. | | |

DT/SE

# Edgewood Neighborhood Association

# PETITION

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**We urge the City of Keene, the Federal Aviation Administration (FAA), the New Hampshire DOT and the Keene Airport Commission to consider other alternatives. To reiterate, we want pilots to be safe; destroying a neighborhood is not the best way to do it!**

**Name** **Address** **Keene, NH 03431**

Signature: Joann Ramsey — Address: 35 Edgewood Ave

~~I affirm the above signatures are all residents of the Edgewood neighborhood. Their signatures were obtained based on their own free will and accord.~~

~~Name____________________ Date__________~~

~~Notary Public: ____________________~~

~~My Commission Expires: ______________~~

DT/SE

# Edgewood Neighborhood Association

# PETITION

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**Name** Nancy N Johnson **Address** (owner of)

Nancy N Johnson 115 Greenwood Ave, Keene, N.H.

**Signature** **Address**

**I affirm the above signatures are all residents of the Edgewood neighborhood. Their signatures were obtained based on their own free will and accord.**

**Name**________________________ **Date**__________

**Notary Public:** ________________________

**My Commission Expires:** __________________

DT

# Edgewood Neighborhood Association
# PETITION

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**Name** **Address**

Keene, NH 03431

Peter J. Rooney

**Signature**

642 Main St. Keene, NH

**Address**

6

DT

# Edgewood Neighborhood Association

## PETITION (Continued)

| | | |
|---|---|---|
| 17. | Tracy Oettegh | EDGEWOOD APTS |
| 18. | Skyla D Louise | EDGEWOOD APTS. |
| 19. | Wayne Lee Hartford | EDGEWOOD APTS. |
| 20. | Beverly [illegible] | EDGEWOOD APTS. |
| 21. | Nathany Perry | EDGEWOOD APTS. |
| 22. | Tena Martineau | EDGEWOOD APTS. |
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| 24. | | |
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| 26. | | |
| 27. | | |
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| 29. | | |
| 30. | | |

I affirm the above signatures are all residents of the Edgewood neighborhood. Their signatures were obtained based on their own free will and accord.

Name______________________ Date__________

Notary Public: ______________________

My Commission Expires: ______________



CIERA I

# Edgewood Neighborhood Association

# PETITION

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| Name | Address | Keene, NH 03431 |
|---|---|---|
| 1. Anna Laffond | 15 Riverton St | |
| 2. Suzanne Nadeau | 3 Kenworth Ave | |
| 3. [illegible] Nadeau | 3 Kenworth Ave | |
| 4. Pamela Jo Cooke | 45 Greenwood | |
| 5. [illegible] Chapin | 77 " " | |
| 6. Peter [illegible] | 7 Riverton St. | |
| 7. Beth E. Stewart | 7 Riverton St. | |
| 8. Noelle Ellis | 28 Greenwood | |
| 9. Susan North | 4 Kenworth Ave. | |
| 10. Charles [illegible] | 4 Kenworth Ave. | |
| 11. Dr. Andrew Cooke | 45 Greenwood | |
| 12. David D [illegible] | 26 Greenwood ave | |
| 13. Gladys [illegible] | 26 Greenwood ave | |
| 14. | | |
| 15. | | |
| 16. | | |



PW

# Edgewood Neighborhood Association

## PETITION

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**We urge the City of Keene, the Federal Aviation Administration (FAA), the New Hampshire DOT and the Keene Airport Commission to consider other alternatives. To reiterate, we want pilots to be safe; destroying a neighborhood is not the best way to do it!**

**Name** **Address** **Keene, NH 03431**

DAVID MAY 7 KENWORTH AVE

David C. May

**Signature** Karen J. May **Address** 7 Kenworth Ave.

Karen J. May

**I affirm the above signatures are all residents of the Edgewood neighborhood. Their signatures were obtained based on their own free will and accord.**

**Name**________________ **Date**________

**Notary Public:** ________________

**My Commission Expires:** ________________



PW

# Edgewood Neighborhood Association

# PETITION

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**We urge the City of Keene, the Federal Aviation Administration (FAA), the New Hampshire DOT and the Keene Airport Commission to consider other alternatives. To reiterate, we want pilots to be safe; destroying a neighborhood is not the best way to do it!**

| Name | Address | Keene, NH 03431 |
|---|---|---|
| 1. Peter Clark | 641 Main St | |
| 2. Kim Clark | 641 Main St. | |
| 3. Brent [illegible] | 1 Riverton St | |
| 4. James T Dawn | 1 Riverton St | |
| 5. George W [illegible] | 27 Old Homestead Hwy | |
| 6. Laura B [illegible] | 14 Edgewood Ave | |
| 7. Ann Arthur-Smith | 637 Main St | |
| 8. Dawn Hope | 631 Main St. | |
| 9. [illegible] | 631 Main St | |
| 10. MJ Lupien | 10 Edgewood Ave | |
| 11. A Lupien | 10 Edgewood Ave. | |
| 12. Marijo Varney | 7 Edgewood Ave | |
| 13. [illegible] | 655 Main St. | |
| 14. [illegible] | 659 Main St | |
| 15. Gerry Frederiksen | 675 Main St | |
| 16. James Frederiksen | 675 Main St. | |

BD

# Edgewood Neighborhood Association

## PETITION (Continued)

17. Charles Canesi 675 Main St #2
18. Jahdiel Torres-Cabá 679 Main St
19. Carrie Young 679 main St
20. Jennifer Otero-Negrón 30 Maple Ave
21. Ronald Willett 693 main st
22.
23.
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**I affirm the above signatures are all residents of the Edgewood neighborhood. Their signatures were obtained based on their own free will and accord.**

**Name**________________ **Date**________

**Notary Public:** ________________

**My Commission Expires:** ____________



BD

# Edgewood Neighborhood Association

# PETITION

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We urge the City of Keene, the Federal Aviation Administration (FAA), the New Hampshire DOT and the Keene Airport Commission to consider other alternatives. To reiterate, we want pilots to be safe; destroying a neighborhood is not the best way to do it!

| Name | Address | Keene, NH 03431 |
|---|---|---|
| 1. Philip L. Mirenyi [signature] | 100 Greenwood Ave K- | |
| 2. Judith Mirenyi [signature] | 100 Greenwood Ave. Keene | |
| 3. [illegible] | 74 Greenwood Ave Keene | |
| 4. Christopher Myers | 77 Greenwood Ave N. Swanzey | |
| 5. Jennifer Myers | 77 Greenwood Ave N. Swanzey | |
| 6. Karen Hareycutt | 71 Greenwood Ave., N. Swanzey | |
| 7. [illegible] | 52 Greenwood Ave, Keene, NH. | |
| 8. Maria Perrin | 52 Greenwood ave Keene NH | |
| 9. Lucee [illegible] | 38 Edgewood Ave | |
| 10. Christie Wright | 66 Greenwood Ave, Keene | |
| 11. [illegible] | 74 Greenwood Ave Keene, NH | |
| 12. Ann C. Shedd | 59 Greenwood Ave, Keene, NH | |
| 13. | | |
| 14. | | |
| 15. | | |
| 16. | | |

#5

# Edgewood Neighborhood Association

# PETITION

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| Name | Address | Keene, NH 03431 |
|---|---|---|
| 1. Kim Dowd | 11 Kenworth Ave | |
| 2. [illegible] | 11 Kenworth Ave | |
| 3. Rob + Chris McLaughlin | 2 Walker St. | |
| 4. David + Jean Johnson | 19 Kenworth Ave | |
| 5. Linda A Piekarski | 15 Edgewood | |
| 6. Karen Costello | 3 Walker St | |
| 7. [illegible] | 6 Greenwood Ave | |
| 8. [illegible] | 2 Lynwood Ave. | |
| 9. [illegible] | 8 Lynwood Ave | |
| 10. Lori Streeter | 8 Lynwood Ave | |
| 11. Deb Miller | 24 Lynwood Ave. | |
| 12. Rosalie Sinclair | 24 Lynwood Ave. | |
| 13. Jonathan Mason | 24 Lynwood Ave. | |
| 14. Timothy Robideau | 24 Lynwood Ave. | |

(13)

CW/RH

15. Jennifer Reno 34 Edgewood Ave
16. Shawn Reno 34 Edgewood Ave

# Edgewood Neighborhood Association

## PETITION (Continued)

17. Valerie Cullen 26 Edgewood Ave Keene
18. [illegible] 3 WALKER ST.
19. Robert E. Fellows 95 Green Wood Ave
20. [illegible] 2 Lynwood Ave
21.
22.
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RH CW

I affirm the above signatures are all residents of the Edgewood neighborhood. Their signatures were obtained based on their own free will and accord.

Name________________________ Date__________

Notary Public: ____________________

My Commission Expires: ________________

# Edgewood Neighborhood Association

## PETITION

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**We urge the City of Keene, the Federal Aviation Administration (FAA), the New Hampshire DOT and the Keene Airport Commission to consider other alternatives. To reiterate, we want pilots to be safe; destroying a neighborhood is not the best way to do it!**

| Name | Address | Keene, NH 03431 |
|---|---|---|
| 1. Christine McMahon | 25 Lynwood Ave | |
| 2. Henry Malone | 30 Edgewood Ave | |
| 3. Gail Hayes | 20 Edgewood Ave. | |
| 4. Joseph Hayes | 20 Edgewood Ave. | |
| 5. | | |
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| 11. | | |
| 12. | | |
| 13. | | |
| 14. | | |

# Edgewood Neighborhood Association

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Name | Address
Brent Myers | 51 Greenwood Ave.Keene, NH 03431

B Myers
5/16/14
Signature

16

## Ed Mattern

**From:** Carol Niewola <Cniewola@dot.state.nh.us>
**Sent:** Wednesday, May 28, 2014 10:08 AM
**To:** 'teri@ne.rr.com'
**Cc:** Ed Mattern; leigh.bartlett@stantec.com; gregg.cohen@stantec.com
**Subject:** RE: Dillant Hopkins/Edgewood Community tree cutting

Mr. and Mrs. Boudreau,

Thank you for taking the time to review the draft Environmental Assessment prepared for the evaluation of the protected airspace to Runway 20 at Dillant-Hopkins Airport. By copy of this e-mail, I'm sharing your communications with the airport and their consultant.

Carol L. Niewola, PE, CM
Senior Aviation Planner
NHDOT/Bureau of Aeronautics
7 Hazen Drive
Concord, NH 03302-0483
p: 603-271-1675
f: 603-271-1689
c: 603-419-0683

-----Original Message-----
From: teri@ne.rr.com [mailto:teri@ne.rr.com]
Sent: Friday, May 23, 2014 10:02 AM
To: Carol Niewola
Subject: Dillant Hopkins/Edgewood Community tree cutting

Hello,

I live in the Edgewood neighborhood in Keene, NH. I'm writing today to protest the proposed tree cutting that borders my property and the Keene airport.

I feel that our and our entire neighborhood's concerns regarding clear-cutting the trees that buffer our area from the airport are being dismissed.

The trees bordering our neighborhood are part of a city park system that the City of Keene was to maintain. Since they failed to do that the trees are now considered "too high" for the pilots flying in. However there are many pilots who fly into the airport who say there are plenty of ways to land there that do NOT require clear-cutting the park's trees.

I don't believe there is anyone in the neighborhood who opposes topping off trees or selectively cutting the trees considered "too high", however the airport officials appear to not want to discuss any alternatives to clear-cutting.

I ask you to consider our dilemma and urge those involved to work with us toward a mutually acceptable solution.

Thank you,

Teri & John Boudreau
91 Greenwood Ave.

Keene/Swanzey, NH
603-903-1100

To the Department of Transportation, the Airport Advisory Committee, the Keene City Council,

For the last 14 and a half years, my family and I have had the pleasure of living in the Edgewood neighborhood. During that time, I have voted in every election, worked at our community hospital as a midwife, delivered approximately 800 babies and paid $94,000 in taxes on this property as well as $127,000 in taxes on the 2 rental properties we own. In addition, with the help of the fabulous Putnam family, my husband and I helped start a high school in the Tilden Building when the city put it on the market. The fledgling Ashuelot River High School is now the thriving Monadnock Waldorf High School. We have appreciated all the hard work that goes into creating such a great community on the city level and have been proud to raise our children here. We admire the master plan the city put in place and agree with it's ideas wholeheartedly, including the "preservation of neighborhoods" and the honoring of green space.

When the city first began public discussion about the need for mitigating visual obstructions to the airport, I realized some tree cutting in the Edgewood Forestry Park would be necessary. As the full extent of the plan was revealed, I was horrified. The area mapped out for tree cutting encompasses almost three quarters of the neighborhood, ending next to my neighbor's property which is 4 houses from route 32 on the far end of Greenwood Ave. The character of our entire neighborhood will be erased. The sentinel pines that have stood majestically gracing our neighborhood will be gone. This is an esthetic tragedy but it is more than that. It is a health issue for our neighborhood and for Keene in general. The trees not only absorb carbon, they help prevent the spread of leaded small plane fuel. Lead, a neurotoxin banned from car fuel and paint since the 1970s, is still present in non jet airplane fuel or "Avgas". The majority of planes leaving and landing at our airport are these small planes using this leaded fuel. In addition, the trees absorb noise and vibrations and filter water going into the aquifer that runs under the airport and Keene Forestry Park.

Unlike some of my neighbors who are hoping we can come to a resolution of no tree cutting, I realize it is inevitable some trees must come down. But I strenuously object to the idea of clear cutting the Keene Forestry Park with the plans to "replant" it. The vicious clearcutting done in Swanzey in the name of our airport is a graphic foretelling of what our park and our neighborhood will look like if the current proposed plan is carried out. There must be provision made for topping trees and a stepwise plan with a neighborhood buffer in place. This plan has been used in the Kenai Alaska Municipal Airport Obstruction Tree Removal Project in March 2012. Kenai is a small city with their airport very close to a neighborhood. I will quote from this report in my letter but am also including a copy of the entire report.

"Project 1-On Airport Property Tree Removal. This project consists of clearing and/or selective tree removal on airport property where and as show on the plan. Most of the affected trees on Airport property will be cleared and removed. However, initially, the trees will be topped to provide a 50-100-foot hedgerow buffer on the Airport, parallel to Float Plane Road....The City will plant replacement reforestation trees, that will not grow as tall, along the buffer area."

"Project 2-Selected Tree Removal on Private Property with Avigation Easements-This project consists of removal and/or topping of obstruction trees on eight private properties located South of the Airport...Although the preference is to completely remove trees to avoid ongoing maintenance, the City recognizes that property owners value the trees in their landscapes and may wish to keep certain affected trees even though they are topped. Accordingly, each property owner will be given the option of removal or topping on a tree by tree basis."

Later in the report under Environmental Consequences section...
"The US Dept. of Agriculture, in it's scoping response, suggested the City institute a tree planting program based on a multi-age, multi-height forest using reforestation stock, not landscape trees. To offset potential impacts to visual resources, the City is proposing to initially top the trees along a 50-100 hedgerow buffer area...and to plant replacement reforestation trees, that will not grow as tall, along the buffer area. The City is also proposing to plant reforestation trees on private properties, if requested by the property owner."

The language in the Kenai plan speaks to a more cooperative and transparent relationship with the airport neighbors than has been evidenced by our airport manager. The plan itself is more nuanced and sensitive than the one set out by Sentac. I would also like to point out that if topping and cutting of the trees in the Keene Forestry Park were carried out carefully, there are MANY healthy, young 20-40 foot deciduous trees that could more quickly restore the park to a forest state that clear cutting and replanting could. This could also save the city money in the long run since the federal government is not footing the bill for replanting. And speaking of saving the city money, it has never been explained to us why lights could not be erected to mark the tree obstructions. These navigation lights could be part of a plan that helps avoid such drastic cutting. The marking of obstructions is a common occurrence according to pilots I've spoken to and the lights are then included on aviation maps.

Wondering how the neighbors in Kenai actually felt about the work that had occurred, I called Kenai Airport. The Airport manager said that people weren't happy with any of the cutting but did affirm that many trees had been topped instead of cut. She described the story of one family who complained that tower lights were shining directly into their bedroom after the changes. The City Manager went to their house at night to experience the situation himself. To remedy the problem, a barrier structure was built. Again, this seems to me that the feelings of the adjoining neighbors were honored in Kenai, not just by listening to their words, but by crafting a plan that addressed FAA concerns AND airport neighbor concerns. What is stopping our airport manager and city from behaving in such a respectful and sensible way?

RECEIVED FROM: S Ellsworth
RECEIVED BY: Dee
DATE RECEIVED: 5/23/2014
DISTRIBUTION DATE: Mayor, Manager,
DISTRIBUTED TO: Councilors.
Airport Director

Sincerely,

Sarah Ellsworth

Sarah Ellsworth
123 Greenwood Ave.
Keene, NH

# FINAL ENVIRONMENTAL ASSESSMENT

# KENAI MUNICIPAL AIRPORT
# OBSTRUCTION TREE REMOVAL PROJECTS

Prepared for:

**FEDERAL AVIATION ADMINISTRATION**
**ALASKAN REGION, AIRPORTS DIVISION**

on behalf of the Sponsor

**CITY OF KENAI, ALASKA**

**March 2012**

Prepared by:
**Aries Consultants Ltd.**
**and**
**Wince-Corthell-Bryson**

This environmental assessment becomes a federal document when evaluated, signed, and dated by the Responsible FAA Official.

Responsible FAA Official | Date

Comments regarding this document should be addressed to:

Bruce Greenwood
Environmental Protection Specialist
FAA Alaskan Region, Airports Division
222 West 7th Avenue, Box 14
Anchorage, Alaska 99513-7587
bruce.greenwood@faa.gov

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Kenai Municipal Airport
Obstruction Tree Removal Projects

## 1.0 INTRODUCTION AND BACKGROUND

The City of Kenai, Alaska, in cooperation with the Federal Aviation Administration (FAA) is proposing to improve the Kenai Municipal Airport by the removal of tree obstructions that penetrate the Federal Aviation Regulations (FAR) Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace*, approach and transitional surfaces and FAA Order 8260.3B, *United States Standard for Terminal Instrument Procedures* (TERPS), departure surface for instrument aircraft operations at the Airport. Based upon a preliminary assessment of potential impacts and completion of a formal scoping process the FAA has determined that an Environmental Assessment (EA) is needed to satisfy the requirements of the National Environmental Policy Act (NEPA).

The projects are located in Sections 31 and 32 of Township 6 North, Range 11 West, Seward Meridian as well as within Sections 5 and 6 of Township 5 North, Range 11 West, Seward Meridian. The Airport Reference Point is Latitude 60° 34' 29.76" North and Longitude 151° 14' 41.81" West.

## 2.0 PURPOSE AND NEED

The Proposed Action is needed in order to protect public safety and preserve the existing published instrument arrival and departure procedures for Runway 1L-19R. The Proposed Action is a safety maintenance project to remove or top trees that penetrate either the 34 to 1 approach surface and associated 7 to 1 transitional surface for Runway 1L or the 40 to 1 departure surface for Runway 19R. Under the provisions of FAR Part 77, trees that penetrate the approach or departure surface are considered obstructions which can adversely affect the navigable airspace. The 34 to 1 approach surface and associated 7 to 1 transitional surface for Runway 1L are defined under the provisions of FAR Part 77.19, *Civil Airport Imaginary Surfaces*. The 40 to 1 departure surface for Runway 19R is defined under the provisions of FAA Order 8260.3B, *United States Standard for Terminal Instrument Procedures* (TERPS) and FAA Advisory Circular 150/5300-13, *Airport Design*, Appendix 2, *Runway End Siting Requirements*. These provisions, together with federal grant obligations noted below require the City of Kenai, as Airport Owner, to remove, relocate or lower (or both relocate and lower) objects to preclude their penetration of the 34 to 1 approach surface and associated 7 to 1 transitional surface and 40 to 1 departure surface unless an object is fixed by function (e.g., a navigational aid) and/or the object is designated to be impractical to remove, relocate or lower. The 34 to 1 approach surface and 40 to 1 departure surface applies to runways being used or planned for instrument arrivals and departures.

In addition, in accepting FAA Airport Improvement Program funds for the Airport, the City has assured the FAA in Grant Assurance 20, *Hazard Removal and Mitigation*, that the City will take appropriate action to assure that the airspace required to protect instrument and visual operations to the Airport will be adequately cleared and protected.

# 3.0 PROPOSED ACTION AND ALTERNATIVES

## 3.1 Proposed Action

The Proposed Action is identified as "Kenai Municipal Airport Obstruction Tree Removal Projects". The Proposed Action is limited to areas where trees currently penetrate the composite FAR Part 77 approach surface and 7 to 1 transitional surface for Runway 1L and the TERPS 40 to 1 departure surface for Runway 19R, as shown on Figures 1 and 2. It is estimated that as many as 2,600 trees are affected by the Proposed Action, approximately 2,300 of these trees are on Airport property and the remainder are on private property. The Proposed Action includes the following projects:

Project 1 – On-Airport Property Tree Removal. This project consists of clearing and/or selective tree removal on Airport property where and as shown on the plan and detail on Figures 1 and 2. Most of the affected trees on Airport property will be cleared and removed. However, initially the trees will be topped to provide a 50- to 100-foot hedgerow buffer area on the Airport, parallel to Float Plane Road, between Second and Fifth Avenues, and around City Lots 123, 173, and 174 (planned for the cemetery expansion). The City will plant replacement reforestation trees, that will not grow as tall, along the buffer area. Trees selected for removal will be cut flush to the ground, removed and disposed of by the City's contractor.

Project 2 – Selected Tree Removal on Private Property with Avigation Easements. This project consists of the removal and/or topping of obstruction trees on eight private properties located south of the Airport. These properties are identified on Figure 1 by a solid yellow outline. Based upon scoping comments from the U.S. Department of Agriculture (see Appendix A) trees that are topped are more prone to decay and rot due to decay causing organisms that could enter from the wounds on the top of the tree contributing to a future decline of area forests around the Airport. Although the preference is to completely remove the trees to avoid ongoing maintenance, the City recognizes that property owners value the trees in their landscapes and may wish to keep certain of the affected trees even though they are topped. Accordingly, each property owner will be given the option of removal or topping on a tree-by-tree basis.

Trees that are being topped will be topped at an elevation approximately 10 feet below the applicable FAR Part 77 / TERPS controlling elevation, unless the property owner requests they be topped at a lower elevation. In accordance with existing avigation easements granted to the City of Kenai by these eight property owners, the City will issue a directive for each private lot to be entered and trees removed or

Figure 1

**TREES ABOVE AND TEN FEET BELOW FAR PART 77 / TERPS SURFACES**

Figure 2

**FAR PART 77 / TERPS CROSS SECTIONAL DETAIL**
Vicinity of Tree Obstructions

topped. The directive will provide a lot plan identifying the obstacle trees and will specify a date and time to accommodate the lot owner's presence on site. The trees selected for removal or topping will be offered to the owners for their use and, if declined, would be removed and disposed of by the City's Contractor. The City's Contractor will be responsible for repair and/or replacement of any fencing, gates, property corners, structures, landscaping or other appurtenances if damaged by clearing operations.

Project 3 – Selected Tree Removal on Private Property currently without Avigation Easements. This project consists of two steps: Step 1) negotiating avigation easements with six additional private properties identified on Figure 1 by a dashed yellow outline; Step 2) remove and/or top trees on these private properties that penetrate the composite FAR Part 77 approach surface and 7 to 1 transitional surface for Runway 1L and the TERPS 40 to 1 departure surface for Runway 19R. Both steps will be arranged for and directed by the City. After the avigation easements are granted to the City by the property owners, the City will issue a directive for each private lot to be entered and trees removed or topped. The directive will provide a lot plan and specify a date and time to accommodate the lot owner's presence on site. Each property owner will be given the option of removal or topping on a tree-by-tree basis. The trees selected for removal or topping will be offered to the owners for the use their use and, if declined, would be removed and disposed of by the City's Contractor. The City's Contractor will be responsible for repair and/or replacement of any fencing, gates, property corners, structures, landscaping or other appurtenances if damaged by clearing operations.

Project 4 – Continuous Obstruction Tree Maintenance Program. The City and FAA recognize that there will be a recurring need for continuous obstruction tree maintenance in the future as other trees grow and penetrate either the FAR Part 77 approach and transitional surfaces or the TERPS departure surface. Therefore, every four to five years, the City and FAA will reevaluate this Environmental Assessment to determine its continuing applicability to obstruction tree maintenance at the Kenai Municipal Airport. Any future tree maintenance projects will include notification in advance to affected property owners, agencies and other interested parties. In addition, the affected environment will be reviewed and FAA will determine if there have been any significant changes to any of the environmental impact categories defined in FAA Order 1050.1E, *Environmental Impacts: Policies and Procedures*. If FAA determines there are significant changes, then additional environmental documentation will be prepared.

### 3.2 Alternatives

Based on the potential aviation safety issues and the current height of the trees, the "No Action" alternative is not considered an option for any of the defined projects. However, with respect to the private properties affected by Projects 2 and 3, there are two other actionable alternatives defined by the elevation at which affected trees will be topped:

- Alternative 1 – Affected trees would be topped at approximately the specific elevation of the relevant FAR Part 77/TERPS surfaces (instead of approximately 10 feet below these surfaces as proposed). This alternative would require almost annual activity to maintain the necessary clearances, depending upon the growth characteristics of the tree species. Since topping a tree has the potential to lead to a decline of area forests, such annual maintenance is inconsistent with good forest management techniques and as a consequence would, over time, be more disruptive to the environment and each property owner. Additionally, the more frequent maintenance schedule would increase the potential risk of damages to private property and result in higher maintenance costs to the detriment of other Airport maintenance projects.

- Alternative 2 – Affected trees would be topped at an elevation approximately 20 feet below the FAR Part 77 / TERPS surfaces. The benefits of this alternative are that such topped trees would likely require maintenance only every 10 to 20 years depending upon the tree species and both maintenance costs and damage risks are reduced. However, topping trees at this lower elevation may not leave enough of the tree canopy for survival and may accelerate the area-wide negative effects of topping a tree. Since, within the Proposed Action, the property owner can elect to have the trees topped at an elevation lower than the Proposed Action, setting a lower mandatory elevation for topping may result in a significant short-term reduction of forest resources that may be significantly detrimental to the environment.

- No Action – If this action is not taken, the FAA has stated that the existing published instrument arrival and departure procedures would not be authorized as at present. The weather minimums will remain higher than necessary and will have to be increased if the trees continue to grow. The Airport would only be operational under visual flight rules (VFR) conditions at times which would have a significant impact on air service to and from Kenai and use of the Airport.

# 4.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

## 4.1 Environmental Categories Affected

Based on a preliminary analysis and comments received in response to scoping documents, Table 1 identifies environmental categories affected by the proposed projects. Based on previously completed environmental analyses noted below categories that were determined to be not affected are not otherwise addressed in this document. Information in the following documentation supports this determination:

- Environmental Assessment, 2006-2008 Kenai Municipal Airport Improvement Program (FAA AIP Project 03-02-0142-3002). 2006.
- Preliminary Jurisdictional Determination & Wetland Functional Assessment. Kenai Municipal Airport. July 1996. Amended February 2005. The findings of the Jurisdictional Determination and Wetland Functional Assessment were agreed to by the U.S. Army Corps of Engineers in correspondence dated October 17, 2005.
- Supplemental Environmental Assessment, 2011-2015 Float Plane Basin Facility Improvement Projects (FAA AIP Project 03-02-0142-134-2010). 2010.

## 4.2 Air Quality

Affected Environment - Currently, the City of Kenai is not classified as non-attainment or maintenance for any of the criteria pollutants defined by National Ambient Air Quality Standards (NAAQS).

Environmental Consequences - Emissions from the tree cutting and trimming equipment (chain saws and hoists), as well as any chipping or hauling equipment used in the Proposed Action would temporarily increase pollutant emissions. The City will not allow the open burning of slash or debris. Trees affected by Project 1 are likely to be cut and removed over a relatively brief construction period estimated to be less than six weeks. Trees affected by Projects 2 and 3 are expected to be cut over a potentially longer period of time since the work will be accomplished based on the property owners availability. As a consequence of the scheduling of the work and the kinds of equipment involved air emissions are not expected to be significant.

Table I

**SUMMARY OF ENVIRONMENTAL CATEGORIES POTENTIALLY AFFECTED BY THE PROPOSED ACTION**

| Environmental Category | Potentially Affected | |
|---|---|---|
| | Yes | No |
| Air Quality | | X |
| Coastal Barriers | | X |
| Compatible Land Use | X | |
| Construction Impacts | X | |
| Department of Transportation Act: Sec. 4(f) | | X |
| Farmlands | | X |
| Fish, Wildlife, and Plants | X | |
| Threatened or Endangered Species | | X |
| Floodplains and Navigability | | X |
| Hazardous Materials, Pollution Prevention, and Solid Waste | X | |
| Historical, Architectural, Archaeological and Cultural Resources | X | |
| Light Emissions and Visual Impacts | X | |
| Natural Resources and Energy Supply | | X |
| Noise | X | |
| Secondary (Induced) Impacts | | X |
| Socioeconomic Impacts, Environmental Justice, and Children's Environmental Health and Safety Risks | | X |
| Water Quality | X | |
| Wetlands | X | |
| Wild and Scenic Rivers | | X |
| Wilderness | | X |

## 4.3 Compatible Land Use

Affected Environment - The affected environment includes wooded airport lands and wooded private single family properties as identified on Figure 1. The single family properties are part of a larger subdivision development adjacent to the Airport. Eight of the affected private properties have an avigation easement deeded to the City/Airport allowing the City to enter the properties and remove airport related obstructions. Six additional properties are affected by the Proposed Action, but currently have no avigation easement. The City will negotiate an avigation easement with these six property owners before taking any actions regarding the tree obstacles.

Environmental Consequences – No new incompatible land uses are being created by the Proposed Action. The removal/topping of a large number of trees will change the views from adjacent properties towards the Airport and vice versa. The Proposed Action is consistent with the Kenai Municipal Airport Master Plan Update adopted by the City in 1997 and the Airport Layout Plan (ALP) approved by FAA in May 2009. The Proposed Action is also consistent with the various existing avigation easements recorded on private property adjacent to the Airport.

The height limits to be imposed on the six properties currently without avigation easements will not affect any existing structures and will create no non-conforming structures based on current zoning. No relocations are required.

## 4.4 Construction Impacts

Affected Environment – Based upon the proposed projects, construction related impacts were determined to be water quality, noise and traffic. The following information describes the affected environment relative to those three issues.

Locally named Airport Creek or Cemetery Creek serves as one of the primary drainage facilities for the Airport handling runoff from all the runways including the water runway. Airport/Cemetery Creek joins another unnamed creek south of the Airport and together they empty into the Kenai River. This second unnamed creek is considered the primary of the two and drains a large portion of the residential area west of the Airport. In the *Catalog of Waters Important for Spawning, Rearing, or Migration of Anadromous Fishes – Southcentral Region* (Alaska Department of Fish & Game Special Publication 04-05) both creeks are identified as unnamed anadromous fish resources. The primary creek to the west is referred to as stream 244-30-10010-2001 and Airport/Cemetery Creek is referred to as 244-30-10010-2001-3004, indicating its secondary status.

The anadromous portion of Airport/Cemetery Creek extends about 200 to 300 feet north of First Avenue and is affected by Project 1 – a small number of trees to be cut are located on uplands adjacent to the Creek. The remainder of the trees affected by Project 1 are scattered throughout the drainage area served by Airport/Cemetery Creek. Trees affected by Projects 2 and 3 are all east of Spruce Street which suggests, based on available topography, that the affected areas are in the Airport/Cemetery Creek watershed and that the second unnamed creek is not affected by any of the proposed projects.

The residential areas affected by the proposed projects are 300 to 800 feet off the extended runway centerline of Runway 1L-19R. Based on current airport operations none of these properties are impacted by aircraft noise at levels above the federal standard of 65 dB based on the Day-Night Level (DNL) noise metric. Existing tree resources between the residential areas and the Airport provide some limited screening of airport operational noises. Traffic and traffic noise is not a factor along First Street or in the residential areas because traffic volumes are very low.

Environmental Consequences - The proposed projects require the cutting or topping of public and privately owned trees that extend into navigable airspace. Equipment to be employed includes tree cutting and trimming equipment such as chain saws, towed commercial chippers, feller bunchers, skidders, logging trucks, and such equipment all weighing less than 50,000 pounds. Construction-like activities associated with these projects include the removal and transport and possible chipping and scattering of cut trees and limbs. To the extent possible Project 1, which affects approximately 2,300 trees, is to be accomplished during the winter months when the creeks are frozen. However, tree removal in City Lots 123, 173 and 174 (planned for the cemetery expansion) and in areas around the water tank and north of Second Avenue in Project 1 may be accomplished during the summer months. To the extent possible, Projects 2 and 3 will also be accomplished in the winter months, but sequenced to accommodate property owner schedules. Potential construction impacts include:

- Construction Water Quality – Under current water quality management guidelines, all land-disturbing activities, including clearing, grading, and excavation, that disturb one or more acres are required to be authorized under the Alaska Construction General Permit (ACGP-AKR100000) prior to land disturbance. These authorizations are issued by the Alaska Department of Environmental Conservation (ADEC) following the submission of a Stormwater Pollution Prevention Plan (SWPPP) and a Notice of Intent (NOI). Most of these clearing projects will be scheduled for the winter months so that the ground vegetation and soil will not be disturbed and permits will not required. However, for those areas that may be cleared in the summer months, the City Contractor will be required to prepare and submit a SWPPP and a NOI.

  Project 1 includes areas that are within 90 meters (300 feet) of an anadromous fish resource. Clearing adjacent to this waterway will be limited to only the highest mature growth encroaching into the Airport airspace, leaving substantial second growth and underbrush along the waterway. In addition clearing specifications will include several best management practices to mitigate disturbance to the waterway during and after clearing operations.

◊ The stream bank and streambed of Airport Creek/Cemetery Creek shall not be altered or disturbed in any way. No equipment shall be allowed within 100 feet of the stream bank and any trees requiring falling will be cabled out.

◊ Equipment shall not operate in flowing water.

◊ There shall be no crossings of Airport Creek/Cemetery Creek except on public roadways.

◊ Activities near the stream bank and streambed shall be scheduled for early winter to early spring (typically November to April) when the ground is frozen and covered with snow to avoid disturbance of surface vegetation and spawning areas and sensitive fish life stages and habitats. To facilitate proper implementation of the practices during the snow covered, winter months when the stream course may not be as obvious, Airport Creek/Cemetery Creek and its buffer area will be clearly flagged.

◊ Downed branches or trunks may not be dropped into Airport Creek/Cemetery Creek. Should this occur inadvertently they will be removed. All operations shall be conducted in compliance with AS 16.05.871 so as to avoid stream silting, interference with the passage of fish, or injury to the spawning grounds.

◊ The stream bank, including stream bank vegetation, shall not be altered to facilitate debris removal.

◊ Parked equipment, refueling of equipment or the storage of petroleum products shall be limited to established staging areas provided on the Airport.

- Construction Equipment Noise – The primary source of equipment noise is expected to be from chainsaws and chippers. A chain saw generates noise at a level between 105 and 110 decibels sound pressure level (dB-SPL) at a distance of about 1 meter (about 3.3 feet). The SPL noise metric provides the following relationship to the range of human hearing:

| | |
|---|---|
| Threshold of hearing | 0 dB-SPL |
| Threshold of discomfort | 120 dB-SPL |
| Threshold of pain | 130 dB-SPL |

Noise levels from a point source, such as construction equipment, decrease at a rate of approximately 6 dB with every doubling of the distance. At least fourteen residential properties are directly affected by Projects 2 and 3 and others may be indirectly affected with regard to noise. Based on the nature of these projects, construction noise impacts have the potential to be significant and unavoidable. To mitigate these adverse affects the City of Kenai will limit work hours to between 8:00 am and 6:00 pm when work is conducted within 300 feet of residential areas. Project 1 is expected to be accomplished during the City schedule work day. Projects 2 and 3 will be accomplished at a time convenient to the property owner (including Saturdays and Sundays). The City will coordinate a time and date for the work to be accomplished on private properties.

- Construction Traffic – Worker trip making and cut-tree hauling needs are expected to increase street traffic during construction periods, but these impacts are considered insignificant. The workforce to be employed on these projects is expected to come from the local labor pool for construction workers. Approximately 3 to 5 workers would be employed on a typical day. Since these workers are located in the Kenai area there should be no net increase in commuting, although there would be a net, but minor, increase in traffic along roads leading to the project site (First Avenue). Truck trips associated with tree removal could be reduced by chipping and spreading the tree elements. Generally, inbound construction traffic will be routed off the Kenai Spur Highway to Float Plane Road by way of Main Street Loop and First Avenue. Both streets have ample width, structural section, and relatively low traffic counts to accommodate increased truck traffic. Outbound construction traffic would be routed on the same streets in a reverse direction. Any potential impacts are likely to occur during peak periods at signal controlled intersections where trucks must make a left turn. At such intersections a truck may occupy a significant portion of the left turn lane and maneuver slowly thereby limiting the capacity of the left-turn signal. Since these traffic impacts are temporary in nature, although lasting for several weeks, they are considered to be less than significant.

### 4.5 Fish, Wildlife, and Plants

Affected Environment -

- Fish – As noted in the above discussion under the topic "Construction Impacts," Airport/Cemetery Creek serving the Airport joins another unnamed creek south of the Airport and together they empty into the Kenai River. Both creeks are identified in *Catalog of Waters Important for Spawning, Rearing, or Migration of Anadromous Fishes – Southcentral Region* (Alaska Department of Fish & Game Special Publication 04-05) as unnamed anadromous fish resources. Based on mapping of the anadromous streams prepared as part of the wetlands functional assessment completed in 2005, the anadromous portion of the stream draining the airfield extends northward from the Kenai River and ends in a wetland area located 200 to 300 feet north of First Avenue.

- Wildlife – A variety of birds and other animals were observed during a one-year study of wildlife hazards at the Airport, conducted between February 2001 and January 2002 by the U.S. Department of Agriculture. Migratory birds and other waterfowl, including ducks, geese and swans make the Kenai River and its surrounding wetlands their home. The surrounding area is also home to many other types of wildlife, including moose, bears, wolves, coyote, and caribou. Portions of the Kenai National Wildlife Refuge are located to the northeast of the Airport. The Airport is currently fenced to reduce the likelihood of finding wildlife on the Airport.

The trees affected by the Proposed Projects are frequently over flown by aircraft at low altitude considerably reducing the likelihood of nesting birds. Although the bald eagle (Haliaeetus leucocephalus) is no longer an endangered species, it is protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. Based upon the studies completed in 2002 (noted above) there were no bald eagle nests in any areas affected by the Projects. Based on information available from the U.S. Fish and Wildlife Service (USFWS), Alaska Region, the bald eagle nesting period in Alaska begins with courtship and nest building in February and ends when the young fledge by late August into early September. The non-nesting period is from mid-September into October through January.

- Plants – Soils in the vicinity of the Projects are generally considered to be upland with variations of wetland inclusions. These soils support spruce and birch trees and in wetter places willows. The forest understory includes native berry and shrub species, with a limited groundcover of low-lying herbaceous plants. Based upon a wetland functional assessment completed in 2005, one small area just north of First Avenue along Airport/Cemetery Creek is rated as a wetland with up to 10 percent upland inclusions (see discussion under Topic 4.12, Wetlands). Areas south of First Avenue were not included in the wetland functional assessment, but information available from the Natural Resources Conservation Service (NRCS) indicates soils in this area are all "partially hydric". Trees in this area are similar to those found throughout the Airport.

Environmental Consequences – Due to the nature and location of the Proposed Action, the potential exists to impact both fish and bird habitats. To avoid potential impacts to fish habitat and the wetland a number of best management practices are to be imposed on the contractor. These are described earlier under the subject Construction Water Quality within Topic 4.4, "Construction Impacts". It should be noted that to the extent possible these projects would be accomplished during the winter months when the creeks are frozen and fish are not spawning.

Accomplishing the projects in winter, to the extent possible, avoids impacts to migratory birds, but tree cutting activities by its nature will remove some bird habitat and has the potential to impact the bald eagle, a protected species. Although no bald eagle nests have been found in previous studies, comments received during scoping from the U.S. Fish and Wildlife Service (see Appendix A) indicate there are issues across the State with bald eagles nesting on airport property or in close proximity. To avoid potential impacts, prior to work commencing, a current nest survey will be accomplished by a qualified researcher to verify that no bald eagle nests are present in the areas to be cleared. Based on U.S. Fish and Wildlife Service guidelines, and the fact that the proposed projects are to be accomplished during the non-nesting period, the area to be surveyed will need to extend at least 330 feet beyond the area of the affected trees, since that distance represents the USFWS recommended minimum avoidance area for any timber operations at any time of the year.

By accomplishing the projects during the winter months, to the extent possible, the proposed projects would avoid any conflicts with the Migratory Bird Treaty Act, which would restrict activities such as tree cutting and clearing between May 1 and July 15 to protect migratory birds. Winter timing of the projects should also avoid conflicts with the Bald and Golden Eagle Protection Act, unless the mitigation nest survey determines that a nearby nesting site affects one or more of the proposed projects. However, the trees could be cleared in some areas in the summer months, as noted earlier, to avoid any conflicts with these Acts.

### 4.6 Hazardous Materials, Pollution Prevention, and Solid Waste

Affected Environment – Previous and recent (January 2010) searches of the Contaminated Sites Program (CSP), Leaking Underground Storage Tanks (LUST) databases available from the Alaska Department of Environmental Conservation (ADEC), Division of Spill Prevention and Response indicates there are no contaminated sites within the areas affected by the proposed projects.

Environmental Consequences – Construction requirements do not include any sub-surface digging, however, tree limbs and trunks will be removed as a result of the proposed projects. To the extent that these natural materials are not recycled or ground as mulch the remainder would be considered as solid waste and disposed of by the City's Contractor, most likely as saw logs and firewood. Some maintenance of logging and hauling equipment, such as topping off chain oil, fueling, or greasing mechanical joints may be done on site, but such activities are limited to the public road system and more significant maintenance would be accomplished at the contractor's place of business. The contractor would be responsible for any spills of these liquids as well as other pollution prevention measures as noted under Topic 4.4, "Construction Impacts". No significant impacts from hazardous materials or solid waste are anticipated.

### 4.7 Historical, Architectural, Archaeological and Cultural Resources

Affected Environment – The State Historic Preservation Officer (SHPO) has previously determined that the Kenai River valley has a very high potential for prehistoric village sites, although the likelihood of finding such sites in already disturbed areas is considerably reduced. All of the proposed projects are located in areas where land disturbance has occurred either as a result of Airport development, highway construction, or residential activities. Based on previous surveys for prehistoric, historic, archeological, or paleontological resources in the Airport vicinity, no Airport properties and none of the private properties are considered to be eligible for inclusion in the National Register of Historic Places.

Environmental Consequences – In response to the scoping request, SHPO issued a "no historic properties affected" determination on August 24, 2011 (see Appendix A). Although no impacts to historical, architectural, archaeological or cultural resources are anticipated, if such resources are discovered, work at that location will be stopped and the State Historic Preservation Officer will be notified.

## 4.8 Light Emissions and Visual Impacts

Affected Environment – There are considerable forest resources on and off the Airport in the area affected by the Proposed Action. In addition to reflecting the natural beauty of the surrounding area, these resources serve to screen some surrounding private properties from on-Airport lighting and provide a visual and limited buffer for aircraft noise.

Environmental Consequences – Since all construction work would be accomplished during daylight hours there should be no light emissions associated with the proposed projects. Proposed Projects 2 and 3, to the extent they affect private properties, may be perceived as affecting the aesthetic values of some private properties and may create visual impacts due to the selected removal of trees that screen unwanted views. Eight of the 14 affected properties are subject to existing avigation easements that permit the removal of objects that penetrate navigable airspace, which is defined uniquely for each property owner in the avigation easement. The affected properties requiring new avigation easements are, in some cases, further away from the runway and the required avigation easement heights are based on a higher elevation. Due to the existing avigation easements and purchase of additional avigation easements, these potential visual issues are not considered to be impacts.

The U.S. Department of Agriculture, in its scoping response, suggested the City institute a tree planting program based on a multi-aged, multi-height forest using reforestation stock, not landscape trees. To offset potential impacts to visual resources, the City is proposing to initially top the trees along a 50- to 100-foot hedgerow buffer area on the Airport parallel to Float Plane Road between Second and Fifth Avenues and to plant replacement reforestation trees, that will not grow as tall, along the buffer area. The City is also proposing to plant reforestation trees on the private properties, if requested by the property owner. This planting program not only addresses the short-term replacement of visual resources, but will also contribute in Project 4 to reducing the need for a continuing tree maintenance program.

## 4.9 Noise

Affected Environment – Residential areas affected by the proposed projects are 300 to 800 feet off the extended runway centerline of Runway 1L-19R. Based on current airport operations none of these properties are impacted by aircraft noise at levels above the federal standard of 65 dB based on the Day-Night Level (DNL) noise metric. Existing tree resources between the residential areas and the Airport provide some limited screening of airport operational noises. Traffic and traffic noise is not a factor along First Avenue or in the residential areas because traffic volumes are very low.

Environmental Consequences – There are potential direct impacts from the noise created by the various equipments used to accomplish the Proposed Action. These are described earlier under the subject Construction Equipment Noise within Topic 4, "Construction Impacts". To mitigate these impacts the City of Kenai will limit work hours to between 8:00 am and 6:00 pm when work is conducted within 300 feet of residential areas.

Removing the trees will not change the modeled effects of aircraft operations at the Airport on surrounding residential areas since the distances between them are not affected by the proposed projects. But trees do provide a screening function and by increasing the visibility between the surrounding residential properties and the Airport by removing many trees there may be an increase in the perception of aircraft operations and therefore aircraft noise. One unavoidable impact of the proposed projects may be increased complaints about aircraft noise. Although the existing tree buffer between the Airport and surrounding residential properties will be reduced by the Proposed Action, no long-term noise issues are created as a result of the Proposed Projects.

The U.S. Department of Agriculture, in its scoping response, suggested the City institute a tree planting program based on a multi-aged, multi-height forest using reforestation stock, not landscape trees. The tree planting program along the Airport property line would also provide a limited noise buffer for aircraft operations. See discussion of the City's proposed tree planting program under Topic 4.8, "Light Emissions and Visual Impacts."

## 4.10 Water Quality

Affected Environment – Water quality at the Airport is affected by contaminants in stormwater runoff from runways and taxiways which may include oil and grease residues, tire particles, plant and animal debris (i.e., leaves, dust, and animal feces), and general litter. The drainage system within the Airport is largely made up of naturally vegetated drainage ditches coupled with storm drains. Runoff from the Airport is directed to a stream locally known as Airport/Cemetery Creek, portions of which are an anadromous fish resource, as previously discussed.

Environmental Consequences – The Airport drainage system is not affected by Project 1, since no structures are being added and no soil along the drainage system is being disturbed. However, trees adjacent to this stream are being removed. To avoid potential impacts to downstream water quality and the fish habitat a number of best management practices are to be imposed on the contractor. These are described earlier under the subject "Construction Water Quality" within Topic 4.4, "Construction Impacts".

The removal of many trees may contribute to slightly increased water runoff since the trees are not available to extract water from the soil. This is not considered to be a significant impact as the work adjacent to this stream will be completed when the ground is frozen and there is snow cover protecting the ground understory vegetation.

## 4.11 Wetlands

Affected Environment – Soils information for the project area is available from the Natural Resources Conservation Service (NRCS) and a Preliminary Jurisdictional Determination and Wetland Functional Assessment that was updated and amended in 2005 to include the entire Airport. Wetlands data are also available through GIS features found on the Kenai Peninsula Borough web site. The referenced functional assessment studies identified wetland areas that were considered to be protected and the relative significance of them as wetland resources. . The findings of the Jurisdictional Determination and Wetland Functional Assessment were agreed to by the U.S. Army Corps of Engineers (USACOE) in their correspondence of October 17, 2005.

With the exception of a small area north of First Avenue, the projects affect lands generally classified as Upland, some with wetland inclusions. The smaller area north of First Avenue is classified as a Wetland with Upland inclusions up to 10 percent. Areas south of First Avenue were not included in the Preliminary Jurisdictional Determination and Wetland Functional Assessment, but NRCS data for this area suggests soils here are partially hydric and there are pools of water observable in the streambed. The area north and south of First Avenue is also an area of steeper topography. Information available from the Kenai Peninsula Borough supports the conclusion of wetland areas south of First Avenue to the Kenai Spur Highway, however these are marked as "disturbed" on available mapping.

Since the Jurisdictional Determination is valid for only a five-year period that has now elapsed, discussions were held with the U.S. Army Corps of Engineers to confirm whether or not those findings as applied to the area affected by these proposed projects would still lead to a conclusion of no impacts, require mitigations, and/or require a new functional assessment, USACOE determination, and potentially a Section 404 permit. The U.S. Army Corps of Engineers stated that no U.S. Army Corps of Engineers' permit would be required for the project (Conversation with David Casey, USACOE on October 14, 2011).

Environmental Consequences – Since the proposed projects do not require any soil disturbance beyond the movement of vehicles over the surface, and since the proposed work in the wetland area would be accomplished during the winter months, no impacts to wetland resources are anticipated. Based on discussions with the U.S. Army Corps of Engineers (as noted above) no Section 404 permit is required.

### 4.12 Other Considerations

Proposed Project 1 is not expected to be controversial on environmental grounds since the project takes place within Airport property. Proposed Projects 2 and 3 affect fourteen private properties and may be controversial on aesthetic grounds because the appearances of private properties would be altered. Existing avigation easements on the eight private properties in Project 2 provide a legal basis for removal or topping of selected trees due to their penetration of approach and departure surfaces defined in Federal Aviation Regulation Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace*, and FAA Order 8260.3B, *United States Standard for Terminal Instrument Procedures* (TERPS). Although these avigation easements have been in place since the mid 1960s they have not been complied with and the trees have not been either removed or topped. The lack of previous compliance potentially contributes to the controversial nature of Projects 2 and 3. However, by following applicable environmental laws and providing appropriate mitigation measures, Projects 2 and 3 should not be controversial on environmental grounds. The existence of avigation easements covering all properties affected by Project 2 suggests that federal, state, and local public agencies anticipated the need to control obstructions in navigable airspace outside the Airport boundary. In this context, Projects 1 and 2 are consistent with federal, state, and local laws pertaining to the environment. Project 3 is also consistent with FAA requirements for the Airport and, based on the anticipated affects associated with the properties already subject to avigation easements in Project 2, is also expected to be consistent with federal, state, and local laws pertaining to the environment.

Some inconsistencies exist between the elevation requirements of individual avigation easements and current FAR Part 77 and TERPS requirements defined by the FAA-approved Airport Layout Plan (ALP). Generally, the avigation easements specify a lower elevation for obstacles and thus allow a greater amount of trimming and cutting than is required to meet FAR Part 77 and TERPS requirements. The City of Kenai will trim the trees consistent with FAR Part 77 and TERPS requirements, with a reasonable undercut, and not trim and cut the trees to the elevations defined by the avigation easements.

The City of Kenai, as the Airport Sponsor, receives grants under various FAA Airport Improvement Programs. These grants obligate the sponsor to maintain the Airport in accordance with FAA regulations, guidelines and grant assurances. Among these obligations, the City is required to remove or mitigate hazards to air navigation including protection of the airspace in order to maintain the present published instrument arrival and departure procedures. The City of Kenai carries out its obligations to the Airport through adoption of the Airport Master Plan, the City's Comprehensive Plan, its zoning code, and an FAA-approved Airport Layout Plan. In the case of these Proposed Projects, the City is required to act directly to resolve a public safety issue. Collectively these various actions provide a basis for preventing the creation of man-made hazards or obstructions. The natural environment, including trees, requires actions such as those proposed. In this context, the requirements are consistent with regional and local plans.

Project 4 incorporates the same impacts and mitigations as Projects 1, 2 and 3. The tree planting program proposed by the City of Kenai is expected to provide a longer-term solution to the tree growth issue and reduce the need for continuous tree cutting maintenance projects in the future as the trees will not grow as tall (see discussion of the City's proposed tree planting program under Topic 4.8, "Light Emissions and Visual Impacts").

## 5.0 AGENCY AND PUBLIC COORDINATION

Federal, State and local agencies, as well as local organizations and affected property owners, were contacted for information or for a review of the findings during preparation of this Environmental Assessment.

A Scoping Document was prepared and distributed to affected agencies on August 22, 2011. Affected private property owners and nearby property owners were also notified of the Proposed Action and the public scoping meeting by mail on August 22, 2011. Agency and public scoping meetings, to discuss the proposed projects, were held on September 8, 2011 at the Kenai City Hall. The affected property owners were also contacted by telephone by the City and follow up letters were sent out inviting the property owners to meet with the City to discuss the process by which they can mutually mitigate the tree obstructions.

The Scoping Document, the notification letter to the private property owners, together with the agency and public comments and responses are included in Appendix A. The Agency Distribution List is also included in Appendix A. A listing of the private property owners notified is available from the City. Meeting notices, minutes for these meetings and attendees are presented in Appendix B.

Government-to-Government Coordination letters were sent to the Kenaitze Indian Tribe and Salamatof Native Association on September 22, 2011 (see Appendix A). Both tribes were also sent copies of the Scoping Document on August 22, 2011. The tribes did not request to coordinate directly with the FAA.

The Draft Environmental Assessment was made available for review by the agencies and public, and notification of the document availability was accomplished through letters to nearby property owners and a notice published in the *Peninsula Clarion*, the local newspaper. The document was available for review at the Kenai Municipal Airport, Kenai Community Library, Kenai City Hall, Federal Aviation Administration and on the Kenai Municipal Airport website. Anyone wishing to comment on the Draft Environmental Assessment could do so either in writing during the review period or in person at the Public Information Meeting.

A notice of the time and location of the Public Information Meeting was placed in the *Peninsula Clarion*. Written comments were accepted up to and including the date of the review period and at the Public Information Meeting. The comments, and responses, from the Public Information Meeting held on January 12, 2011 are included in Appendix B.

## 6.0 ENVIRONMENTAL COMMITMENTS AND MITIGATION

The following environmental commitments, mitigation measures, and best management practices are proposed to reduce the potential impacts to less than significant levels. These various requirements will be added to the contractual specifications.

- To avoid potential impacts prior to work commencing, a bald eagle nest survey will be accomplished by a qualified researcher to verify that no bald eagle nests are present in the areas to be cleared.
- Cutting and clearing activities must be completed outside the May 1 through July 15 "window" specified in the Migratory Bird Treaty Act. The City and City Contractor will also comply with the 2012 USFWS Advisory Guidelines.
- Work hours shall be limited to between 8:00 am and 6:00 pm when work is conducted within 300 feet of residential areas. The City will coordinate a time and date for the work to be accomplished on private properties and this may include Saturdays and Sundays.
- The stream bank and streambed of Airport Creek/Cemetery Creek shall not be altered or disturbed in any way. No equipment shall be allowed within 100 feet of the stream bank and any trees requiring falling will be cabled out.
- Equipment shall not operate in flowing water.
- There shall be no crossings of Airport Creek/Cemetery Creek except on public roadways.
- Activities near the stream bank and streambed shall be scheduled for early winter to early spring (typically November to April) when the ground is frozen and covered with snow to avoid disturbance of surface vegetation and spawning areas and sensitive fish life stages and habitats. To facilitate proper implementation of the practices during the snow covered winter months, when the stream course may not be as obvious, Airport Creek/Cemetery Creek and its buffer area will be clearly flagged.

- Downed branches or trunks may not be dropped into Airport Creek/Cemetery Creek. Should this occur inadvertently they will be removed. All operations shall be conducted in compliance with AS 16.05.871 so as to avoid stream silting, interference with the passage of fish, or injury to the spawning grounds.
- The stream bank, including stream bank vegetation, shall not be altered to facilitate debris removal.
- In City Lots 123, 173 and 174 (planned for the cemetery expansion) and in areas around the water tank and north of Second Avenue, tree removal activities may be accomplished during summer months. The City Contractor will be required to prepare and submit a Stormwater Pollution Prevention Plan (SWPPP) and a Notice of Intent (NOI) prior to proceeding in the areas that may be cleared during summer months.
- Parked equipment, refueling of equipment or the storage of petroleum products shall be limited to established staging areas provided on the Airport.
- The City of Kenai initially will top the trees to provide a 50- to 100-foot hedgerow buffer area on the Airport property parallel to Float Plane Road between Second and Fifth Avenues and around the City Lots (123, 173 and 174) planned for the cemetery expansion. The City will also plant replacement reforestation trees, that will not grow as tall, along the buffer area. The City of Kenai will implement a reforestation program using reforestation trees on the private properties, if requested by the property owner.

FRIENDS OF OPEN SPACE IN KEENE

PO Box 255 Keene, NH 03431

May 10, 2014

The Friends of Open Space in Keene would like to respond to the Environmental Assessment report issued by Stantech for the City of Keene.

As stated in a letter to Mr. Edward Mattern, Director of Dillant-Hopkins Airport, dated May 27, 2012, our group had concerns with the proposed land alterations two years ago. In particular, we continue to be concerned about the disruption of the unique wetland bog sited within the study zone.

It is crucial that no foot or vehicular traffic be allowed in the bog area, as it is very sensitive to disturbance. We request a sufficient buffer of vegetation be maintained around the bog to minimize disturbance from machinery. We are concerned about excessive run-off of water during heavy rainfall events. Erosion of sediment into the bog is likely because of the heavy machinery required for logging work.

This bog is a small natural jewel on the airport property. It's been a miracle it has survived for thousands of years so close to human habitation. It would be a shame to lose it now.

Sincerely,

Eloise Clark

Eloise Clark
Vice President
Friends of Open Space in Keene
PO Box 255
Keene, NH 03431

## Ed Mattern

**From:** cburrows <cburrows@ne.rr.com>
**Sent:** Monday, May 19, 2014 7:44 AM
**To:** gregg.cohen@stantec.com
**Cc:** Ed Mattern
**Subject:** Airport Environmental Assessment

Dear Mr. Cohen and Mr. Mattern:

I have reviewed this report. Thank you for placing a copy at the library after I requested it.

I feel the tree cutting that is proposed in many of the alternatives effects the environment in many ways. This is a sensitive area with the bog in the area and being so close to the Ashuleot river and wetlands. Already so much of the shrubbery and brush has been cut that affects the birds that used to nest/reside in the area. I am not seeing as many birds in the area especially the grass sparrows, migratory ducks and hawks.Also, how will all this activity affect the dwarf mussels in the river.

There is mention that there aren't any vernal pools in the area. I have heard and seen amphibians in the wetlands in the airport.

My biggest concern is how the air quality is affected by the jets and smaller planes that are constantly coming and going into this airport. Keene has poor air quality mainly due to the inversion issues because of the valley. The vapor which is emitted has lead and other gases that go into the air . My daughter had serious asthma issues growing up in Keene and I was an asthma educator in for the Keene Clinic. I think the city needs to do more to protect the health of its citizens and those of the surrounding towns.. Keene wants to be known as a green city...is the airport accomplishing these goals.These trees help with air pollution too and cutting them will not help.

By cutting the trees and expanding the airport you are contributing to more noise pollution and light pollution. These jets flying around Keene seem very unnecessary.All of this noise and light pollution also effects the health of the citizens of Keene and surrounding towns.Does all this comply with the Healthy 2020 goals that the city, Keene Clinic/Cheshire Hospital and other agencies are working on.

I feel that the cutting of the trees , expanding the airport as proposed in several of the alternatives is a poor decision and affects the entire area in many negative ways. I recommend that the city implement one of the alternatives that would be no action taken.We do not need a large, busy airport with another airport like this only an hour away. Thank you.
Cheryl P. Burrows, 26 Liberty Ln. Keene, N.H. 603-357-4259

RECEIVED

MAY 12 2014

NH AERONAUTICS

Edgewood Neighborhood Association May 2014

Many members of the Keene community are aware that the City of Keene and the Dillant-Hopkins Airport, are planning to cut some 15 acres – 600 trees—in and around our beautiful neighborhood. This proposed project is in the name of pilot safety, which we support of course, but we believe there are viable alternatives to the devastation of such widespread tree-cutting.

In light of the values outlined in the Keene Master Plan, we are looking for public support to consider other plans.

Issues include:

**1. Property values**

There is little question that the tree-clearing will affect not only the 30+ homeowners on whose property the City is seeking easements, but all the residents of the neighborhood, 80+ households. Landowners have the right to protect the aesthetic value of their property. The residents of Edgewood pay over $ 500,000 annually in property taxes, not including residents on Lower Main Street.

**2. Environment**

The value of the woods to the community is immeasurable – the paths are used by many people, not all of whom live within walking distance, but who drive here to use the woods for recreation and study. Edgewood is not just an isolated neighborhood, but part of the vital community of Keene, justifiably proud of its Master Plan which specifies dedication to preserving natural resources and green space as well as the integrity of neighborhoods. To quote:

*A healthy urban forest can help the community achieve goals of environmental, social, and economic sustainability, while reducing greenhouse gas emissions and removing carbon dioxide from the atmosphere. ... It also functions as a place for recreation and relief from urban stress. By shading and sheltering buildings, trees reduce the cost of cooling and heating.*

*The benefits of urban trees are many, and as part of the community's commitment to greening its streets and addressing air quality and climate change, an urban forestry program should be created.*

*(www.ci.keene.nh.us/departments/planning/keene-cmp-2010/plan/climate-change)*

The Edgewood Forest Park, some 12 acres of wooded land, was originally designated as a buffer between the airport and the residential area. The City never maintained that area as a park, and now they tell us the trees are "too tall." The peat bog is a rare site. Many birds and mammals live in the forest here – where will they go?

**3. Health**

This is related to the environmental concerns, but specifically our research has found that small planes, such as the ones used in flight training, emit hazardous particulate matter, including lead. The health impact of airports is monitored in some places (not here), and is well documented as a significant risk. Although it is not clear what the trees can do to protect us from lead, we must acknowledge their value in noise reduction, shade from increasingly hot summers, wind barrier, and toxic emissions. Quality of life is a health issue! Healthy Monadnock 2020 should be aware of this.

# A major concern about the way this whole project has been handled, is that our questions and suggestions are not being specifically addressed. Our suggestions for alternatives, specifically extension of the runway onto land already cleared to the south, and/or putting up guide lights for pilots, were brushed aside. A couple of pilots suggested that a slight adjustment to the angle of incline on approach would solve the problem. It has been stated publically that the residents of Edgewood care more about trees than pilot safety. A member of the Airport Advisory Committee complained about how much it is costing the City to "placate" the residents. We don't know how much the Stantec report cost the taxpayers of Keene, but we do know that Edgewood pays over a half-million in taxes every year. In addition, the airport is supported in part by tax dollars, and is not self-supporting.

We are asking for support in our struggle to help the City do what is right, not just for the airport, but for the whole community.

Thank you for your attention to this matter.
Edgewood Neighborhood Association

Board Members:
Brenda Dunn, 1 Riverton St Keene, 357 7993 benamurray@gmail.com
Ann Shedd,
Dominick Tralli
Richard Hersom
Lynda Elkind
Peter Weinert

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MAY 12 2014

NH AERONAUTICS

May 8, 2014

Ms. Carol Niewola
Department of Transportation
PO Box 483
Concord, NH 03302

Dear Ms. Niewola,

In September 2005, My husband and I drove into the Edgewood neighborhood in Keene, NH for the first time and saw what we thought of as our "dream house". It was in the perfect neighborhood, surrounded my mature trees, lovely houses and kids playing in the park area in the center of the neighborhood. We spoke with our realtor about our concern as to how close we were to the airport and went and walked through the forest area that separates the airport from the residential neighborhood. She assured us that the area was actually owned by the Edgewood Association and that there would never be any building on that area and that it was protected. We were thrilled that we had found the perfect neighborhood and that fact that our property taxes would be almost $10,000 was worth it to live in such a peaceful place. On two occasions before we put in our offer on the house, a Saturday and a Tuesday to be exact, my family and I drove to the neighborhood and sat and played in the common to see what the airport traffic was and if we thought it would be an issue. There were a few planes in and out during our several hours there and we felt that that seems ok especially because we had the forest that separates us protecting us from noise and air pollution from the planes.

In November of that same year, we moved in to 38 Edgewood Avenue and could not have been happier. We have wonderful neighbors and a beautiful neighborhood. Our way of life, our health and the value of our home is now in jeopardy.

It has been almost 9 years since we moved in and we have enjoyed the forest countless times for hikes, school nature projects, going to the peat bog, and well as bird watching. Many people that do not live in the neighborhood, come to Edgewood to use and enjoy the forest.

If the plan to clear the trees in the forest between the airport and the residential neighborhood comes to fruition, the neighborhood that we moved into will be gone. We will not be able to be outside in the spring, summer and fall due to noise and fumes and toxic emissions polluting the area. The forest also protects the neighborhood from wind in the winter months. Our health and quality of life is at risk.

We have been told that the runway in question is already longer than needed for the planes that come in and out of the airport. I guess my question is why aren't the powers that be even considering other options and answering our questions? As a group, we have suggested having the pilots land further down the runway, extend the runway, cut only the specific trees that are above the height requirement, better yet, cut the tops off the trees to maintain the density of the forest. We have been told that it is not financially feasible, period.

Some, have accused us of only caring about the trees and not caring about the safety of the pilots. If that were true, we would not have made all of the suggestions that we have made. Speaking of safety, what about the safety of the residents of Edgewood? Dare I say that the City does not care about one of the largest property tax revenue generating neighborhoods in the City of Keene? The airport is supported by the taxpayers and we should have a say in how it will affect the local residents.

The bottom line is that there are options that will protect the residents of the Edgewood neighborhood and the pilots yet they are not even being considered. Our hope is, that clear thinking will prevail and consider the impact on not only the neighborhood, but the city of Keene and the right decision will be made of the good of all involved

We certainly would appreciate your assistance in our plight in making this a win, win for the airport, the City of Keene and the hundreds of residents in the neighborhood that will be directly affected by the planned course of de-foresting the area.

Sincerely,
C Paris

Carolyn Paris
38 Edgewood Avenue
Keene, NH 03431
603-352-4140

RECEIVED

MAY 12 2014

NH AERONAUTICS

Brant A. Elkind
108 Greenwood Ave.
Keene, NH 03431

May 8, 2014

Ms. Carol Niewola
Department of Transportation
PO Box 483
Concord, NH 03302

Ref: Tree Cutting Edgewood Neighborhood
Keene, NH

Dear Ms. Niewola:

My wife and I are one of the 31 homeowners of the Edgewood Neighborhood affected by the proposed airport tree cutting. **We vehemently oppose the tree cutting and strongly suggest acceptable alternatives be identified.**

It is our understanding the following five remedies have been proposed;

1. Displacement of the threshold to have less or no tree clearing
2. Relocation of the runway
3. Doing nothing
4. Clear cut the trees and acquire Avigation Easements, which will result in an Eminent Domain action by the City if Avigation Easements are not able to be obtained

Local Pilots have suggested:

1. Waive the rules to change the glide slope
2. Mark the obstruction with red lights, leaving the trees in place. Reportedly the trees are at maximum height and pilots report this to be common practice
3. The City of Keene is planning to replace the PABI system and has built the cost into their 2015 budget. If the system is to be replaced, move it farther down the runway thus raising the ceiling. (Each of these suggestions have been flatly rejected by Mr. Mattern and the Airport Commission)

Mr. Mattern stated in the December 2013 Airport Commission minutes: "The practical alternative must be one that does not impact or reduce the capabilities of the existing airport and its users and it must be one that is least environmentally harmful." Mr. Mattern went on to say: "The practical alternative is Avigation Easements and the remove the trees."

He did not mention the impact it would have on 81 households paying over $500,000 each year in taxes to the City of Keene. It's a bit ironic, with the exception of C&S Grocers (2 Jets), the other (approx.) 80 planes housed at the airport are commonly believed to be owned and flown by people, who do not live in Keene, many are not NH residents, they don't pay local taxes nor do they pay fees other than for hanger space. Additionally, the airport serves an absolute minority, especially when one considers its cost of operation. The airport will run a projected deficit this year (according to the Airport Commission's December minutes) of $50,000. To the best of anyone's knowledge, the airport has never broken even and has proven not to be viable for a commercial travel. Why should the tax paying residents of the Edgewood neighborhood be required to pay for the continuing deficit of a "white elephant" that is also about to significantly diminish their quality of life, geometrically reduce the value of their property and forcibly remove our land owner rights relative to noise and air pollution, building and planting heights. Our neighborhood's quality of life is in a large part provided by the forest buffer.

The Edgewood residents have consistently said, "We want pilots to be safe". The Airport Commission and Mr. Mattern appear to believe they have a pre-determined right to clear these trees because the FAA has allegedly said the trees must go and that is the only answer. Mr. Mattern and the Commission have not answered many of the community's questions, have not been truthful with their presentations and are Hell bent to have their way.

The Edgewood neighborhood is asking for consideration relative to our quality of life, our rights and our investments in our homes. We respectfully ask for viable alternative to clear cutting the trees.

Sincerely,

Brant and Lynda Elkind

To: Federal Aviation Administration, NH Department of Transportation
Re: Public Comment on Environmental Assessment for Keene Dillant-Hopkins Airport

For your information:

The Environmental Assessment was discussed at the May 19, 2014 meeting of the City of Keene Conservation Commission. The City Attorney had communicated that the Commission's role in relation to City Council precluded independent submission of a Comment by the Commission. The Commission did have a number of questions, primarily about the design and execution of the tree-clearing project. Airport Director Mattern was present for most of the discussion before needing to leave for another meeting, and he responded to some of the questions. Minutes of the meeting documenting the Commission's discussion should be available by about June 12, 2014, at http://ci.keene.nh.us/government/minutes-agendas/minutes/conservation-commission-minutes.

The City of Keene Cities for Climate Protection Committee also heard a presentation by Airport Director Mattern and discussed the EA, at its meeting on May 7, 2014. At that meeeting the Committee did vote to prepare a comment, but after that meeting the City Attorney again communicated that the Committee's role in relation to City Council precluded independent submission of a Comment by the Committee. Minutes of that meeting should become available in early June, at http://ci.keene.nh.us/government/minutes-agendas/minutes/cities-climate-protection-committee-minutes.

Thank you for your attention and follow-up,

Ann C. Shedd, MD

Ann Shedd
59 Greenwood Avenue
Keene, NH 03431

To: Federal Aviation Administration, NH Department of Transportation
Re: Public Comment on Environmental Assessment for Keene Dillant-Hopkins Airport

I have previously sent comments but wanted to add more.... thanks for reviewing all of the public comments.

At our neighborhood meeting last evening ATTENDED BY 45 PEOPLE it seemed clear to me that:

1) Many households will refuse to sign an avigation easement (this is true for me)
2) Topping trees on private property should be offered as an alternative to removing trees entirely.
3) A buffer strip closest to the houses on Greenwood Ave should have the trees topped, even if they will eventually die, while awaiting regrowth of vegetation closer to the airport, where trees need to be cut completely. A second logging operation to remove topped trees in the buffer strip can be done in 10 – 20 years, after vegetation regrowth in the area closer to the airport is well underway.
4) Consideration should be given to creating a sound/visual berm on this buffer strip, or just to the airport side of it.
5) Lights on poles, to mark the obstructions, is another option that might be useful, especially if used in conjunction with tree-topping.
6) The city of Keene is legally responsible for managing this forest in a wooded state, and should have a master-plan for future management, before the tree-cutting starts.
7) The Environmental Assessment provided by Stantec was a "rubber-stamp" document, in the opinion of many, and designed to be useful only to the airport.

In our research, we found many examples of cases like this, with descriptions of how the airport and city worked hard to address the concerns of the citizens that would be most affected. Unfortunately that has not happened here, and now you have many angry, motivated people, concerned about their environment, property values, and about plans to further expand an airport that provides no benefit to them.

Sincerely,

M A Meess, MD

Mark Meess

59 GREENWOOD AVE
KEENE, NH
23-5-2014

24 Lynwood Ave
Keene, NH 03431

May 19, 2014

Ms. Carol Niewola
Department of Transportation
PO Box 483
Concord, NH 03302

RE: Keene Airport tree removal.

Dear Ms Niewola,

We are Jonathan Mason having lived in this house all my life, 47 years and counting! I also run my business from the same location for 18 years now, and Debra Miller, living and working here for 10 years both residing at 24 Lynwood Ave. in Keene. This Edgewood sub-neighborhood of Keene is about 100 years old and one of the extra desirable and charming areas of the city because of it's design, the comfortable proximity to the other going's on in the city's offerings while still maintaining a bit of a rural feel. The Forest that is in question to be cleared was gifted to the city and many people outside of the area actually come to this area slated to be cleared to walk, bike, exercise, play with their dogs, and study an ancient peat bog. There are many species of wildlife large and small, flora and fauna, common and unusual that live there. This is what will be gone for decades should the plan being proposed go through. The property values will plummet. The homes will suffer more from the vibrations. The sound will be worse than it is now, as will the pollution, right into the lower terrain of our populated Main St. and other incalculable ripples will continue as is the case when any ecosystem is devastated.

We understand through numerous articles and meetings that the trees have become a problem with the airport and jeopardize a safe landing approach from the north. Our house is in line with runway 02/20; and essentially right underneath the runway glide path. We're concerned with the major change in the appearance and ecosystem in the neighborhood that we as a collective entity have enjoyed over the years. Other concerns have been on our minds as well. Since the trees would be generally cleared leaving the area mostly void of anything over 10', a concern turns to the wind coming from the airport "funneling" right into the neighborhood creating not only the dust and fumes from airport activity to infect the neighborhood, but any dangerous winds to do property damage to the area, as has been the case on the other side of the airport where this type of clearing has happened. Creating such a vast void of a large tree stand makes it possible for this type of phenomena to occur. I remember a few years ago of a violent thunderstorm happening here and what could have been a small tornado or violent wind shear traveled from the airport over the hill and did damage to other properties including the Cheshire Ice Arena. The belief is that the lack of trees in that area from previous clearing withdrew a buffer of protection that could have averted this. Also, with Keene being a valley community, much of these fumes, now naturally controlled, could easily collect in the downtown, Main St. area, with very little ability to clear easily.

We are very much against complete removal of the trees since it makes an excellent buffer between our neighborhood and the airport. There have been other reports from similarly configured small airports that have resolved issues with creative means that were not as destructive or costly as is being suggested. We believe there has to be more compromise here with the needs of both parties. It is natural and needs no major up keep such as a man made barrier and will not displace or kill a wildlife ecosystem and recreation area. We know we are not experts in these matters, but we do know there are other ways to handle these situations. There is never just a couple of options, especially when there is so much at stake. The trees have reached their maturity in height and age and will have some natural decline that perhaps selective topping could capitalize on. At this point we'd suggest a combination of taking some of the trees as individual residents may agree to on their own property leaving the forest itself near the airport more in agreement with the original intent of the gift to the city prior to the City of Keene's modification of the language of the Gift of the land meant to be kept AND maintained as a Forest and a displacement of the threshold to have less or in some areas no clearing or some other creative resolution toward a constructive settlement - perhaps moving the necessary landing navigational instruments to fit, constructing a tower like other comparable airports have done. We'd also suggest planting some lower growth trees when the most minimal amount of the existing ones are removed.

We find it difficult to believe that the minimal amount is in the very high hundreds, even if they are the same kind of trees. We have attended many meetings and read the minutes of meetings going back several years that we were either not able to attend or not permitted to attend, and although some of those minutes were "edited", from the earliest point on it appears that clearing these trees has been the primary focus of management so when we have discussed other options it really has been more handling of the community, and a sense of not wanting to repeat the drama of what had happened in Swanzey years ago, and the feeling that we are being given a forum to "have a voice" has become obvious to us. In one meeting our meeting officiates are on record responding to Mr. and Ms.Bendell's (non-residents and owners of small flight school) complaint's about the cost to the city for the time it was taking to allow us time to have our say, knowing the outcome was the trees were to be cleared that "the AAC believes that trees coming down for safety reasons is best for the overall community" This leads us to believe decisions were made long ago and our actual input is really just a formality than a consideration in outcome. and "the area is not developable. The community wants a forest in that area. They can accomplish that without too much difficulty." Also... and that we (the community) are "not interested in having or making a mobile surface with berms to address the noise issue, and having it always be maintained." Mr. Mattern. This language seems specific to work around the FAA grant language of non-landscape funding but perhaps funding for other things such as sound wall more than genuine concern for our needs and wants as we survey the tone of conversations globally. While there seems to be some understanding of our needs, there has been no actual discussion on what that regeneration plan for a forest on such a scale actually is. Later in the same minutes, Mr. Thompson speaks about how we have a right to have our say but the general flavor of this particular meeting is that the clearing will happen, without the need for environmental permits around the bog and people are being given a forum, but we have decided and we will handle the community and the hold-outs accordingly, however unpleasant as it may be. (12/20/2013 AACMinutes generally p3of9 and on) How can we be in any state of understanding? It seems that there is a lot of environmental, ecosystem, wildlife, pollution, sound and habitat destruction as well as devaluation of property and resident quality of life that is starkly unbalanced to the need for the outcome to satisfy FAA requirements and that Stantech's reports have some flaws and their approach with the residents has been patronizing and pre-packaged at having "done this before" adn comments from them like "we all know how this is going to end" occasionally slip out at the end of some meeting in the hallway. We also understand from reading meeting minutes that this patronization and handling is somewhat expected to be planned for as is noted in other AAC meeting notes that "

Page 2 of 9Airport Advisory Committee Meeting Minutes, February 15, 2013

If, say, an entity such as Boston Scientific finds that their current lease at another airport is up and is non-renewable, and they move here to Keene and build a hangar, they have to be concerned about the neighbors. Neighbors come out of the woodwork every time something happens" in an early discussion about courting corporations to build hangars here knowing it would require public meetings. We are CERTAIN this clear cutting approach is NOT the best route for our neighborhood, for our airport, for our city's environment, nor the Forest in its original intent and its inhabitants. Letting us come out of the woodwork to have our say is nice enough, but we would like it to matter. Several people we have spoken with feel helpless and like they have no choices or ability to make a difference in the outcome, even though they are very unhappy and gravely concerned. We want to emphasize that we are certainly not against the safety of the pilots using the airport but even other pilots have offered other options and solutions that would be FAR less destructive.

Also, as a result of this tree clearing project, as a secondary concern, we think about the airport value in general. We have been told repeatedly that the airport has no plans to expand and that this clearing project is unrelated to future ideals and yet the AAC meeting minutes clearly show evidence to the opposite over the previous years. This also breaks trust with our process. While the airport currently has a stunt pilot that practices there in the fair weather season as well as a flight school with lots of take-off, turns and landings and a regular amount of jet traffic, we are aware that this airport really doesn't generate income for the city, benefit the residents or operate in the black. There's a few dozen jobs, and some money from this and that, it's true, but as compared to airports in general, it just doesn't pay for itself, therefore, it doesn't benefit us enough. Increased air traffic may only diminish our property values and existing way of life because it's more transitory than secured. Previous attempts at creating a pilot school or another hangar are off in the distance or have fallen flat and Swanzey benefits from the tax revenues generated. Although at this time there is no planned expansion or so they say to us directly, we can see from the minutes and the budget that they need to try to do this to make the airport more profitable for the upkeep it requires, knowing that it already is fiscally not sustaining.

To lose so much for an airport that is consistently in the red, takes more than it gives back and now is threatening to irretrievably ripple so much damage seems too high of a cost for us to just accept the recommendation as is. In its current proposal, it is disregardingly imposing on the very people and environment that has been sustaining it's survival and using some smooth words and tactics to do so. Safety is of course important, but so is the voice for the environment that can not speak for itself and the taxpayer and the third largest taxpaying neighborhood in the city, as well as the original intent of the establishment of the Forest, also mismanaged and altered by our City.

Sincerely,

Jonathan Mason and Debra Miller

# City had a plan as early as 1913

*David Proper*

With so many new sections of homes in the Keene area, Edgewood today seems quite like a part of the "old city," but it isn't. Edgewood was perhaps the first section of Keene developed as a unit, much on the order of today's several new residential areas which are made up of numerous housing units erected at about the same time according to an overall plan.

Lower Main Street was, of course, farm land in earlier days. It became the site of the Keene Driving Park and fair grounds, where some may recall seeing their first races, agricultural exhibits or traveling shows.

The Keene Driving Park Association opened the area July 3, 1875. The show ground was complete with a trotting course constructed and graded under the supervision of E.B. Locke.

A large grandstand for [illegible] spectators was constructed by Thatcher & Taylor, and a judges' stand was built under the direction of Mr. Stone and Mr. Kingsbury. The stand sported a gilt weathervane representing "Goldsmith Maid," a famed racing horse of the period.

Stables were also built, and a fancy arched gateway to the grounds was erected by A.B. and E.S. Foster. The grounds were the site of various races and many shows and exhibits. Keene's first airplane took off from the site in 1912, only to land in the top of a nearby tree.

A building is located in this neighborhood that once housed the Monadnock Agricultural Works and in which Jonathan Hall made plows, harrows and other farming implements after 1882.

Today this is part of a structure just north of the Hungry Lion Steak House, and still displays an individualistic style for which Hall was famous in Keene.

The outline of the trotting and race track of the Driving Park now forms the basis for a street in Edgewood, and there are still a few relics of the old Driving Park reported in the area.

The Keene Park Corporation, proprietors of the land at the Driving Park, converted it to homes in 1913. It was one of the first developments of this nature in the Monadnock Region, and was named under authority of a special committee consisting of George H. Eames, Frank H. Whitcomb and Samuel Wadsworth.

The committee selected the name Edgewood from 179 suggestions submitted to them by the public. A $25 prize for the winning name was awarded to Mrs. H.H. Pease of Marlborough. Although there were many duplications in the suggestions received, the name Edgewood appeared only once.

There are at least three other sections of Keene which were once used for sporting events, shows, exhibitions and carnivals. One was located off Island Street where today street names Wood, Hooper, Cady, Speaker and Cobb honor great pioneer baseball players, some of whom may have played there.

> *Edgewood was probably the first residential section developed as a unit.*

Most of Keene's circuses of the late 19th century played on grounds at the end of Appian Way, today site of Keene State College's Spaulding Gymnasium. Here appeared Buffalo Bill and his star attraction, Annie Oaklie, and near the site Albert, the rogue elephant, was shot by a squad of the Keene Light Guard in 1885.

Perhaps the last show ground in Keene, before the Cheshire Fair grounds became site of such special events, was on lower Marlboro Street, today an industrial park and bisected by Optical Avenue. Ringling Bros. Barnum & Bailey made their last Keene appearance here about 1941, and it was scene of annual visitations by O.C. Buck Shows still remembered by many.


PLAN of EDGEWOOD
A SUBURB OF
Keene, N.H.
SCALE 1"-80'
SURVEYED BY SAMUEL WADSWORTH. APRIL-1913.
FROM DESIGN OF C. HOWARD. WALKER.
DRAWN BY NORMAN H. SMITH. KEENE, N.H. 8/6/45.
N
S
W
E
TO COMMON
MAIN STREET
TROY
JOHN A. PETERSON
OSCAR I. GOULD
AVENUE
GREENWOOD
LYNWOOD
EDGEWOOD AVENUE
GRANDVIEW
CLUB LOT
SCHOOL LOT
RIVERTON STREET
CENTRAL AVE
VILLAGE GREEN
STREET
AVE
CHURCH LOT
FAIRMOUNT ST.
EDGEWOOD
AVENUE
WALKER ST.
KENWORTH AVE.
Wm. F. HATTON
C. C. HALL
ANN LAHIFF
ROBERT. A. RAY
GREENWOOD AVE.
KEENE
SWANZEY
GROVE
TOWN LINE

View looking toward Rte 32 from Edgewood home, 3d floor
~1926

Feb 6 1926

View looking east across Edgewood neighborhood

# Appendix I

## I.1 ENVIRONMENTAL ASSESSMENT PHASE 2

# Final Environmental Assessment
# Phase 2 Dillant-Hopkins Airport
# Keene, New Hampshire

This Final Phase 2 Environmental Assessment has been prepared in response to comments received during the public review period of the 2014 Obstruction Removal Draft EA. The Phase 2 Final EA provides information not included in the original Draft relative to specific impact categories reviewed under NEPA

Prepared for:
Dillant-Hopkins Airport

Prepared by:
Gregg Cohen, Stantec
Janice Bland, Stantec
Harris Miller Miller & Hanson (HMMH)
Capital Appraisal
Buzzell Associates
RDV Systems

**January 2017**

## Table of Contents

# 1.0 INTRODUCTION

The City of Keene and Dillant-Hopkins Airport prepared a Draft Environmental Assessment (EA) in 2014 to evaluate potential environmental impacts associated with removing trees identified as obstructions to Runway 20 approach surfaces. As stated in the 2014 Draft EA, approximately 15.6 acres of trees have been identified as obstructions to Runway 20 approach surfaces. Approximately 12 acres of obstructions occur on airport property roughly 1,500 feet north of the runway end. The remaining obstructions are located further north, off airport property and require the acquisition of 32 avigation easements in order for the City and airport to manage vegetation height within proposed easements.

The Draft EA considered several alternatives intended to provide an obstruction-free approach to Runway 20. Alternatives presented in the draft, in addition to the *No Action* alternative included:

1. Acquiring 32 easements and removing trees, on and off airport property, obstructing airspace (15.6 acres);

2. Displacing the Runway 20 threshold 1,587 feet to the south, eliminating off-airport obstructions and limiting tree removal to 1.6 acres of trees located on airport property;

3. Displacing the Runway 20 threshold 2,485 feet to the south, eliminating all obstructions from approach surfaces; and

4. Shifting Runway 02-20 1,587 feet to the south, enabling the airport to maintain existing runway length of 6,200 feet and limiting tree removal to 1.6 acres on airport property.

The runway threshold displacement alternatives were determined to shorten the runway to such an extent that a significant segment of the existing fleet (most jets) could no longer reliably use the airport (Runway 02-20 is the primary runway at the airport). Shifting the runway to the south to avoid removing trees off airport property was deemed not viable due in large part to the need to fill wetlands and relocate the existing medium intensity approach lighting system with runway alignment indicator lights (MALSR). The MALSR relocation requires property acquisition, rerouting or lowering Route 32, and establishing new approach surfaces to Runway 02. The acquisition of easements to mark trees and elevated terrain obstructing new approaches would also likely be necessary. For these reasons, the easement acquisition and tree removal alternative was presented as the preferred alternative for implementation.

Concerns with the preferred alternative were expressed during public information meetings and during the public review and comment period for the Draft EA. Public comments were incorporated into a matrix for inclusion in the draft. Many comments received objected to the project based on the premise the Draft EA did not fully address potential impacts to property values as a result of easements on their property and the tree removal proposed on airport property (socio-economic impacts); increased noise and air quality impacts resulting from tree removal; and impacts to the character and aesthetic of the landscape from tree removal as presented in the preferred alternative.

Upon review of the public comments, the City determined to evaluate these impact categories more fully within the context of a supplement to the Draft. This supplement, or Phase 2, has been prepared expressly to address the four principle concerns identified above. Consultants specializing in the areas of concern were retained to analyze these topics in greater detail than was presented in the 2014 Draft EA. Their findings are summarized in the sections below. Technical reports prepared by the individual consultants have been included in appendices of this document.

# 2.0 SOCIO-ECONOMIC IMPACTS – PROPERTY VALUE

Comments provided during the public review period of the 2014 Draft EA (Phase 1) expressed concern over decreased property values due to proposed obstruction removal for those properties abutting or adjacent to the area of trees proposed for removal. Capital Appraisal has collected data from the New Hampshire Association of Realtors database and completed grant history research to determine other airports within New Hampshire where avigation easements have recently been acquired for obstruction removal. This information was used to determine if there is a trend analysis available regarding impacts to property values from obtaining avigation easements and removing obstructions. Adjustments were made to the level of impact on property values based on fluctuations in the market.

Data research from the New Hampshire Association of Realtors also included a review of properties within the Runway 2 approach at Dillant-Hopkins Airport on properties containing avigation easements to determine the level of impact the clearing had on those property values. No sales data was found within the Runway 2 approach to determine whether the avigation easements and subsequent obstruction removal impacted property value. Capital Appraisal's report is included in Appendix A.

Buzzell Associates has reviewed the report prepared by Capital Associates to ensure the independent nature of the data. It was determined that the data found through Capital Associates' research included properties located within the Federal Aviation Regulations (FAR) Part 77 transitional surfaces. There was limited public data found as most avigation easements are acquired through negotiated settlements and the negotiated amounts are not a matter of public record. Buzzell Associates agreed with the estimated damage range of 0-6% for avigation easements for properties within the transitional surfaces but determined that a higher range would be warranted for properties located within the approach surface as is the case with the impacted properties adjacent to Dillant-Hopkins Airport. A complete "before and after" value appraisal would be needed for each individual property to accurately estimate damages from acquiring avigation easements and removing obstructions as per Federal Aviation Administration regulations. A summary of Buzzell Associates' review is included in Appendix A.

# 3.0 NOISE

Comments received during Phase 1 of the Draft EA expressed concern related to increased noise levels to residents of the Edgewood Avenue from aircraft operations as a result of tree removal proposed on airport property. A noise analysis was not prepared as a component of the Phase 1 EA as it was asserted that the 65 dB DNL noise contour (the baseline threshold for determining noise impact significance) did not extend beyond the limits of airport property to noise sensitive receptors therefore there would be no increase of 1.5 dB or greater to noise sensitive receptors located within the 65 dB DNL contour—the threshold trigger of significance used by FAA when considering noise impacts from proposed actions.

Phase 1 of the EA included an assessment of potential noise attenuation provided by the trees proposed for removal on airport property. The assessment, prepared by Sanchez Industrial Design Inc., utilized the International Standard Organization for Standardization (ISO) 9613-2 *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General Method of Calculation* as a reference to establish noise attenuating capabilities of the trees proposed for removal on-airport. The Sanchez memorandum states that for some homes on Greenwood Avenue, the maximum attenuation of 10-12 dB at mid-range frequencies would apply provided the vegetation proposed for removal met the ISO 9613-2 standard for vegetation density. That is, foliage of trees and shrubs dense enough for a distance of 650 feet to completely block the view along the noise propagation path (from source to receptor). The memorandum concluded, however, that a) forest composition within a significant region of the subject area does not provide vegetation density assumed in the ISO standard due to the height of the tree canopy and lack of vegetated understory and therefore the mature white pine stand likely provides less attenuation than estimated by the ISO standard, and b) several years of regrowth within tree removal areas would provide denser foliage and likely greater noise reduction than the existing pine stand.

In response to the Phase 1 EA comments regarding noise, Harris Miller Miller & Hanson Inc. (HMMH) of Burlington, MA., was retained to prepare a noise analysis using noise modeling software. HMMH utilized the Aviation Environmental Design Tool (AEDT), developed by the FAA, to model aircraft flight operations. AEDT utilizes model inputs such as: airfield layout; terrain, flight track geometry; climate data; aircraft noise and performance data, aircraft operations; and runway use. The AEDT software does not account for trees or other structures that could serve to attenuate sound. The model assumes sound travels unhindered or unobstructed from source to receptor inputs. Modeling results indicate the 65 dB DNL contour for existing and future conditions is primarily contained to airport property within the immediate runway environment, see the *Dillant-Hopkins Airport Environmental Assessment Draft Noise and Air Quality Technical Report, HMMH Report No. 308290 November 2016* included in Appendix B. The modeling analysis also determined the most impactful (loudest) noise experienced by pre-established locations within the Edgewood neighborhood is experienced during overflight operations, with ground operations contributing 0.3 to 0.6 dB to the total DNL when considering all operations—well below the 1.5 dB increase required for the determination of a significant impact. The AEDT results and accompanying report are included in Appendix B of this document and were submitted to FAA for review. The FAA approved the use of AEDT to use overflight profiles for use in modeling ground noise at Dillant-Hopkins Airport, see FAA letter dated December 20, 2016 located in Appendix B.

To determine whether noise levels from individual aircraft ground operations may change because of tree removal, HMMH conducted a noise measurement field exercise at the airport in September 2016. Sound was broadcast from a loud speaker at five locations, including three locations within the forest north of Runway 20 and two locations over grass field. Measurements were recorded at intervals of 35, 70, 140 and 280 feet from each broadcast location. HMMH analyzed their results, incorporating the ISO 9613-2 standard, to assess potential increases in noise from tree removal to the five neighborhood receptors used in the AEDT model. Their primary conclusions are summarized below:

- Sound levels for in-flight aircraft will not be perceptibly changed by on-airport tree removal;
- During poor propagation conditions (wind from the north) noise from ground operations in the Edgewood neighborhood may be low;
- Under good propagation conditions (wind from the south), the curved sound path for receptors greater than approximately 3,500 feet from the ground noise source will be high enough to pass over existing trees;
- The sound path for Runway 14 departures may experience increased single-event sound levels of 3 dB to 5 dB at two of the five neighborhood receptors as a result of tree removal;
- The sound path for Runway 20 departures may experience increased single-event sound levels of 6 dB to 10 dB at all five AEDT model receptors as a result of tree removal;
- Estimated increases in single-event sound levels may be partially or completely offset by changes in ground effect described in their report; and
- Changes to sound levels may be smaller with the preservation of existing underbrush and shorter trees and new growth in tree removal areas will aid in the restoration of existing sound levels.

HMMH's analysis suggests that tree removal on airport property may contribute to increased sound levels experienced in the Edgewood neighborhood during certain aircraft operations. However, these results assume the ISO 9613-2 standard for dense vegetation are present in the subject area. Additionally, changes in ground effect and wind conditions alter the results. As stated in FAA Order 1050.1F, Section B-1.2, noise monitoring data is not required for noise analysis but may be included in a NEPA document. The Order continues that such data should not be used to calibrate the AEDT model or to make a finding of significance. For this reason, the FAA did not approve the noise monitoring technique used in conjunction with ISO 96-13-2 for adjusting modeled noise levels. FAA indicated the measured attenuation levels can be included in this document as supplemental information without the need for approval but this data may not be used to "alter or draw alternative conclusions to as to the findings of noise significance under NEPA." See FAA letter dated December 20, 2016 located in Appendix B.

# 4.0 AIR QUALITY

An air quality analysis was not included in the 2014 Draft EA because the project location is not within an EPA-designated non-attainment or maintenance area and the project would not alter the number of operations conducted at the airport or the fleet of aircraft currently using the facility. Aircraft emissions would therefore remain unchanged between the No Action alternative and the preferred Easement Acquisition and Obstruction Removal alternative presented in the 2014 Draft EA. Comments received during the public review period expressed concern over potential increases in air pollution and the loss of carbon sequestration capability due to the removal of trees on airport property.

HMMH provided a qualitative analysis of potential impacts to air quality, evaluating potential increases in criteria pollutants (ozone, carbon monoxide, nitrogen oxide, sulfur dioxide, particulate matter, and lead) established by the EPA from construction activity associated with proposed tree removal. An analysis of aircraft emissions related to operations at the airport was not conducted as a component of the Final Phase 2 EA.

Cheshire County is currently viewed as an attainment area by EPA, meaning air quality in the region meets the requirements for the criteria pollutants mentioned above. HMMH conducted a qualitative air quality analysis for tree removal operations utilizing equipment and emission duration expected to be used for a forestry project of the scale presented in the 2014 Draft EA. HMMH's findings indicate that emissions of criteria pollutants will increase during construction. Increases will be limited to the period of construction and these short-term increases will not result in significant impacts or and/or violations of National Ambient Air Quality Standards (NAAQS) established by the EPA.

HMMH also reviewed proposed tree removal within the context of increased Greenhouse gasses (GHG) from the combustion of fossil fuels and their effect on climate change. Construction during the forestry operation and the resultant loss of trees were considered in HMMH's assessment. Increases in GHG emissions from gasoline and diesel fuel usage during construction would not exceed applicable thresholds and would not be regionally significant. Like the criteria emissions, increased GHG emissions from construction and operational activity comprises a very small percentage of U.S. based and global GHG emissions. The short-term loss of forested area, comprised mostly of mature white pine, correlates with some short-term loss of carbon sequestration (the capture of carbon dioxide from the atmosphere through photosynthesis stored as carbon in the trunks, branches, leaves, and roots of trees). Carbon stocks and sequestration rates may be reduced in the short term until carbon uptake by remaining trees and regrowth within tree removal areas meets or exceeds the current sequestration rate. Sustainable forestry practices, such as the forestry management plan to be implemented at Dillant-Hopkins airport, can increase a forest's ability store carbon while enhancing other ecosystem functions, see *Dillant-Hopkins Airport Environmental Assessment Draft Noise and Air Quality Technical Report, HMMH Report No. 308290 November 2016* included in Appendix B.

## 4.1 GENERAL AVIATION IMPACTS TO LOCAL AIR QUALITY

Additional resources including local air quality studies and scientific/industry journals were reviewed during the preparation of the Final Phase 2 EA to qualitatively assess the impacts to local air quality from general aviation (GA) activity. Presently, there is not a great deal of data available to quantify these impacts. FAA uses modeling software to quantify the level of aircraft emissions at an individual airport. According to the Airport Cooperative Research Program (ACRP) Research Report 164 *Exhaust Emissions from In-Use General Aviation Aircraft* published in 2016, this approach is problematic for several reasons. To summarize, the report finds that emission data from piston engines common in many small planes is not available to the extent that current data is available for larger jet engines used by commercial jets. Additionally, the report finds that emissions data for piston engines used in current software models is incomplete—a number of engines in service around the country are not included in the models, resulting in substitute engines used in the model that may have different emission characteristics than the actual in-service aircraft. Furthermore, in limited instances, the report's authors found, based on their analysis of emissions from several commonly used piston engines, that modeling software underestimated hydrocarbon emissions data. Finally, the study finds that modeling software does not account for pilots' operating tendencies. Piston engine performance and emissions for a given engine are not static. Emissions are affected by the amount of thrust administered by the pilot during a specific operation, such as during take-off, and the amount of fuel burned during that operation directly corresponds to the amount of thrust applied to the engine. Pilots do not conduct operations in identical fashion and the models cannot account for these variabilities. The ACRP report acknowledges that emissions modeling software is necessary to provide regulatory guidance regarding impacts to air quality as it is not practical to perform an emissions inventory based on field-measured emissions for each FAA project requiring air quality analysis. The ACRP report has made several recommendations aimed at improving the accuracy of modeling software and the report is under review by FAA.

The difficulty in acquiring meaningful aircraft emission data is also evident in the City of Keene's Climate Action Plan, formally adopted by the Keene City Council in 2004. A component of this plan included the preparation of the *City of Keene, New Hampshire Greenhouse Gas Emissions Inventory 2006-2008*. This report, compiled by the Cities for Climate Protection Committee and the City of Keene Planning Department, was prepared to assess the City's energy use and estimate GHG emissions. The report used publicly available data and data from municipal operations (evaluated by "sector") to complete the GHG inventory. The report concluded that energy use and emissions are increasing in Keene. However, carbon dioxide emissions (represented as $CO_{2e}$ or the carbon dioxide equivalent) from the Municipal Facilities and Operations sector, which includes the airport, decreased 1% between the years of 1995 and 2008. During that 13-year period, $CO_{2e}$ emissions from airport operations and maintenance decreased by almost 40% due to appliance upgrades. The airport GHG inventory did not include emissions from air traffic. Aircraft emissions were identified as "Scope 3" emissions, defined as an indirect emission from a source not owned or controlled by the reporting entity (in this case the City of Keene and the airport), were not included in the inventory. The absence of Scope 3 emissions relates directly to the inherent difficulties associated with quantifying GA emissions.

Another study reviewed for the Final Phase 2 EA included a scholarly report entitled "GIS Analysis of Factors Influencing Particulate Pollution in Keene, New Hampshire" published in the *International Journal of Undergraduate Research and Creative Activities* (Volume 6 Special Issue Article 4 April 2014). As stated previously above in Section 4.0 Air Quality, particulate matter is NAAQS criteria pollutant monitored regionally by the EPA and considered within the context of a NEPA review. Particulate pollutants consist of microscopic mixtures of solid particles and liquid droplets suspended in the air. Some particulate matter occurs naturally, formed by very small dust and dirt particles bonded to moisture. Other particles form in the atmosphere, the result of chemical reactions from emissions from power plants, industries, automobiles, and airplanes.

The "GIS Analysis of Factors Influencing Particulate Pollution in Keene, New Hampshire" study aims to characterize the relationship of air inversions (in winter, when a layer of warm air overlays a layer of cold air, preventing the exchange of air between layers) and $PM_{2.5}$ (particulate matter with a diameter of less than 2.5 microns) in the City of Keene. The study asserts that wood burning as a means of home heating is thought to be the main source of $PM_{2.5}$ in Keene and concluded that air inversions and high $PM_{2.5}$ events are most likely to occur during winter on cold, clear, windless nights. There is no consideration of local air traffic as a possible source of $PM_{2.5}$ pollution in Keene. Though the intent of the study was not to determine the impact of aircraft emissions on air quality in Keene, the findings are in line with similar studies and again reflect the difficulty with determining the impact GA airports have on regional air quality.

## 4.2 MONITORING AIR QUALITY AT GENERAL AVIATION AIRPORTS

The general assessment of air quality at a specific location typically involves obtaining and interpreting data from state and federal monitoring stations at various regional locations, that may or may not be in close proximity to the desired study area. Air quality monitoring stations may collect data for one or more of the NAAQS criteria pollutants but rarely do they collect information on all the criteria pollutants, as HMMH indicates in their report included in this Phase 2 EA. Air quality monitoring stations are often located at airports but unless that airport is the subject of an air quality analysis, it is not reasonable to attempt to analyze air quality at one airport in relation to data obtained from a monitoring station located at another airport. Geographic distance, climatic differences, and aircraft fleet and operational variations would make such comparisons inaccurate and unreliable. Establishing a monitoring station(s) at an airport to monitor the effects of aircraft emissions on air quality is a costly option not easily afforded by regional and general aviation facilities.

Over the past few years several European airports, including large commercial hub airports as well as smaller airports, have adopted a relatively simple inexpensive method to test the impact of aircraft emissions. Airports located in Germany (Frankfurt, Dusseldorf, Hamburg, Nuernberg, Hannover, and Dresden) and Sweden's Malmo Airport have been using honey bees to monitor airport air quality. Bees absorb pollutants directly from water or the air, or indirectly from the nectar and pollen collected from plants. These airports have established bee hives on their grounds and have been collecting the honey from these hives. Honey and beeswax collected from airport hives is tested, usually twice annually, for the presence of pollutants including heavy metals and polycyclic aromatic hydrocarbons. Airport honey and beeswax sampling results are also compared to honey and beeswax sampling results collected from hives located in non-industrial areas. Dresden Airport has also grown kale and green cabbage to trace ground and air pollutants.

Reported results indicate that toxin levels in honey and beeswax collected from airport hives are far below official limits and similar to those levels found in the honey collected from hives located in non-industrial areas. Although the results of biomonitoring with bees are consistent with traditional air quality monitoring techniques utilized in Europe, the Association of German Airports states that using bees as bio-indicators to assess environmental health is a fairly new undertaking and the use of conventional monitoring continued study of bees as bio-indicators is warranted. One study analyzing toxin levels in bee carcasses—not collected from airport colonies--suggests bees' bodies may filter and retain toxins rather than passing toxins through to their honey.

Although definitive results regarding the effectiveness of using honey bees at airports to monitor air quality may not be known, establishing hives at airports is may provide an interesting, useful, and inexpensive means for communicating the importance of airport air quality issues to the local community. Assistance with establishing beehives and collecting honey may be obtained from the New Hampshire Beekeepers Association and the Monadnock Beekeepers club at www.monadnockbeekeepers.com.

# 5.0 VISUALZATION MODEL

An interactive visualization model has been created using aerial photography overlaid onto terrain surface models in an attempt to create a computer-generated rendering of the visual impacts to the Edgewood neighborhood from tree removal conducted on airport property. The model includes generic-looking residential structures in the adjacent neighborhood, proposed REILs, rotating beacon, and simulation of trees based on existing tree survey information, approximation of trees and foliage outside of the study area based on visualization inspection of aerial photography and Google Earth, and simulation of a representative aircraft landing on Runway 20.

The visualization model of existing conditions includes display control buttons to turn model layers on and off to enable easy viewing of existing conditions, proposed final conditions, and phases of obstruction removal. The visualization modeling of the easement acquisition and obstruction removal includes simulation of obstruction surfaces, and delineation of easement acquisitions. The visualization model will be interactive using 123Bim through February 2017. An archive version of the model will be available starting March 2017 that can be viewed using the desktop Navigator application.

Screenshots taken from the visualization model have been included in this report. The screenshots are intended to capture the view of proposed airport tree removal from locations within the Edgewood neighborhood. The following screenshots include "before" and "after" tree removal views from points along Greenwood and Lynwood Avenues in Keene.

**Figure 1 Rendering of view from 48 Greenwood Avenue facing south-existing conditions.**

**Figure 2 Rendering of view from 48 Greenwood Avenue facing south-post tree removal.**

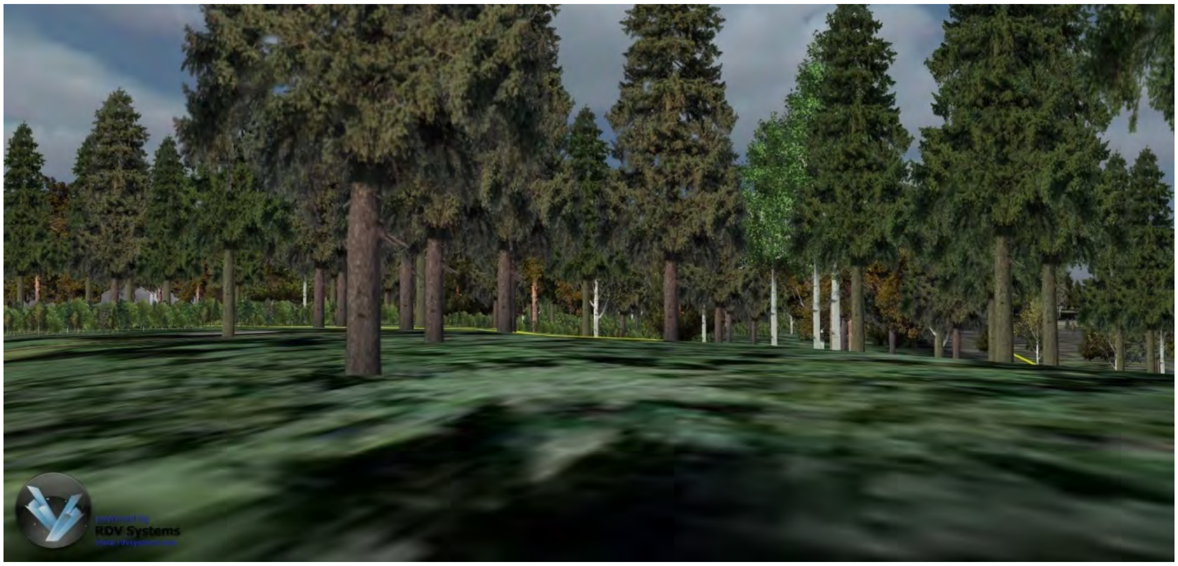


**Figure 3 Rendering of view from 59 Greenwood Avenue facing south-existing conditions.**

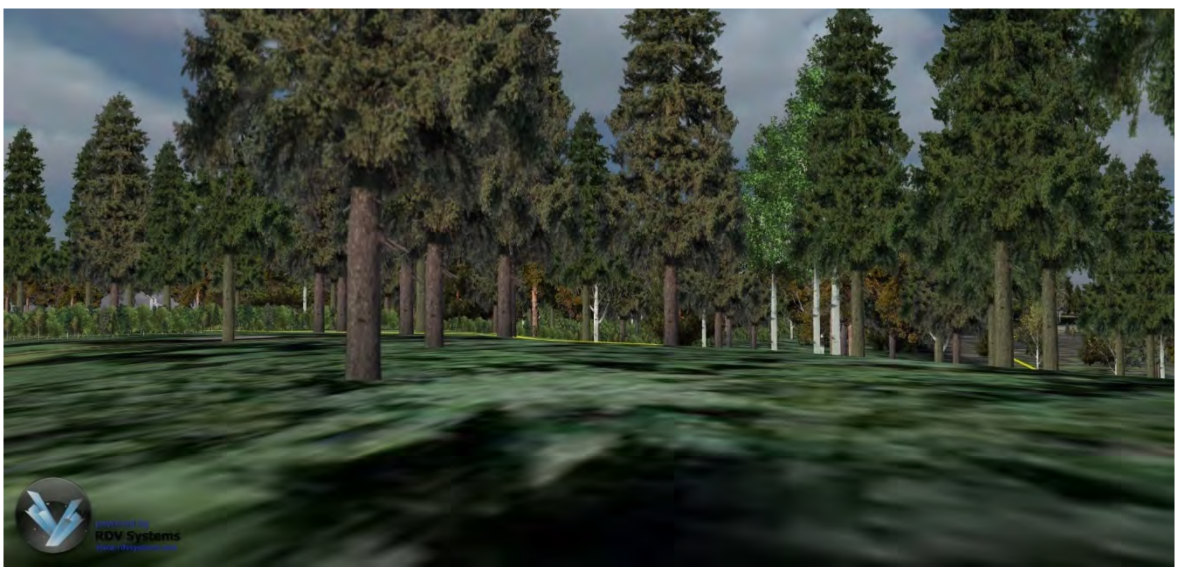


**Figure 4 Rendering of view from 59 Greenwood Avenue facing south-post tree removal.**

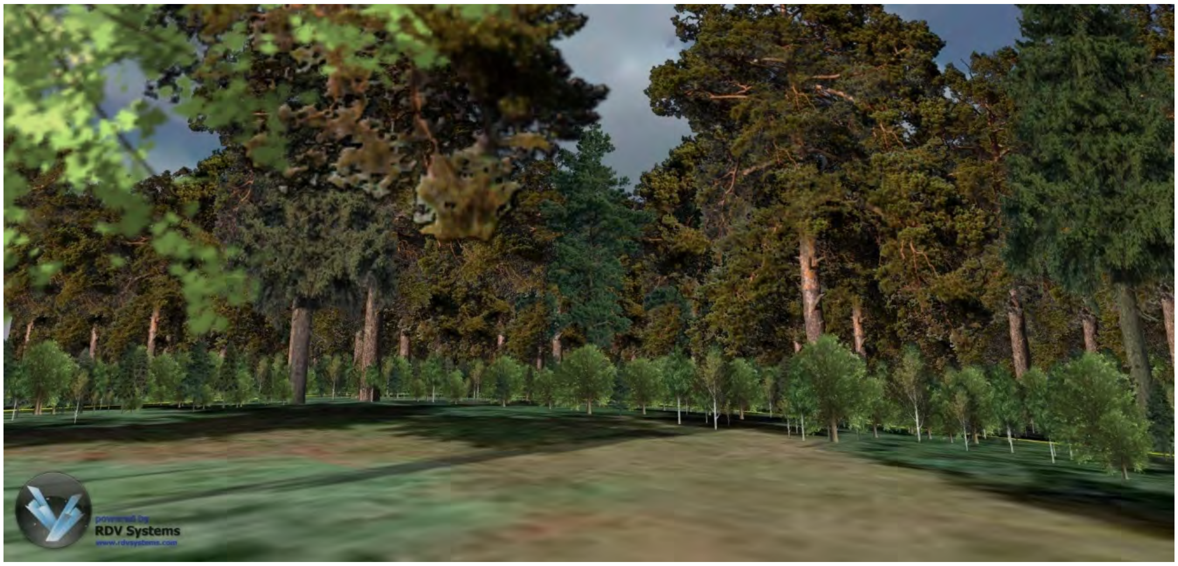


**Figure 5 Rendering of view from 71 Greenwood Avenue facing south-existing conditions.**


**Figure 6 Rendering of view from 71 Greenwood Avenue facing south-post tree removal.**


**Figure 7 Rendering of view from 74 Greenwood Avenue facing south-existing conditions**


**Figure 8 Rendering of view from 74 Greenwood Avenue facing south-post tree removal.**

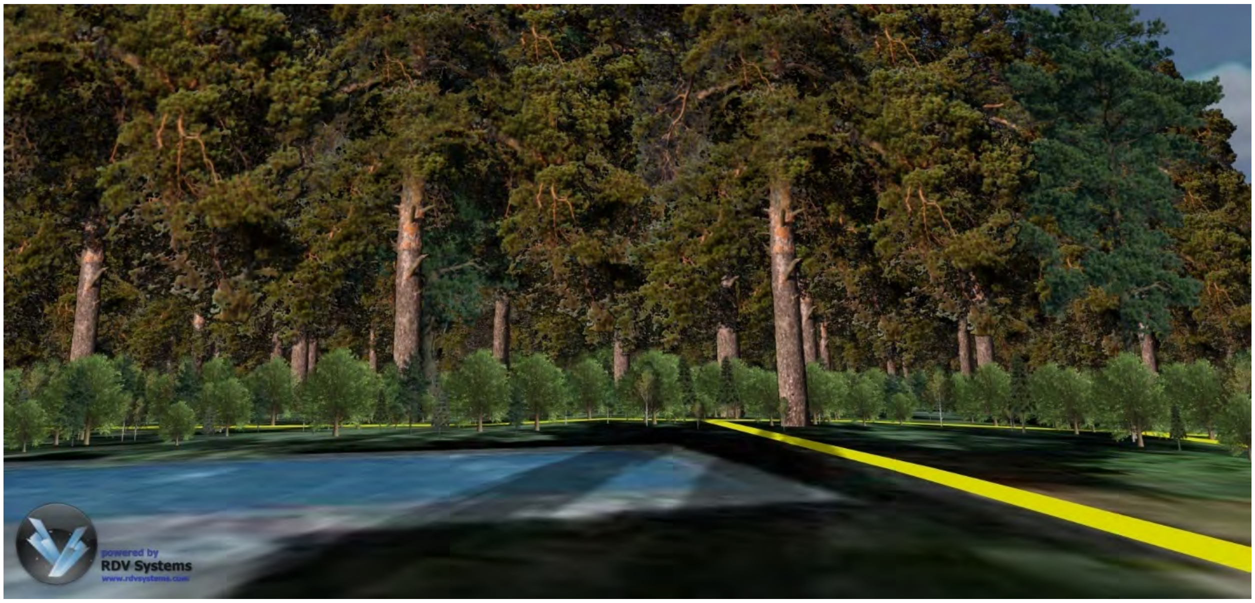


**Figure 9 Rendering of view from 77 Greenwood Avenue facing south-existing conditions.**

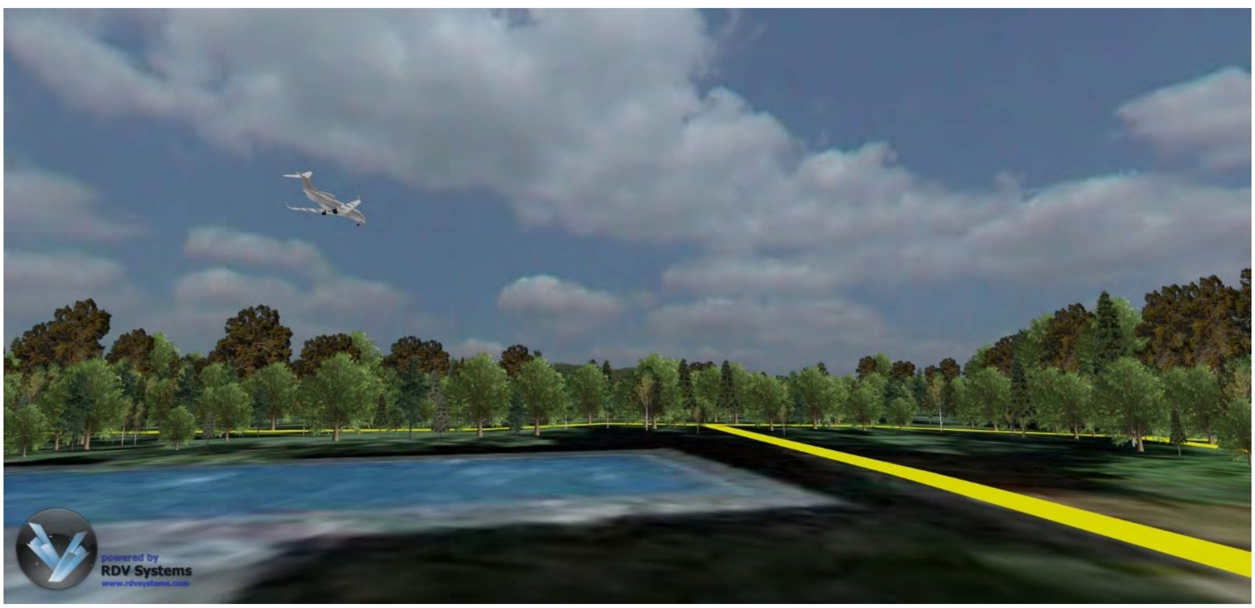


**Figure 10 Rendering of view from 77 Greenwood Avenue facing south-post tree removal.**

**Figure 11Rendering of view from 99 Greenwood Avenue facing south-existing conditions.**

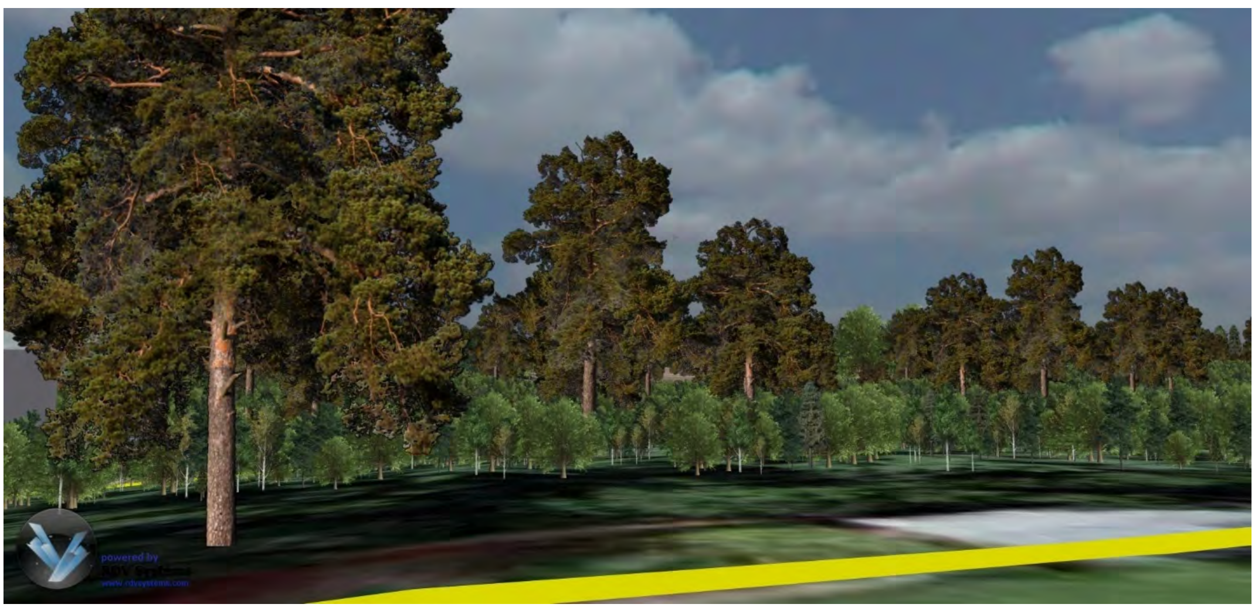

**Figure 12 Rendering of view from 99 Greenwood Avenue facing south-post tree removal.**


**Figure 13 Rendering of view from 100 Greenwood Avenue facing south-existing conditions.**

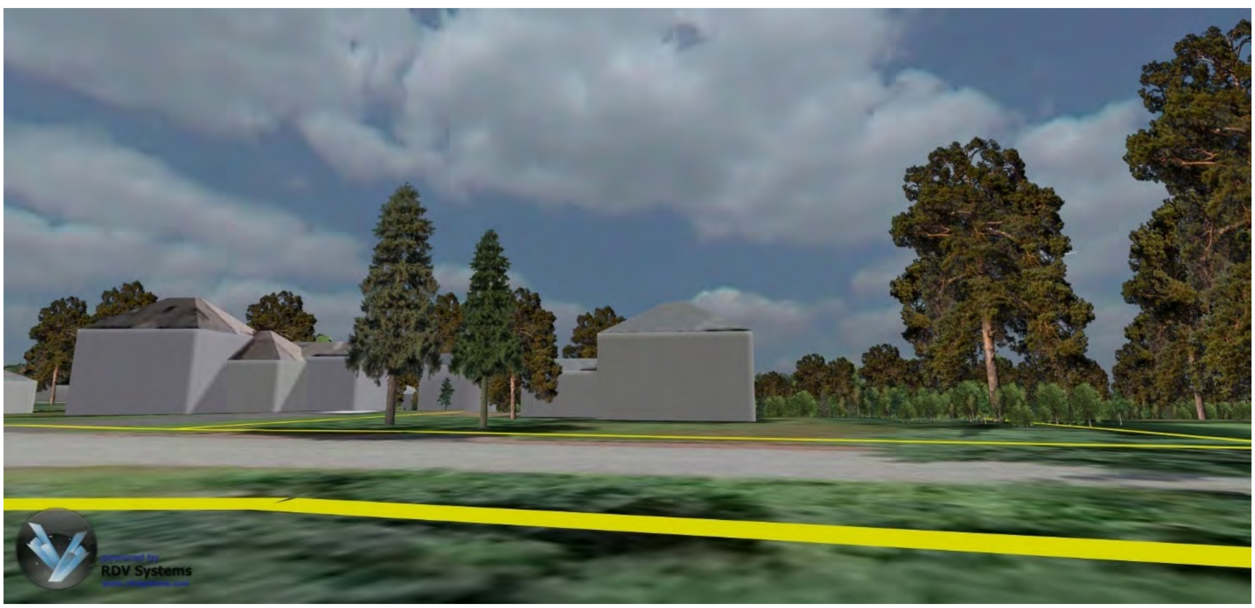


**Figure 14 Rendering of view from 100 Greenwood Avenue facing south-post tree clearing.**

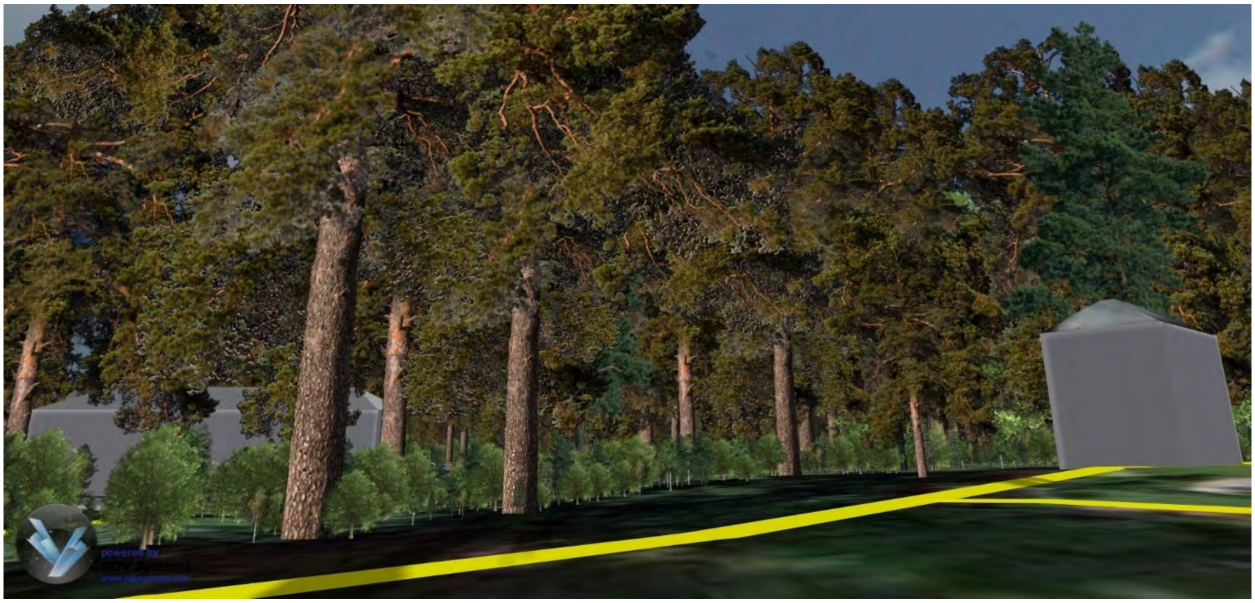

**Figure 15 Rendering of view from 103 Greenwood Avenue facing south-existing conditions.**

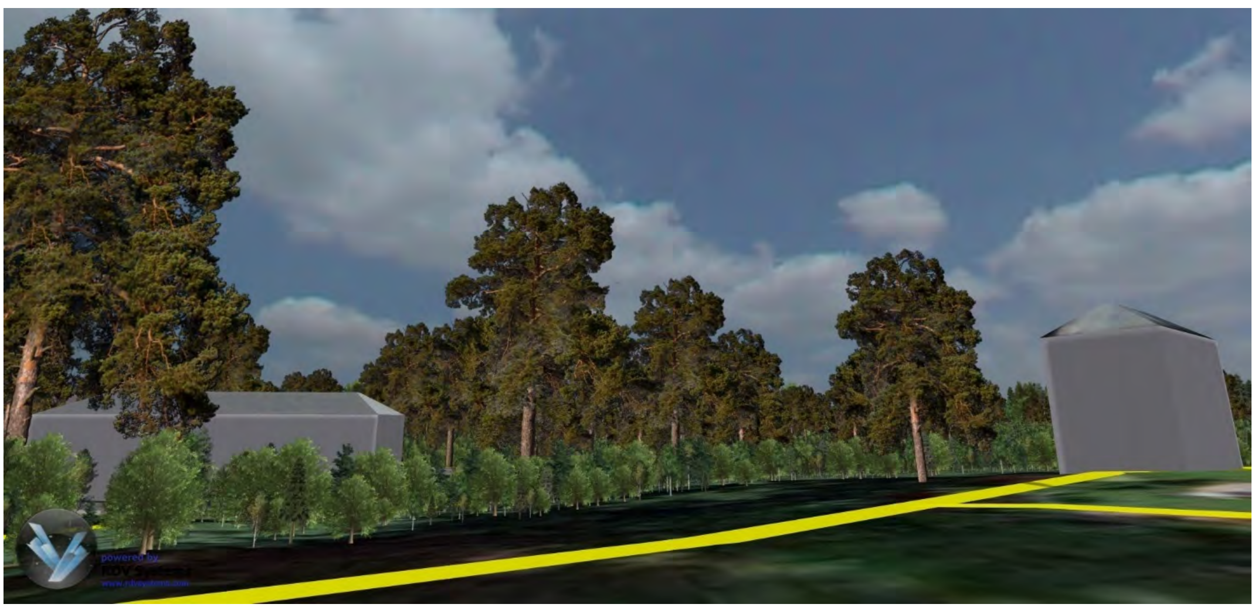

**Figure 16 Rendering of view from 103 Greenwood Avenue facing south-post tree removal.**


**Figure 17 Rendering of view from 108 Greenwood Avenue facing south-existing conditions.**


**Figure 18 Rendering of view from 108 Greenwood Avenue facing south-post tree removal.**

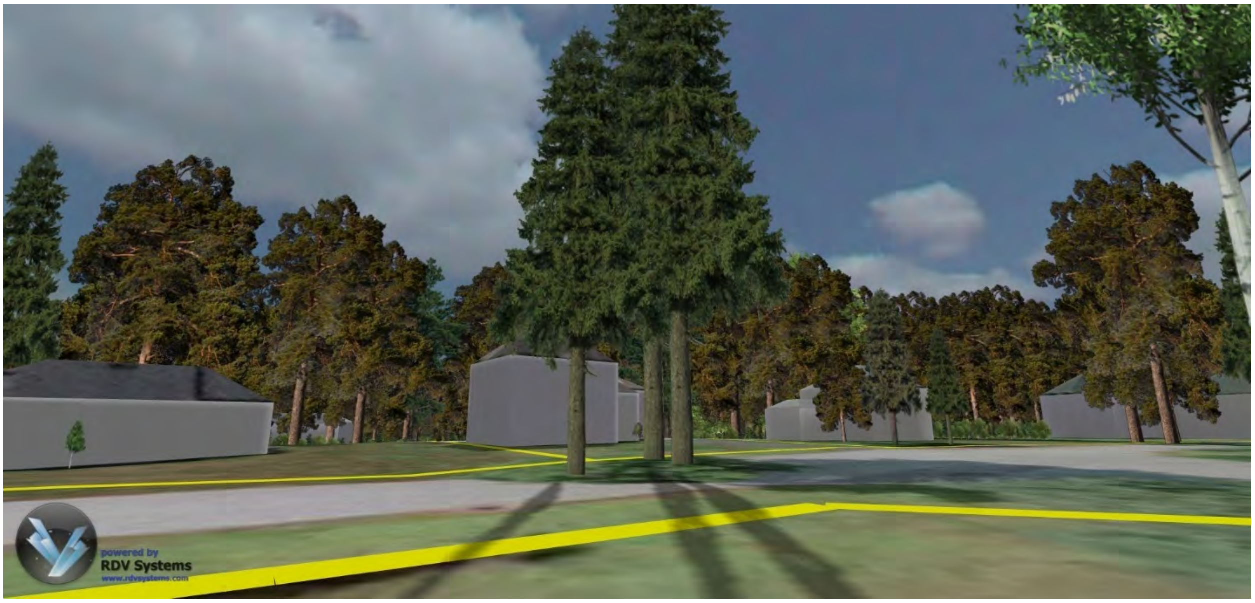


**Figure 19 Rendering of view from 46 Lynwood Avenue facing south-existing conditions.**

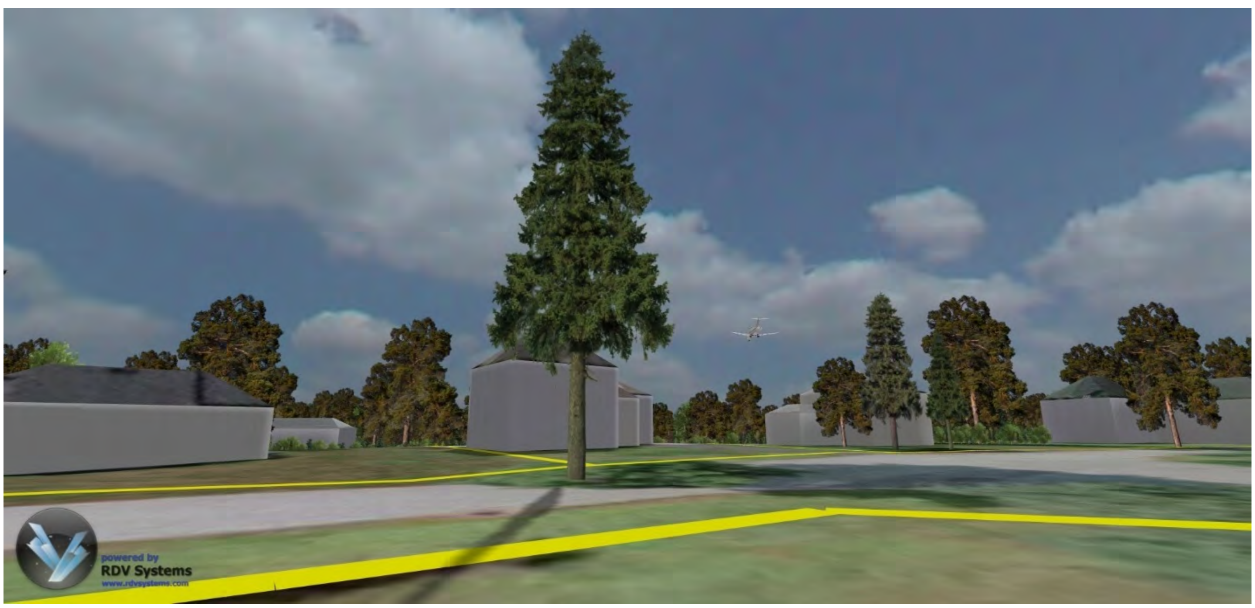


**Figure 20 Rendering of view from 46 Lynwood Avenue facing south-post tree removal.**

# APPENDIX A / SOCIO-ECONOMIC IMPACTS: PROPERTY VALUE

**CONSULTATION REPORT**
of Real Estate

*Located At*
Dillant-Hopkins Airport
80 Airport Road
Keene, New Hampshire

*Current Owner:*
City of Keene, NH

*As Of:*
October 1, 2016

*Report Date:*
November 21, 2016

*Prepared For:*
Ms. Janice Bland
Stantec Consulting Services, Inc.
482 Payne Road, Scarborough, ME 04074


*Prepared By:*
Louis C. Manias
NH Certified General Appraiser #5
Capital Appraisal Associates, Inc.
128 South Fruit Street
Concord, New Hampshire 03301


Appraisal File No. 16-156
Federal Tax ID 02-0492128

**Capital Appraisal Associates, Inc.** *Real Estate Appraisers and Consultants*

128 S. Fruit Street, Concord, New Hampshire 03301
Telephone (603) 228-9040, Facsimile (603) 228-2072

November 21, 2016

Ms. Janice Bland
Stantec Consulting Services, Inc.
482 Payne Road
Scarborough, ME 04074

Re: Consulting Assignment for Runway 2 Approach
at Dillant-Hopkins Airport
Currently owned by the City of Keene, NH
Located at 80 Airport Road, Keene, New Hampshire

Dear Ms. Bland:

As you requested, I have researched the market area in order to determine if data exists that would indicate whether or not impacts to property values exist as a result of avigation easements. This is done by examining real estate sales data within the Runway 2 approach as well as researching sales data surrounding other smaller airports in New Hampshire with somewhat similar characteristics. I made an initial view of the neighborhood surrounding the airport in July of 2016 and a second visit on October 1, 2016 which is the effective date of this document.

This consultation report is intended for use only by my client, Stantec Consulting Services, Inc., and/or affiliates. The purpose of this consultation report is for the client to ascertain whether or not the existing and/or any proposed avigation easements will negatively impact the value of real estate surrounding Keene Dillant-Hopkins Airport. Use of this report by others is not intended by the appraiser. This report is not intended for any other use.

This is a Consultation Assignment Report and since no valuations or conclusions of value are determined as a result of this report, it is not required that it be in compliance with the 2016-2017 Uniform Standards of Professional Appraisal Practice for an Appraisal Report. Standards 4 and 5 which dealt with the development and reporting for an appraisal consulting assignment have been retired and are no longer part of that document. As such, this report presents only summary discussions of the data, reasoning, and analyses that were used in the collection and analysis process, if any, in order to allow for the client to make an informed decision. Supporting documentation that is not provided with the report concerning the data, reasoning, and analyses is retained in the appraiser's file. The depth of discussion contained in this report is specific to the needs of the client and for the intended use stated in this report. The appraisers are not responsible for unauthorized use of this report.

I hereby certify that I have made a view of the subject neighborhood on **October 1, 2016**, that I have taken into consideration all factors which I felt were pertinent to the consultation assignment, and that I have not knowingly or intentionally omitted any important data.

Overall, based on my interpretation of the market data included in this consultation report, I am of the opinion that a range of 0% to a maximum of 6% could possibly be supported by an adjustment to properties that are subject to or may be subject to an avigation easement.

Sincerely,

Louis C. Manias
NH Certified General Appraiser #5

## APPRAISAL CERTIFICATION

I certify that, to the best of my knowledge and belief:

1. The statements of fact contained in this report are true and correct.
2. The reported analyses, opinions, and conclusions are limited only by the reported assumptions and limiting conditions and is my personal, impartial, and unbiased professional analyses, opinions and conclusions.
3. I have no present or prospective interest in the property that is the subject of this report and no personal interest with respect to the parties involved.
4. I or Capital Appraisal Associates have performed no appraisal service, as an appraiser or in any other capacity, regarding the property that is the subject of this report, within the three-year period immediately preceding acceptance of this assignment.
5. I have no bias with respect to the property that is the subject of this report or to the parties involved with this assignment.
6. My engagement in this assignment is not contingent upon developing or reporting predetermined results.
7. My compensation for completing this assignment is not contingent upon the development or reporting of a predetermined value or direction in value that favors the cause of the client, the amount of the value opinion, the attainment of a stipulated result, or the occurrence of a subsequent event directly related to the intended use of this appraisal
8. My analyses, opinions and conclusions, if any, were developed, and this report has been prepared, in conformity with the *Uniform Standards of Professional Appraisal Practice*.
9. I have made a personal inspection of the property that is the subject of this report.
10. No one provided significant professional assistance to the person signing this certification.

Louis C. Manias
NH Certified General Appraiser #5

## COMPETENCY STATEMENT

**Louis C. Manias**

Title XI of the Federal Financial Institution's Reform, Recovery and Enforcement Act of 1989 requires the Federal Reserve Board and other federal agencies to issue regulations to protect federal financial and public policy interests in real estate transactions requiring the services of an appraiser. Federal law recognizes the Uniform Standards of Professional Appraisal Practice as the current industry standards and identifies the Appraisal Foundation as the authority for professional appraisal standards.

The uniform standards contain three provisions, one of which is the competency provision which requires appraisers to have the knowledge and experience to complete their assignments competently and contains specific requirements for appraisers who do not possess sufficient competence.

As part of the regulatory process, two primary classifications of appraisers have been established by the State of New Hampshire in accordance with the federal regulations in order to gauge education and competence. The classifications are licensed appraiser and certified appraiser. The licensed appraiser classification identifies those individuals possessing the basic educational and experience requirements needed to competently appraise residential properties, while the general appraiser classification identifies those appraisers who are competent to appraise all types of real estate.

With regards to my competency to complete this assignment, I submit the following:

1. I currently hold the general appraiser certification classification as issued by the State of New Hampshire. My certification number is New Hampshire Certified General Appraiser #5.
2. I have completed numerous appraisals on various types of real estate including vacant industrial, commercial, and residential sites, commercial/industrial and residential subdivisions, professional office buildings, small village, neighborhood and regional shopping centers, restaurants, gas stations, regional chain food stores, as well as other non-typical and special use properties.
3. In order to familiarize myself with the local market I have conferred with local Realtors, interviewed numerous local municipal officials, property owners, and tenants. I believe that this research and activity has provided additional insight into the market in which the subject exists and the economic conditions prevalent in the community and the region.

Because of my experience, education, and professional recognition, I possess the necessary background and knowledge to competently complete this assignment.

## TABLE OF CONTENTS

## EXECUTIVE SUMMARY

**CURRENT OWNER:**

City of Keene, NH

**ADDRESS:**

Keene Dillant-Hopkins Airport, 80 Airport Road, Keene, NH (Mailing)

Physical location is in Swanzey, NH.

**SUBJECT:**

The subject of this consultation assignment is to research the market in order to locate sales of properties within the Runway 2 approach with and without avigation easements in order to determine whether any market effect could be measured as a result of the presence of an avigation easement. Additionally, other neighborhoods around some of the smaller airports around the state have been researched to locate additional similar data, if available.

**INTEREST VALUED:**

None

**DATE OF APPRAISAL INSPECTION:**

October 1, 2016

**DATE OF CONSULTATION OPINION:**

October 1, 2016, which in this instance is also the date the neighborhood was viewed.

**DATE OF REORT:**

November 21, 2016, is the date when the consulting report was transmitted.

## INTRODUCTION

### INTENDED USE & USER:

This report is intended for use only by my client, Stantec Consulting Services, Inc., and-or affiliates. Use of this report by others is not intended by the appraiser. It is my understanding that this report is to be used to allow for Stantec Consulting Services, Inc. to present to the City of Keene, the property owner, a comprehensive report regarding effects of avigation easements on real estate. This report is not intended for any other use.

### PURPOSE:

The purpose of this consulting assignment is to present the client with enough data to reach a reliable conclusion relative to avigation easements that currently exist or that may exist. In completing this report, I have considered the actions of the market and have presented the material in a manner that recognizes any measurable market effect.

### SCOPE:

This consultation report is intended to comply with the reporting requirements set forth under the 2016-2017 Uniform Standards of Professional Appraisal Practice for an Appraisal Report, if necessary. As stated earlier, consultation assignments are not specifically addressed under USPAP as Standards 4 & 5 were both retired. The scope of this consulting assignment included a view of the subject neighborhood on October 1, 2016, and investigation, collection and analyses of the market data as may be necessary for this consultation assignment.

The investigation included research of public records through the use of commercial sources of data such as printed comparable sales data services and computerized databases. Search parameters such as dates of sale, leases, locations, sizes, types of properties, and distances from the subject started with relatively narrow constraints and, if necessary, were expanded until, in the appraiser's opinion, sufficient data was retrieved or until the appraiser believed that the available pool of data was reasonably exhausted. Researched sales data was viewed and, if found to be appropriate, efforts were made to verify the data with persons directly involved in the transactions such as buyers, sellers, brokers or agents. At the appraiser's discretion, some data may have been used without personal verification if, in the appraiser's opinion, the data appeared to be correct. In addition, the appraiser considered any appropriate listings or properties found through observation during the data collection process. Only the data deemed to be pertinent to the consultation assignment has been reported.

**ENVIRONMENTAL:**

I did not observe any ground contaminants or evidence of waste such as sludge, chemical residue or oil spillage on the subject site**.** To the best of my knowledge, the subject property has not been recently tested for the presence of any hazardous waste. Based on the OneStop web site as prepared by the NH Environmental Services the environmental history of the subject (based on a search of the subject's address), the web site indicates there are no current or historic hazardous waste generators. It should be noted that I am not an expert in determining the presence or absence of hazardous substances. Therefore, I assume no responsibility for studies or analyses which would be required to conclude the presence or absence of such substances or potential impact as a result of the presence of such substances. This consultation report was prepared under the extraordinary assumption that the subject property is "clean", being free and clear of any hazardous/toxic materials.

**DEFINITIONS:**

**Market Value**

The term ***Market Value*** is defined in the 2016-2017 Edition of the Uniform Standards of Professional Practice (Page A-150), as promulgated by the Appraisal Standards Board of The Appraisal Foundation, as *"the most probable price which a property should bring in a competitive and open market under all conditions requisite to a fair sale, the buyer and seller each acting prudently and knowledgeably, and assuming the price is not affected by undue stimulus. Implicit in this definition is the consummation of a sale as of a specified date and the passing of title from seller to buyer under conditions whereby:*

- *Buyer and seller are typically motivated.*
- *Both parties are well informed or well advised, and acting in what they consider their own best interests;*
- *A reasonable time is allowed for exposure in the open market;*
- *Payment is made in terms of cash in United States dollars or in terms of financial arrangements comparable thereto; and*
- *The price represents the normal consideration for the property sold unaffected by special or creative financing or sales concessions granted by anyone associated with the sale."*

## CONSULTING REPORT DEVELOPMENT AND REPORTING PROCESS:

In preparing this appraisal, the appraiser . . .

1. - Viewed the subject neighborhood on October 1, 2016;
2. - Researched and collected market data related to market conditions and market activity;
3. - Confirmed and analyzed the data as necessary;
4. - Exercised some degree of due diligence to determine the existence of apparent adverse conditions; and
5. - Arrived at a conclusion, the results of which are summarized in the consultation report.

It is important to note this consultation report does <u>not</u> include the following:

1. - Full regional, state, and local analysis
2. - Detailed review of the zoning ordinance which governs the subject neighborhood
3. - Review of environmental or other survey reports
4. - Full tax and assessment analysis of the subject property
5. - Full site and improvement analysis
6. - In-depth market and highest and best use analysis.

## GENERAL REGIONAL AND MUNICIPAL DATA

The following data has been extracted mostly from published studies by the State Occupational Information Coordinating Committee (SOICC) Of New Hampshire. The information is funded through a grant from the New Hampshire Department of Resources and Economic Development, Office of Business and Industrial Development.

**Municipality:**

| | |
|---|---|
| City/Town: | City of Keene |
| County: | Cheshire |
| Labor Market Area: | Keene NH Micropolitan NECTA |
| Tourism Region: | Monadnock |
| Planning Commission: | Southwest Region |
| Regional Development | Monadnock Economic Development Corp. |

**Municipal Services:**

| | |
|---|---|
| Type of Government: | Mayor, Council & Manager |
| Planning Board: | Appointed |
| Industrial Plans: | Planning Board |
| Zoning: | 1927/07 |
| Master Plan: | 2010 |
| Capital Improvement Plan: | Yes |
| Full Time Police Department: | Full time |
| Full Time Fire Department: | Full time |
| Emergency Medical Service: | Municipal |
| -216Nearest Hospital: | Cheshire Medical Center, Keene |
| Distance to Hospital: | Local |
| Number of Beds: | 116 staffed beds |

**Available Utilities:**

| | |
|---|---|
| Electric Supplier: | Eversource Energy |
| Natural Gas Supplier: | Keene Gas Corp. |
| Water Supplier: | Municipal |
| Sanitation: | Municipal |
| Telephone Company: | Fairpoint |
| Cellular Phone Access: | Yes |
| Cable Television: | Yes |

**2015 Tax Burden Allocations:**

| | |
|---|---|
| Residential: | 61.8% |
| Commercial: | 35.5% |
| Public Utilities, Current Use, Other: | 2.7% |

**Housing Statistics** (ACS 2010-2014)**:**

| | |
|---|---|
| Total Estimated Housing Units: | 9,937 |
| Single Family Units: | 5,098 |
| Two to Four Units: | 2,263 |
| Five or More Units: | 2,197 |
| Manufactured Housing Units: | 379 |

**Demographics:**

| Population | 2014 | 2010 | 2000 | 1990 | 1980 | 1970 |
|---|---|---|---|---|---|---|
| Community | 23,281 | 23,409 | 22,589 | 23,081 | 21,449 | 20,467 |
| County | 76,596 | 77,117 | 73,993 | 70,223 | 62,116 | 52,364 |

**Income Estimate (**ACS 2010-2014**):**

| | |
|---|---|
| Per Capita Income: | $29,366 |
| Median 4-Person Family Income: | $75,057 |
| Median Household Income: | $52,327 |
| Average Weekly Wage (2014): | $ 868 (Total, private plus government) |

**The Top Five Major Employers:**

| Employer | Product/Services | Employees |
|---|---|---|
| Cheshire Medical Center | Health Care Services | 1,500 |
| C & S Wholesale Grocers | Wholesale Foods | 1,200 |
| Keene School District | Education | 1,198 |
| Keene State College | Education | 933 |
| Smith Industrial Medical Systems | Hospital Supplies | 480 |

**Transportation:**

| | |
|---|---|
| Road Access: | NH Routes 9, 10, 12, 12A, 32 & 101 |
| Nearest Interstate Exit: | Interstate 91 in Vermont, Exit 3 – 17 Miles |
| Railroad: | None |
| Public Transportation: | City Express |
| Nearest Commercial Airport: | Manchester-Boston Regional - 57 miles |

**Distance to Major Metropolitan Areas:**

| | |
|---|---|
| Manchester, NH: | 65± miles |
| Portland, ME: | 157± miles |
| Boston, MA: | 98± miles |
| New York, NY: | 223± miles |
| Montreal, Canada: | 243± miles |

**Commuting Patterns (**ACS 2010-2014**):**

| | |
|---|---|
| Mean Travel Time to Work: | 15.9 minutes |
| Percent of residents: | |
| working in the community | 73.6% |
| Commuting to NH community | 19.8% |
| Commuting outside of NH | 6.6% |

**Conclusions:**

The City of Keene is an attractive location for both residential, commercial, and light industrial development, with several easy access roads to major transportation routes, air service at the Keene Airport, major shopping, and recreation facilities in both Keene and Peterborough. Keene is the location of Keene State College with a student population of 5,300 students. Its location close to the Vermont state line also makes it an attractive location for retail and commercial services. During the time from 2006 through 2008 it appears the commercial and industrial markets stabilized where no appreciable changes in the valuations have been evidenced. From 2008 through 2010 the overall residential market and segments of the commercial market have shown a decline of approximately 6% per year. Based on data examined for the state it appears the market has leveled off through 2012 and some small segments of the market are beginning to show signs of increasing median prices.

The data for the City of Keene is utilized as the location of the airport is adjacent to the town line for Keene which is the economic center for this region of the state. Although the airport has a physical location in Swanzey, NH its economic impact is for the entire region dominated by Keene as its center.

# NEIGHBORHOOD ANALYSIS

## General

A neighborhood is defined as, "A group of complementary land uses; a related grouping of inhabitants, buildings or business enterprises". A neighborhood should be distinguished from a district, which is defined as, "A market area characterized by one predominant land use - e.g., apartment, commercial, industrial, agricultural".[1] A neighborhood will contain land uses, complementary to one another. For example, predominantly residential neighborhoods typically contain some commercial properties that provide services for the local residents. The boundaries of a neighborhood can be physical, such as a lake, stream, or major highway, or they may be less easily discernible such as changes in prevailing land use or occupant characteristics.

## Neighborhood Boundaries

The subject property is located just south of the center of Keene. The boundaries include NH Route 101 to the north, Sawyer Crossing Road and Eaton Road to the south, NH Route 12 to the east and NH Route 32 to the west. Economically speaking, the neighborhood would include all those towns surrounding the City of Keene which is the major employment and facility center for this part of the state. Most properties in the subject's immediate neighborhood are a mix of residential uses with a few commercial buildings and small retail establishments also noted. Economically speaking, the neighborhood would include all those areas with similar characteristics to the subject neighborhood.

## Character

### *Access*

Access to the subject's neighborhood is good, being primarily a two-way paved town maintained roadway. Access to the airport is from NH Route 12 which leads to NH Route 32. These two roads provide access both north and south through this community. It is within 10 minutes of NH Route 101, the most heavily traveled east and west artery through this part of the state. It is also within easy driving access to State Route 9 just north of Keene which leads to Concord, the state capital.

*h*

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1 [1]The Appraisal of Real Estate (Chicago, Ill: Appraisal Institute, Twelfth Edition, 2001) page 164.

*Uses*

Uses in the subject's immediate neighborhood primarily consists of a mix of mostly residential properties along with several retail and light commercial uses found along NH Route 32. Found in the subject neighborhood are a couple of offices, apartment buildings, auto service centers, truck service and sales. As one gets closer to Keene along NH Route 32, there are more retail uses, gas station, convenience stores, thrift stores and municipal buildings typical of a small New England town. The subject neighborhood is approximately 90% built-up with some additional land available for commercial development.

## Growth and Development

*Life Stage of Neighborhood*

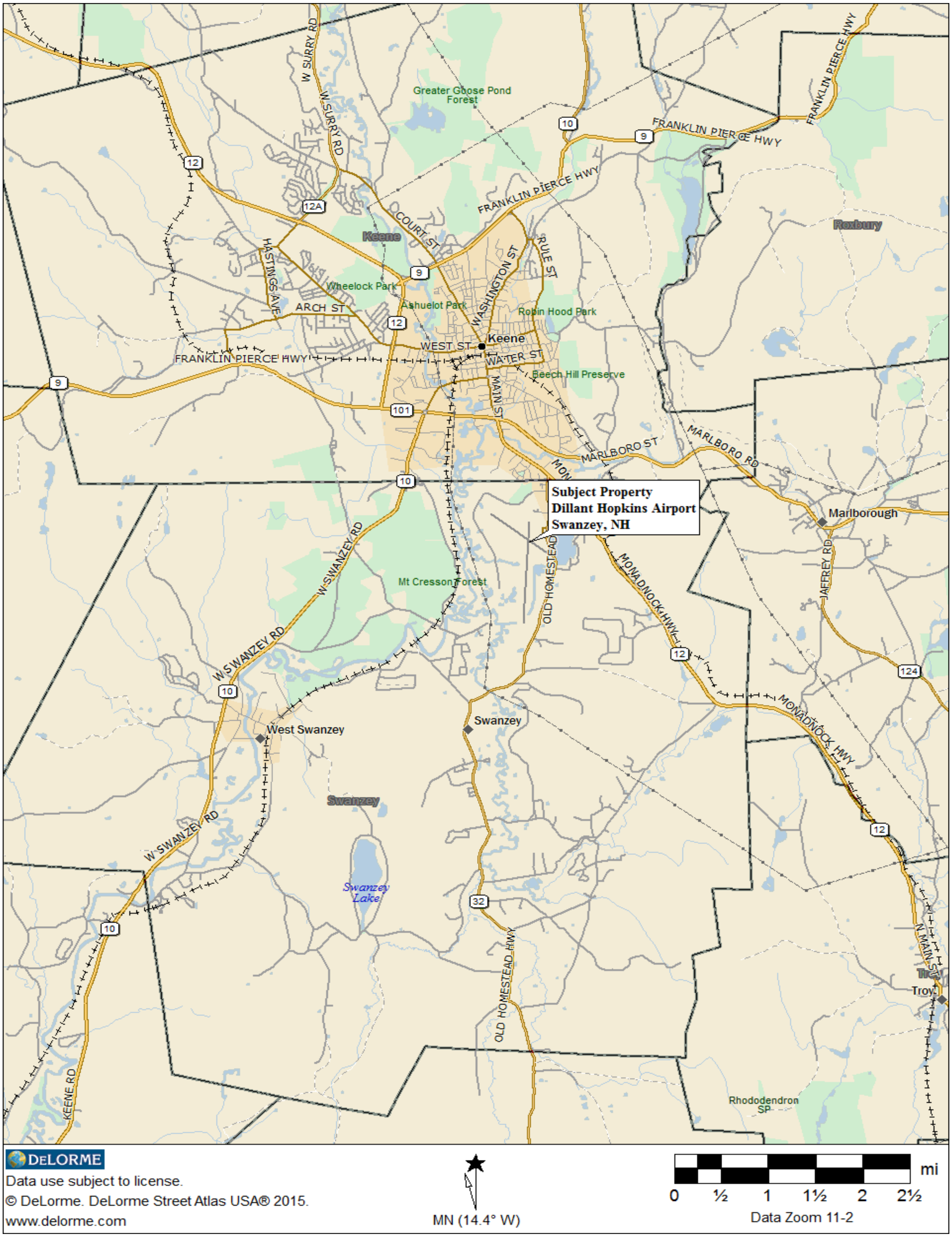
The majority of the commercial structures in the subject neighborhood were constructed within the past twenty or so years. Over the past few years the commercial market has somewhat stabilized, with the typical vacancy rate ranging from a low of about 5% to as high as 30%, with the average vacancy rate being near 5 to 10%. The condition of the subject property appears to be similar to other commercial uses in the immediate neighborhood.

The life stage of the neighborhood, based on my observations, appears to be one of stability to very moderate growth.

## Conclusions

Overall, the subject airport enjoys fairly good exposure because of its location. This neighborhood enjoys good infrastructure of street improvements, easy access to nearby downtown Keene area, as well as easy access to the major highway systems connecting most of New Hampshire to this area, and adequate pubic services. This general neighborhood enjoys good infrastructure of street improvements, easy access to other parts of the town and to the major highway systems connecting most of New Hampshire to this area, as well as adequate public services. Generally, most properties in this neighborhood have been adequately maintained and are of average quality and condition. Because of its location, this neighborhood will, in my opinion, continue to be a fairly desirable commercial location in the foreseeable future.

## NEIGHBORHOOD MAP



## SITE DESCRIPTION

**Site Description:**

According to the tax assessment records and map, the subject site is irregular in shape containing approximately 728.67± acres of land. The tax map indicates the parcel is 819.97 acres of land. The airport Master Record indicates the site is 939 acres of land and the City of Keene states on its site that the airport is approximately 1,000 acres in size. There are two runways servicing this airport. Runway 2-20 is the main runway with a length of 6,200 feet and runs north to south. There is a crosswind runway that is approximately 4,000 feet in length going in a northwesterly direction. No detailed description of the airport, its land or improvements is completed as part of this consultation report.

**Flood Hazard:**

The subject has portions of the site that appear to be located in a flood hazard zone as referenced by the National Flood Insurance Program/U.S. Department of Housing & Urban Development flood insurance rate map. It is noted that I am not qualified to make flood plain determinations. If the client is so concerned, an independent analysis and determination should be conducted by a qualified expert.

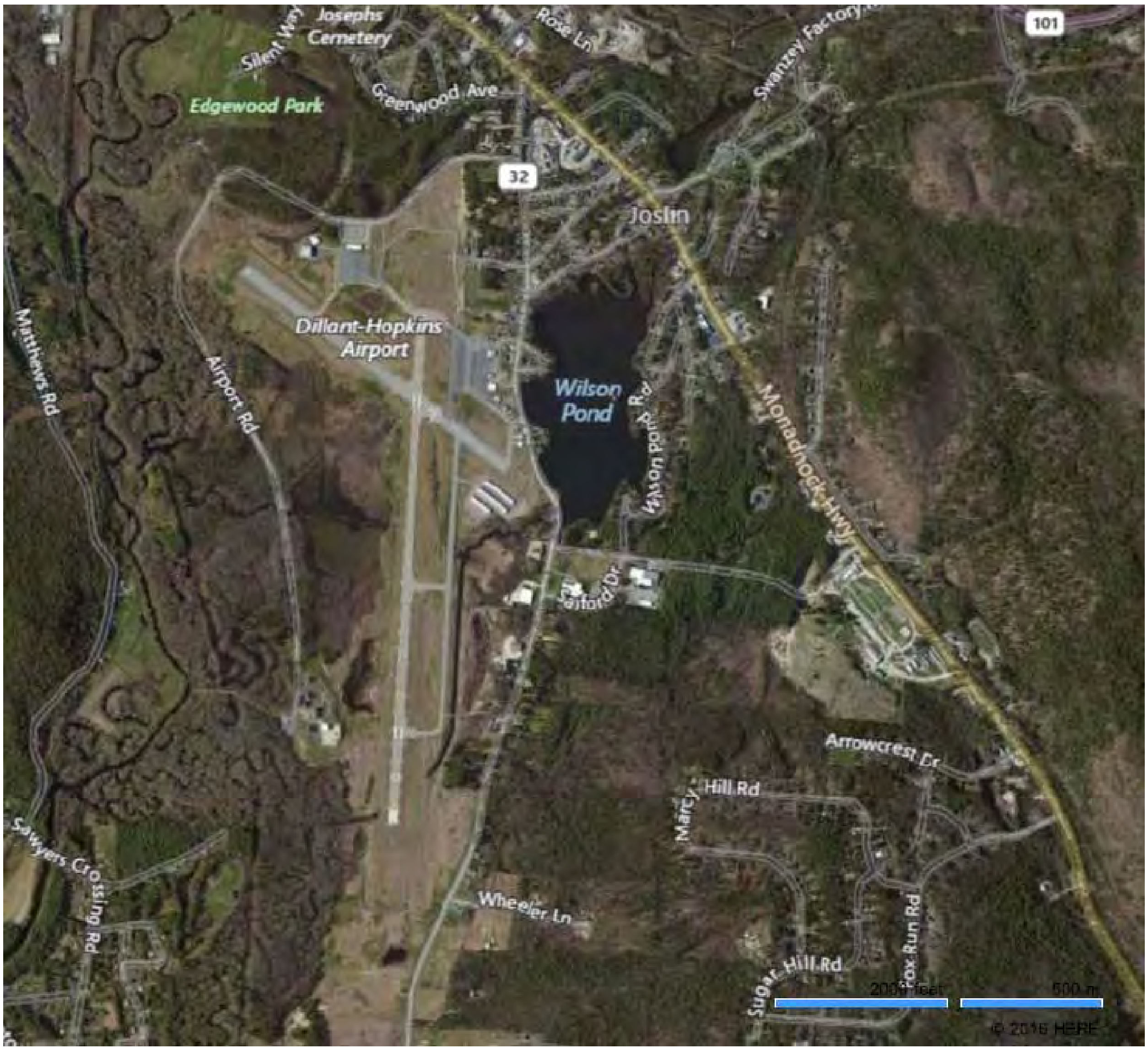
**Zoning:**

The subject property is located in the Airport Zoning District, as defined by the Town of Swanzey, NH. It is assumed the client is familiar with all the regulations pertaining to this particular neighborhood an, if not, are referred to the Town of Swanzey Zoning Ordinance for any clarifications needed. This consulting assignment does not require an analysis of zoning conformity and the reader is referred to the appropriate town officials as needed.

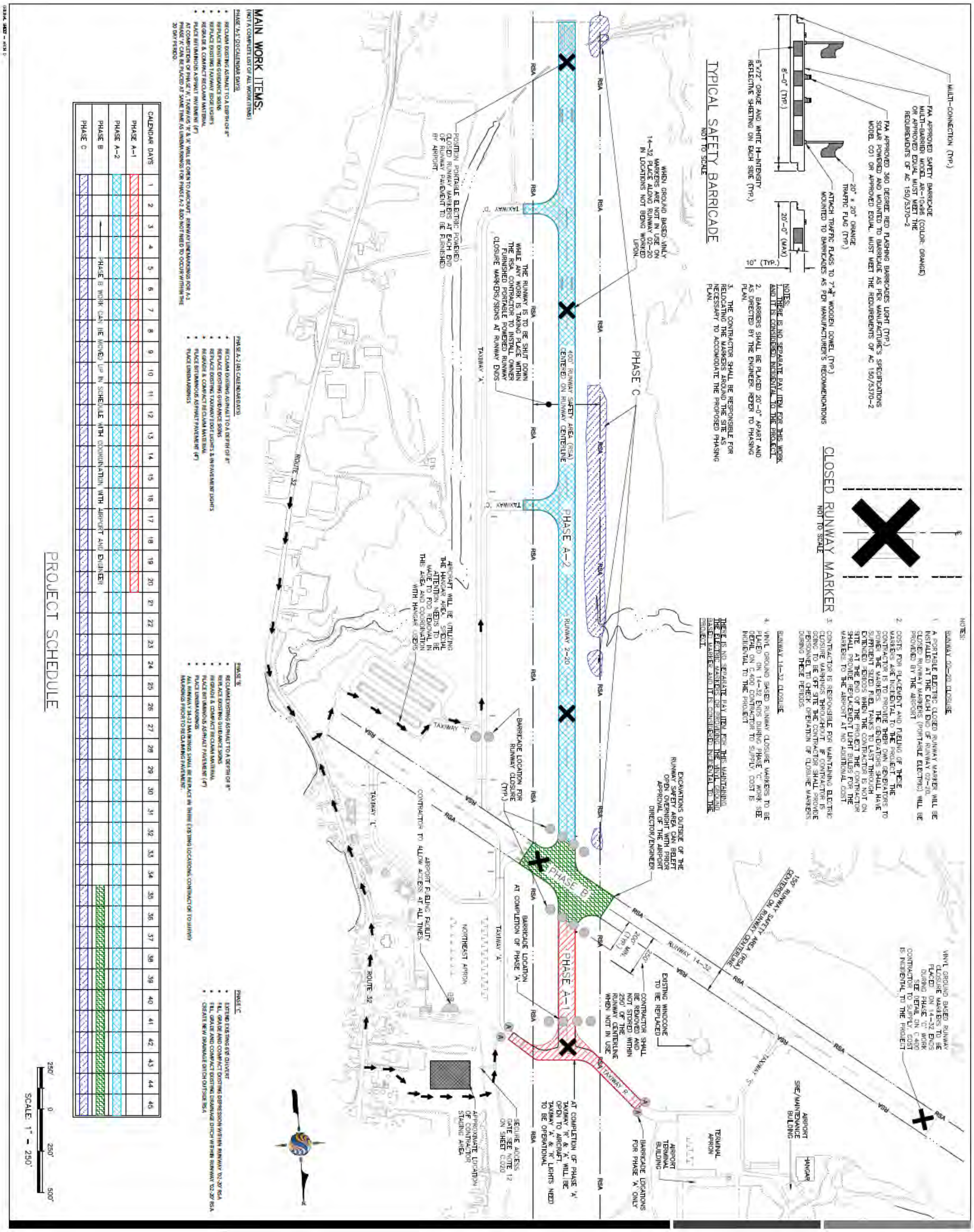
**Easements & Detrimental Conditions:**

I was not made aware of any detrimental conditions, easements, encroachments, or restrictions that exist on the subject property, which I would consider to adversely affect the marketability of the subject property. It appears there may be typical utility easements on the site. However, no examinations of legal documents pertaining to the airport were examined or were required to be examined as part of this consultation assignment. Therefore, if the client is so concerned, it is recommended that a professional title abstract be completed by a qualified expert.

## AERIAL VIEW – BING MAPS



## AIRPORT RUNWAY OVERVIEW



## FLOOD MAP

InterFlood by a la mode

Prepared for: Capital Appraisal Assoc., Inc.
80 Airport Rd
Keene, NH 03431-4415


Powered by CoreLogic©

MAP DATA

FEMA Special Flood Hazard Area: **No**
Map Number: **33005C0269E**
Zone: **X**
Map Date: **May 23, 2006**
FIPS: **33005**

MAP LEGEND

- Areas inundated by 500-year flooding
- Areas inundated by 100-year flooding
- Velocity Hazard
- Protected Areas
- Floodway
- Subject Area

## DATA COLLECTION PROCESS

### General Overview

Several different general aviation airports were contacted in order to examine their Exhibit A plans in order to located properties that have avigation easements on them. Dillant Hopkins Airport provided an extensive listing of properties that are encumbered with avigation easements. There are 16 separate properties that have avigation easements on them. The easements are on properties located in Swanzey, NH. Most of the easements were recorded in the Cheshire County Registry of Deeds and are referenced on that list. I also examined a list of avigation easements for Lebanon Airport in Lebanon, Nashua Municipal Airport – Boire Field, Skyhaven Airport in Rochester, Mt. Washington Regional Airport in Whitefield and Concord Airport. Lists of avigation easements are found on the Exhibit A- Airport Property Plans for each of these facilities. I limited my research to a 10-15 year period in order that I may be able to locate the data for some of the properties with avigation easements that sold. This is considered fairly important data to consider as it represents some of the more recent transfers of properties with an easement similar to those that may currently or possibly exist in the future.

In each case, where a property with an avigation easement was sold, I then completed a brief comparison and analysis of the sale by comparing it to other similar homes that sold in that community without an avigation easement. After making adjustments to the sales for differing features, the resulting difference, if any, could be attributed to the presence of the avigation easement. On the following pages are individual grids where I made an attempt to isolate the potential impact of the avigation easement. In each grid, the control is the property that sold with an existing avigation easement. The three additional sales found on the grids are similar properties from that community that sold without an avigation easement. Each grid is followed with the Multiple Listing Sheets for all of the sales analyzed. I will provide a brief summary analysis of the properties utilized and the adjustments that were applied as an introduction to each of the grids.

I was able to confirm 5 relatively recent sales of properties with avigation easements from the documents I examined. One is from Swanzey, two are from Rochester and another two are from Concord. They all occurred at different times in the market but the analysis that was completed centered on each date of transfer. Details of the properties are discussed prior to each grid analysis along with a summary of the adjustments.

**Swanzey Data**

297 Old Homestead Highway in Swanzey transferred on January 30, 2008. This is identified as the control property on the following grid. On May 8, 2006, an avigation easement on this property was granted to the City of Keene, NH. The property was marketed initially for $279,900. It was on the market for six months and the price was lowered to $229,900 on August 15, 2007. It went under agreement just two weeks later and closed in five (5) months. Even though this was a bank owned property at the time of sale, it is considered to satisfy the definition of an arm's length transfer.

The date of transfer for this property is January 30, 2008 and the three additional sales all occurred prior to that date. Each of the additional sales was found in the same town as the control but not located in a neighborhood adjacent to the airport. It is my opinion that the neighborhood locations for the comparables are considered similar to the subject neighborhood. No adjustments are made for location.

Adjustments made to the additional comparables include bedrooms and full baths at $4,000 each with half baths at $2,000. The comparables are adjusted for differences in gross living area by a market extracted $25 per square foot. This adjustment is not based on the cost to recreate the differing amounts of area. It is simply a measure of the market reaction to that difference. Comparables B-2 and B-3 are younger in actual and effective age as compared to Comparable B-1 and the control property. It is more typical that the market reacts to conditional differences rather than age. A negative 10% condition adjustment is applied. Each of the sales utilized has a different sized lot. However, in this community, little difference in contributory value could be supported by an adjustment. No lot size adjustment is applied. The control property has two separate garages. Garage space is adjusted at $5,000 per stall and is applied to the comparables as necessary. The control property is constructed on a slab and the other comparables have full basements. A negative $10,000 adjustment is applied to recognize the superior utility of having a basement. Minor adjustments are also applied for differences in porches, decks, fireplaces, sheds, in ground pool and other market recognized features. The adjustments made are not based on the cost of any particular feature. The adjustment is based on the contributory value of each item as observed in the market. Superior features on the additional comparables are recognized with a negative adjustment and inferior features are recognized with a positive adjustment.

**Reconciliation of Swanzey Data**

Based on the comparison of the control sale with the other comparables, a difference (delta) between their adjusted prices and the control is identified. That difference (delta) could represent the potential effect of an avigation easement. If the reconciled price of the comparables is higher than the sale price of the control, then a reasonable conclusion would be that the difference could be attributable to the presence of the avigation easement on the control. If the reconciled price of the comparable is lower than the sale price of the control, then the conclusion would be that little to no effect would occur as a result of the presence of the easement.

Comparable B-1 is 0.61% higher than the control. Comparable B-2 is 2.24% lower than the control. Comparable B-3 is 1.05% lower than the control. Based on this data set, it does not appear that the market would sustain an adjustment for the presence of an avigation easement. On the following page is the grid analysis along with the listing sheets for the control property and the three additional comparables.

## Swanzey Grid

| FACTOR | CONTROL 1 | COMP. B-1 | ADJ. | COMP. B-2 | ADJ. | COMP. B-3 | ADJ. |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| ADDRESS | 297 Old Homestead Hwy. | 134 Sawyer's Crossing Rd. | | 173 Partridgeberry Ln. | | 270 Cobble Hill Road | |
| | Swanzey | Swanzey | | Swanzey | | Swanzey | |
| DATE OF SALE | 1/30/2008 | 8/10/2007 | | 1/2/2008 | | 7/25/2008 | |
| SALES PRICE | $222,000 | $190,000 | | $215,000 | | $217,000 | |
| CONCESSIONS | ($11,200) | $0 | | $0 | | $0 | |
| NET SALES PRICE | $210,800 | $190,000 | | $215,000 | | $217,000 | |
| FINANCING TERMS | Conventional | Conventional | | Conventional | | Conventional | |
| SALE CONDITIONS | Typical | Typical | | Typical | | Typical | |
| TIME ADJUSTMENT | 0.0% | 0.0% | | 0.0% | | 0.0% | |
| ADJ. SALES PRICE | $210,800 | $190,000 | | $215,000 | | $217,000 | |
| LOCATION | Average | Average | | Average | | Average | |
| STYLE | Ranch | Ranch | | Split Level | | Ranch | |
| ROOM COUNT | 8-3-2.5 | 8-3-1.5 | $4,000 | 8-3-1.5 | $4,000 | 7-3-1.5 | $4,000 |
| GROSS LIVING AREA | 2,946 | 1,828 | $22,360 | 2,070 | $17,520 | 1,802 | $22,880 |
| QUALITY OF CONSTRUCTIO | Average | Similar | | Similar | | Similar | |
| HEAT | OFHW | OFHW | | Gas FWA | | OFWA | |
| AGE - ACTUAL & EFF. | A-66 E-20 | A-53 E-20 | | A-28 E-10 | | A-33 E-10 | |
| CONDITION | Average | Average | | Good (-10%) | ($21,500) | Good (-10%) | ($21,700) |
| LOT SIZE | 3.08 Ac. | 0.79 Ac. | N/A | 1.42 Ac. | N/A | 3.8 Ac. | N/A |
| ZONING | Res. | Res. | | Res. | | Res. | |
| UTILITIES | Private | Private | | Private | | Private | |
| PARKING | 2-Att. , 2 Det. | 1 Att. | $15,000 | 2 Att. | $10,000 | 2 Det. | $10,000 |
| PORCHES | Encl. & Scrnd | Encl. & Deck | | Scrnd Porch, Deck | | Open Porch | $4,000 |
| BASEMENT/FINISHED | Slab/N/A | 100%/0% | ($10,000) | 100%/0% | ($10,000) | 100% / 0% | ($10,000) |
| FRPL/WS | 2 Frpl | 1 Frpl | $2,000 | 1 Frpl | $2,000 | None | $4,000 |
| OTHER | None | None | | None | | IG Pool | ($10,000) |
| LOCATION INFLUENCE | AVIGATION EASEMENT | None | | None | | Shed | ($500) |
| | | | | | | | |
| NET ADJUSTMENTS | | | $33,360 | | $2,020 | | $2,680 |
| | | Delta | | Delta | | Delta | |
| INDICATED VALUE | $222,000 | 0.61% | $223,360 | -2.24% | $217,020 | -1.05% | $219,680 |

## Control Property

Previsite VTour URL **List:** 8/15/2007

**Sold:** 1/30/2008

**2673412 Note: Report Includes Internal Fields**

| | |
|---|---|
| **Listing Status** | Closed |
| **Price** | $222,000 |
| **Class** | Residential |
| **Type** | Single Family |
| **Address** | 297 Old Homestead Highway |
| **Unit/Lot #** | |
| **City** | Swanzey |
| **State-** | New Hampshire |
| **Zip** | 03446 |
| **VillDstLoc** | |
| **County** | NH-Cheshire |

| | |
|---|---|
| **Dev/Subd** | |
| **Rooms - Total** | 8 |
| **BedsTot** | 3 |
| **Baths - Full** | 1 |
| **Baths - 3/4** | 1 |
| **Baths - 1/2** | 1 |
| **SqFtFnAG** | 3,100 |
| **SqFtFnBG** | 0 |
| **Price/SqFtFnAG** | $71.61 |
| **Days On Market** | 14 |

**Remarks - Public** Great home for entertaining. Expansive island kitchen. Living room with fireplace and large dining room. Cozy den or office with fireplace, and 3 good sized bedroom. Home affords gracious living on one level. Two car attached as well as 2-car detached and large circular drive. Ready for immediate occupancy.

**Directions** From Keene Route 12 South - Right onto Route 32 South (aka Old Homestead Hwy). After Wilson Pond house on right.

### General Property Information

| | |
|---|---|
| **Year Built** | 1942 |
| **Taxes TBD** | |
| **TaxGrosAmt** | $4,737.00 |
| **Tax Year** | 2005 |
| **Tax Year Notes** | |
| **Garage Type** | Attached |
| **Garage Capacity** | 4 |
| **Basement** | |
| **SchDistrct** | Monadnock Sch Dst SAU #93 |
| **SchHigh** | Monadnock Regional High Sch |
| **SchMiddle** | Monadnock Regional Jr. High |
| **SchElem** | Mount Caesar School |

| | |
|---|---|
| **ROWParcAc** | |
| **ROWOthPar** | |
| **ROWLength** | |
| **ROWWidth** | |
| **WaterBody** | |
| **WatrBdyTp** | |
| **WaterAcc** | |
| **WtrFrnLgth** | |
| **Map** | 36 |
| **Block** | |
| **Lot** | 001 |
| **SPAN Number** | |

| | |
|---|---|
| **CS** | Wood Frame |
| **Lot - Acres** | 3.08 |
| **Total Stories** | |
| **PlanUrbDev** | |
| **Flood Zone** | Unknown |
| **Time/Frac** | No |
| **Resort** | |

**IN** Fireplace - Gas, Fireplace - Wood, Laundry - 1st Floor

**EX** Patio

**Fee**

### Property Features

| | |
|---|---|
| **Foreclosed/Bank-Owned/REO** | |
| **Short Sale** | |
| **Listing Type** | Exclusive Right |
| **Listing Service** | |
| **Buyer Agency** | 3.00 |
| **Buyer Agency Type** | % |
| **SubAgency** | 0.00 |
| **SubAgency Type** | % |
| **NonAgency Facilitator** | 3.00 |
| **NonAgency Facilitator Type** | % |
| **Transactional Broker** | |
| **Transactional Broker Type** | |
| **List Agent - Phone Number** | Off: 603-889-7600 |
| **Showing Instructions** | Call List Office, Combo Lockbox |

**Appliances** Dishwasher, Microwave, Range - Electric
**Exterior** Vinyl
**Heating** Baseboard, Hot Water

| | |
|---|---|
| **Prepared By** | Louis Manias |
| **Agent Phone** | Off: 603-228-9040 |
| **Office Name** | Capital Appraisal Assoc. |

| | |
|---|---|
| **Listing Agent** | David Millett |
| **Agent Phone** | Off: 603-889-7600 |
| **Listing Office** | BHG Masiello Nashua |

# Comparable B-1

**2641837 Note: Report Includes Internal Fields**

| | |
|---|---|
| **Listing Status** | Closed |
| **Price** | $190,000 |
| **Class** | Residential |
| **Type** | Single Family |
| **Address** | 134 Sawyers Crossing Road |
| **Unit/Lot #** | |
| **City** | Swanzey |
| **State-** | New Hampshire |
| **Zip** | 03446 |
| **VillDstLoc** | |
| **County** | NH-Cheshire |

| | |
|---|---|
| **Dev/Subd** | |
| **Rooms - Total** | 8 |
| **BedsTot** | 3 |
| **Baths - Full** | 1 |
| **Baths - 3/4** | 1 |
| **Baths - 1/2** | 0 |
| **SqFtFnAG** | 1,828 |
| **SqFtFnBG** | 0 |
| **Price/SqFtFnAG** | $103.94 |
| **Days On Market** | 128 |

Previsite VTour URL **List:** 3/10/2007

**Sold:** 8/10/2007

**Remarks - Public** Well constructed home w/frpl and hdwd flrs under carpet in most rms. Formal dining w/corner cabinet. Eat-in kit. Den and office/ldry area. 10-1 /2x14-/12 enclosed porch overlooking priv backyd. Very lg bsmt for playrm/workshop/storage. Nice area of Swanzey Ctr-close to Mt Caesar and Monadnock Regional Schools. Rails to trails and river access close.

**Directions** Matthews Rd to Sawyers Crossing Rd - Left thru covered bridge. Home on right 1/2 mile +/-.

## General Property Information

| | |
|---|---|
| **Year Built** | 1955 |
| **Taxes TBD** | |
| **TaxGrosAmt** | $4,057.00 |
| **Tax Year** | 2006 |
| **Tax Year Notes** | |
| **Garage Type** | Attached |
| **Garage Capacity** | 1 |
| **Basement** | |
| **SchDistrct** | |
| **SchHigh** | Monadnock Regional High Sch |
| **SchMiddle** | Monadnock Regional Jr. High |
| **SchElem** | Mount Caesar School |

| | |
|---|---|
| **ROWParcAc** | |
| **ROWOthPar** | |
| **ROWLength** | |
| **ROWWidth** | |
| **WaterBody** | |
| **WatrBdyTp** | |
| **WaterAcc** | |
| **WtrFrnLgth** | |
| **Map** | 41 |
| **Block** | |
| **Lot** | 125 |
| **SPAN Number** | |

| | |
|---|---|
| **CS** | Wood Frame |
| **Lot - Acres** | 0.79 |
| **Total Stories** | 1 |
| **PlanUrbDev** | |
| **Flood Zone** | No |
| **Time/Frac** | No |
| **Resort** | |

**IN** Attic, Fireplace - Wood, Walk-in Pantry, Laundry - 1st Floor

**EX** Porch

**Fee**

## Property Features

| | |
|---|---|
| **Foreclosed/Bank-Owned/REO** | |
| **Short Sale** | |
| **Listing Type** | Exclusive Right |
| **Listing Service** | |
| **Buyer Agency** | 2.50 |
| **Buyer Agency Type** | % |
| **SubAgency** | 0.00 |
| **SubAgency Type** | % |
| **NonAgency Facilitator** | 2.50 |
| **NonAgency Facilitator Type** | % |
| **Transactional Broker** | |
| **Transactional Broker Type** | |
| **List Agent - Phone Number** | Cell: 603-499-2499 |
| **Showing Instructions** | Call List Broker, Combo Lockbox |

**Appliances** Dishwasher, Disposal, Range - Electric, Refrigerator
**Exterior** Clapboard, Vinyl
**Heating** Baseboard, Hot Water

| | |
|---|---|
| **Prepared By** | Louis Manias |
| **Agent Phone** | Off: 603-228-9040 |
| **Office Name** | Capital Appraisal Assoc. |

| | |
|---|---|
| **Listing Agent** | Timothy S Keating |
| **Agent Phone** | Cell: 603-499-2499 |
| **Listing Office** | BH&G - The Masiello Group |

## Comparable B-2

**2684826 Note: Report Includes Internal Fields**

Previsite VTour URL **List:** 10/11/2007 **Sold:** 1/2/2008

| | |
|---|---|
| **Listing Status** | Closed |
| **Price** | $215,000 |
| **Class** | Residential |
| **Type** | Single Family |
| **Address** | 173 Partridgeberry Lane |
| **Unit/Lot #** | |
| **City** | Swanzey |
| **State-** | New Hampshire |
| **Zip** | 03446 |
| **VillDstLoc** | |
| **County** | NH-Cheshire |

| | |
|---|---|
| **Dev/Subd** | |
| **Rooms - Total** | 8 |
| **BedsTot** | 3 |
| **Baths - Full** | 1 |
| **Baths - 3/4** | 1 |
| **Baths - 1/2** | 0 |
| **SqFtFnAG** | 0 |
| **SqFtFnBG** | 0 |
| **Price/SqFtFnAG** | |
| **Days On Market** | 3 |

**Remarks - Public** Enjoy this multi level home in a peaceful country setting. 3 to 4 bedrooms, 2 baths, fireplace and screened porch for summer enjoyment. Short distance to schools. Nature walk close by. Home warranty included.

**Directions** From Monadnock High School: Take Route 32 toward W. Swanzey - Take Left on Rolling Wood - At top of hill go Left - 2nd on Left.

### General Property Information

| | |
|---|---|
| **Year Built** | 1980 |
| **Taxes TBD** | |
| **TaxGrosAmt** | $4,220.00 |
| **Tax Year** | 2007 |
| **Tax Year Notes** | |
| **Garage Type** | Attached |
| **Garage Capacity** | 2 |
| **Basement** | |
| **SchDistrct** | Monadnock Sch Dst SAU #93 |
| **SchHigh** | Monadnock Regional High Sch |
| **SchMiddle** | Monadnock Regional Jr. High |
| **SchElem** | Mount Caesar School |

| | |
|---|---|
| **ROWParcAc** | |
| **ROWOthPar** | |
| **ROWLength** | |
| **ROWWidth** | |
| **WaterBody** | |
| **WatrBdyTp** | |
| **WaterAcc** | |
| **WtrFrnLgth** | |
| **Map** | 41 |
| **Block** | |
| **Lot** | 033 |
| **SPAN Number** | |

| | |
|---|---|
| **CS** | Wood Frame |
| **Lot - Acres** | 1.42 |
| **Total Stories** | |
| **PlanUrbDev** | |
| **Flood Zone** | No |
| **Time/Frac** | No |
| **Resort** | |

**IN** Dining Area, Fireplace - Wood, Kitchen Island, Laundry Hook-ups, Master BR w/ BA, Window Treatment, Laundry - 1st Floor

**EX** Porch, Porch - Screened

**Fee**

### Property Features

| | |
|---|---|
| **Foreclosed/Bank-Owned/REO** | |
| **Short Sale** | |
| **Listing Type** | Exclusive Right |
| **Listing Service** | |
| **Buyer Agency** | 2.50 |
| **Buyer Agency Type** | % |
| **SubAgency** | 0.00 |
| **SubAgency Type** | % |
| **NonAgency Facilitator** | 2.50 |
| **NonAgency Facilitator Type** | % |
| **Transactional Broker** | |
| **Transactional Broker Type** | |
| **List Agent - Phone Number** | Cell: 603-361-5897 |
| **Showing Instructions** | Call List Broker |

**Appliances** Dishwasher, Disposal, Range - Electric, Refrigerator
**Exterior** Vinyl
**Heating** Gas Heater, Hot Air

| | |
|---|---|
| **Prepared By** | Louis Manias |
| **Agent Phone** | Off: 603-228-9040 |
| **Office Name** | Capital Appraisal Assoc. |

| | |
|---|---|
| **Listing Agent** | Nancy Proctor |
| **Agent Phone** | Cell: 603-361-5897 |
| **Listing Office** | BH&G - The Masiello Group |

## Comparable B-3

Previsite VTour URL **List:** 5/25/2008

**Sold:** 7/25/2008

**2723771 Note: Report Includes Internal Fields**

| | |
|---|---|
| **Listing Status** | Closed |
| **Price** | $217,000 |
| **Class** | Residential |
| **Type** | Single Family |
| **Address** | 270 Cobble Hill Road |
| **Unit/Lot #** | |
| **City** | Swanzey |
| **State-** | New Hampshire |
| **Zip** | 03446 |
| **VillDstLoc** | |
| **County** | NH-Cheshire |

| | |
|---|---|
| **Dev/Subd** | |
| **Rooms - Total** | 7 |
| **BedsTot** | 3 |
| **Baths - Full** | 1 |
| **Baths - 3/4** | 0 |
| **Baths - 1/2** | 1 |
| **SqFtFnAG** | 1,830 |
| **SqFtFnBG** | 0 |
| **Price/SqFtFnAG** | $118.58 |
| **Days On Market** | 8 |

**Remarks - Public** This Executive Ranch boasts pride of ownership and features many recent improvements. Vaulted ceiling in master bedroom and family room, open concept living room, dining room and kitchen area. The perfect floor plan for entertaining. Partially finished basement ready for final touches. Spacious yard area and inground pool. All on 3.8+/- ac of land.

**Directions** Rt 10S towards Winchester. Bear right after Gamarlo's Market. Follow 1 mile to #270. Property on the left.

### General Property Information

| | |
|---|---|
| **Year Built** | 1975 |
| **Taxes TBD** | |
| **TaxGrosAmt** | $4,142.00 |
| **Tax Year** | 2008 |
| **Tax Year Notes** | |
| **Garage Type** | Detached |
| **Garage Capacity** | 2 |
| **Basement** | |
| **SchDistrct** | |
| **SchHigh** | Monadnock Regional High Sch |
| **SchMiddle** | Monadnock Regional Jr. High |
| **SchElem** | Mount Caesar School |

| | |
|---|---|
| **ROWParcAc** | |
| **ROWOthPar** | |
| **ROWLength** | |
| **ROWWidth** | |
| **WaterBody** | |
| **WatrBdyTp** | |
| **WaterAcc** | |
| **WtrFrnLgth** | |
| **Map** | 87 |
| **Block** | |
| **Lot** | 07 |
| **SPAN Number** | |

| | |
|---|---|
| **CS** | Modular Prefab |
| **Lot - Acres** | 3.80 |
| **Total Stories** | 1 |
| **PlanUrbDev** | |
| **Flood Zone** | No |
| **Time/Frac** | No |
| **Resort** | |

**IN** Ceiling Fan, Walk-in Pantry

**EX** Outbuilding, Patio, Pool - In Ground

**Fee**

### Property Features

| | |
|---|---|
| **Foreclosed/Bank-Owned/REO** | |
| **Short Sale** | |
| **Listing Type** | Exclusive Right |
| **Listing Service** | |
| **Buyer Agency** | 2.50 |
| **Buyer Agency Type** | % |
| **SubAgency** | 0.00 |
| **SubAgency Type** | % |
| **NonAgency Facilitator** | 2.50 |
| **NonAgency Facilitator Type** | % |
| **Transactional Broker** | |
| **Transactional Broker Type** | |
| **List Agent - Phone Number** | Cell: 603-566-2618 |
| **Showing Instructions** | Call List Broker, Combo Lockbox |

**Appliances** Dishwasher, Refrigerator
**Exterior** Vertical, Wood
**Features - Accessibility** 1st Floor Full Bathroom, One-Level Home
**Heating** Hot Air

| | |
|---|---|
| **Prepared By** | Louis Manias |
| **Agent Phone** | Off: 603-228-9040 |
| **Office Name** | Capital Appraisal Assoc. |

| | |
|---|---|
| **Listing Agent** | Pat Paquette |
| **Agent Phone** | Cell: 603-566-2618 |
| **Listing Office** | BH&G - The Masiello Group |

**Rochester Data #1**

296 Rochester Hill Road in Rochester transferred on March 27, 2015. This is identified as the control property on the following grid. On April 26, 1985, an avigation easement on this property was granted to the City of Rochester, NH. The property was marketed $190,000. It was on the market for 43 days before going under agreement. It closed six weeks later for the price indicated. This is considered an arm’s length transfer. The sale price of $194,500 included a seller concession of $7,000 leaving a net sales price of $187,500.

The date of transfer for this property is March 27, 2015 and the three additional sales all occurred prior to that date. Each of the additional sales was found in the same town as the control but not located in a neighborhood adjacent to the airport. It is my opinion that the neighborhood locations for the comparables are considered similar to the subject neighborhood. No adjustments are made for location.

Adjustments made to the additional comparables include bedrooms and full baths at $4,000 each with half baths at $2,000. The comparables are adjusted for differences in gross living area by a market extracted $25 per square foot. This adjustment is not based on the cost to recreate the differing amounts of area. It is simply a measure of the market reaction to that difference. Comparables B-1 and B-2 are slightly younger in actual and effective age as compared to the control property. Comparable B-3 is a much newer home. It is more typical that the market reacts to conditional differences rather than age. A negative 5% and 10% condition adjustment is applied respectively. Each of the sales utilized has a different sized lot. However, in this community, little difference in contributory value could be supported by an adjustment. No lot size adjustment is applied. The control property has two separate garages. Garage space is adjusted at $5,000 per stall and is applied to the comparables as necessary. Minor adjustments are also applied for differences in porches, decks, fireplaces, sheds, pellet stoves and other market recognized features. The adjustments made are not based on the cost of any particular feature. The adjustment is based on the contributory value of each item as observed in the market. Superior features on the additional comparables are recognized with a negative adjustment and inferior features are recognized with a positive adjustment.

**Reconciliation of Rochester Data #1**

Based on the comparison of the control sale with the other comparables, a difference (delta) between their adjusted prices and the control is identified. That difference (delta) could represent the potential effect of an avigation easement. If the reconciled price of the comparables is higher than the sale price of the control, then a reasonable conclusion would be that the difference could be attributable to the presence of the avigation easement on the control. If the reconciled price of the comparable is lower than the sale price of the control, then the conclusion would be that little to no effect would occur as a result of the presence of the easement.

Comparable B-1 is 3.34% higher than the control. Comparable B-2 is 6.11% higher than the control. Comparable B-3 is 2.87% higher than the control. Based on this data set, it appears there might be a slight impact of negative 2 to 6% for a property that has an avigation easement. Although the next data set, also from Rochester might prove otherwise. On the following page is the grid analysis along with the listing sheets for the control property and the three additional comparables.

## Rochester Grid #1

| FACTOR | CONTROL 1 | COMP. B-1 | ADJ. | COMP. B-2 | ADJ. | COMP. B-3 | ADJ. |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| ADDRESS | 296 Rochester Hill Road | 6 Landry Lane | | 99 Eastern Avenue | | 18 Copper Lane | |
| | Rochester | Rochester | | Rochester | | Rochester | |
| DATE OF SALE | 3/27/2015 | 10/3/2014 | | 9/22/2014 | | 9/2/2014 | |
| SALES PRICE | $194,500 | $199,900 | | $199,900 | | $212,000 | |
| CONCESSIONS | ($7,000) | $0 | | $0 | | $0 | |
| NET SALES PRICE | $187,500 | $199,900 | | $199,900 | | $212,000 | |
| FINANCING TERMS | Conventional | Conventional | | Conventional | | Conventional | |
| SALE CONDITIONS | Typical | Typical | | Typical | | Typical | |
| TIME ADJUSTMENT | 0.0% | 0.0% | | 0.0% | | 0.0% | |
| ADJ. SALES PRICE | $187,500 | $199,900 | | $199,900 | | $212,000 | |
| LOCATION | Average | Average | | Average | | Average | |
| STYLE | Ranch | Ranch | | Raised Ranch | | Ranch | |
| ROOM COUNT | 8-4-2 | 6-3-2 | $4,000 | 6-3-2 | $4,000 | 8-3-2.5 | $2,000 |
| GROSS LIVING AREA | 1,746 | 1,728 | $360 | 1,543 | $4,060 | 1,792 | ($920) |
| QUALITY OF CONSTRUCTION | Average | Similar | | Similar | | Similar | |
| HEAT | OFHW | OFHW | | OFHW | | OFHW | |
| AGE - ACTUAL & EFF. | A-46 E-20 | A-28 E-10 | | A-28 E-10 | | A-13 E-5 | |
| CONDITION | Average | Sl. Superior (-5%) | ($10,000) | Sl. Superior (-5%) | ($10,000) | Good (-10%) | ($21,200) |
| LOT SIZE | 2.4 Ac. | 2.67 Ac. | N/A | 0.77 Ac. | N/A | 0.71 Ac. | N/A |
| ZONING | Res. | Res. | | Res. | | Res. | |
| UTILITIES | Private | Private | | Public | N/A | Public | N/A |
| PARKING | 2 Det. & 1 Det. | 2 Att. | $5,000 | 2 Att. | $5,000 | 2 Att. | $5,000 |
| PORCHES | Entry Deck | Cov. Porch & Deck | ($4,000) | Open Porch, Deck | ($4,000) | Cov. Porch, Deck | ($4,000) |
| BASEMENT/FINISHED | 100%/0% | 100%/0% | | 100%/0% | | 100% / 0% | |
| FRPL/WS | None | Pellet Stove | ($1,500) | None | | None | |
| OTHER | None | None | | None | | None | |
| LOCATION INFLUENCE | AVIGATION EASEMENT | None | | None | | None | |
| | | | | | | | |
| NET ADJUSTMENTS | | | ($6,140) | | ($940) | | ($19,120) |
| | | Delta | | Delta | | Delta | |
| INDICATED VALUE | $187,500 | 3.34% | $193,760 | 6.11% | $198,960 | 2.87% | $192,880 |

## Control Property

**4397247 Note: Report Includes Internal Fields**

Previsite VTour URL **List:** 12/24/2014

**Sold:** 3/27/2015

| | |
|---|---|
| **Listing Status** | Closed |
| **Price** | $194,500 |
| **Class** | Residential |
| **Type** | Single Family |
| **Address** | 296 Rochester Hill Road |
| **Unit/Lot #** | |
| **City** | Rochester |
| **State-** | New Hampshire |
| **Zip** | 03867 |
| **VillDstLoc** | |
| **County** | NH-Strafford |

| | |
|---|---|
| **Dev/Subd** | |
| **Rooms - Total** | 8 |
| **BedsTot** | 4 |
| **Baths - Full** | 1 |
| **Baths - 3/4** | 1 |
| **Baths - 1/2** | 0 |
| **SqFtFnAG** | 1,746 |
| **SqFtFnBG** | 0 |
| **Price/SqFtFnAG** | $111.40 |
| **Days On Market** | 43 |

**Remarks - Public** Looking for a single-level home to commute from, with space for everyone, on a beautiful piece of picturesque land? As you meander down the driveway, you'll be welcomed home to this spacious four bedroom house with a two-car garage. This space has everything you're looking for: a solid house with a layout that is conducive to all things home -- perfect for entertaining, playing, enjoying, celebrating, and living. The property is zoned agricultural, so bring along the animals and enjoy the natural environment and the wildlife that is naturally drawn to this level lot, bordered by trees. The extra outbuilding and garage have so many uses, so bring along the tools and toys! Just minutes to Dover and Portsmouth, this location provides the privacy and accessibility that you seek. Very easy to show. If you're looking to take a property from solid to stunning, this home is the perfect canvas!

**Directions**

### General Property Information

| | |
|---|---|
| **Year Built** | 1969 |
| **Taxes TBD** | No |
| **TaxGrosAmt** | $4,878.67 |
| **Tax Year** | 2014 |
| **Tax Year Notes** | |
| **Garage Type** | Detached |
| **Garage Capacity** | 3 |
| **Basement** | Yes |
| **SchDistrct** | Rochester School District |
| **SchHigh** | Spaulding High School |
| **SchMiddle** | Rochester Middle School |
| **SchElem** | |

**ROWParcAc**
**ROWOthPar**
**ROWLength**
**ROWWidth**
**WaterBody**
**WatrBdyTp**
**WaterAcc**
**WtrFrnLgth**
**Map**
**Block**
**Lot**
**SPAN Number**

| | |
|---|---|
| **CS** | Existing, Wood Frame |
| **Lot - Acres** | 2.40 |
| **Total Stories** | 1 |
| **PlanUrbDev** | |
| **Flood Zone** | No |
| **Time/Frac** | No |
| **Resort** | |

**IN** Kitchen/Dining

**EX** Outbuilding

**Fee**

### Property Features

| | |
|---|---|
| **Foreclosed/Bank-Owned/REO** | No |
| **Short Sale** | No |
| **Listing Type** | Exclusive Agency |
| **Listing Service** | |
| **Buyer Agency** | 2.50 |
| **Buyer Agency Type** | % |
| **SubAgency** | 0.00 |
| **SubAgency Type** | % |
| **NonAgency Facilitator** | 2.50 |
| **NonAgency Facilitator Type** | % |
| **Transactional Broker** | |
| **Transactional Broker Type** | |
| **List Agent - Phone Number** | Cell: 603-833-7051 |
| **Showing Instructions** | 24 Hour Notice, Showings by Email |

**Appliances** Dishwasher, Range - Electric, Refrigerator
**Exterior** Vinyl
**Features - Accessibility** 1st Floor 3/4 Bathroom, 1st Floor Full Bathroom, 1st Floor Hrd Surfce Flr, No Stairs, One-Level Home
**Heating** Hot Water

| | |
|---|---|
| **Prepared By** | Louis Manias |
| **Agent Phone** | Off: 603-228-9040 |
| **Office Name** | Capital Appraisal Assoc. |

| | |
|---|---|
| **Listing Agent** | Christina Laroche |
| **Agent Phone** | Cell: 603-833-7051 |
| **Listing Office** | Bean Group / Portsmouth |

## Comparable B-1

**4371058 Note: Report Includes Internal Fields**

| | |
|---|---|
| **Listing Status** | Closed |
| **Price** | $199,900 |
| **Class** | Residential |
| **Type** | Single Family |
| **Address** | 6 Landry Lane |
| **Unit/Lot #** | |
| **City** | Rochester |
| **State-** | New Hampshire |
| **Zip** | 03839 |
| **VillDstLoc** | |
| **County** | NH-Strafford |

| | |
|---|---|
| **Dev/Subd** | |
| **Rooms - Total** | 6 |
| **BedsTot** | 3 |
| **Baths - Full** | 2 |
| **Baths - 3/4** | 0 |
| **Baths - 1/2** | 0 |
| **SqFtFnAG** | 1,728 |
| **SqFtFnBG** | 0 |
| **Price/SqFtFnAG** | $115.68 |
| **Days On Market** | 7 |

Previsite VTour URL **List:** 7/14/2014

**Sold:** 10/3/2014

**Remarks - Public** Beautiful, Custom Built, Expanded Ranch Home Boasting Spacious, 1 Level Living W/Over-Sized Front To Back Eat-In-Kitchen, Living Room With Pellet Stove & Vaulted Ceiling, Family Room, Master Bedroom W/Private, Full Bathroom, 2 Additional Bedrooms, 1 Additional Full Bathroom, Large, Unfinished Basement, 2 Car Attached Garage W/Direct Entry, Back Yard W/Deck, Farmer's Porch & 2.67 Acres On A Cull-De-Sac In Beautiful Setting. Short Sale Subject To Sellers' Lender's Approval.

**Directions** Route 125 (Gonic Road) To Loring Drive, Take First Right Onto Landry Lane. #6 Landry Lane Is On The Right.

### General Property Information

| | |
|---|---|
| **Year Built** | 1987 |
| **Taxes TBD** | No |
| **TaxGrosAmt** | $5,702.00 |
| **Tax Year** | 2013 |
| **Tax Year Notes** | |
| **Garage Type** | Attached |
| **Garage Capacity** | 2 |
| **Basement** | Yes |
| **SchDistrct** | |
| **SchHigh** | |
| **SchMiddle** | |
| **SchElem** | |

| | |
|---|---|
| **ROWParcAc** | |
| **ROWOthPar** | |
| **ROWLength** | |
| **ROWWidth** | |
| **WaterBody** | |
| **WatrBdyTp** | |
| **WaterAcc** | |
| **WtrFrnLgth** | |
| **Map** | |
| **Block** | |
| **Lot** | |
| **SPAN Number** | |

| | |
|---|---|
| **CS** | Existing, Wood Frame |
| **Lot - Acres** | 2.67 |
| **Total Stories** | 1 |
| **PlanUrbDev** | |
| **Flood Zone** | Unknown |
| **Time/Frac** | No |
| **Resort** | |

**IN** Blinds, Cathedral Ceiling, Ceiling Fan, Kitchen Island , Master BR w/ BA, Natural Woodwork, Skylight, Vaulted Ceiling, Walk-in Closet, Window Treatment

**EX** Deck, Porch - Covered

**Fee**

### Property Features

| | |
|---|---|
| **Foreclosed/Bank-Owned/REO** | No |
| **Short Sale** | Yes |
| **Listing Type** | Exclusive Right |
| **Listing Service** | |
| **Buyer Agency** | 2.00 |
| **Buyer Agency Type** | % |
| **SubAgency** | 0.00 |
| **SubAgency Type** | % |
| **NonAgency Facilitator** | 2.00 |
| **NonAgency Facilitator Type** | % |
| **Transactional Broker** | |
| **Transactional Broker Type** | |
| **List Agent - Phone Number** | Cell: 603-617-0806 |
| **Showing Instructions** | 24 Hour Notice, Combo Lockbox, Owner Occupied, Showing Via Appt Service |

**Appliances** Dishwasher, Range - Electric, Refrigerator
**Exterior** Vinyl
**Features - Accessibility** 1st Floor Bedroom, 1st Floor Full Bathroom, 1st Floor Hrd Surfce Flr, 1st Floor Low-Pile Carpet, Bathroom w/Tub, One-Level Home
**Heating** Alternative Heat Stove, Baseboard, Hot Water, Stove - Pellet, Stove - Wood

| | |
|---|---|
| **Prepared By** | Louis Manias |
| **Agent Phone** | Off: 603-228-9040 |
| **Office Name** | Capital Appraisal Assoc. |

| | |
|---|---|
| **Listing Agent** | Lisa M Corbin-Walker |
| **Agent Phone** | Cell: 603-617-0806 |
| **Listing Office** | Versailles Properties |

## Comparable B-2

**4375664 Note: Report Includes Internal Fields**

Previsite VTour URL **List:** 8/4/2014

**Sold:** 9/22/2014

| | |
|---|---|
| **Listing Status** | Closed |
| **Price** | $199,900 |
| **Class** | Residential |
| **Type** | Single Family |
| **Address** | 99 Eastern Avenue |
| **Unit/Lot #** | |
| **City** | Rochester |
| **State-** | New Hampshire |
| **Zip** | 03867 |
| **VillDstLoc** | |
| **County** | NH-Strafford |

| | |
|---|---|
| **Dev/Subd** | |
| **Rooms - Total** | 6 |
| **BedsTot** | 3 |
| **Baths - Full** | 1 |
| **Baths - 3/4** | 1 |
| **Baths - 1/2** | 0 |
| **SqFtFnAG** | 1,543 |
| **SqFtFnBG** | 0 |
| **Price/SqFtFnAG** | $129.55 |
| **Days On Market** | 7 |

**Remarks - Public** Elegant, Spacious, Private, Open Concept, Comfortable, Picturesque, Bright....are all words to describe this Beautiful Home. This three bedroom raised ranch boosts many desirable features such as: Private .77 acre lot, Beautiful Flower Gardens Galore, Central Air, Whole House Auto on Generator, Large Deck, Nearly all new Windows, Stainless steel Stove & Refrigerator less than a year old, Awesome Kitchen, Great Room, Over sized Garage, Master Suite and Much More. Move in Ready for You!

**Directions** Spaulding Turnpike North to Exit 16 toward RT-125/E. ROCHESTER/SANFORD ME.Turn SLIGHT RIGHT onto US-202/RT-11 Take the 1st Right onto Eastern Ave.. House / Sign is on the left.

### General Property Information

| | |
|---|---|
| **Year Built** | 1986 |
| **Taxes TBD** | No |
| **TaxGrosAmt** | $4,731.00 |
| **Tax Year** | 2012 |
| **Tax Year Notes** | |
| **Garage Type** | Attached |
| **Garage Capacity** | 2 |
| **Basement** | Yes |
| **SchDistrct** | |
| **SchHigh** | |
| **SchMiddle** | |
| **SchElem** | |

**ROWParcAc**
**ROWOthPar**
**ROWLength**
**ROWWidth**
**WaterBody**
**WatrBdyTp**
**WaterAcc**
**WtrFrnLgth**
**Map**
**Block**
**Lot**
**SPAN Number**

| | |
|---|---|
| **CS** | Modular Prefab, Wood Frame |
| **Lot - Acres** | 0.77 |
| **Total Stories** | 1 |
| **PlanUrbDev** | |
| **Flood Zone** | Unknown |
| **Time/Frac** | No |
| **Resort** | |

**IN** Cathedral Ceiling, Ceiling Fan, Laundry Hook-ups, Master BR w/ BA, Walk-in Closet

**EX** Deck, Patio

**Fee**

### Property Features

| | |
|---|---|
| **Foreclosed/Bank-Owned/REO** | No |
| **Short Sale** | No |
| **Listing Type** | Exclusive Right |
| **Listing Service** | |
| **Buyer Agency** | 2.50 |
| **Buyer Agency Type** | % |
| **SubAgency** | 0.00 |
| **SubAgency Type** | % |
| **NonAgency Facilitator** | 2.50 |
| **NonAgency Facilitator Type** | % |
| **Transactional Broker** | |
| **Transactional Broker Type** | |
| **List Agent - Phone Number** | Cell: 603-312-1164 |
| **Showing Instructions** | Call List Agent |

**Appliances** Dishwasher, Exhaust Hood, Microwave, Range - Gas, Refrigerator
**Exterior** Vinyl
**Heating** Baseboard, Hot Water
**Cooling** Air Conditioner, Central AC

| | | | |
|---|---|---|---|
| **Prepared By** | Louis Manias | **Listing Agent** | Pat Qualey |
| **Agent Phone** | Off: 603-228-9040 | **Agent Phone** | Cell: 603-312-1164 |
| **Office Name** | Capital Appraisal Assoc. | **Listing Office** | Hourihane, Cormier & Assoc |

## Comparable B-3

Previsite VTour URL **List:** 4/11/2014

**Sold:** 9/2/2014

**4347392 Note: Report Includes Internal Fields**

| | |
|---|---|
| **Listing Status** | Closed |
| **Price** | $212,000 |
| **Class** | Residential |
| **Type** | Single Family |
| **Address** | 18 Copper Lane Lane |
| **Unit/Lot #** | |
| **City** | Rochester |
| **State-** | New Hampshire |
| **Zip** | 03868 |
| **VillDstLoc** | |
| **County** | NH-Strafford |

| | |
|---|---|
| **Dev/Subd** | |
| **Rooms - Total** | 8 |
| **BedsTot** | 3 |
| **Baths - Full** | 2 |
| **Baths - 3/4** | 0 |
| **Baths - 1/2** | 1 |
| **SqFtFnAG** | 1,782 |
| **SqFtFnBG** | 0 |
| **Price/SqFtFnAG** | $118.97 |
| **Days On Market** | 109 |

**Remarks - Public** Not a short sale, not a foreclosure - a completely move in ready affordable home in a quiet and peaceful cul-de-sac neighborhood awaiting it's lucky new owners. This three bedroom, three bath home has ample space for all, great storage, an open concept kitchen, and a wonderful lay out providing space along with privacy and quiet spots. This newer constructed home is low maintenance with high quality siding, composite decking on the front farmer's porch, a deck along the private back yard, and a yard size just right for play and gardening but no need to spend all weekend maintaining. First floor living at it's best. A large, dry, tall ceiling wide open basement could provide extra living space if needed. Close to major commuting routes and amenities, yet quiet and the nearby Salmon Falls River makes for a peaceful retreat at the end of the day. Easy to show. Welcome Home!

**Directions** Spaulding Turnpike/Rt 16 to Exit 16. Stay right onto US 202E/NH 11E toward NH 125E E Rochester/Sanford. Turn right onto Main Street, Left on Crowhill Road, Left on Copper Lane. #18 is on your left. Look for posted sign.

### General Property Information

| | |
|---|---|
| **Year Built** | 2001 |
| **Taxes TBD** | No |
| **TaxGrosAmt** | $5,939.78 |
| **Tax Year** | 2013 |
| **Tax Year Notes** | |
| **Garage Type** | Attached |
| **Garage Capacity** | 2 |
| **Basement** | Yes |
| **SchDistrct** | |
| **SchHigh** | Spaulding High School |
| **SchMiddle** | Rochester Middle School |
| **SchElem** | |

| | |
|---|---|
| **ROWParcAc** | |
| **ROWOthPar** | |
| **ROWLength** | |
| **ROWWidth** | |
| **WaterBody** | Salmon Falls River |
| **WatrBdyTp** | River |
| **WaterAcc** | Shared Private |
| **WtrFrnLgth** | |
| **Map** | |
| **Block** | |
| **Lot** | |
| **SPAN Number** | |

| | |
|---|---|
| **CS** | Existing, Wood Frame |
| **Lot - Acres** | 0.71 |
| **Total Stories** | 1 |
| **PlanUrbDev** | |
| **Flood Zone** | Unknown |
| **Time/Frac** | No |
| **Resort** | |

**IN** Dining Area, Laundry Hook-ups, Master BR w/ BA, Laundry - 1st Floor

**EX** Deck, Porch - Covered, ROW to Water, Windows - Storm

**Fee**

### Property Features

| | |
|---|---|
| **Foreclosed/Bank-Owned/REO** | No |
| **Short Sale** | No |
| **Listing Type** | Exclusive Right |
| **Listing Service** | |
| **Buyer Agency** | 2.50 |
| **Buyer Agency Type** | % |
| **SubAgency** | 0.00 |
| **SubAgency Type** | % |
| **NonAgency Facilitator** | 2.00 |
| **NonAgency Facilitator Type** | % |
| **Transactional Broker** | |
| **Transactional Broker Type** | |
| **List Agent - Phone Number** | Cell: 603-475-7513 |
| **Showing Instructions** | 24 Hour Notice, Appointment, Assisted Showings Reqrd, Call List Agent, Security System, Showing Use ICON, Showings by Email, Sign on Property |

**Appliances** Dishwasher, Range - Electric, Refrigerator
**Exterior** Vinyl
**Features - Accessibility** 1st Floor 1/2 Bathroom, 1st Floor 3/4 Bathroom, 1st Floor Bedroom, 1st Floor Full Bathroom, 1st Floor Hrd Surfce Flr, 1st Floor Low-Pile Carpet, Access Laundry No Steps, Bathroom w/Tub, Kitchen w/5 Ft. Diameter, One-Level Home
**Heating** Baseboard, Hot Water, Multi Zone
**Cooling** Multi Zone

| | |
|---|---|
| **Prepared By** | Louis Manias |
| **Agent Phone** | Off: 603-228-9040 |
| **Office Name** | Capital Appraisal Assoc. |

| | |
|---|---|
| **Listing Agent** | Sue Doyle |
| **Agent Phone** | Cell: 603-475-7513 |
| **Listing Office** | Keller Williams Coastal Realty |

**Rochester Data #2**

265 Rochester Hill Road in Rochester transferred on June 1, 2007. This is identified as the control property on the following grid. On August 8, 1991, an avigation easement on this property was granted to the City of Rochester, NH. The property was marketed for $299,900. It was on the market for 13 days before going under agreement. It closed 30 days later for the price indicated. This is considered an arm's length transfer.

The date of transfer for this property is June 1, 2007 and the three additional sales all occurred prior to that date. Each of the additional sales was found in the same town as the control but not located in a neighborhood adjacent to the airport. It is my opinion that the neighborhood locations for the comparables are considered similar to the subject neighborhood. No adjustments are made for location.

Adjustments made to the additional comparables include bedrooms and full baths at $4,000 each with half baths at $2,000. The comparables are adjusted for differences in gross living area by a market extracted $25 per square foot. This adjustment is not based on the cost to recreate the differing amounts of area. It is simply a measure of the market reaction to that difference. Comparables B-1 and B-2 are slightly younger in actual and effective age as compared to the control property. It is more typical that the market reacts to conditional differences rather than age. A negative 5% condition adjustment is applied to both of these comparables. Each of the sales utilized has a different sized lot. Comparable B-3 is on a very small lot as compared to the subject. A positive $5,000 adjustment is applied for this significant difference. The control property has a two car attached garage. Garage space is adjusted at $5,000 per stall and is applied to the comparables as necessary. The control also has a 48 x 48 barn which is a feature the additional comparables lack. A positive $10,000 adjustment is applied to recognize the contributory value of this item. Minor adjustments are also applied for differences in porches, decks, fireplaces, sheds, pellet stoves and other market recognized features. The adjustments made are not based on the cost of any particular feature. The adjustment is based on the contributory value of each item as observed in the market. Superior features on the additional comparables are recognized with a negative adjustment and inferior features are recognized with a positive adjustment.

**Reconciliation of Rochester Data #2**

Based on the comparison of the control sale with the other comparables, a difference (delta) between their adjusted prices and the control is identified. That difference (delta) could represent the potential effect of an avigation easement. If the reconciled price of the comparables is higher than the sale price of the control, then a reasonable conclusion would be that the difference could be attributable to the presence of the avigation easement on the control. If the reconciled price of the comparable is lower than the sale price of the control, then the conclusion would be that little to no effect would occur as a result of the presence of the easement.

Comparable B-1 is 2.12% higher than the control. Comparable B-2 is 0.81% higher than the control. Comparable B-3 is 0.76% lower than the control. Based on this data set, it appears there is little support for an adjustment for the presence of an avigation easement. This is a little different than the prior data set, also from Rochester. On the following page is the grid analysis along with the listing sheets for the control property and the three additional comparables.

## Rochester Grid #2

| FACTOR | CONTROL 1 | COMP. B-1 | ADJ. | COMP. B-2 | ADJ. | COMP. B-3 | ADJ. |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| ADDRESS | 265 Rochester Hill Road | 16 Sullivan Farm Drive | | 85 Gear Road | | 9 Old Gonic Road | |
| | Rochester | Rochester | | Rochester | | Rochester | |
| DATE OF SALE | 6/1/2007 | 6/9/2006 | | 6/29/2006 | | 7/5/2006 | |
| SALES PRICE | $260,000 | $265,000 | | $250,000 | | $235,900 | |
| CONCESSIONS | $0 | $0 | | $0 | | $0 | |
| NET SALES PRICE | $260,000 | $265,000 | | $250,000 | | $235,900 | |
| FINANCING TERMS | Conventional | Conventional | | Conventional | | Cash Sale | |
| SALE CONDITIONS | Typical | Typical | | Typical | | Typical | |
| TIME ADJUSTMENT | 0.0% | 0.0% | | 0.0% | | 0.0% | |
| ADJ. SALES PRICE | $260,000 | $265,000 | | $250,000 | | $235,900 | |
| LOCATION | Average | Average | | Average | | Average | |
| STYLE | Gambrel | Cape | | Cape | | Cape | |
| ROOM COUNT | 8-3-2.5 | 6-3-2 | $2,000 | 7-3-2 | $2,000 | 7-4-1.5 | N/A |
| GROSS LIVING AREA | 1,792 | 1,704 | $1,760 | 1,612 | $3,600 | 1,536 | $5,120 |
| QUALITY OF CONSTRUCTIO | Average | Similar | | Similar | | Similar | |
| HEAT | OFHW | OFHW | | OFHW | | OFHW | |
| AGE - ACTUAL & EFF. | A-33 E-15 | A-13 E-10 | | A-7 E-5 | | A-66 E-25 | |
| CONDITION | Average | Sl. Sup. (-5%) | ($13,250) | Sl. Sup. (-5%) | ($12,500) | Average | |
| LOT SIZE | 2.06 | 1.43 Ac. | N/A | 1.78 Ac. | N/A | 0.32 Ac. | $5,000 |
| ZONING | Res. | Res. | | Res. | | Res. | |
| UTILITIES | Public | Private | | Private | N/A | Public | N/A |
| PARKING | 2 Att. | 2 Att. | | 1 Under | $7,000 | 2 Det. | |
| PORCHES | Lge Deck | Deck | | Cov. Porch | | Encl. Porch | -$2,000 |
| BASEMENT/FINISHED | 100%/0% | 100%/0% | | 100%/0% | | 100% / 0% | |
| FRPL/WS | 1 Frpl | 1 Frpl | | 1 ws-hu | $2,000 | None | $4,000 |
| OTHER | 48x48 Barn | None | $10,000 | None | $10,000 | None | $10,000 |
| LOCATION INFLUENCE | AVIGATION EASEMENT | None | | None | | None | |
| | | | | | | | |
| NET ADJUSTMENTS | | | $510 | | $12,100 | | $22,120 |
| | | Delta | | Delta | | Delta | |
| INDICATED VALUE | $260,000 | 2.12% | $265,510 | 0.81% | $262,100 | -0.76% | $258,020 |

## Control Property

| | |
|---|---|
| Previsite VTour URL | **List:** 4/21/2007 |
| | **Sold:** 6/1/2007 |

**2649378 Note: Report Includes Internal Fields**

| | |
|---|---|
| **Listing Status** | Closed |
| **Price** | $260,000 |
| **Class** | Residential |
| **Type** | Single Family |
| **Address** | 265 Rochester Hill Road |
| **Unit/Lot #** | |
| **City** | Rochester |
| **State-** | New Hampshire |
| **Zip** | 03867 |
| **VillDstLoc** | |
| **County** | NH-Strafford |

| | |
|---|---|
| **Dev/Subd** | |
| **Rooms - Total** | 8 |
| **BedsTot** | 3 |
| **Baths - Full** | 2 |
| **Baths - 3/4** | 0 |
| **Baths - 1/2** | 1 |
| **SqFtFnAG** | 1,792 |
| **SqFtFnBG** | 0 |
| **Price/SqFtFnAG** | $145.09 |
| **Days On Market** | 13 |

**Remarks - Public** -Horse lovers, gardeners, aviators and hobbyists alike will love this versatile property that has something for everyone. Enjoy your favorite hobby in the separate 48x48 barn/workshop or sit on the new deck surrounded by mature landscaping. Add your special touches to this well-built, open concept Lindal cedar home to make it your own.

**Directions** Exit 9 off Spaulding Tnpk. Route 108 from Dover. Just before Skyhaven airport on left.

### General Property Information

| | |
|---|---|
| **Year Built** | 1974 |
| **Taxes TBD** | |
| **TaxGrosAmt** | $5,210.00 |
| **Tax Year** | 2006 |
| **Tax Year Notes** | |
| **Garage Type** | Attached |
| **Garage Capacity** | 2 |
| **Basement** | |
| **SchDistrct** | |
| **SchHigh** | Spaulding High School |
| **SchMiddle** | Rochester Middle School |
| **SchElem** | |

| | |
|---|---|
| **ROWParcAc** | |
| **ROWOthPar** | |
| **ROWLength** | |
| **ROWWidth** | |
| **WaterBody** | |
| **WatrBdyTp** | |
| **WaterAcc** | |
| **WtrFrnLgth** | |
| **Map** | 254 |
| **Block** | |
| **Lot** | 23 |
| **SPAN Number** | |

| | |
|---|---|
| **CS** | Post and Beam |
| **Lot - Acres** | 2.06 |
| **Total Stories** | 2 |
| **PlanUrbDev** | |
| **Flood Zone** | No |
| **Time/Frac** | No |
| **Resort** | |

**IN** Cathedral Ceiling, Dining Area, Fireplace - Wood, Hot Tub, Laundry Hook-ups, Master BR w/ BA

**EX** Barn, Deck, Outbuilding, Patio

**Fee**

### Property Features

| | |
|---|---|
| **Foreclosed/Bank-Owned/REO** | |
| **Short Sale** | |
| **Listing Type** | Exclusive Agency |
| **Listing Service** | |
| **Buyer Agency** | 2.25 |
| **Buyer Agency Type** | % |
| **SubAgency** | 0.00 |
| **SubAgency Type** | % |
| **NonAgency Facilitator** | 2.25 |
| **NonAgency Facilitator Type** | % |
| **Transactional Broker** | |
| **Transactional Broker Type** | |
| **List Agent - Phone Number** | Cell: 603-661-8127 |
| **Showing Instructions** | Call List Broker, Sign on Property |

**Appliances** Dishwasher, Dryer, Range - Electric, Refrigerator, Trash Compactor, Washer
**Exterior** Wood
**Heating** Baseboard, Hot Water, Multi Zone
**Cooling** Multi Zone

| | | | |
|---|---|---|---|
| **Prepared By** | Louis Manias | **Listing Agent** | Adam Dean |
| **Agent Phone** | Off: 603-228-9040 | **Agent Phone** | Cell: 603-661-8127 |
| **Office Name** | Capital Appraisal Assoc. | **Listing Office** | Bean Group / Portsmouth |

## Comparable B-1

**229685 Note: Report Includes Internal Fields**

| | |
|---|---|
| **Listing Status** | Closed |
| **Price** | $265,000 |
| **Class** | Residential |
| **Type** | Single Family |
| **Address** | 16 Sullivan Farm Drive |
| **Unit/Lot #** | |
| **City** | Rochester |
| **State-** | New Hampshire |
| **Zip** | 03867 |
| **VillDstLoc** | |
| **County** | NH-Strafford |

| | |
|---|---|
| **Dev/Subd** | |
| **Rooms - Total** | 6 |
| **BedsTot** | 3 |
| **Baths - Full** | 1 |
| **Baths - 3/4** | 1 |
| **Baths - 1/2** | 0 |
| **SqFtFnAG** | 1,704 |
| **SqFtFnBG** | 0 |
| **Price/SqFtFnAG** | $155.52 |
| **Days On Market** | 199 |

Previsite VTour URL **List:** 9/22/2005

**Sold:** 6/9/2006

**Remarks - Public** PRICE REDUCED. Just the kind of house lot everyone is looking for. This 3 BR, 1 3/4 bath cape style home is situated on 1.43 acres in sought after neighborhood. Hardwood floors, brick FP, applianced kitchen, formal dining room, quiet cul-de-sac..

**Directions** Whitehall Rd., right onto Salmon Falls Rd. Right onto Sullivan Farm Rd. 2nd house on left.

### General Property Information

| | |
|---|---|
| **Year Built** | 1993 |
| **Taxes TBD** | |
| **TaxGrosAmt** | $4,004.95 |
| **Tax Year** | 2004 |
| **Tax Year Notes** | |
| **Garage Type** | Attached |
| **Garage Capacity** | 2 |
| **Basement** | |
| **SchDistrct** | Rochester |
| **SchHigh** | Spaulding High School |
| **SchMiddle** | Rochester Middle School |
| **SchElem** | |

| | |
|---|---|
| **ROWParcAc** | |
| **ROWOthPar** | |
| **ROWLength** | |
| **ROWWidth** | |
| **WaterBody** | |
| **WatrBdyTp** | |
| **WaterAcc** | |
| **WtrFrnLgth** | |
| **Map** | 241 |
| **Block** | 20 |
| **Lot** | 2 |
| **SPAN Number** | |

| | |
|---|---|
| **CS** | Wood Frame |
| **Lot - Acres** | 1.43 |
| **Total Stories** | 1.75 |
| **PlanUrbDev** | |
| **Flood Zone** | Unknown |
| **Time/Frac** | No |
| **Resort** | |

**IN** Attic, Ceiling Fan, Fireplace - Wood

**EX** Deck

**Fee**

### Property Features

| | |
|---|---|
| **Foreclosed/Bank-Owned/REO** | |
| **Short Sale** | |
| **Listing Type** | Exclusive Right |
| **Listing Service** | |
| **Buyer Agency** | 2.00 |
| **Buyer Agency Type** | % |
| **SubAgency** | 0.00 |
| **SubAgency Type** | % |
| **NonAgency Facilitator** | |
| **NonAgency Facilitator Type** | |
| **Transactional Broker** | |
| **Transactional Broker Type** | |
| **List Agent - Phone Number** | Cell: 603-534-3949 |
| **Showing Instructions** | Call List Broker |

**Appliances** Dishwasher, Refrigerator
**Exterior** Clapboard, Wood
**Heating** Baseboard, Hot Water

| | |
|---|---|
| **Prepared By** | Louis Manias |
| **Agent Phone** | Off: 603-228-9040 |
| **Office Name** | Capital Appraisal Assoc. |

| | |
|---|---|
| **Listing Agent** | Sally Fontneau |
| **Agent Phone** | Cell: 603-534-3949 |
| **Listing Office** | Hourihane, Cormier & Assoc |

## Comparable B-2

**257907 Note: Report Includes Internal Fields**

| | |
|---|---|
| **Listing Status** | Closed |
| **Price** | $250,000 |
| **Class** | Residential |
| **Type** | Single Family |
| **Address** | 85 Gear Road |
| **Unit/Lot #** | |
| **City** | Rochester |
| **State-** | New Hampshire |
| **Zip** | 03839 |
| **VillDstLoc** | |
| **County** | NH-Strafford |

| | |
|---|---|
| **Dev/Subd** | |
| **Rooms - Total** | 7 |
| **BedsTot** | 3 |
| **Baths - Full** | 1 |
| **Baths - 3/4** | 1 |
| **Baths - 1/2** | 0 |
| **SqFtFnAG** | |
| **SqFtFnBG** | |
| **Price/SqFtFnAG** | |
| **Days On Market** | 31 |

Previsite VTour URL **List:** 4/3/2006

**Sold:** 6/29/2006

**Remarks - Public** Private setting for this cape style homeon 1.780 acres. Lower level has finished room with 3/4 bath. Large kitchen has attached dining area. 1 car garage under plus additional partially finished detached garage/work shop.

**Directions** Spaulding (Rt 16) North to 125 South. Gear Road right off 125, House on right....not visible from road. Look for sign.

### General Property Information

| | |
|---|---|
| **Year Built** | 1999 |
| **Taxes TBD** | |
| **TaxGrosAmt** | $3,519.00 |
| **Tax Year** | 2005 |
| **Tax Year Notes** | |
| **Garage Type** | Under |
| **Garage Capacity** | 1 |
| **Basement** | |
| **SchDistrct** | Rochester |
| **SchHigh** | Rochester School |
| **SchMiddle** | Rochester Middle School |
| **SchElem** | |

| | |
|---|---|
| **ROWParcAc** | |
| **ROWOthPar** | |
| **ROWLength** | |
| **ROWWidth** | |
| **WaterBody** | |
| **WatrBdyTp** | |
| **WaterAcc** | |
| **WtrFrnLgth** | |
| **Map** | 259 |
| **Block** | |
| **Lot** | 2 |
| **SPAN Number** | |

| | |
|---|---|
| **CS** | Wood Frame |
| **Lot - Acres** | 1.78 |
| **Total Stories** | |
| **PlanUrbDev** | |
| **Flood Zone** | Unknown |
| **Time/Frac** | No |
| **Resort** | |

**IN** Cathedral Ceiling, Laundry Hook-ups, Wood Stove Hook-up

**EX** Porch

**Fee**

### Property Features

| | |
|---|---|
| **Foreclosed/Bank-Owned/REO** | |
| **Short Sale** | |
| **Listing Type** | Exclusive Right |
| **Listing Service** | |
| **Buyer Agency** | 2.00 |
| **Buyer Agency Type** | % |
| **SubAgency** | 0.00 |
| **SubAgency Type** | % |
| **NonAgency Facilitator** | 0.00 |
| **NonAgency Facilitator Type** | % |
| **Transactional Broker** | |
| **Transactional Broker Type** | |
| **List Agent - Phone Number** | Off: 603-431-1111 |
| **Showing Instructions** | Call List Broker, Call List Office |

**Appliances** Dishwasher, Range - Electric
**Exterior** T-111
**Heating** Hot Water, Stove, Stove - Wood

| | |
|---|---|
| **Prepared By** | Louis Manias |
| **Agent Phone** | Off: 603-228-9040 |
| **Office Name** | Capital Appraisal Assoc. |

| | |
|---|---|
| **Listing Agent** | house 3019 |
| **Agent Phone** | Off: 603-431-1111 |
| **Listing Office** | Coast To Coast Properties |

## Comparable B-3

Previsite VTour URL **List:** 4/5/2006

**Sold:** 7/5/2006

**258605 Note: Report Includes Internal Fields**

| | |
|---|---|
| **Listing Status** | Closed |
| **Price** | $235,900 |
| **Class** | Residential |
| **Type** | Single Family |
| **Address** | 9 Old Gonic Road |
| **Unit/Lot #** | |
| **City** | Rochester |
| **State-** | New Hampshire |
| **Zip** | 03867 |
| **VillDstLoc** | |
| **County** | NH-Strafford |

| | |
|---|---|
| **Dev/Subd** | |
| **Rooms - Total** | 7 |
| **BedsTot** | 4 |
| **Baths - Full** | 1 |
| **Baths - 3/4** | 0 |
| **Baths - 1/2** | 1 |
| **SqFtFnAG** | |
| **SqFtFnBG** | |
| **Price/SqFtFnAG** | |
| **Days On Market** | 57 |

**Remarks - Public** Great corner lot . Spacious kitchen with cherry cabiniets, fabulous for entertaining. Large deck and back yard with a seperate detached 2 car garage with storage space above. Room for expansion. Great Investment, easy access for commuters.

**Directions** Off Spaulding Turnpike Exit 12, Bear right, left at light onto Brock Street, 1st left on Old Gonic Raod, sign on property

### General Property Information

| | |
|---|---|
| **Year Built** | 1941 |
| **Taxes TBD** | |
| **TaxGrosAmt** | $2,763.00 |
| **Tax Year** | 2005 |
| **Tax Year Notes** | |
| **Garage Type** | Detached |
| **Garage Capacity** | 2 |
| **Basement** | |
| **SchDistrct** | Rochester |
| **SchHigh** | Springfield High School |
| **SchMiddle** | Rochester Middle School |
| **SchElem** | |

| | |
|---|---|
| **ROWParcAc** | |
| **ROWOthPar** | |
| **ROWLength** | |
| **ROWWidth** | |
| **WaterBody** | |
| **WatrBdyTp** | |
| **WaterAcc** | |
| **WtrFrnLgth** | |
| **Map** | 131 |
| **Block** | |
| **Lot** | .32 |
| **SPAN Number** | |

| | |
|---|---|
| **CS** | Wood Frame |
| **Lot - Acres** | 0.32 |
| **Total Stories** | 2 |
| **PlanUrbDev** | |
| **Flood Zone** | No |
| **Time/Frac** | No |
| **Resort** | |

**IN** Laundry - 1st Floor

**EX** Deck, Outbuilding

**Fee**

### Property Features

| | |
|---|---|
| **Foreclosed/Bank-Owned/REO** | |
| **Short Sale** | |
| **Listing Type** | Exclusive Right |
| **Listing Service** | |
| **Buyer Agency** | 2.50 |
| **Buyer Agency Type** | % |
| **SubAgency** | 0.00 |
| **SubAgency Type** | % |
| **NonAgency Facilitator** | 2.50 |
| **NonAgency Facilitator Type** | % |
| **Transactional Broker** | |
| **Transactional Broker Type** | |
| **List Agent - Phone Number** | Off: 603-431-8977 |
| **Showing Instructions** | Call List Broker |

**Appliances** Dishwasher, Disposal, Microwave, Range - Gas, Refrigerator
**Exterior** Clapboard
**Heating** Hot Water

| | |
|---|---|
| **Prepared By** | Louis Manias |
| **Agent Phone** | Off: 603-228-9040 |
| **Office Name** | Capital Appraisal Assoc. |

| | |
|---|---|
| **Listing Agent** | Agent House Rush Ports |
| **Agent Phone** | Off: 603-431-8977 |
| **Listing Office** | Prudential Rush Realty/Portsmouth |

**Concord Data #1**

10 Grant Street in Concord transferred on June 28, 2010. This is identified as the control property on the following grid. On June 17, 2009, an avigation easement on this property was granted to the City of Concord, NH. The property was marketed for $184,900. It was on the market for 39 days before going under agreement. It closed 27 days later for the price indicated. This is considered an arm's length transfer.

The date of transfer for this property is June 28, 2010 and the three additional sales all occurred prior to that date. Each of the additional sales was found in the same city as the control but not located in a neighborhood adjacent to the airport. It is my opinion that the neighborhood locations for the comparables are considered similar to the subject neighborhood. No adjustments are made for location.

Adjustments made to the additional comparables include bedrooms and full baths at $4,000 each with half baths at $2,000. The comparables are adjusted for differences in gross living area by a market extracted $25 per square foot. This adjustment is not based on the cost to recreate the differing amounts of area. It is simply a measure of the market reaction to that difference. All of the comparables have a similar effective age as the control and no condition adjustments are considered necessary. Each of the sales utilized has a different sized lot. Comparable B-1 is on a very large lot as compared to the control. A negative $5,000 adjustment is applied for this significant difference. The control property has a one car attached garage. Garage space is adjusted at $5,000 per stall and is applied to the comparables as necessary. Minor adjustments are also applied for differences in porches, decks, fireplaces, sheds, pellet or wood stoves and other market recognized features. The adjustments made are not based on the cost of any particular feature. The adjustment is based on the contributory value of each item as observed in the market. Superior features on the additional comparables are recognized with a negative adjustment and inferior features are recognized with a positive adjustment.

**<u>Reconciliation of Concord Data #1</u>**

Based on the comparison of the control sale with the other comparables, a difference (delta) between their adjusted prices and the control is identified. That difference (delta) could represent the potential effect of an avigation easement. If the reconciled price of the comparables is higher than the sale price of the control, then a reasonable conclusion would be that the difference could be attributable to the presence of the avigation easement on the control. If the reconciled price of the comparable is lower than the sale price of the control, then the conclusion would be that little to no effect would occur as a result of the presence of the easement.

Comparable B-1 is 0.59% higher than the control. Comparable B-2 is 1.87% lower than the control. Comparable B-3 is 1.93% higher than the control. Based on this data set, it appears there is little support for an adjustment for the presence of an avigation easement. On the following page is the grid analysis along with the listing sheets for the control property and the three additional comparables.

## Concord Grid #1

| FACTOR | CONTROL 1 | COMP. B-1 | ADJ. | COMP. B-2 | ADJ. | COMP. B-3 | ADJ. |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| ADDRESS | 10 Grant Street | 228 Airport Road | | 14 Robin Road | | 144 Airport Road | |
| | Concord | Concord | | Concord | | Concord | |
| DATE OF SALE | 6/28/2010 | 10/22/2009 | | 4/2/2010 | | 4/23/2010 | |
| SALES PRICE | $164,000 | $172,000 | | $165,000 | | $165,000 | |
| CONCESSIONS | $0 | $0 | | $0 | | $0 | |
| NET SALES PRICE | $164,000 | $172,000 | | $165,000 | | $165,000 | |
| FINANCING TERMS | Conventional | Conventional | | Conventional | | Conventional | |
| SALE CONDITIONS | Typical | Typical | | Typical | | Typical | |
| TIME ADJUSTMENT | 0.0% | 0.0% | | 0.0% | | 0.0% | |
| ADJ. SALES PRICE | $164,000 | $172,000 | | $165,000 | | $165,000 | |
| LOCATION | Average | Average | | Average | | Average | |
| STYLE | Ranch | Ranch | | Ranch | | Ranch | |
| ROOM COUNT | 7-3-1 | 5-3-1 | | 7-3-1 | | 4-2-1 | $4,000 |
| GROSS LIVING AREA | 1,156 | 1,008 | $2,960 | 1,309 | ($3,060) | 898 | $5,160 |
| QUALITY OF CONSTRUCTIO | Average | Similar | | Similar | | Similar | |
| HEAT | GasFWA | Gas FWA | | Gas FHW | | OFHW | |
| AGE - ACTUAL & EFF. | A-52 E-20 | A-36 E-20 | | A-46 E-20 | | A-81 E-20 | |
| CONDITION | Average | Average | | Average | | Average | |
| LOT SIZE | 0.31 Ac. | 1.23 Ac. | ($5,000) | 0.25 Ac. | | 0.26 Ac. | |
| ZONING | Res. | Res. | | Res. | | Res. | |
| UTILITIES | Public | Public | | Public | | Public | |
| PARKING | 1 Att. | 2 Att. | ($5,000) | 1 Att. | | 1 Att. | |
| PORCHES | Deck | Deck | | None | $2,000 | Mud Room | -$4,000 |
| BASEMENT/FINISHED | 100%/0% | 100%/0% | | 100%/25% | ($3,000) | 100% /20% | ($3,000) |
| FRPL/WS | None | None | | None | | None | |
| OTHER | None | None | | None | | None | |
| LOCATION INFLUENCE | AVIGATION EASEMENT | None | | None | | None | |
| | | | | | | | |
| NET ADJUSTMENTS | | | ($7,040) | | ($4,060) | | $2,160 |
| | | Delta | | Delta | | Delta | |
| INDICATED VALUE | $164,000 | 0.59% | $164,960 | -1.87% | $160,940 | 1.93% | $167,160 |

## Control Property

Previsite VTour URL **List:** 4/23/2010

**Sold:** 6/28/2010

**2831647 Note: Report Includes Internal Fields**

| | |
|---|---|
| **Listing Status** | Closed |
| **Price** | $164,000 |
| **Class** | Residential |
| **Type** | Single Family |
| **Address** | 10 Grant Street |
| **Unit/Lot #** | |
| **City** | Concord |
| **State-** | New Hampshire |
| **Zip** | 03301 |
| **VillDstLoc** | |
| **County** | NH-Merrimack |

| | |
|---|---|
| **Dev/Subd** | |
| **Rooms - Total** | 7 |
| **BedsTot** | 3 |
| **Baths - Full** | 1 |
| **Baths - 3/4** | 0 |
| **Baths - 1/2** | 0 |
| **SqFtFnAG** | 1,156 |
| **SqFtFnBG** | 276 |
| **Price/SqFtFnAG** | $141.87 |
| **Days On Market** | 39 |

**Remarks - Public** A very rare find! Same owner for over 50 years! Time to start your new life in this cute and cozy three bedroom Ranch with lots of room for your growing family! Great location. Convenient to shopping, schools, parks and highways. A large and level back yard big enough to put a baseball field on! Don't wait to view this great home!

**Directions** Loudon Road to Pembroke Road to right on Grant Street

### General Property Information

| | |
|---|---|
| **Year Built** | 1958 |
| **Taxes TBD** | No |
| **TaxGrosAmt** | $4,062.66 |
| **Tax Year** | 2009 |
| **Tax Year Notes** | |
| **Garage Type** | Attached |
| **Garage Capacity** | 1 |
| **Basement** | |
| **SchDistrct** | |
| **SchHigh** | Concord High School |
| **SchMiddle** | Rundlett Middle School |
| **SchElem** | |

| | |
|---|---|
| **ROWParcAc** | |
| **ROWOthPar** | |
| **ROWLength** | |
| **ROWWidth** | |
| **WaterBody** | |
| **WatrBdyTp** | |
| **WaterAcc** | |
| **WtrFrnLgth** | |
| **Map** | 116 |
| **Block** | 1 |
| **Lot** | 6 |
| **SPAN Number** | |

| | |
|---|---|
| **CS** | Wood Frame |
| **Lot - Acres** | 0.31 |
| **Total Stories** | 1 |
| **PlanUrbDev** | |
| **Flood Zone** | Unknown |
| **Time/Frac** | No |
| **Resort** | |

**IN** Dining Area, Fireplace - Wood, Laundry Hook-ups, Window Treatment

**EX** Deck

**Fee**

### Property Features

| | |
|---|---|
| **Foreclosed/Bank-Owned/REO** | |
| **Short Sale** | |
| **Listing Type** | Exclusive Right |
| **Listing Service** | |
| **Buyer Agency** | 2.25 |
| **Buyer Agency Type** | % |
| **SubAgency** | 0.00 |
| **SubAgency Type** | % |
| **NonAgency Facilitator** | 2.25 |
| **NonAgency Facilitator Type** | % |
| **Transactional Broker** | |
| **Transactional Broker Type** | |
| **List Agent - Phone Number** | Off: 603-224-0700 |
| **Showing Instructions** | Combo Lockbox |

**Appliances** Cooktop - Electric, Dishwasher, Dryer, Refrigerator
**Exterior** Vinyl
**Heating** Baseboard, Gas Heater, Hot Air, In Ceiling, In Floor

| | |
|---|---|
| **Prepared By** | Louis Manias |
| **Agent Phone** | Off: 603-228-9040 |
| **Office Name** | Capital Appraisal Assoc. |

| | |
|---|---|
| **Listing Agent** | Kathy Lee |
| **Agent Phone** | Off: 603-224-0700 |
| **Listing Office** | BHHS Verani Concord |

## Comparable B-1

**2799129 Note: Report Includes Internal Fields**

Previsite VTour URL **List:** 9/14/2009

**Sold:** 10/22/2009

| | |
|---|---|
| **Listing Status** | Closed |
| **Price** | $172,000 |
| **Class** | Residential |
| **Type** | Single Family |
| **Address** | 228 Airport Road |
| **Unit/Lot #** | |
| **City** | Concord |
| **State-** | New Hampshire |
| **Zip** | 03301 |
| **VillDstLoc** | |
| **County** | NH-Merrimack |

| | |
|---|---|
| **Dev/Subd** | |
| **Rooms - Total** | 5 |
| **BedsTot** | 3 |
| **Baths - Full** | 1 |
| **Baths - 3/4** | 0 |
| **Baths - 1/2** | 0 |
| **SqFtFnAG** | 1,008 |
| **SqFtFnBG** | 0 |
| **Price/SqFtFnAG** | $170.63 |
| **Days On Market** | 7 |

**Remarks - Public** Well maintained ranch on oversized lot of 1.23 acres. Close to in-town services and easy commute to Route 93 and 89. Large back yard with trees for privacy. House has new carpet and fresh paint throughout. The basement would be great to finish for additional living space.

**Directions** Manchester Street to Airport Road. House on LEFT with sign.

### General Property Information

| | |
|---|---|
| **Year Built** | 1974 |
| **Taxes TBD** | No |
| **TaxGrosAmt** | $4,327.95 |
| **Tax Year** | 2009 |
| **Tax Year Notes** | |
| **Garage Type** | Attached |
| **Garage Capacity** | 2 |
| **Basement** | |
| **SchDistrct** | Concord School District SAU #8 |
| **SchHigh** | Concord High School |
| **SchMiddle** | |
| **SchElem** | |

| | |
|---|---|
| **ROWParcAc** | |
| **ROWOthPar** | |
| **ROWLength** | |
| **ROWWidth** | |
| **WaterBody** | |
| **WatrBdyTp** | |
| **WaterAcc** | |
| **WtrFrnLgth** | |
| **Map** | 110 |
| **Block** | E3 |
| **Lot** | 5 |
| **SPAN Number** | |

| | |
|---|---|
| **CS** | Wood Frame |
| **Lot - Acres** | 1.23 |
| **Total Stories** | 1 |
| **PlanUrbDev** | |
| **Flood Zone** | No |
| **Time/Frac** | No |
| **Resort** | |

**IN** Laundry Hook-ups

**EX** Deck

**Fee**

### Property Features

| | |
|---|---|
| **Foreclosed/Bank-Owned/REO** | |
| **Short Sale** | |
| **Listing Type** | Exclusive Right |
| **Listing Service** | |
| **Buyer Agency** | 2.00 |
| **Buyer Agency Type** | % |
| **SubAgency** | 0.00 |
| **SubAgency Type** | % |
| **NonAgency Facilitator** | 2.00 |
| **NonAgency Facilitator Type** | % |
| **Transactional Broker** | |
| **Transactional Broker Type** | |
| **List Agent - Phone Number** | Cell: 603-344-2276 |
| **Showing Instructions** | Call List Office, Combo Lockbox, Sign on Property |

**Appliances** Range - Electric, Refrigerator
**Exterior** Aluminum
**Heating** Baseboard, Space Heater

| | | | |
|---|---|---|---|
| **Prepared By** | Louis Manias | **Listing Agent** | Rachel D Eames |
| **Agent Phone** | Off: 603-228-9040 | **Agent Phone** | Cell: 603-344-2276 |
| **Office Name** | Capital Appraisal Assoc. | **Listing Office** | Eames Realty Services |

## Comparable B-2

**2768388 Note: Report Includes Internal Fields**

| | |
|---|---|
| **Listing Status** | Closed |
| **Price** | $165,000 |
| **Class** | Residential |
| **Type** | Single Family |
| **Address** | 14 Robin Road |
| **Unit/Lot #** | |
| **City** | Concord |
| **State-** | New Hampshire |
| **Zip** | 03301 |
| **VillDstLoc** | |
| **County** | NH-Merrimack |

| | |
|---|---|
| **Dev/Subd** | |
| **Rooms - Total** | 8 |
| **BedsTot** | 3 |
| **Baths - Full** | 1 |
| **Baths - 3/4** | 0 |
| **Baths - 1/2** | 0 |
| **SqFtFnAG** | 1,309 |
| **SqFtFnBG** | 319 |
| **Price/SqFtFnAG** | $126.05 |
| **Days On Market** | 345 |

Previsite VTour URL **List:** 3/30/2009

**Sold:** 4/2/2010

**Remarks - Public** Spacious Ranch featuring first floor family room with brick hearth and wood stove, living room with hardwood floor, kitchen open to dining for easy entertaining, 3 good-sized bedrooms with hardwood floors, huge bonus room downstairs plus attached garage!

**Directions** From East Side Drive, turn onto Partridge Drive to right onto Robin Road. House on left.

### General Property Information

| | |
|---|---|
| **Year Built** | 1964 |
| **Taxes TBD** | No |
| **TaxGrosAmt** | $2,536.00 |
| **Tax Year** | 2009 |
| **Tax Year Notes** | |
| **Garage Type** | Attached |
| **Garage Capacity** | 1 |
| **Basement** | |
| **SchDistrct** | Concord School District SAU #8 |
| **SchHigh** | Concord High School |
| **SchMiddle** | Rundlett Middle School |
| **SchElem** | |

| | |
|---|---|
| **ROWParcAc** | |
| **ROWOthPar** | |
| **ROWLength** | |
| **ROWWidth** | |
| **WaterBody** | |
| **WatrBdyTp** | |
| **WaterAcc** | |
| **WtrFrnLgth** | |
| **Map** | 114A1 |
| **Block** | 4 |
| **Lot** | 3 |
| **SPAN Number** | |

| | |
|---|---|
| **CS** | Wood Frame |
| **Lot - Acres** | 0.25 |
| **Total Stories** | 1 |
| **PlanUrbDev** | |
| **Flood Zone** | Unknown |
| **Time/Frac** | No |
| **Resort** | |

**IN** Dining Area, Laundry Hook-ups, Wood Stove Hook -up

**EX** Outbuilding

**Fee**

### Property Features

| | |
|---|---|
| **Foreclosed/Bank-Owned/REO** | |
| **Short Sale** | |
| **Listing Type** | Exclusive Right |
| **Listing Service** | |
| **Buyer Agency** | 2.00 |
| **Buyer Agency Type** | % |
| **SubAgency** | 0.00 |
| **SubAgency Type** | % |
| **NonAgency Facilitator** | 0.00 |
| **NonAgency Facilitator Type** | % |
| **Transactional Broker** | |
| **Transactional Broker Type** | |
| **List Agent - Phone Number** | Off: 603-226-0800 |
| **Showing Instructions** | Call List Office, Sign on Property |

**Exterior** Aluminum
**Heating** Alternative Heat Stove, Hot Water

| | |
|---|---|
| **Prepared By** | Louis Manias |
| **Agent Phone** | Off: 603-228-9040 |
| **Office Name** | Capital Appraisal Assoc. |

| | |
|---|---|
| **Listing Agent** | Dwight Keeler |
| **Agent Phone** | Off: 603-226-0800 |
| **Listing Office** | Dwight Keeler and Company, LLC |

## Comparable B-3

**2810985 Note: Report Includes Internal Fields**

Previsite VTour URL **List:** 12/12/2009

**Sold:** 4/23/2010

| | |
|---|---|
| **Listing Status** | Closed |
| **Price** | $165,000 |
| **Class** | Residential |
| **Type** | Single Family |
| **Address** | 144 Airport Rd |
| **Unit/Lot #** | |
| **City** | Concord |
| **State-** | New Hampshire |
| **Zip** | 03301 |
| **VillDstLoc** | |
| **County** | NH-Merrimack |

| | |
|---|---|
| **Dev/Subd** | |
| **Rooms - Total** | 4 |
| **BedsTot** | 2 |
| **Baths - Full** | 1 |
| **Baths - 3/4** | 0 |
| **Baths - 1/2** | 0 |
| **SqFtFnAG** | 898 |
| **SqFtFnBG** | 0 |
| **Price/SqFtFnAG** | $183.74 |
| **Days On Market** | 86 |

**Remarks - Public** Short Sale. Paperwork is just about ready for this Ranch with a finished room with heat in lower level, large back yard, and a 3 zone heating system, mud room. Attached 1 car garage.Freshly painted living room. Subject to 3rd party approval.

**Directions** Manchester St. to Airport Rd. House is on left.

### General Property Information

| | |
|---|---|
| **Year Built** | 1929 |
| **Taxes TBD** | No |
| **TaxGrosAmt** | $3,208.00 |
| **Tax Year** | 2009 |
| **Tax Year Notes** | |
| **Garage Type** | Attached |
| **Garage Capacity** | 1 |
| **Basement** | |
| **SchDistrct** | |
| **SchHigh** | |
| **SchMiddle** | |
| **SchElem** | |

| | |
|---|---|
| **ROWParcAc** | |
| **ROWOthPar** | |
| **ROWLength** | |
| **ROWWidth** | |
| **WaterBody** | |
| **WatrBdyTp** | |
| **WaterAcc** | |
| **WtrFrnLgth** | |
| **Map** | 110B |
| **Block** | 6 |
| **Lot** | 9 |
| **SPAN Number** | |

| | |
|---|---|
| **CS** | Wood Frame |
| **Lot - Acres** | 0.26 |
| **Total Stories** | |
| **PlanUrbDev** | |
| **Flood Zone** | Unknown |
| **Time/Frac** | No |
| **Resort** | |

**IN** Laundry Hook-ups

**EX** Deck

**Fee**

### Property Features

| | |
|---|---|
| **Foreclosed/Bank-Owned/REO** | |
| **Short Sale** | |
| **Listing Type** | Exclusive Agency |
| **Listing Service** | |
| **Buyer Agency** | 2.00 |
| **Buyer Agency Type** | % |
| **SubAgency** | 0.00 |
| **SubAgency Type** | % |
| **NonAgency Facilitator** | 2.00 |
| **NonAgency Facilitator Type** | % |
| **Transactional Broker** | |
| **Transactional Broker Type** | |
| **List Agent - Phone Number** | Cell: 603-738-6816 |
| **Showing Instructions** | Call List Office |

**Appliances** Dishwasher, Range - Gas, Refrigerator
**Exterior** Shingle, Wood
**Heating** Hot Water, Multi Zone
**Cooling** Multi Zone

| | |
|---|---|
| **Prepared By** | Louis Manias |
| **Agent Phone** | Off: 603-228-9040 |
| **Office Name** | Capital Appraisal Assoc. |

| | |
|---|---|
| **Listing Agent** | Simone Barry |
| **Agent Phone** | Cell: 603-738-6816 |
| **Listing Office** | RE/MAX Connection |

**Concord Data #2**

237 Airport Road in Concord transferred on July 24, 2015. This is identified as the control property on the following grid. On October 16, 1985, an avigation easement on this property was granted to the City of Concord, NH. The property was marketed for $259,900. It was on the market for 244 days before going under agreement. It closed 16 days later for the price indicated. This is considered an arm's length transfer.

The date of transfer for this property is July 24, 2015 and the three additional sales all occurred prior to that date. Each of the additional sales was found in the same city as the control but not located in a neighborhood adjacent to the airport. It is my opinion that the neighborhood locations for the comparables are considered similar to the subject neighborhood. No adjustments are made for location.

Adjustments made to the additional comparables include bedrooms and full baths at $4,000 each with half baths at $2,000. The comparables are adjusted for differences in gross living area by a market extracted $25 per square foot. This adjustment is not based on the cost to recreate the differing amounts of area. It is simply a measure of the market reaction to that difference. Comparable B-1 is slightly better condition as compared to the other sales or the control. A negative 10% condition adjustment is applied to this comparable. Each of the sales utilized has a different sized lot. Comparable B-2 is on a very small lot as compared to the subject. A positive $5,000 adjustment is applied for this significant difference. Comparable B-3 is on a much larger lot and a negative $5,000 adjustment is applied. Garage space is adjusted at $5,000 per stall and is applied to the comparables as necessary. Minor adjustments are also applied for differences in porches, decks, fireplaces, sheds, pellet stoves and other market recognized features. The adjustments made are not based on the cost of any particular feature. The adjustment is based on the contributory value of each item as observed in the market. Superior features on the additional comparables are recognized with a negative adjustment and inferior features are recognized with a positive adjustment. I interviewed the agent who listed this property and asked whether she felt the avigation easement impacted the property at the time of sale. She was actually unaware of the easement but opined that it would have had no effect.

**Reconciliation of Concord Data #2**

Based on the comparison of the control sale with the other comparables, a difference (delta) between their adjusted prices and the control is identified. That difference (delta) could represent the potential effect of an avigation easement. If the reconciled price of the comparables is higher than the sale price of the control, then a reasonable conclusion would be that the difference could be attributable to the presence of the avigation easement on the control. If the reconciled price of the comparable is lower than the sale price of the control, then the conclusion would be that little to no effect would occur as a result of the presence of the easement.

Comparable B-1 is 0.35% higher than the control. Comparable B-2 is 0.59% higher than the control. Comparable B-3 is 5.7% lower than the control. Based on this data set, it appears there is little support for an adjustment for the presence of an avigation easement. This is not much different than the previous data set with the exception of the last comparable. On the following page is the grid analysis along with the listing sheets for the control property and the three additional comparables.

## Concord Grid #2

| FACTOR | CONTROL 1 | COMP. B-1 | ADJ. | COMP. B-2 | ADJ. | COMP. B-3 | ADJ. |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| ADDRESS | 237 Airport Road | 60 Penacook Street | | 8 Lawrence Street Ext. | | 25 Hot Hole Pond Rd | |
| | Concord | Concord | | Concord | | Concord | |
| DATE OF SALE | 7/24/2015 | 8/1/2014 | | 10/31/2014 | | 10/1/2014 | |
| SALES PRICE | $210,000 | $238,000 | | $210,000 | | $187,380 | |
| CONCESSIONS | $0 | $0 | | $0 | | $0 | |
| NET SALES PRICE | $210,000 | $238,000 | | $210,000 | | $187,380 | |
| FINANCING TERMS | Cash | Conventional | | Conventional | | Conventional | |
| SALE CONDITIONS | Typical | Typical | | Typical | | Typical | |
| TIME ADJUSTMENT | 0.0% | 0.0% | | 0.0% | | 0.0% | |
| ADJ. SALES PRICE | $210,000 | $238,000 | | $210,000 | | $187,380 | |
| LOCATION | Average | Average | | Average | | Average | |
| STYLE | Two Story | Cape | | Mod. Cape | | Cape | |
| ROOM COUNT | 6-3-1 | 7-3-1.5 | ($2,000) | 5-2-1 | $4,000 | 5-2-2 | N/A |
| GROSS LIVING AREA | 2,379 | 1,952 | $8,540 | 1,317 | $21,240 | 1,846 | $10,660 |
| QUALITY OF CONSTRUCTIO | Average | Similar | | Similar | | Similar | |
| HEAT | OFHW | Gas FHW | | Gas FHW | | Gas FHW | |
| AGE - ACTUAL & EFF. | A-51 E-35 | A-77 E-20 | | A-60 E-35 | | A-174 E-35 | |
| CONDITION | Fair | Average | ($23,800) | Similar | | Similar | |
| LOT SIZE | 1.72 Ac. | 1.35 Ac. | | 0.72 Ac. | $5,000 | 5.1 Ac. | ($5,000) |
| ZONING | Res. | Res. | | Res. | | Res. | |
| UTILITIES | Public | Public | | Public | | Private | |
| PARKING | OSP | 2 Att. | ($10,000) | 2 Det. | ($10,000) | OSP | |
| PORCHES | Deck & Porch | Deck, Cov. Porch | | None | $2,000 | Deck & Porch | |
| BASEMENT/FINISHED | 100%/0% | 100%/0% | | 100%/50% | ($6,000) | Partial | $5,000 |
| FRPL/WS | 1 Frpl | 1 Frpl | | 1 Frpl | | 1 Frpl | |
| OTHER | None | None | | 1440 sf shop | ($15,000) | None | |
| LOCATION INFLUENCE | AVIGATION EASEMENT | None | | None | | None | |
| | | | | | | | |
| NET ADJUSTMENTS | | | ($27,260) | | $1,240 | | $10,660 |
| | | Delta | | Delta | | Delta | |
| INDICATED VALUE | $210,000 | 0.35% | $210,740 | 0.59% | $211,240 | -5.70% | $198,040 |

## Control Property

Previsite VTour URL **List:** 11/6/2014

**Sold:** 7/24/2015

**4392461 Note: Report Includes Internal Fields**

| | |
|---|---|
| **Listing Status** | Closed |
| **Price** | $210,000 |
| **Class** | Residential |
| **Type** | Single Family |
| **Address** | 237 Airport Road |
| **Unit/Lot #** | |
| **City** | Concord |
| **State-** | New Hampshire |
| **Zip** | 03301 |
| **VillDstLoc** | |
| **County** | NH-Merrimack |

| | |
|---|---|
| **Dev/Subd** | |
| **Rooms - Total** | 6 |
| **BedsTot** | 3 |
| **Baths - Full** | 1 |
| **Baths - 3/4** | 0 |
| **Baths - 1/2** | 0 |
| **SqFtFnAG** | 2,239 |
| **SqFtFnBG** | 0 |
| **Price/SqFtFnAG** | $93.79 |
| **Days On Market** | 244 |

**Remarks - Public** One owner home built by family in 1964. Great location!! Large 1.72 acre lot located near shopping. This unique one of a kind contemporary family home is ideal for an office or in home business. it is situated on almost 2 acres . the lot has approximately 250 feet of frontage on airport road and no one can build behind it. it offers privacy but yet it is open and has plenty of space for OFFICE/BUSINESS parking. situated near Manchester street and concord airport. this country feeling home has a brick fireplace in the living room, open concept design with wood and large windows throughout. the second floor offers a picturesque and relaxing deck that covers the entire length of the home.

**Directions** From Rt. 93 --Take left off Manchester Street onto Airport Road. Home will be on your right set back off road. From Loudon Road take right and continue until end of Airport Road on Left.

### General Property Information

| | |
|---|---|
| **Year Built** | 1964 |
| **Taxes TBD** | Yes |
| **TaxGrosAmt** | $0.00 |
| **Tax Year** | 2013 |
| **Tax Year Notes** | |
| **Garage Type** | |
| **Garage Capacity** | 0 |
| **Basement** | Yes |
| **SchDistrct** | Concord School District SAU #8 |
| **SchHigh** | Concord High School |
| **SchMiddle** | Andover Elem/Middle School |
| **SchElem** | Abbot-Downing School |

| | |
|---|---|
| **ROWParcAc** | No |
| **ROWOthPar** | |
| **ROWLength** | |
| **ROWWidth** | |
| **WaterBody** | |
| **WatrBdyTp** | |
| **WaterAcc** | |
| **WtrFrnLgth** | |
| **Map** | |
| **Block** | |
| **Lot** | |
| **SPAN Number** | |

| | |
|---|---|
| **CS** | Existing, Wood Frame |
| **Lot - Acres** | 1.72 |
| **Total Stories** | 2 |
| **PlanUrbDev** | No |
| **Flood Zone** | Unknown |
| **Time/Frac** | No |
| **Resort** | No |

**IN** Fireplace - Wood, Fireplaces - 1, Laundry - 2nd Floor

**EX** Balcony, Outbuilding, Porch - Covered, Shed

**Fee**

### Property Features

| | |
|---|---|
| **Foreclosed/Bank-Owned/REO** | No |
| **Short Sale** | No |
| **Listing Type** | Exclusive Right |
| **Listing Service** | |
| **Buyer Agency** | 2.50 |
| **Buyer Agency Type** | % |
| **SubAgency** | 2.50 |
| **SubAgency Type** | % |
| **NonAgency Facilitator** | 2.50 |
| **NonAgency Facilitator Type** | % |
| **Transactional Broker** | |
| **Transactional Broker Type** | |
| **List Agent - Phone Number** | Cell: 603-231-5240 |
| **Showing Instructions** | Combo Lockbox, Showings by Email, Sign on Property , Vacant |

| | |
|---|---|
| **Exterior** | Wood |
| **Heating** | None |
| **Cooling** | None |

| | |
|---|---|
| **Prepared By** | Louis Manias |
| **Agent Phone** | Off: 603-228-9040 |
| **Office Name** | Capital Appraisal Assoc. |

| | |
|---|---|
| **Listing Agent** | Robert Sullivan |
| **Agent Phone** | Cell: 603-231-5240 |
| **Listing Office** | Allison James Estates & Homes/Chichester |

## Comparable B-1

**4356457 Note: Report Includes Internal Fields**

Previsite VTour URL **List:** 5/16/2014

Unbranded Tour URL 1 **Sold:** 8/1/2014

| | |
|---|---|
| **Listing Status** | Closed |
| **Price** | $238,000 |
| **Class** | Residential |
| **Type** | Single Family |
| **Address** | 60 Penacook Street |
| **Unit/Lot #** | |
| **City** | Concord |
| **State-** | New Hampshire |
| **Zip** | 03303 |
| **VillDstLoc** | Penacook |
| **County** | NH-Merrimack |

| | |
|---|---|
| **Dev/Subd** | |
| **Rooms - Total** | 7 |
| **BedsTot** | 3 |
| **Baths - Full** | 1 |
| **Baths - 3/4** | 1 |
| **Baths - 1/2** | 0 |
| **SqFtFnAG** | 1,952 |
| **SqFtFnBG** | 0 |
| **Price/SqFtFnAG** | $121.93 |
| **Days On Market** | 35 |

**Remarks - Public** Absolutely gorgeous 3 bedroom Cape with over 1950 sq ft. of living area. Beautifully remodeled with modern fully applianced kitchen w/ center island, gas range, built in mircrowave, SS fridge, dishwasher & trash compactor. Gleaming hardwood floors throughout. Fabulous showcase family room in rear with hardwood floor, cathedral ceiling, skylights, spectacular fireplace with tile surround, brass front and oak mantle. Two sliders and door to huge deck overlooking private wooded ravine. Open concept dining room and living room with hardwood floor and cased ceiling beams. Large first floor bedroom with 3/4 bath. Second floor has two more bedrooms with views of Merrimack River Valley across the street, Berber carpet and large full bath. Home sits on 1.35 acre lot with lovely landscaping. Spacious 2 bay attached garage. Much more. Great location and fabulous house.

**Directions** Rt. 93 to exit 17 toward US-3, enter roundabout take 2nd exit onto Barrett which becomes Tremont which becomes Canal, turn left on Maccoy then onto Merrimack and right on Pennacook, house on right at top of hill.

### General Property Information

| | |
|---|---|
| **Year Built** | 1938 |
| **Taxes TBD** | No |
| **TaxGrosAmt** | $6,396.00 |
| **Tax Year** | 2013 |
| **Tax Year Notes** | |
| **Garage Type** | Attached |
| **Garage Capacity** | 2 |
| **Basement** | Yes |
| **SchDistrct** | Merrimack Valley SAU #46 |
| **SchHigh** | Merrimack Valley High School |
| **SchMiddle** | Merrimack Valley Middle School |
| **SchElem** | Penacook Elementary |

| | |
|---|---|
| **ROWParcAc** | |
| **ROWOthPar** | |
| **ROWLength** | |
| **ROWWidth** | |
| **WaterBody** | |
| **WatrBdyTp** | |
| **WaterAcc** | |
| **WtrFrnLgth** | |
| **Map** | |
| **Block** | |
| **Lot** | |
| **SPAN Number** | |

| | |
|---|---|
| **CS** | Wood Frame |
| **Lot - Acres** | 1.35 |
| **Total Stories** | 2 |
| **PlanUrbDev** | |
| **Flood Zone** | No |
| **Time/Frac** | No |
| **Resort** | |

**IN** Cathedral Ceiling, Ceiling Fan, Dining Area, Fireplace - Wood, Fireplaces - 1, Hearth, Kitchen Island, Laundry Hook-ups, Living/Dining, Master BR w/ BA, Skylight

**EX** Deck, Fence - Partial, Porch, Porch - Covered

**Fee**

### Property Features

| | |
|---|---|
| **Foreclosed/Bank-Owned/REO** | No |
| **Short Sale** | No |
| **Listing Type** | Exclusive Right |
| **Listing Service** | |
| **Buyer Agency** | 2.50 |
| **Buyer Agency Type** | % |
| **SubAgency** | 0.00 |
| **SubAgency Type** | $ |
| **NonAgency Facilitator** | 2.50 |
| **NonAgency Facilitator Type** | % |
| **Transactional Broker** | |
| **Transactional Broker Type** | |
| **List Agent - Phone Number** | Cell: 603-818-1869 |
| **Showing Instructions** | Combo Lockbox, Pets, Security System, Showings by Email, ShowingTime 800-746-9464, Sign on Property, Single Broker Showing |

**Appliances** Dishwasher, Dryer, Microwave, Range - Gas, Refrigerator, Trash Compactor, Washer
**Exterior** Vinyl
**Features - Accessibility** 1st Floor 3/4 Bathroom, 1st Floor Bedroom, 1st Floor Hrd Surfce Flr, 1st Floor Low-Pile Carpet
**Heating** Baseboard, Hot Water, Stove
**Cooling** Air Conditioner, Window AC

| | |
|---|---|
| **Prepared By** | Louis Manias |
| **Agent Phone** | Off: 603-228-9040 |
| **Office Name** | Capital Appraisal Assoc. |

| | |
|---|---|
| **Listing Agent** | Team Sutton & Wells |
| **Agent Phone** | Cell: 603-818-1869 |
| **Listing Office** | BHHS Verani Londonderry |

## Comparable B-2

**4359811 Note: Report Includes Internal Fields**

Previsite VTour URL

**List:** 5/29/2014

**Sold:** 10/31/2014

| | |
|---|---|
| **Listing Status** | Closed |
| **Price** | $210,000 |
| **Class** | Residential |
| **Type** | Single Family |
| **Address** | 8 Lawrence Street Ext |
| **Unit/Lot #** | |
| **City** | Concord |
| **State-** | New Hampshire |
| **Zip** | 03301 |
| **VillDstLoc** | |
| **County** | NH-Merrimack |

| | |
|---|---|
| **Dev/Subd** | |
| **Rooms - Total** | 9 |
| **BedsTot** | 2 |
| **Baths - Full** | 1 |
| **Baths - 3/4** | 1 |
| **Baths - 1/2** | 0 |
| **SqFtFnAG** | 1,317 |
| **SqFtFnBG** | 586 |
| **Price/SqFtFnAG** | $159.45 |
| **Days On Market** | 102 |

**Remarks - Public** Great place for a small business...rent the house as another source of income...OR Need home for all your year round toys? Look no further. This unique property offers a 7 bay oversized detached and heated garage with 220 V electric service. Whether you are a woodworking hobbyist or need space for tools, cycles, cars, boats, or inventory, this IS it. Excited? Don't forget about this impeccable 2 bedroom home with a first floor master, eat -in kitchen and a one of a kind copper soaking tub. Utilize the finished lower level for additional living space or in an home office. You will be favorite hot spot during summer months enjoying your very own 20x40 in-ground pool. Nestled on a dead end street with privacy and close to shopping, schools & 93, makes this your perfect place to call HOME.

**Directions** Take Airport Rd to Lawrence St, L on Lawrence St Ext to #8 on right at dead end.

### General Property Information

| | |
|---|---|
| **Year Built** | 1944 |
| **Taxes TBD** | No |
| **TaxGrosAmt** | $5,105.52 |
| **Tax Year** | 2013 |
| **Tax Year Notes** | |
| **Garage Type** | Detached |
| **Garage Capacity** | 7 |
| **Basement** | Yes |
| **SchDistrct** | Concord School District SAU #8 |
| **SchHigh** | Concord High School |
| **SchMiddle** | Rundlett Middle School |
| **SchElem** | Broken Ground School |

| | |
|---|---|
| **ROWParcAc** | |
| **ROWOthPar** | |
| **ROWLength** | |
| **ROWWidth** | |
| **WaterBody** | |
| **WatrBdyTp** | |
| **WaterAcc** | |
| **WtrFrnLgth** | |
| **Map** | |
| **Block** | |
| **Lot** | |
| **SPAN Number** | |

| | |
|---|---|
| **CS** | Existing, Wood Frame |
| **Lot - Acres** | 0.72 |
| **Total Stories** | 1.5 |
| **PlanUrbDev** | |
| **Flood Zone** | No |
| **Time/Frac** | No |
| **Resort** | |

**IN** Ceiling Fan, Draperies, Fireplace - Gas, Fireplaces - 1, Hearth, Kitchen Island, Laundry Hook-ups, Master BR w/ BA, Natural Woodwork, Skylight, Window Treatment

**EX** Deck, Fence - Partial, Patio, Pool - In Ground, Porch - Covered, Handicap Modified

**Fee**

### Property Features

| | |
|---|---|
| **Foreclosed/Bank-Owned/REO** | No |
| **Short Sale** | No |
| **Listing Type** | Exclusive Right |
| **Listing Service** | |
| **Buyer Agency** | 2.50 |
| **Buyer Agency Type** | % |
| **SubAgency** | 0.00 |
| **SubAgency Type** | % |
| **NonAgency Facilitator** | 2.50 |
| **NonAgency Facilitator Type** | % |
| **Transactional Broker** | |
| **Transactional Broker Type** | |
| **List Agent - Phone Number** | Cell: 603-494-7327 |
| **Showing Instructions** | Showing Via Appt Service, Sign on Property |

**Appliances** Disposal, Exhaust Hood, Range - Electric
**Exterior** Board and Batten, Vinyl
**Features - Accessibility** 1st Floor 3/4 Bathroom, 1st Floor Bedroom, 1st Floor Full Bathroom, 1st Floor Hrd Surfce Flr, Access Parking, Bathroom w/Step-in Shower, Bathroom w/Tub, Handicap Modified, One-Level Home, Zero-Step Entry Ramp
**Heating** Baseboard, Hot Water
**Cooling** Air Conditioner, Window AC

| | |
|---|---|
| **Prepared By** | Louis Manias |
| **Agent Phone** | Off: 603-228-9040 |
| **Office Name** | Capital Appraisal Assoc. |

| | |
|---|---|
| **Listing Agent** | Michelle Gannon |
| **Agent Phone** | Cell: 603-494-7327 |
| **Listing Office** | Coldwell Banker Classic Realty |

## Comparable B-3

**4365501 Note: Report Includes Internal Fields**

Previsite VTour URL **List:** 6/20/2014

**Sold:** 10/1/2014

| | |
|---|---|
| **Listing Status** | Closed |
| **Price** | $187,380 |
| **Class** | Residential |
| **Type** | Single Family |
| **Address** | 25 Hot Hole Pond |
| **Unit/Lot #** | |
| **City** | Concord |
| **State-** | New Hampshire |
| **Zip** | 03301 |
| **VillDstLoc** | |
| **County** | NH-Merrimack |

| | |
|---|---|
| **Dev/Subd** | |
| **Rooms - Total** | 5 |
| **BedsTot** | 2 |
| **Baths - Full** | 1 |
| **Baths - 3/4** | 1 |
| **Baths - 1/2** | 0 |
| **SqFtFnAG** | 2,088 |
| **SqFtFnBG** | 0 |
| **Price/SqFtFnAG** | $89.74 |
| **Days On Market** | 75 |

**Remarks - Public** Charming country setting 1840 Cape style home, nestled on 5.10 acres. Enjoy a specious screened in porch off updated kitchen during the breezy summer evenings. Exposed beams throughout. First Floor full bath, laundry and bedroom. You don;t want to miss this one, landscaping is full of love and joy.

**Directions** Mountain Rd, take right on Shaker Rd, Right on Hot Hole Pond Rd, house is on left, sign on property.

### General Property Information

| | |
|---|---|
| **Year Built** | 1840 |
| **Taxes TBD** | No |
| **TaxGrosAmt** | $3,880.00 |
| **Tax Year** | 2014 |
| **Tax Year Notes** | |
| **Garage Type** | |
| **Garage Capacity** | 0 |
| **Basement** | Yes |
| **SchDistrct** | Concord School District SAU #8 |
| **SchHigh** | Concord High School |
| **SchMiddle** | Rundlett Middle School |
| **SchElem** | Broken Ground School |

**ROWParcAc**
**ROWOthPar**
**ROWLength**
**ROWWidth**
**WaterBody**
**WatrBdyTp**
**WaterAcc**
**WtrFrnLgth**
**Map**
**Block**
**Lot**
**SPAN Number**

| | |
|---|---|
| **CS** | Existing, Wood Frame |
| **Lot - Acres** | 5.10 |
| **Total Stories** | 1.5 |
| **PlanUrbDev** | |
| **Flood Zone** | Unknown |
| **Time/Frac** | No |
| **Resort** | |

**IN** Ceiling Fan, Dining Area, Fireplace - Gas, Fireplaces - 1, Kitchen Island, Kitchen/Dining, Laundry Hook -ups, Master BR w/ BA, Natural Woodwork, Skylight , Window Treatment, Laundry - 1st Floor

**EX** Outbuilding, Porch - Screened

**Fee**

### Property Features

| | |
|---|---|
| **Foreclosed/Bank-Owned/REO** | No |
| **Short Sale** | No |
| **Listing Type** | Exclusive Right |
| **Listing Service** | |
| **Buyer Agency** | 3.00 |
| **Buyer Agency Type** | % |
| **SubAgency** | 0.00 |
| **SubAgency Type** | % |
| **NonAgency Facilitator** | 3.00 |
| **NonAgency Facilitator Type** | % |
| **Transactional Broker** | |
| **Transactional Broker Type** | |
| **List Agent - Phone Number** | Cell: 603-520-2286 |
| **Showing Instructions** | 24 Hour Notice, Showings by Email, Sign on Property |

**Appliances** Cooktop - Gas, Dishwasher, Dryer, Exhaust Hood, Microwave, Refrigerator, Washer
**Exterior** Cedar, Shake
**Features - Accessibility** 1st Floor Full Bathroom, 1st Floor Hrd Surfce Flr
**Heating** Hot Water, Stove - Gas

| | |
|---|---|
| **Prepared By** | Louis Manias |
| **Agent Phone** | Off: 603-228-9040 |
| **Office Name** | Capital Appraisal Assoc. |

| | |
|---|---|
| **Listing Agent** | Kathy Ahlin |
| **Agent Phone** | Cell: 603-520-2286 |
| **Listing Office** | Exit Realty Great Beginnings |

**Conclusions**

In each of the previous sales grids, I have made an attempt to isolate an adjustment that could be attributed to the presence of an avigation easement. The data indicates that the market may not support a significant adjustment, if any. The previous sales grids indicate the following data.

Based on the summary of data shown above, the indicated range of a potential adjustment is from -1.59% to +4.11%. The difference between the control properties and the additional comparables identifies that those comparables that have a negative delta are reconciled to a value below the sale price of the control property. This could potentially indicate no effect as a result of the presence of an avigation easement. Thos properties with a positive delta are reconciled to a value that is higher than the sale price of the control property. That could potentially indicate a negative effect as a result of the presence of an avigation easement. Only the Rochester #1 grid indicates a positive delta for all three comparables. The Rochester Grid #2 indicates a positive delta for two of the three comparables. What is interesting is that the Swanzey data indicates a negative delta which would support no adjustment. The cumulative average indicated in the table above is the average of all 15 sales that were analyzed. That calculation indicates a total that is less than 1% which is nearly impossible to justify with an adjustment.

Overall, based on my interpretation of the market data included in this consultation report, I am of the opinion that a range of 0% to a maximum of 6% could possibly be supported by an adjustment to properties that are subject to or may be subject to an avigation easement.

**Additional Considerations**

Other considerations were examined by the appraiser in order to locate market data to show whether or not any impacts can be measured. One question is whether or not, in addition to an avigation easement, the removal of trees from an adjacent property has any impact on that other property's market value? Most if not all properties where avigation easements have been acquired have a right for the easement holder to remove the trees as necessary for airport and airplane safety. For properties located near the ends of the runways, this could be of some concern. However, in the several hundred properties that I examined where avigation easements were acquired, none of the sales were at the ends of the runways. What has occurred is that typically, an easement was acquired and paid for after negotiations between the airport and the adjacent property owner have taken place.

Data related to the amount paid for the easements is considered personal and private financial information. It is not available to the public as these negotiations are private and the amounts paid are not a matter of public record. It is also not clear, based on publicly available data, what the basis for the payment for the avigation easement might have been.

Specific data related to tree removal on properties adjacent to an airport, not owned by an airport, is also not readily available. One of the major areas of concern is the Edgewood Forest which is a property owned by the City of Keene that is adjacent to the airport. The City of Keene also owns Dillant-Hopkins Airport. The Edgewood Forest was donated to the City of Keene in 1960 and is subject to a conservation easement which includes a forest management plan. As part of the EA proposed by the Airport, trees located in this forest have to be removed to increase safety for pilots flying in to and leaving the airport. A question came up regarding the removal of trees on city owned property next to the airport and what potential impact it could have on adjacent properties.

Research related to this specific scenario revealed no data available that could be measured. This is an extremely specific submarket and no quantifiable conclusions can be made when no market sales data is available.

The Edgewood neighborhood was originally designed in 1913 and has evolved into a residential neighborhood with homes varying in age from 1910 through the present date. It was originally designed near an old horse racing area known as the Keene Driving Park. The Airport was purchased by the City of Keene in 1942 and continues its operation today. As mentioned earlier, there is a conservation easement on the Edgewood Forest along with a forest management plan that allows for harvesting and maintenance. I find that because the City of Keene owns both the Airport and Edgewood Park they clearly have a right to maintain those properties as needed. I would assume that any clearing of trees on the Edgewood Park parcel would be in compliance with any local, state or federal guidelines that may be imposed. It would also be reasonable to assume that owners of properties adjacent to Edgewood Park, in close proximity to the Airport, would have exercised their due diligence in researching the neighborhood and would be aware of the potential issues with respect to the airport, the avigation easements and the rights the City has to clear the trees at Edgewood Park. Because the City has the right to clear the trees, as necessary and within governmental guidelines, any issues with respect to potential changes in property values may not be a compensable item.

A property owner who lives in this neighborhood would be implicitly aware of any issues with respect to the operation of the Airport which is in close proximity to their homes. They are or should be expressly aware that airplanes fly over their neighborhood as they approach or leave Dillant-Hopkins Airport. With that knowledge in mind, they did choose to buy a home and live in this neighborhood. I do believe that the City of Keene would do its best to maintain the property identified as Edgewood Park in a manner that protects the pilots and airplanes that use the airport equally with the protection of properties in close proximity to the airport.

In conclusion, I was unable to locate data specific to the submarket which is identified as properties adjacent to airport property, where trees will be removed, showing any additional impact to value. The data does not exist, and if it does, the results of that data remain the personal, private and financial information of the parties involved which is not available as public information. I also contacted the State of New Hampshire Department of Transportation, Right of Way Bureau. I asked if there were any studies or compilations of data that were somewhat similar to what I described for them as part of my assignment. I asked this department because they are involved in the process of eminent domain for public roads and byways along with purchasing easements for rights of way, slopes, drainage and many others. The response from that department was they were not aware of any data they had in their files or reports that would be considered similar.

# APPRAISER QUALIFICATIONS

**APPRAISAL QUALIFICATIONS**

**of**

**LOUIS C. MANIAS**

**New Hampshire Certified General Appraiser**

**License No. 5**

## Education

Appraisal University
2012 - Site Analysis and Valuation
2012 - Appraising Historic Property
New Hampshire Real Estate Appraiser Board
2005 - Supervisor/Apprentice Training Seminar
LeMay School of Real Estate
2015 - National USPAP Update
2015 - Darker Shades of Gray
2014 - The Strange Case on Agile Mountain
2013 - National USPAP Update
2012 - Beyond Paired Sales
2010 - 2010-2011 National Uniform Standards of Appraisal Practice Update Seminar
2009 - National Uniform Standards of Appraisal Practice Update Course
2006- Federal Land Acquisition Appraising
2005 - Statistics & Modeling
Brooks Real Estate Services
2012 - National Uniform Standards of Appraisal Practice Update Course
2003 - National Uniform Standards of Appraisal Practice Update Course
Society of Real Estate Appraisers Seminar
Guide to Small Residential Income Property Form
Marshall & Swift
2004 - Calculator Method Workshop
JMB Real Estate Academy
2011 - Statistics, Modeling & Finance
1996 - Uniform Standards of Appraisal Practice Update Course
1995 - Appraising Income Properties
Institute of Real Estate Technologies
1993 - Let's Get Real About the Cost Approach
American Institute of Real Estate Appraisers
2007 - Appraising Contaminated Properties Seminar
1999 - Board of Tax & Land Appeal Preparedness Seminar
1998 - Litigation Skills for the Real Estate Appraiser
1988 - Standards of Professional Practice
1987 - Capitalization Techniques, Parts A & B
1986 - Basic Valuation Procedures
Principles of Real Estate Appraisal

McKissock Data Systems

2016 - Residential Appraisal Review
2016 - Even Odder - More Oddball Appraisals
2014 - Appraisal of Self Storage Facilties
2011 - Introduction to Expert Witness Testimony

2008 - Private Appraisal Assignments
The Cost Approach
Mortgage Fraud - Protect Yourself

2005 - National Uniform Standards of Appraisal Practice Update Course
Fannie Mae Revisions and the Appraiser
Appraising High Value Residential Properties
Appraisal Review

1999 - FHA Exam Prep and Residential Appraisal Guidelines

Trans-American Institute of Professional Studies, Inc.

2007 - National Uniform Standards of Appraisal Practice Update Course

Lee Institute of Real Estate

1986 - Course for Real Estate Salesman's License

University of New Hampshire

1975 - 1977 - Liberal Arts Course

**Professional Experience**

1989 - Present: .......................................... Capital Appraisal Associates
............... 128 So. Fruit Street, Concord, New Hampshire 03301

1985 - 1989: ............................................. Manias Appraisal Associates
...................101 Centre Street, Concord, New Hampshire 03301

1981 - 1985: ..................................Co-owner Fife and Drum Restaurant
84 North Main Street, Concord, NH 03301

**Professional Affiliations**

2002 - President Elect - Association of Appraiser Regulatory Officials
2001 - Vice President - Association of Appraiser Regulatory Officials
1999 - 2000 - Director at Large - Association of Appraiser Regulatory Officials
2001 - 2003 - Chairman of the New Hampshire Real Estate Appraiser Board
1996 - 2003 - Member of the New Hampshire Real Estate Appraisal Board
Certified Compliance Inspector - U. S. Department of H.U.D.
Certified Appraiser - U. S. Department of H.U.D.

**Court Experience**

Qualified Expert - Belknap County
Qualified Expert - Cheshire County
Qualified Expert - Grafton County
Qualified Expert - Merrimack County

Qualified Expert - Sullivan County
Qualified Expert - Carroll County
Qualified Expert - Hillsborough County
Qualified Expert - Rockingham County
Qualified Expert - Coos County
Qualified Expert - NH Board of Tax & Land Appeals
Qualified Expert - US Bankruptcy Court - NH Division
Qualified as expert in real estate appraiser in many local district courts.

# State of New Hampshire

**REAL ESTATE APPRAISER BOARD**

APPROVED TO PRACTICE AS A

**CERTIFIED GENERAL APPRAISER**

ISSUED TO: LOUIS C MANIAS

Certificate No: NHCG-5

EXPIRATION DATE: 04/30/2018

**State of New Hampshire**

**REAL ESTATE APPRAISER BOARD**

APPROVED TO PRACTICE AS A

**Certified General Appraiser**

ISSUED TO: LOUIS C MANIAS

Certificate No:
NHCG-5

EXPIRATION DATE:
04/30/2018

For additional information please contact the Board office at **dawn.couture@nh.gov** or visit our web site at **http://www.nh.gov/nhreab**

BUZZELL ASSOCIATES
Real Estate Appraisers & Consultants
9B Amy's Way * Gorham, Maine 04038 Phone/Fax (207) 839-6651

December 14, 2016

Ms. Janice E. Bland, M.Sc.
Associate/Senior Aviation Planner
Stantec Consulting Services Inc.
482 Payne Road
Scarborough, ME 04074

**RE: Dillant-Hopkins Airport**
**Environmental Assessment Phase 2**

As you requested, I have reviewed the Consulting Report for Runway 2 Approach at Dillant-Hopkins Airport, that was prepared by Louis C. Manias of Capital Appraisal Associates, Inc., of Concord, New Hampshire.

The prepared report was determined to meet the scope and purpose of the assignment, which generally was to determine if sufficient available public information existed to aid in the estimate of reasonable and realistic potential damage ranges due to the existence of avigation easements. As was found and reported, limited public data exists as most easements are acquired through negotiated settlement and thus do not become public records.

The data included in this consulting report involves properties over which transitional surface easements (7:1 slopes) were acquired and properties that are located along the sides of an airport and not those within the approach surface, which involve runways into the airport. The potential damage range estimated, 0% to 6%, is felt to be consistent with transitional surface easement adjustments experienced in my role as an airport project review appraiser over the past 35+ years.

The acquisition of approach surface avigation easements is quite different in that the clearance levels, proximity of flying aircraft and overall impact to properties is typically greater. Such damages exist when proposed approach surfaces are close enough to structures or the ground level that surrounding mature trees have to be removed or chimneys need to be taken down. Such instances impact the utility and desirability of the properties involved.

As each proposed avigation easement is inherently different for each property, there is no known formula or universally acceptable method that can be utilized to accurately estimate damages other than the accepted "before and after" appraisal process as required by the Federal Aviation Administration currently.

Please advise me if you require additional submissions or have any questions.

Respectfully submitted,
Buzzell Associates

Leland E Buzzell, Review Appraiser
Maine Certified General Appraiser
#CG-245 (12/31/16)

# APPENDIX B / NOISE AND AIR QUALITY ANALYSIS

U.S. Department
of Transportation
**Federal Aviation
Administration**

Office of Environment and Energy

800 Independence Ave., S.W.
Washington, D.C. 20591

12/20/2016

Richard Doucette
Airports Division
Federal Aviation Administration, New England Region
1200 District Avenue
Burlington, MA 01803

Dear Richard,

The Office of Environment and Energy (AEE) has received the memo dated November 23rd 2016, referencing HMMH Project Number 308290 requesting approval for custom taxi profiles and for a noise attenuation modeling technique for consideration of tree removal at the Dillant-Hopkins Airport (EEN) in Keene, NH in support of an environmental assessment.

In attachment A, the memo requests approval for custom AEDT 2c overflight profiles for use in modeling taxiway ground noise. The profiles will be developed at a height of 10 ft. above airfield elevation, at a constant taxi speed of 10 knots and an idle power setting of 10% of an aircraft's static thrust. These custom profiles will then be paired with taxiway path flight tracks to represent taxiway movements.

AEE **APPROVES** the use of these custom AEDT 2c overflight profiles for use in modeling taxiway ground noise at EEN.

In attachment B, the memo requests approval for the use of a noise attenuation modeling technique to evaluate the attenuation of single event A-weighted sound levels due to trees near the airfield. The measurement process outlined is used to determine the attenuation and is compared with the ISO 9613-2 standard for attenuation due to dense foliage.

As stated in FAA Order 1050.1F Section B-1.2
*Noise monitoring data is not required for FAA noise analyses, but may optionally be included in a NEPA document. Noise monitoring data should not be used to calibrate the noise model or to make a finding of significance.*

AEE therefore **DOES NOT APPROVE** the use of this technique for use in calibrating or adjusting modeled noise levels. AEE does however acknowledge that the measured attenuation levels may be reported without the need for approval as optional supplemental information. This supplemental information may not however, be used to alter or draw any alternative conclusions as to the findings of noise significance under NEPA.

Please understand that any approvals listed here are limited to this particular request for AEDT 2c and for the current Environmental Assessment at Dillant-Hopkins Airport (EEN) only. Any additional projects or non-standard modeling request at EEN or any other site will require separate approval.

Sincerely,

Rebecca Cointin
Manager
AEE/Noise Division

cc: Jim Byers (APP)

# Dillant-Hopkins Airport Environmental Assessment Draft Noise and Air Quality Technical Report

HMMH Report No. 308290
November 2016

Prepared for:

**Stantec, Inc.**

Scarborough, ME

Prepared by:

Brad Nicholas

Dominic Scarano

Phil DeVita

77 South Bedford Street

Burlington, MA 01803

# Contents

# Figures

# Tables

# 1 Background

This Technical Noise Report provides the results of the noise analyses completed by Harris Miller Miller & Hanson (HMMH) under contract to Stantec, Inc. for the Dillant-Hopkins Airport (EEN) Environmental Assessment (EA). The information contained within this report will help produce the noise section to the environmental documentation required by Federal Aviation Administration (FAA) to show compliance with the National Environmental Policy Act (NEPA).

## 1.1 Project Description

Dillant-Hopkins Airport (EEN) is a publically owned and operated general aviation airport located in Swanzey, New Hampshire. The airport is owned and operated by the City of Keene and serves the City of Keene, New Hampshire and surrounding areas. Airside facilities include: a 6,200 foot long by 100 foot wide asphalt runway, oriented along a north / south axis (Runway 2/20); a 4,000 foot long by 150 foot wide asphalt crosswind runway, oriented along a south-east / north-west axis (Runway 14/32), a taxiway paralleling Runway 2/20, with two (2) intersecting, exit/entrance taxiways; and, a general aviation ramp/apron area with several hangars, aircraft tie-downs, and a Fixed Base Operator (FBO) to the east of Runway 2/20. The airport also has a terminal building, aircraft parking, and a private commercial hangar to the north and west of Runway 2/20. The airport currently accommodates approximately 49,000 annual aircraft operations.

The purpose of this EA is to examine the potential environmental consequences of actions to address safety hazards resulting from vegetative obstructions to the Runway 20 approach. The Proposed Action that would be undertaken by the City of Keene is to remove these vegetative obstructions which are located both on and off airport property. In order to accomplish this, the City of Keene plans to acquire 32 avigation easements under the approach to Runway 20 and to clear approximately four (4) acres of vegetative obstructions to the Runway 20 approach. These easements are associated with a residential area located approximately 2,300 feet north of the Runway 20 end. The City of Keene will then selectively remove canopy trees within an approximately 15.6 acre area of forest to the north of Runway 20. The airport hopes to begin a forest management plan in this area to the north of Runway 20 in order to maintain a lack of obstructions to the Runway 20 approach.

### 1.1.1 Aircraft Noise Terminology

Noise is a complex physical quantity. The properties, measurement, and presentation of noise involve specialized terminology that can be difficult to understand. To provide a basic reference on these technical issues, this section introduces fundamentals of noise terminology (Section 1.1.2), the effects of noise on human activity (Section 1.1.3), noise propagation (Section 1.1.4), and noise-land use compatibility guidelines (Section 1.1.5).

### 1.1.2 Introduction to Noise Terminology

Analyses of potential impacts from changes in aircraft noise levels rely largely on a measure of cumulative noise exposure over an entire calendar year, expressed in terms of a metric called the Day-Night Average Sound Level (DNL). However, DNL does not provide an adequate description of noise for many purposes. A variety of measures, which are further described in subsequent sub-sections, are available to address essentially any issue of concern, including:

- Sound Pressure Level, SPL, and the Decibel, dB
- A-Weighted Decibel, dBA
- Maximum A-Weighted Sound Level, $L_{max}$
- Time Above, TA

- Sound Exposure Level, SEL
- Equivalent A-Weighted Sound Level, $L_{eq}$
- Day-Night Average Sound Level, DNL

#### 1.1.2.1 Sound Pressure Level, SPL, and the Decibel, dB

All sounds come from a sound source – a musical instrument, a voice speaking, an airplane passing overhead. It takes energy to produce sound. The sound energy produced by any sound source travels through the air in sound waves – tiny, quick oscillations of pressure just above and just below atmospheric pressure. The ear senses these pressure variations and – with much processing in our brain – translates them into "sound."

Our ears are sensitive to a wide range of sound pressures. The loudest sounds that we can hear without pain contain about one million times more energy than the quietest sounds we can detect. To allow us to perceive sound over this very wide range, our ear/brain "auditory system" compresses our response in a complex manner, represented by a term called sound pressure level (SPL), which we express in units called decibels (dB).

Mathematically, SPL is a logarithmic quantity based on the ratio of two sound pressures, the numerator being the pressure of the sound source of interest ($P_{source}$), and the denominator being a reference pressure ($P_{reference}$) [1]

$$\textit{Sound Pressure Level (SPL)} = 20 * Log\left(\frac{P_{source}}{P_{reference}}\right) dB$$

The logarithmic conversion of sound pressure to SPL means that the quietest sound that we can hear (the reference pressure) has a sound pressure level of about 0 dB, while the loudest sounds that we hear without pain have sound pressure levels of about 120 dB. Most sounds in our day-to-day environment have sound pressure levels from about 40 to 100 dB[2].

Because decibels are logarithmic quantities, we cannot use common arithmetic to combine them. For example, if two sound sources each produce 100 dB operating individually, when they operate simultaneously they produce 103 dB -- not the 200 dB we might expect. Increasing to four equal sources operating simultaneously will add another three decibels of noise, resulting in a total SPL of 106 dB. For every doubling of the number of equal sources, the SPL goes up another three decibels.

If one noise source is much louder than another is, the louder source "masks" the quieter one and the two sources together produce virtually the same SPL as the louder source alone. For example, a 100 dB and 80 dB sources produce approximately 100 dB of noise when operating together.

Two useful "rules of thumb" related to SPL are worth noting: (1) humans generally perceive a six to 10 dB increase in SPL to be about a doubling of loudness,[3] and (2) changes in SPL of less than about three decibels for an particular sound are not readily detectable outside of a laboratory environment.

---

[1] The reference pressure is approximately the quietest sound that a healthy young adult can hear.
[2] The logarithmic ratio used in its calculation means that SPL changes relatively quickly at low sound pressures and more slowly at high pressures. This relationship matches human detection of changes in pressure. We are much more sensitive to changes in level when the SPL is low (for example, hearing a baby crying in a distant bedroom), than we are to changes in level when the SPL is high (for example, when listening to highly amplified music).
[3] A "10 dB per doubling" rule of thumb is the most often used approximation.

### 1.1.2.2 A-Weighted Decibel

An important characteristic of sound is its frequency, or "pitch." This is the per-second oscillation rate of the sound pressure variation at our ear, expressed in units known as Hertz (Hz).

When analyzing the total noise of any source, acousticians often break the noise into frequency components (or bands) to consider the "low," "medium," and "high" frequency components. This breakdown is important for two reasons:

- Our ear is better equipped to hear mid and high frequencies and is least sensitive to lower frequencies. Thus, we find mid- and high-frequency noise more annoying.
- Engineering solutions to noise problems differ with frequency content. Low-frequency noise is generally harder to control.

The normal frequency range of hearing for most people extends from a low of about 20 Hz to a high of about 10,000 to 15,000 Hz. Most people respond to sound most readily when the predominant frequency is in the range of normal conversation – typically around 1,000 to 2,000 Hz. The acoustical community has defined several "filters," which approximate this sensitivity of our ear and thus, help us to judge the relative loudness of various sounds made up of many different frequencies.

The so-called "A" filter ("A weighting") generally does the best job of matching human response to most environmental noise sources, including natural sounds and sound from common transportation sources. "A-weighted decibels" are abbreviated "dBA." Because of the correlation with our hearing, the U. S. Environmental Protection Agency (EPA) and nearly every other federal and state agency have adopted A-weighted decibels as the metric for use in describing environmental and transportation noise. Figure 1 depicts A-weighting adjustments to sound from approximately 20 Hz to 10,000 Hz.

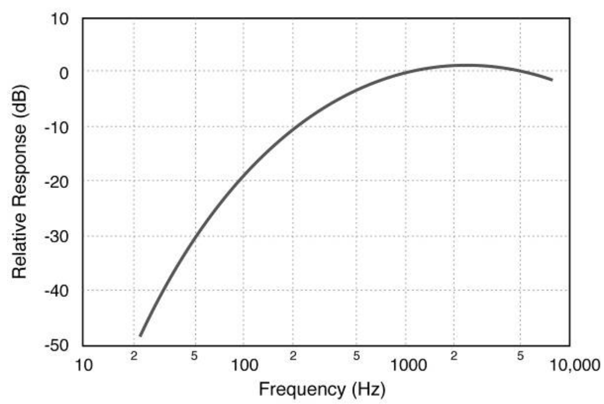



**Figure 1 A-Weighting Frequency Response**

Source: Extract from Harris, Cyril M., Editor, "Handbook of Acoustical Measurements and Control," McGraw-Hill, Inc., 1991, pg. 5.13; HMMH

As the figure shows, A-weighting significantly de-emphasizes noise content at lower and higher frequencies where we do not hear as well, and has little effect, or is nearly "flat," in for mid-range frequencies between 1,000 and 5,000 Hz. All sound pressure levels presented in this document are A-weighted unless otherwise specified.

Figure 2 depicts representative A-weighted sound levels for a variety of common sounds.

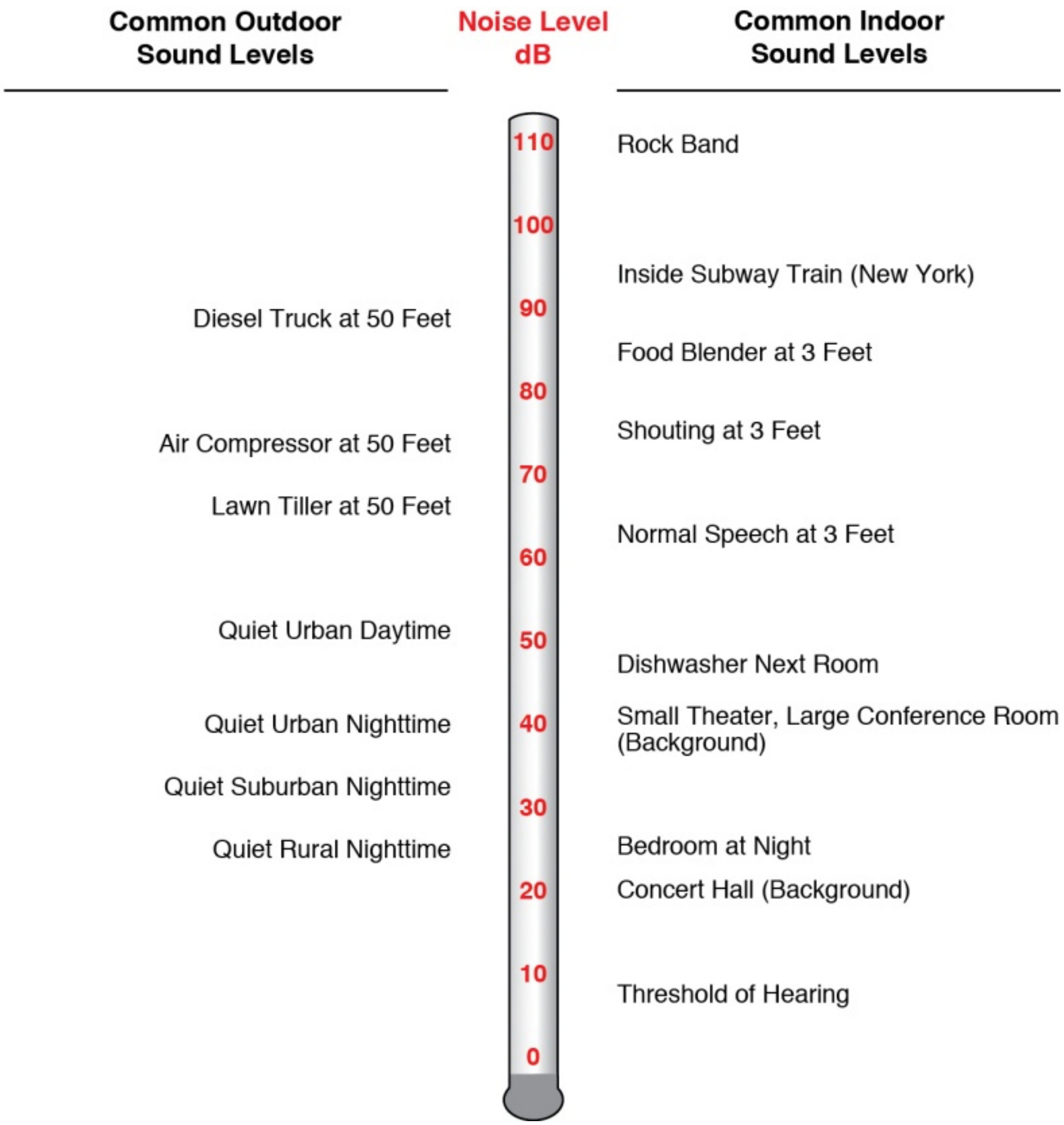



**Figure 2 A-Weighted Sound Levels for Common Sounds**

#### 1.1.2.3 Maximum A-Weighted Sound Level, $L_{max}$

An additional dimension to environmental noise is that A-weighted levels vary with time. For example, the sound level increases as a car or aircraft approaches, then falls and blends into the background as the aircraft recedes into the distance. The background or "ambient" level continues to vary in the absence of a distinctive source, for example due to birds chirping, insects buzzing, leaves rustling, etc. It is often convenient to describe a particular noise "event" (such as a vehicle passing by, a dog barking, etc.) by its maximum sound level, abbreviated as $L_{max}$.

Figure 3 depicts this general concept, for a hypothetical noise event with an $L_{max}$ of approximately 102 dB.

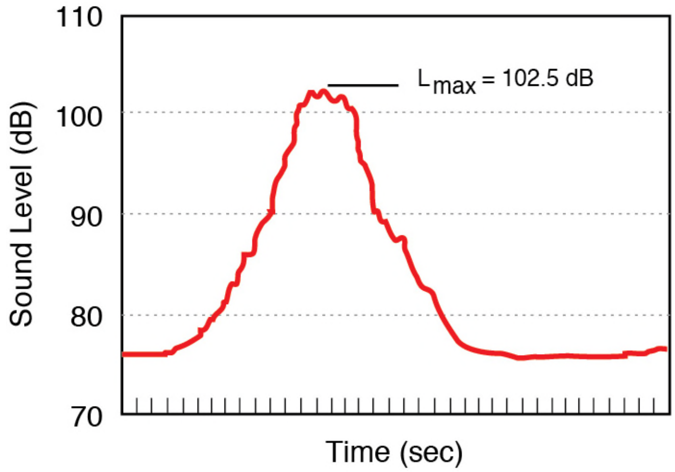



**Figure 3 Variation in A-Weighted Sound Level over Time and Maximum Noise Level**

Source: HMMH

While the maximum level is easy to understand, it suffers from a serious drawback when used to describe the relative "noisiness" of an event such as an aircraft flyover; i.e., it describes only one dimension of the event and provides no information on the event's overall, or cumulative, noise exposure. In fact, two events with identical maximum levels may produce very different total exposures. One may be of very short duration, while the other may continue for an extended period and be judged much more annoying. The next section introduces a measure that accounts for this concept of a noise "dose," or the cumulative exposure associated with an individual "noise event" such as an aircraft flyover.

#### 1.1.2.4 Time Above, TA

The Time Above metric reports the amount of time (in minutes or seconds) that the noise source of interest exceeds a given A-weighted sound level threshold. Every time the noise level goes above a given threshold, the number of seconds is accumulated and added to any previous periods that the noise exceeded the threshold. Similar to Number Above, Time Above is often abbreviated with the letters TA and the threshold level (e.g. TA65 for the Time Above 65 dBA). The Time Above value can be used to determine the duration of a noise effect, such as speech interference, using the thresholds discussed in Section 2.2.

#### 1.1.2.5 Sound Exposure Level, SEL

The most commonly used measure of cumulative noise exposure for an individual noise event, such as an aircraft flyover, is the Sound Exposure Level, or SEL. SEL is a summation of the A-weighted sound energy over the entire duration of a noise event. SEL expresses the accumulated energy in terms of the one-second-long steady-state sound level that would contain the same amount of energy as the actual time-varying level.

SEL provides a basis for comparing noise events that generally match our impression of their overall "noisiness," including the effects of both duration and level. The higher the SEL, the more annoying a noise event is likely to be. In simple terms, SEL "compresses" the energy for the noise event into a single second. Figure 4 depicts this compression, for the same hypothetical event shown in Figure 3. Note that the SEL is higher than the Lmax.

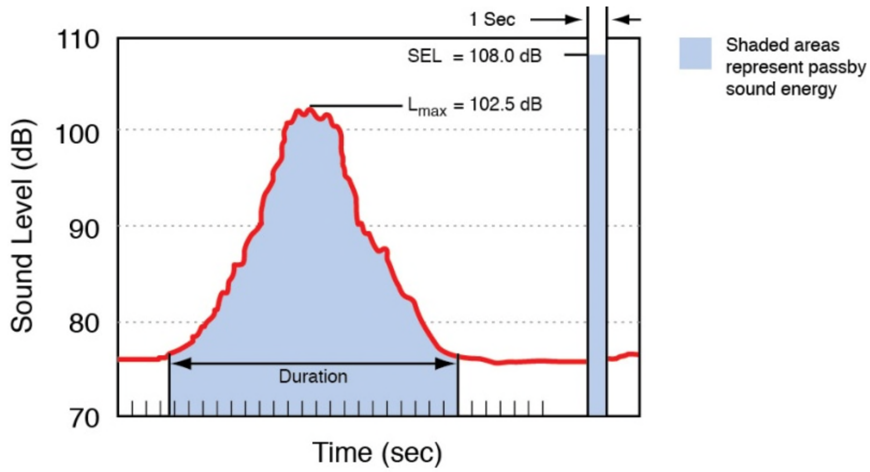



**Figure 4 Graphical Depiction of Sound Exposure Level**

Source: HMMH

The “compression “ of energy into one second means that a given noise event’s SEL will almost always will be a higher value than its Lmax. For most aircraft flyovers, SEL is roughly five to 12 dB higher than Lmax. Adjustment for duration means that relatively slow and quiet propeller aircraft can have the same or higher SEL than faster, louder jets, which produce shorter duration events.

### 1.1.2.6 Equivalent A-Weighted Sound Level, $L_{eq}$

The Equivalent Sound Level, abbreviated $L_{eq}$, is a measure of the exposure resulting from the accumulation of sound levels over a particular period of interest; e.g., one hour, an eight-hour school day, nighttime, or a full 24-hour day. Leq plots for consecutive hours can help illustrate how the noise dose rises and falls over a day or how a few loud aircraft significantly affect some hours.

Leq may be thought of as the constant sound level over the period of interest that would contain as much sound energy as the actual varying level. It is a way of assigning a single number to a time-varying sound level. Figure 5 illustrates this concept for the same hypothetical event shown in Figure 3 and Figure 4. Note that the Leq is lower than either the Lmax or SEL.

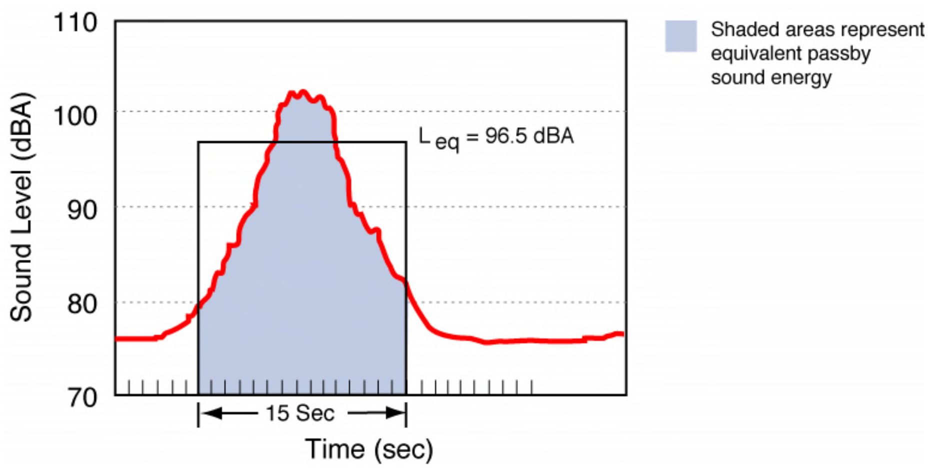



**Figure 5 Example of a 15-Second Equivalent Sound Level**

Source: HMMH

### 1.1.2.7 Day-Night Average Sound Level, DNL or Ldn

The FAA requires that airports use a measure of noise exposure that is slightly more complicated than Leq to describe cumulative noise exposure – the Day-Night Average Sound Level, DNL.

The U.S. Environmental Protection Agency identified DNL as the most appropriate means of evaluating airport noise based on the following considerations[4].

- The measure should be applicable to the evaluation of pervasive long-term noise in various defined areas and under various conditions over long periods.
- The measure should correlate well with known effects of the noise environment and on individuals and the public.
- The measure should be simple, practical, and accurate. In principal, it should be useful for planning as well as for enforcement or monitoring purposes.
- The required measurement equipment, with standard characteristics, should be commercially available.
- The measure should be closely related to existing methods currently in use.
- The single measure of noise at a given location should be predictable, within an acceptable tolerance, from knowledge of the physical events producing the noise.
- The measure should lend itself to small, simple monitors, which can be left unattended in public areas for long periods.

Most federal agencies dealing with noise have formally adopted DNL. The Federal Interagency Committee on Noise (FICON) reaffirmed the appropriateness of DNL in 1992. The FICON summary report stated: “There are no new descriptors or metrics of sufficient scientific standing to substitute for the present DNL cumulative noise exposure metric.”

In simple terms, DNL is the 24-hour Leq with one adjustment; all noises occurring at night (defined as 10 p.m. through 7 a.m.) are increased by 10 dB, to reflect the added intrusiveness of nighttime noise events when background noise levels decrease. In calculating aircraft exposure, this 10 dB increase is mathematically identical to counting each nighttime aircraft noise event ten times.

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[4] "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety," U. S. EPA Report No. 550/9-74-004, March 1974.

DNL can be measured or estimated. Measurements are practical only for obtaining DNL values for limited numbers of points, and, in the absence of a permanently installed monitoring system, only for relatively short periods. Most airport noise studies use computer-generated DNL estimates depicted as equal-exposure noise contours (much as topographic maps have contours of equal elevation).

The annual DNL is mathematically identical to the DNL for the average annual day; i.e., a day on which the number of operations is equal to the annual total divided by 365 (366 in a leap year). Figure 6 graphically depicts the manner in which the nighttime adjustment applies in calculating DNL. Figure 7 presents representative outdoor DNL values measured at various U.S. locations.

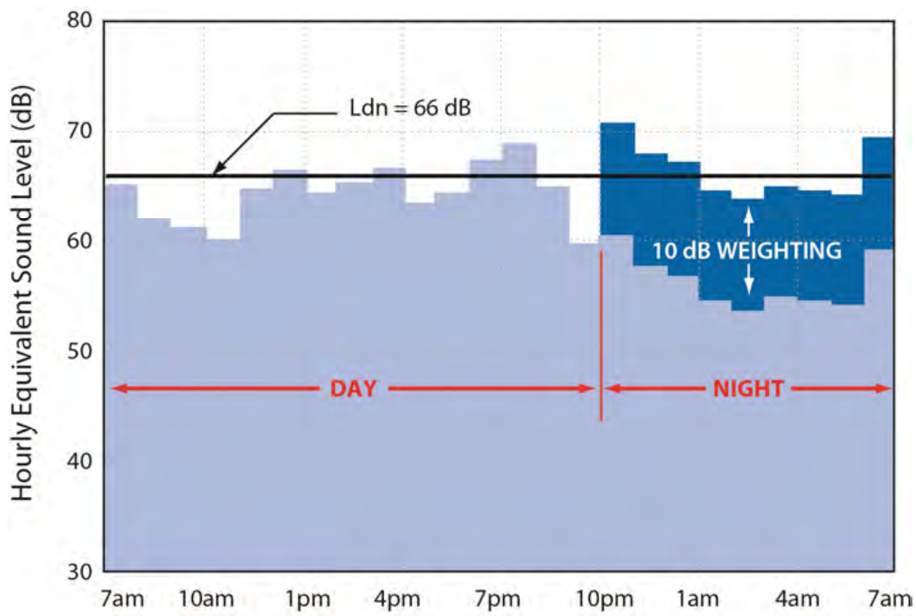


**Figure 6 Example of a Day-Night Average Sound Level Calculation**

Source: HMMH

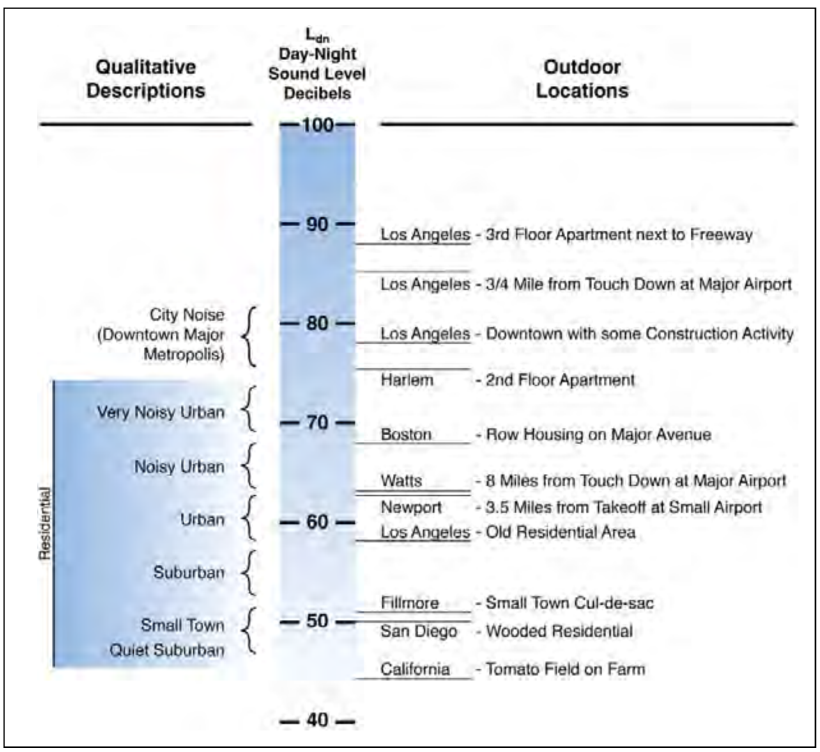


**Figure 7 Examples of Measured Day-Night Average Sound Levels, DNL**

Source: U.S. Environmental Protection Agency, "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety," March 1974, p.14.

### 1.1.3 Aircraft Noise Effects on Human Activity

Aircraft noise can be an annoyance and a nuisance. It can interfere with conversation and listening to television, disrupt classroom activities in schools, and disrupt sleep. Relating these effects to specific noise metrics helps in the understanding of how and why people react to their environment.

#### 1.1.3.1 Speech Interference

One potential effect of aircraft noise is its tendency to "mask" speech, making it difficult to carry on a normal conversation. The sound level of speech decreases as the distance between a talker and listener increases. As the background sound level increases, it becomes harder to hear speech.

Figure 8 presents typical distances between talker and listener for satisfactory outdoor conversations, in the presence of different steady A-weighted background noise levels for raised, normal, and relaxed voice effort. As the background level increases, the talker must raise his/her voice, or the individuals must get closer together to continue talking.

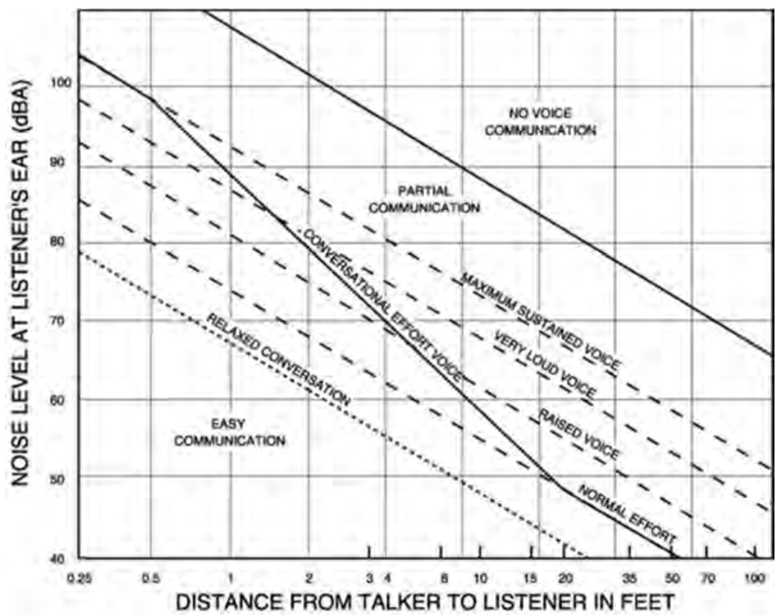


**Figure 8 Outdoor Speech Intelligibility**

Source: U.S. Environmental Protection Agency, “Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety,” March 1974, p.D-5.

Satisfactory conversation does not always require hearing every word; 95% intelligibility is acceptable for many conversations. In relaxed conversation, however, we have higher expectations of hearing speech and generally require closer to 100% intelligibility. Any combination of talker-listener distances and background noise that falls below the bottom line in the figure (which roughly represents the upper boundary of 100% intelligibility) represents an ideal environment for outdoor speech communication. Indoor communication is generally acceptable in this region as well.

One implication of the relationships in Figure 8 is that for typical communication distances of three or four feet, acceptable outdoor conversations can be carried on in a normal voice as long as the background noise outdoors is less than about 65 dB. If the noise exceeds this level, as might occur when an aircraft passes overhead, intelligibility would be lost unless vocal effort were increased or communication distance were decreased.

Indoors, typical distances, voice levels, and intelligibility expectations generally require a background level less than 45 dB. With windows partly open, housing generally provides about 10 to 15 dB of interior-to-exterior noise level reduction. Thus, if the outdoor sound level is 60 dB or less, there is a reasonable chance that the resulting indoor sound level will afford acceptable interior conversation. With windows closed, 24 dB of attenuation is typical.

### 1.1.3.2 Sleep Interference

Research on sleep disruption from noise has led to widely varying observations. In part, this is because (1) sleep can be disturbed without awakening, (2) the deeper the sleep the more noise it takes to cause arousal, (3) the tendency to awaken increases with age, and other factors. Figure 9 shows a recent summary of findings on the topic.

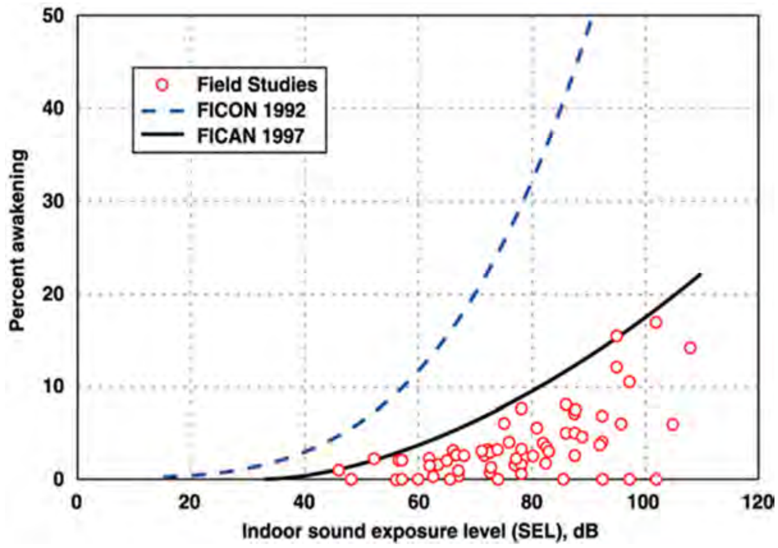


**Figure 9 Sleep Interference**

Source: Federal Interagency Committee on Aircraft Noise (FICAN), “Effects of Aviation Noise on Awakenings from Sleep,” June 1997, pg. 6

Figure 9 uses indoor SEL as the measure of noise exposure; current research supports the use of this metric in assessing sleep disruption. An indoor SEL of 80 dBA results in a maximum of 10% awakening.[5]

### 1.1.3.3 Community Annoyance

Numerous psychoacoustic surveys provide substantial evidence that individual reactions to noise vary widely with noise exposure level. Since the early 1970s, researchers have determined (and subsequently confirmed) that aggregate community response is generally predictable and relates reasonably well to cumulative noise exposure such as DNL. Figure 10 depicts the widely recognized relationship between environmental noise and the percentage of people “highly annoyed,” with annoyance being the key indicator of community response usually cited in this body of research.

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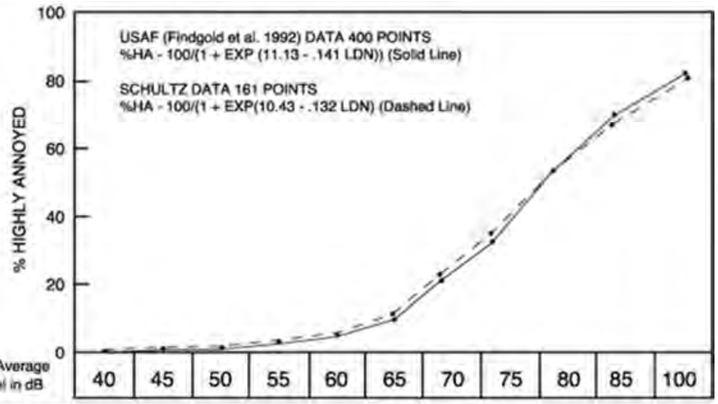
[5] The awakening data presented in Figure 9 apply only to individual noise events. The American National Standards Institute (ANSI) has published a standard that provides a method for estimating the number of people awakened at least once from a full night of noise events: ANSI/ASA S12.9-2008 / Part 6, “Quantities and Procedures for Description and Measurement of Environmental Sound – Part 6: Methods for Estimation of Awakenings Associated with Outdoor Noise Events Heard in Homes.” This method can use the information on single events computed by a program such as the FAA’s Aviation Environmental Design Tool, to compute awakenings.




| Day - Night Average Sound Level in dB | | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Calculated %HA Points | USAF | 0.41 | 0.831 | 1.66 | 3.31 | 6.48 | 12.29 | 22.1 | 36.47 | 53.74 | 70.16 | 82.64 |
| | SCHULTZ | 0.576 | 1.11 | 2.12 | 4.03 | 7.52 | 13.59 | 23.32 | 37.05 | 53.25 | 68.78 | 81 |

**Figure 10 Percentage of People Highly Annoyed**

Source: FICON, "Federal Agency Review of Selected Airport Noise Analysis Issues," September 1992

Separate work by the EPA has shown that overall community reaction to a noise environment is also dependent on DNL. Figure 11 depicts this relationship.

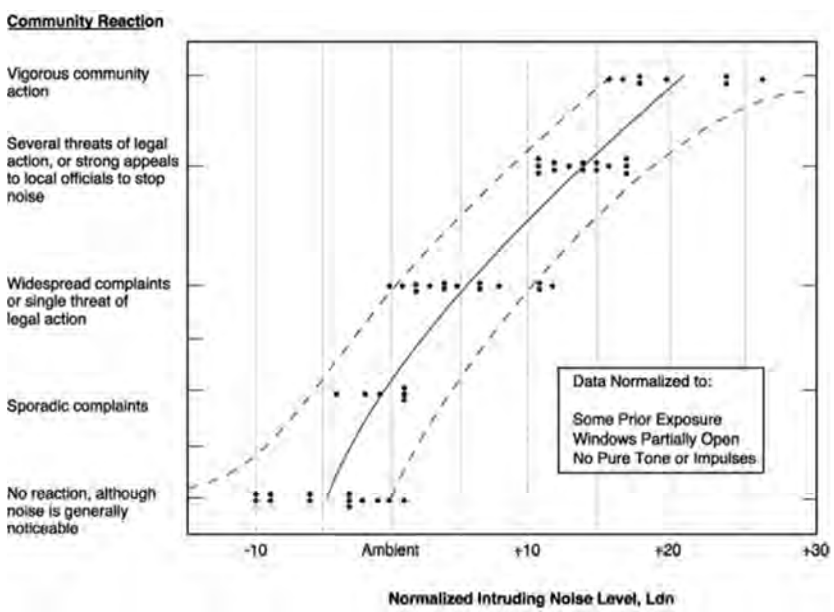



**Figure 11 Community Reaction as a Function of Outdoor DNL**

Source: Wyle Laboratories, Community Noise, prepared for the U.S. Environmental Protection Agency, Office of Noise Abatement and Control, Washington, D.C., December 1971, pg. 63

Data summarized in the figure suggest that little reaction would be expected for intrusive noise levels five decibels below the ambient, while widespread complaints can be expected as intruding noise exceeds background levels by about five decibels. Vigorous action is likely when levels exceed the background by 20 dB.

## 1.1.4 Noise Propagation

This section presents information sound-propagation effect due to weather, source-to-listener distance, and vegetation.

#### 1.1.4.1 Weather-Related Effects

Weather (or atmospheric) conditions that can influence the propagation of sound include humidity, precipitation, temperature, wind, and turbulence (or gustiness). The effect of wind – turbulence in particular – is generally more important than the effects of other factors. Under calm-wind conditions, the importance of temperature (in particular vertical “gradients”) can increase, sometimes to very significant levels. Humidity generally has little significance relative to the other effects.

***Influence of Humidity and Precipitation***

Humidity and precipitation rarely effect sound propagation in a significant manner. Humidity can reduce propagation of high-frequency noise under calm-wind conditions. This is called “Atmospheric absorption.” In very cold conditions, listeners often observe that aircraft sound “tinny,” because the dry air increases the propagation of high-frequency sound. Rain, snow, and fog also have little, if any noticeable effect on sound propagation. A substantial body of empirical data supports these conclusions.[6]

***Influence of Temperature***

The velocity of sound in the atmosphere is dependent on the air temperature.[7] As a result, if the temperature varies at different heights above the ground, sound will travel in curved paths rather than straight lines. During the day, temperature normally decreases with increasing height. Under such “temperature lapse" conditions, the atmosphere refracts ("bends") sound waves upwards and an acoustical shadow zone may exist at some distance from the noise source.

Under some weather conditions, an upper level of warmer air may trap a lower layer of cool air. Such a “temperature inversion” is most common in the evening, at night, and early in the morning when heat absorbed by the ground during the day radiates into the atmosphere.[8] The effect of an inversion is just the opposite of lapse conditions. It causes sound propagating through the atmosphere to refract downward.

The downward refraction caused by temperature inversions often allows sound rays with originally upward-sloping paths to bypass obstructions and ground effects, increasing noise levels at greater distances. This type of effect is most prevalent at night, when temperature inversions are most common and when wind levels often are very low, limiting any confounding factors.[9] Under extreme conditions, one study found that noise from ground-borne aircraft might be amplified 15 to 20 dB by a temperature inversion. In a similar study, noise caused by an aircraft on the ground registered a higher level at an observer location 1.8 miles away than at a second observer location only 0.2 miles from the aircraft.[10]

***Influence of Wind***

Wind has a strong directional component that can lead to significant variation in propagation. In general, receivers that are downwind of a source will experience higher sound levels, and those that are upwind will experience lower sound levels. Wind perpendicular to the source-to-receiver path has no significant effect.

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[6]Ingard, Uno. “A Review of the Influence of Meteorological Conditions on Sound Propagation,” *Journal of the Acoustical Society of America*, Vol. 25, No. 3, May 1953, p. 407.
[7]In dry air, the approximate velocity of sound can be obtained from the relationship:
$c = 331 + 0.6T_c$ (c in meters per second, $T_c$ in degrees Celsius). Pierce, Allan D., *Acoustics: An Introduction to its Physical Principles and Applications.* McGraw-Hill. 1981. p. 29.
[8]Embleton, T.F.W., G.J. Thiessen, and J.E. Piercy, “Propagation in an inversion and reflections at the ground,” *Journal of the Acoustical Society of America*, Vol. 59, No. 2, February 1976, p. 278.
[9]Ingard, p. 407.
[10]Dickinson, P.J., “Temperature Inversion Effects on Aircraft Noise Propagation,” (Letters to the Editor) *Journal of Sound and Vibration.* Vol. 47, No. 3, 1976, p. 442.

The refraction caused by wind direction and temperature gradients is additive. [11] One study suggests that for frequencies greater than 500 Hz, the combined effects of these two factors tends towards two extreme values: approximately 0 dB in conditions of downward refraction (temperature inversion or downwind propagation) and -20 dB in upward refraction conditions (temperature lapse or upwind propagation). At lower frequencies, the effects of refraction due to wind and temperature gradients are less pronounced. [12]

Wind turbulence (or "gustiness") can also affect sound propagation. Sound levels heard at remote receiver locations will fluctuate with gustiness. In addition, gustiness can cause considerable attenuation of sound due to effects of eddies traveling with the wind. Attenuation due to eddies is essentially the same in all directions, with or against the flow of the wind, and can mask the refractive effects discussed above. [13]

#### 1.1.4.2 Distance-Related Effects

People often ask how distance from an aircraft to a listener affects sound levels. Changes in distance may be associated with varying terrain, offsets to the side of a flight path, or aircraft altitude. The answer is a bit complex, because distance affects the propagation of sound in several ways.

The principal effect results from the fact that any emitted sound expands in a spherical fashion – like a balloon – as the distance from the source increases, resulting in the sound energy being spread out over a larger volume. With each doubling of distance, spherical spreading reduces instantaneous or maximum level by approximately six decibels and SEL by approximately three decibels.

#### 1.1.4.3 Vegetation-Related Effects

Sound can be scattered and absorbed as it travels through vegetation. This results in a decrease in sound levels. The literature on the effect of vegetation on sound propagation contains several approaches to calculating its effect. Though these approaches differ in some aspects, they agree on the following:

- The vegetation must be dense and deep enough to block the line of sight
- The noise reduction is greatest at high frequencies and least at low frequencies

The International Standard ISO 9613-2[14] provides a useful example of the types of calculations employed in these methods. Originally developed for industrial noise sources, ISO 9613-2 is well-suited for the evaluation of ground-based aircraft noise sources under favorable meteorological conditions for sound propagation. ISO 9613-2's methodology for calculating sound propagation includes geometric dispersion from acoustical point sources, atmospheric absorption, the effects of areas of hard and soft ground, screening due to barriers, and reflections. The attenuation provided by dense foliage varies by octave band and by distance as shown in Table 1.

For propagation through less than 10 m of dense foliage, no attenuation is assumed. For propagation through 10 m to 20 m of dense foliage, the total attenuation is shown in the first row of Table 1.

For distances between 20 m and 200 m, the total attenuation is computed by multiplying the distance of propagation through dense foliage by the dB/m values shown in the second row of Table 1.

[11] Piercy and Embleton, p. 1412. Note, in addition, that as a result of the scalar nature of temperature and the vector nature of wind, the following is true: under lapse conditions, the refractive effects of wind and temperature add in the upwind direction and cancel each other in the downwind direction. Under inversion conditions, the opposite is true.
[12] Piercy and Embleton, p. 1413.
[13] Ingard, pp. 409-410.
[14] International Organization for Standardization, Acoustics – Attenuation of sound during propagation outdoors – Part 2: General Method of calculation, International Standard ISO9613-2, Geneva, Switzerland (15 December 1996).

**Table 1 Dense Foliage Noise Attenuation**

Source: ISO 9613-2, Table A.1

| Propagation Distance | Nominal Midband Frequency (Hz) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1,000 | 2,000 | 4,000 | 8,000 |
| 10 m to 20 m (dB Attenuation) | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 3 |
| 20 m to 200 m (dB/m Attenuation) | 0.02 | 0.03 | 0.04 | 0.05 | 0.06 | 0.08 | 0.09 | 0.12 |

ISO 9613-2 assumes a moderate downwind condition. The equations in the ISO Standard also hold, equivalently, for average propagation under a well-developed moderate ground-based temperature inversion, such as commonly occurs on clear, calm nights. In either case, the sound is refracted downward. The radius of this curved path is assumed to be 5 km. With this curved sound path, only portions of the sound path may travel through the dense foliage, as illustrated by Figure 12. Thus the relative locations of the source and receiver, the dimensions of the volume of dense foliage, and the contours of the intervening terrain are essential to the estimation of the noise attenuation.

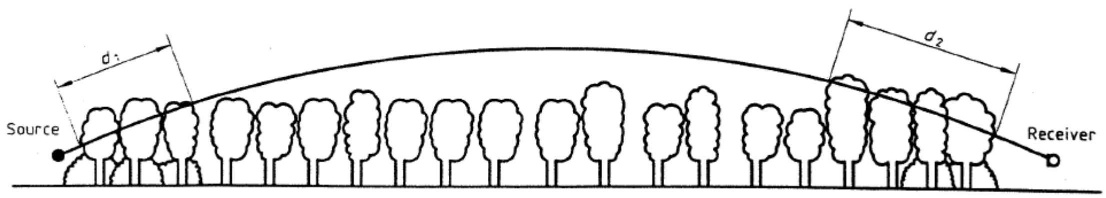



**Figure 12 Downward Refracting Sound Path (source: ISO 9613-2)**

As illustrated in, Figure 12, the foliage only provides attenuation if the sound path passes through the foliage. For aircraft in the air, the sound will pass through little, if any foliage. Thus, the focus of this study is on noise generated by aircraft on the ground. Additionally, either the noise source or receiver must be near the foliage for it to have an effect. Since, the aircraft ground operations are removed from the immediate area of the Proposed Action, the potential for changes in noise levels only exists for locations near the area of tree removal.

For this study, the effect of vegetation on sound propagation was directly measured on-site at the airport. This effort is discussed in detail in Section 4 .

### 1.1.5 Noise / Land Use Compatibility Guidelines

DNL estimates provide a quantitative basis for identifying potential noise impacts. 14 CFR Part 150 Appendix A provides land use compatibility guidelines as a function of DNL values. Table 2 reproduces those guidelines.

## Table 2 14 CFR Part 150 Noise / Land Use Compatibility Guidelines

Source: 14 CFR Part 150, Appendix A, Table 1

| Land Use | Yearly Day-Night Average Sound Level, DNL, in Decibels (Key and notes on following page) <65 | 65-70 | 70-75 | 75-80 | 80-85 | >85 |
|---|---|---|---|---|---|---|
| **Residential Use** | | | | | | |
| Residential other than mobile homes and transient lodgings | Y | N(1) | N(1) | N | N | N |
| Mobile home park | Y | N | N | N | N | N |
| Transient lodgings | Y | N(1) | N(1) | N(1) | N | N |
| **Public Use** | | | | | | |
| Schools | Y | N(1) | N(1) | N | N | N |
| Hospitals and nursing homes | Y | 25 | 30 | N | N | N |
| Churches, auditoriums, and concert halls | Y | 25 | 30 | N | N | N |
| Governmental services | Y | Y | 25 | 30 | N | N |
| Transportation | Y | Y | Y(2) | Y(3) | Y(4) | Y(4) |
| Parking | Y | Y | Y(2) | Y(3) | Y(4) | N |
| **Commercial Use** | | | | | | |
| Offices, business and professional | Y | Y | 25 | 30 | N | N |
| Wholesale and retail--building materials, hardware and farm equipment | Y | Y | Y(2) | Y(3) | Y(4) | N |
| Retail trade--general | Y | Y | Y(2) | Y(3) | Y(4) | N |
| Utilities | Y | Y | Y(2) | Y(3) | Y(4) | N |
| Communication | Y | Y | 25 | 30 | N | N |
| **Manufacturing and Production** | | | | | | |
| Manufacturing general | Y | Y | Y(2) | Y(3) | Y(4) | N |
| Photographic and optical | Y | Y | 25 | 30 | N | N |
| Agriculture (except livestock) and forestry | Y | Y(6) | Y(7) | Y(8) | Y(8) | Y(8) |
| Livestock farming and breeding | Y | Y(6) | Y(7) | N | N | N |
| Mining and fishing, resource production and extraction | Y | Y | Y | Y | Y | Y |
| **Recreational** | | | | | | |
| Outdoor sports arenas and spectator sports | Y | Y(5) | Y(5) | N | N | N |
| Outdoor music shells, amphitheaters | Y | N | N | N | N | N |
| Nature exhibits and zoos | Y | Y | N | N | N | N |
| Amusements, parks, resorts and camps | Y | Y | Y | N | N | N |
| Golf courses, riding stables, and water recreation | Y | Y | 25 | 30 | N | N |

**Key to Table 2**

SLCUM: Standard Land Use Coding Manual.

Y(Yes): Land use and related structures compatible without restrictions.

N(No): Land use and related structures are not compatible and should be prohibited.

NLR: Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.

25, 30, or 35: Land use and related structures generally compatible; measures to achieve NLR of 25, 30, or 35 dBA must be incorporated into design and construction of structure.

**Notes for Table 2**

The designations contained in this table do not constitute a Federal determination that any use of land covered by the program is acceptable or unacceptable under Federal, State, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under Part 150 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise compatible land uses.

(1) Where the community determines that residential or school uses must be allowed, measures to achieve outdoor to indoor Noise Level Reduction (NLR) of at least 25 dBA and 30 dBA should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dBA, thus, the reduction requirements are often started as 5, 10, or 15 dBA over standard construction and normally assume mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems.

(2) Measures to achieve NLR of 25 dBA must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

(3) Measures to achieve NLR of 30 dBA must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.

(4) Measures to achieve NLR of 35 dBA must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

(5) Land use compatible provided special sound reinforcement systems are installed.

(6) Residential buildings require an NLR of 25.

(7) Residential buildings require an NLR of 30

(8) Residential buildings not permitted.

## 1.2 Regulatory Context

Navigable airspace and civil aircraft operations therein are regulated by the FAA. The airports, air traffic communications/navigation/surveillance infrastructure, operating rules, policies, and personnel engaged in air commerce are collectively referred to as the National Airspace System (NAS), and under US law the FAA, an agency of the US Department of Transportation, is the primary steward of the NAS. Accordingly, civil airports in the US are designed and operate according to FAA regulations.

The President's Council on Environmental Quality (CEQ) issues regulations for implementing NEPA (40 CFR 1500-1508) which are binding upon all Executive Branch departments and agencies of the Federal Government and which direct departments and agencies to issue implementing regulations. In turn, the FAA has adopted an agency-wide order (FAA Order 1050.1F *Environmental Impacts: Policies and Procedures*) and the FAA Office of Airports has similarly issued supplemental implementing regulations, FAA Order 5040.1A *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions.*

CEQ regulations establish three levels of analysis for Federal actions under NEPA. Initial investigation by the FAA and airport sponsor indicates that the intermediate level of analysis is indicated, an Environmental Assessment (EA) to determine whether significant impacts would occur if the Proposed Action or its alternatives were implemented.

The noise analysis for this EA was conducted in accordance the guidance and regulations specified above. In particular, FAA Order 1050.1F, effective July 16, 2015, and its associated desk reference published concurrently, specifies a number of requirements for the noise analyses. These include:

- Acceptable noise models to be used and the circumstances under which their use is required;
- The metrics to be used for characterizing the noise environment and quantifying impacts;
- Thresholds of significance for determining whether the effects of an action would constitute a significant impact under NEPA; and
- Circumstances indicating that supplemental noise analyses are indicated.

### 1.2.1 Noise Models and Metrics

For an action occurring on or in the vicinity of a single airport, the desk reference directs the use of the Aviation Environmental Design Tool for detailed noise modeling (§11.1.4 of FAA Order 1050.1F desk reference). This software package models aircraft operations to determine predicted noise exposure, enabling an evaluation of anticipated effects that the Proposed Action or its alternatives would have on the noise setting. Specifically, FAA Order 1050.1F and the desk reference require the use of AEDT to determine the significance of changes in exposure to aircraft noise. The model must also be used to produce DNL 75 dB, DNL 70 dB, and DNL 65 dB contours and others as may be needed.

### 1.2.2 Thresholds of Significance

FAA Order 1050.1F identifies the threshold of "significant impact" based on the yearly DNL and an incorporation of compatible land-use standards found at 14 CFR Part 150, *Airport Noise Compatibility Planning*, specifically in Appendix A of that regulation. Implementation of a proposed Federal action would have a significant impact with respect to aircraft noise if it would cause a location with an incompatible land use (as identified in 14 CFR Part 150, Appendix A) to be exposed to a project-related increase in noise level of DNL 1.5 dB or more, provided that location would also lie within the 65 dB DNL noise contour upon implementation of the action. The noise setting to which the Proposed Action is compared is that which would be present under the No Action alternative, as required under FAA guidance (FAA Order 1050.1F, §4.3.3, Exhibit 4-1).

The FAA Orders previously referenced also provide direction for disclosing changes in aircraft noise exposure that while not meeting the threshold of significance, are nonetheless of interest to stakeholders. These are referred to as "reportable" changes. This implements a 1992 Federal Interagency Committee on

Noise (FICON) recommendation that in addition to significant impacts, less-than-significant noise level changes be identified for noise-sensitive locations exposed to Project-related increases. FICON recommended reporting any increases in DNL of 3 dB or more between 60 and 65 dB DNL, and increases of DNL 5 dB or more between 45 and 60 dB DNL. These recommendations ordinarily only apply to cases where the significant threshold (increase of 1.5 dB or more within the 65 dB DNL contour) is met or exceeded. Levels of significance for noise sensitive locations are summarized below.

Significant noise impact:

- DNL increase of 1.5 dB or more in areas of 65 dB DNL and higher

Less than significant impact:

- DNL increase of 3 dB or more in areas between 60 and 65 dB DNL
- DNL increase of 5 dB or more in areas between 45 and 60 dB DNL

### 1.2.3 Study Area

In NEPA documents, the study area for noise is the geographic area with the potential to be impacted by noise from the proposed project. It must be large enough to include the area within the DNL 65 dB contours and may be larger. In this EA, the noise analysis included the extents of the 65 dB DNL contours and the neighborhood immediately north of the tree removal area. This is the only area where the removal of trees may potentially change noise levels from aircraft ground operations.

# 2 Development of Noise Modeling Input

The basic tool used to model aircraft flight operations is the AEDT, developed by the FAA. For all analyses in the EA, HMMH used the latest available version of AEDT, Version 2c. The AEDT uses airport geometry, descriptions of aircraft operations, and an internal database of noise and performance characteristics to compute the noise of individual flights. The AEDT then adds noise of individual flights together and presents the accumulation as a set of contours noise calculations at specific points. These results can be reported at each point or presented as a set of contours of equal noise exposure.

Detailed inputs to the AEDT fall into two general categories of information:

- Physical characteristics
  - Airfield layout
  - Flight track geometry
  - Terrain
  - Climatological data
  - Aircraft noise and performance data
- Operational characteristics
  - Aircraft operations (daily by time of day)
  - Runway use
  - Flight track use

Historical data traceable to sources, such as airport operations records and radar data, are used to develop descriptions of past noise environments. Predicted aspects of an airport's operations are used to evaluate alternative assumptions regarding growth, future aircraft fleets, shifting of flight paths, new runway and taxiway configurations, delay, noise mitigation measures, and other critical planning efforts.

## 2.1 Physical Characteristics

The physical characteristics of the noise model input are distinguished from operational inputs by the fact that they can be measured in physical units. The characteristics of the airfield layout and flight track geometry inputs are specified by their spatial geometry with geographic coordinates and elevations. Climatological data, aircraft noise, and aircraft performance are measured using other physical units such as percent relative humidity, decibels, or pounds of thrust.

### 2.1.1 Airfield Layout and Flight Track Geometry

The Proposed Action will not change the airfield layout at EEN. The current runway layout is shown in Table 3.

**Table 3 Runway Layout**

Source: FAA Form 5010

| Runway | Latitude | Longitude | Elevation (ft.) | Threshold Crossing Height (ft.) | Glide Slope (deg.) | Displaced Threshold (ft) | Width (ft) |
|---|---|---|---|---|---|---|---|
| 2 | 42.887320 | -72.270871 | 488 | 39 | 3 | 0 | 100 |
| 20 | 42.904308 | -72.269565 | 482 | 50 | 3 | 0 | 100 |
| 14 | 42.905714 | -72.27761 | 472 | 50 | 3 | 0 | 150 |
| 32 | 42.899094 | -72.265699 | 482 | 50 | 3 | 1100 | 150 |

Because the Proposed Action is not expected to change aircraft flight paths and is primarily focused on ground noise, the EA utilized a single set of "straight-in, straight-out" flight tracks for all scenarios. These tracks are shown in Figure 13. In order to model taxi operations, HMMH developed a special set of taxi tracks. Arrival taxi tracks originate at a runway end and terminate at a specific area on the airfield where aircraft are likely to park, while departure taxi tracks originate at a parking area and terminate at a runway end where the aircraft will depart. All parking areas and the distribution of operations that utilized each taxi track and parking area were developed by HMMH in accordance with input from interviews conducted with airport users. The distribution of operations to each parking area is shown in Table 4 and the tracks themselves are shown in Figure 14. Note that the taxi tracks are represented in green while runway centerlines are represented in red. These percentages were distributed across all air operations. Also note that the propeller category includes all SEP, MEP, and turboprop aircraft.

**Table 4 Taxi Track Distribution**

Source: EEN Airport Users, HMMH

| Parking Area | Jet | Propeller |
|---|---|---|
| Northwest Ramp | 100% | 0% |
| Terminal Ramp | 0% | 30% |
| Northeast Ramp | 0% | 30% |
| T Hangars | 0% | 40% |

**Figure 13 Flight Operation Model Tracks**

Source: HMMH

## Figure 14 Taxi Operation Model Tracks

Source: HMMH

### 2.1.2 Aircraft Noise and Performance Characteristics

The AEDT includes a database of noise and performance data for a broad range of representative aircraft types. Noise data cover a range of distances (from 200 feet to 25,000 feet) for specific thrust levels. Performance data include thrust, speed, and altitude profiles for takeoff and landing operations. The AEDT database contains more than three hundred different aircraft types, including fixed-wing aircraft and helicopters, both civilian and military. The program automatically accesses the applicable noise and performance data for departure and approach operations by those aircraft. For aircraft not included in the database, the FAA maintains a list of acceptable substitutes.

AEDT users do not normally alter the model's internal noise and performance databases as a part of the modeling process. However, when there is an identifiable need such as a frequently-used non-standard thrust setting or climb profile, the FAA requires that any changes to these databases be approved by them prior to use on any FAA-sponsored project. FAA also requires approval for certain substitutions of aircraft types that occasionally appear in historical radar data but are not represented within the AEDT database.

HMMH did not use any aircraft substitutions or alter any noise or performance characteristics for AEDT standard aircraft. In order to model taxi operations, however, HMMH used a non-standard modeling procedure. As discussed in Section 2.1.1, several taxi tracks were created around the airfield. In order to model taxi operations, each taxi operation follows the appropriate track as an overflight operation at an altitude of 10 feet above field elevation, a constant speed of 10 knots, and an idle power setting that is 10% of the maximum static thrust for the aircraft.

### 2.1.3 Climatological Data

The AEDT accounts for the effects that airfield elevation and the average annual meteorological conditions have on aircraft performance. Aircraft departing an airport with a high temperature and/or a high elevation must use more thrust than at lower temperatures and elevations. The performance data used by the model define the length of the takeoff roll (based on aircraft takeoff weight), the climb rate, and speeds for each flight segment. Additionally, the AEDT accounts for the effect of temperature and humidity on acoustic propagation as explained in Section 1.1.4.1. The AEDT contains standard reference climatological data for airports throughout the US. The EA noise modeling utilized the following average data for EEN from the AEDT database:

- Temperature of 44.0 degrees F
- Sea-level pressure of 1016.64 millibars
- Relative humidity of 71.05 percent
- Wind speed of 4.62 knots

## 2.2 Operational Characteristics

Once the physical characteristics are defined in AEDT, the numbers and types of aircraft using the runways, flight tracks, and noise and performance data must be specified. These operational characteristics can be broken into three categories: airport operations data, runway use, and flight track use.

### 2.2.1 Airport Operations Data

Noise modeling in the AEDT requires a detailed specification of the number of operations, types of aircraft, and the time of day at which the aircraft depart and land. Each aspect influences the total computed noise exposure. Obviously, the number of flights is important to the noise generated, but the time of day for aircraft operations is equally vital. Each nighttime flight has a ten-decibel increase applied. This makes each nighttime flight equivalent to ten daytime flights. Likewise, the careful selection of AEDT aircraft types ensures that the most representative noise and performance data is used from AEDT's database.

Stantec developed general aircraft group estimates for current (2016) and future (2021) conditions at the airport. HMMH took the operations by aircraft group and further developed detailed fleet mix and day/night splits of operations using flight plan data from the FAA's Traffic Flow Management System. Table 5 and Table 6 present the noise modeling operations for the current and future scenarios, respectively. Note that these numbers represent daily operations. Also note that SEP stands for "single engine piston" while MEP stands for "multi-engine piston". Note that the AEDT type CNA208 appears in both the turboprop and SEP groups in the tables. This is because the noise data for the Cessna Caravan is used in AEDT as the FAA's approved substitution for some single engine piston aircraft that do not have noise data within the model.

## Table 5 Existing (2016) Conditions Operations

Source: Stantec, HMMH

| AEDT Type | Ops Group | Arrivals | | | Departures | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | Day | Night | Total | Day | Night | Total | |
| CL600 | Jet | 0.59 | 0.07 | 0.67 | 0.59 | 0.07 | 0.67 | **1.33** |
| LEAR35 | Jet | 0.43 | 0.05 | 0.48 | 0.43 | 0.05 | 0.48 | **0.96** |
| CNA750 | Jet | 0.19 | 0.02 | 0.21 | 0.19 | 0.02 | 0.21 | **0.42** |
| CNA560U | Jet | 0.13 | 0.02 | 0.15 | 0.13 | 0.02 | 0.15 | **0.30** |
| CNA525C | Jet | 0.06 | 0.01 | 0.07 | 0.06 | 0.01 | 0.07 | **0.14** |
| CNA500 | Jet | 0.05 | 0.01 | 0.06 | 0.05 | 0.01 | 0.06 | **0.12** |
| COMJET | Jet | 0.04 | 0.00 | 0.04 | 0.04 | 0.00 | 0.04 | **0.09** |
| CNA55B | Jet | 0.03 | 0.00 | 0.04 | 0.03 | 0.00 | 0.04 | **0.08** |
| CNA680 | Jet | 0.03 | 0.00 | 0.04 | 0.03 | 0.00 | 0.04 | **0.08** |
| GV | Jet | 0.01 | 0.00 | 0.02 | 0.01 | 0.00 | 0.02 | **0.03** |
| GIV | Jet | 0.01 | 0.00 | 0.01 | 0.01 | 0.00 | 0.01 | **0.02** |
| CNA510 | Jet | 0.01 | 0.00 | 0.01 | 0.01 | 0.00 | 0.01 | **0.01** |
| IA1125 | Jet | 0.01 | 0.00 | 0.01 | 0.01 | 0.00 | 0.01 | **0.01** |
| BEC58P | MEP | 4.78 | 0.24 | 5.02 | 4.78 | 0.24 | 5.02 | **10.04** |
| CNA172 | SEP | 20.07 | 1.02 | 21.09 | 20.07 | 1.02 | 21.09 | **42.19** |
| GASEPF | SEP | 17.87 | 0.91 | 18.78 | 17.87 | 0.91 | 18.78 | **37.56** |
| GASEPV | SEP | 6.27 | 0.32 | 6.58 | 6.27 | 0.32 | 6.58 | **13.17** |
| CNA182 | SEP | 4.41 | 0.22 | 4.63 | 4.41 | 0.22 | 4.63 | **9.27** |
| CNA208 | SEP | 3.02 | 0.15 | 3.17 | 3.02 | 0.15 | 3.17 | **6.34** |
| COMSEP | SEP | 2.55 | 0.13 | 2.68 | 2.55 | 0.13 | 2.68 | **5.37** |
| PA30 | SEP | 0.81 | 0.04 | 0.85 | 0.81 | 0.04 | 0.85 | **1.71** |
| CNA208 | Turboprop | 1.93 | 0.10 | 2.03 | 1.93 | 0.10 | 2.03 | **4.05** |
| DHC6 | Turboprop | 1.07 | 0.05 | 1.13 | 1.07 | 0.05 | 1.13 | **2.25** |
| CNA441 | Turboprop | 0.19 | 0.01 | 0.20 | 0.19 | 0.01 | 0.20 | **0.39** |
| **TOTAL** | | **64.56** | **3.40** | **67.96** | **64.56** | **3.40** | **67.96** | **135.92** |

## Table 6 Future (2021 Forecast) Operations

Source: Stantec, HMMH

| AEDT Type | Ops Group | Arrivals | | | Departures | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | Day | Night | Total | Day | Night | Total | |
| CL600 | Jet | 0.60 | 0.07 | 0.67 | 0.60 | 0.07 | 0.67 | **1.35** |
| LEAR35 | Jet | 0.43 | 0.05 | 0.49 | 0.43 | 0.05 | 0.49 | **0.97** |
| CNA750 | Jet | 0.19 | 0.02 | 0.21 | 0.19 | 0.02 | 0.21 | **0.42** |
| CNA560U | Jet | 0.14 | 0.02 | 0.15 | 0.14 | 0.02 | 0.15 | **0.30** |
| CNA525C | Jet | 0.06 | 0.01 | 0.07 | 0.06 | 0.01 | 0.07 | **0.14** |
| CNA500 | Jet | 0.05 | 0.01 | 0.06 | 0.05 | 0.01 | 0.06 | **0.12** |
| COMJET | Jet | 0.04 | 0.00 | 0.04 | 0.04 | 0.00 | 0.04 | **0.09** |
| CNA55B | Jet | 0.03 | 0.00 | 0.04 | 0.03 | 0.00 | 0.04 | **0.08** |
| CNA680 | Jet | 0.03 | 0.00 | 0.04 | 0.03 | 0.00 | 0.04 | **0.08** |
| GV | Jet | 0.01 | 0.00 | 0.02 | 0.01 | 0.00 | 0.02 | **0.03** |
| GIV | Jet | 0.01 | 0.00 | 0.01 | 0.01 | 0.00 | 0.01 | **0.02** |
| CNA510 | Jet | 0.01 | 0.00 | 0.01 | 0.01 | 0.00 | 0.01 | **0.01** |
| IA1125 | Jet | 0.01 | 0.00 | 0.01 | 0.01 | 0.00 | 0.01 | **0.01** |
| BEC58P | MEP | 4.83 | 0.24 | 5.07 | 4.83 | 0.24 | 5.07 | **10.15** |
| CNA172 | SEP | 20.28 | 1.03 | 21.31 | 20.28 | 1.03 | 21.31 | **42.62** |
| GASEPF | SEP | 18.05 | 0.92 | 18.97 | 18.05 | 0.92 | 18.97 | **37.94** |
| GASEPV | SEP | 6.33 | 0.32 | 6.65 | 6.33 | 0.32 | 6.65 | **13.30** |
| CNA182 | SEP | 4.45 | 0.23 | 4.68 | 4.45 | 0.23 | 4.68 | **9.36** |
| CNA208 | SEP | 3.05 | 0.16 | 3.20 | 3.05 | 0.16 | 3.20 | **6.41** |
| COMSEP | SEP | 2.58 | 0.13 | 2.71 | 2.58 | 0.13 | 2.71 | **5.42** |
| PA30 | SEP | 0.82 | 0.04 | 0.86 | 0.82 | 0.04 | 0.86 | **1.72** |
| CNA208 | Turboprop | 1.95 | 0.10 | 2.05 | 1.95 | 0.10 | 2.05 | **4.09** |
| DHC6 | Turboprop | 1.08 | 0.05 | 1.14 | 1.08 | 0.05 | 1.14 | **2.27** |
| CNA441 | Turboprop | 0.19 | 0.01 | 0.20 | 0.19 | 0.01 | 0.20 | **0.40** |
| **TOTAL** | | **65.22** | **3.43** | **68.65** | **65.22** | **3.43** | **68.65** | **137.31** |

### 2.2.2 Run-up Operations

Run-up operations, a significant contribution to ground noise, were also modeled. A run-up operation occurs when a stationary aircraft increases power for maintenance purposes or for a safety check prior to departure. Run-up operations were developed by HMMH in accordance with input from both the based-jet operator and FBO at EEN as well as data from Stantec. Jet run-ups were modeled at the jet operator ramp to the west of the terminal building while piston run-ups were modeled at the hold line for each runway end for safety checks prior to departure. Daily run-up operations are shown in Table 7 while run-up locations are shown in Table 8. Note that the thrust setting can be listed in either pounds of thrust or percentage of maximum thrust depending on the AEDT aircraft type. Settings below 100 are percentage while settings above 100 are pounds of thrust.

**Table 7 Run-up Operations**

Source: Stantec, EEN Airport Management, HMMH

| Ops Group | AEDT Type | 2016 Daily Ops | | 2021 Daily Ops | | Thrust (lbs/percent) | Duration (s) |
|---|---|---|---|---|---|---|---|
| | | Day | Night | Day | Night | | |
| Jet | CL600 | 0.03 | 0.00 | 0.03 | 0.00 | 7500 | 5400 |
| MEP | BEC58P | 1.37 | 0.07 | 1.38 | 0.07 | 70 | 60 |
| SEP | CNA172 | 5.73 | 0.29 | 5.79 | 0.29 | 70 | 30 |
| SEP | GASEPF | 5.10 | 0.26 | 5.15 | 0.26 | 70 | 30 |
| SEP | GASEPV | 1.79 | 0.09 | 1.81 | 0.09 | 70 | 30 |
| SEP | CNA182 | 1.26 | 0.06 | 1.27 | 0.06 | 676 | 30 |
| SEP | CNA208 | 0.86 | 0.04 | 0.87 | 0.04 | 1610 | 30 |
| SEP | COMSEP | 0.73 | 0.04 | 0.74 | 0.04 | 70 | 30 |
| SEP | PA30 | 0.23 | 0.01 | 0.23 | 0.01 | 544 | 30 |

**Table 8 Run-up Locations**

Source: Stantec, EEN Airport Management, HMMH

| Ops Group | Location | Heading (deg) | Percent Use |
|---|---|---|---|
| Jet | Northwest Ramp | 4 | 100% |
| SEP/MEP | Runway 2 Hold | 273 | 25% |
| | Runway 20 East Hold | 310 | 21% |
| | Runway 20 West Hold | 139 | 9% |
| | Runway 14 Hold | 217 | 25% |
| | Runway 32 South Hold | 3 | 8% |
| | Runway 32 North Hold | 183 | 12% |

### 2.2.3 Runway Use

Runway use refers to the frequency with which aircraft utilize each runway during the course of a year, as dictated or permitted by wind, weather, aircraft weight, air traffic control conditions, and noise considerations. Aircraft generally take off and land facing into the wind, making it the primary factor in selecting a runway for takeoff or landing. At EEN, the length of Runway 2/20 results in a high percentage of usage of Runway 2/20 for larger turboprop and jet aircraft while smaller piston aircraft use a mix of Runway 2/20 and the shorter Runway 14/32.

Stantec developed runway use rates for SEP, MEP, turboprop, and jet operations. Table 9 shows the results of their analysis.

**Table 9 Runway Utilization**

Source: Stantec

| Aircraft Group | Arrival | | | | | Departure | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Runway 2 | Runway 20 | Runway 14 | Runway 32 | Total | Runway 2 | Runway 20 | Runway 14 | Runway 32 | Total |
| SEP | 30% | 24% | 18% | 28% | **100%** | 25% | 30% | 25% | 20% | **100%** |
| MEP | 30% | 24% | 18% | 28% | **100%** | 25% | 30% | 25% | 20% | **100%** |
| Turboprop | 40% | 30% | 15% | 15% | **100%** | 40% | 30% | 15% | 15% | **100%** |
| Jet | 60% | 40% | 0% | 0% | **100%** | 60% | 40% | 0% | 0% | **100%** |

# 3 AEDT Noise Modeling Results

The sections below present the noise modeling results in the form of DNL contours and noise levels at individual noise receptors, respectively.

## 3.1 Noise Exposure Contours

The DNL contours for each of the noise modeling scenarios are presented in the following figures:

- Figure 15 Existing Conditions (2016) 65, 70, 75 dB DNL Contours
- Figure 16 Future Conditions (2021) 65, 70, 75 dB DNL Contours

The following items are of note:

- No noise sensitive land uses are within the 65 dB DNL contour under any noise modeling scenario.
- The inputs for the current and future conditions contour sets differ only slightly in their operations; therefore the contours are nearly identical to one another.

The criteria for significant impact require a 1.5 dB increase in noise levels due to the Proposed Action as compared to the No Action alternative at a noise sensitive location with a DNL of 65 dB or greater. As shown in the figures, no residences lie within the 65 dB DNL contour in the either the Existing Conditions or Future Conditions noise modeling scenarios.

AEDT does not incorporate any noise reductions provided by the existing trees. Therefore, since these contours represent an upper limit on noise levels with all attenuation provided by vegetation removed and there are no noise sensitive locations within the 65 dB DNL contours, there is no potential for significant impact due to noise, regardless of changes in noise levels due to the clearing of trees.

**Figure 15 Existing Conditions (2016) 65, 70, 75 dB DNL Contours**

Source: HMMH

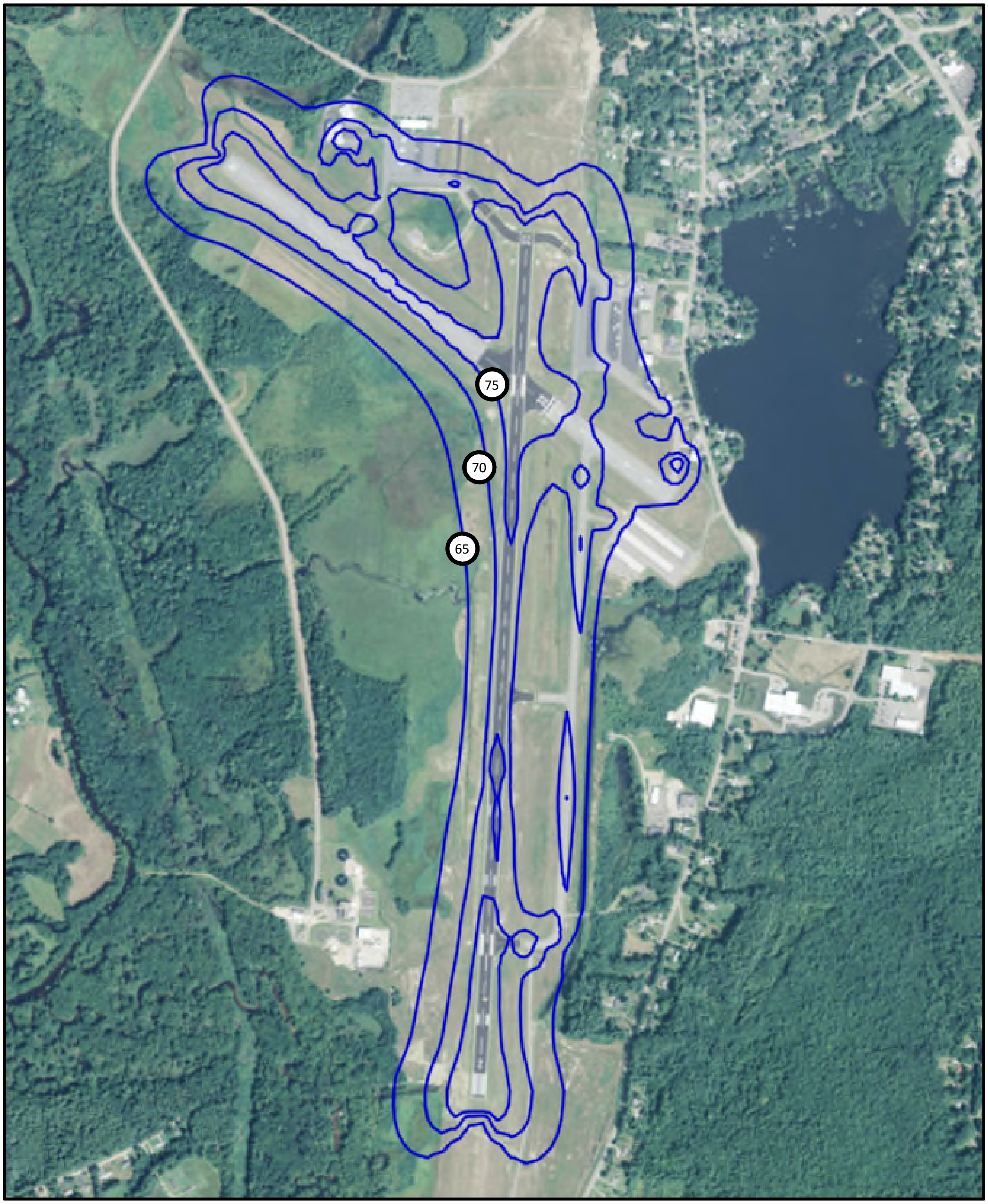
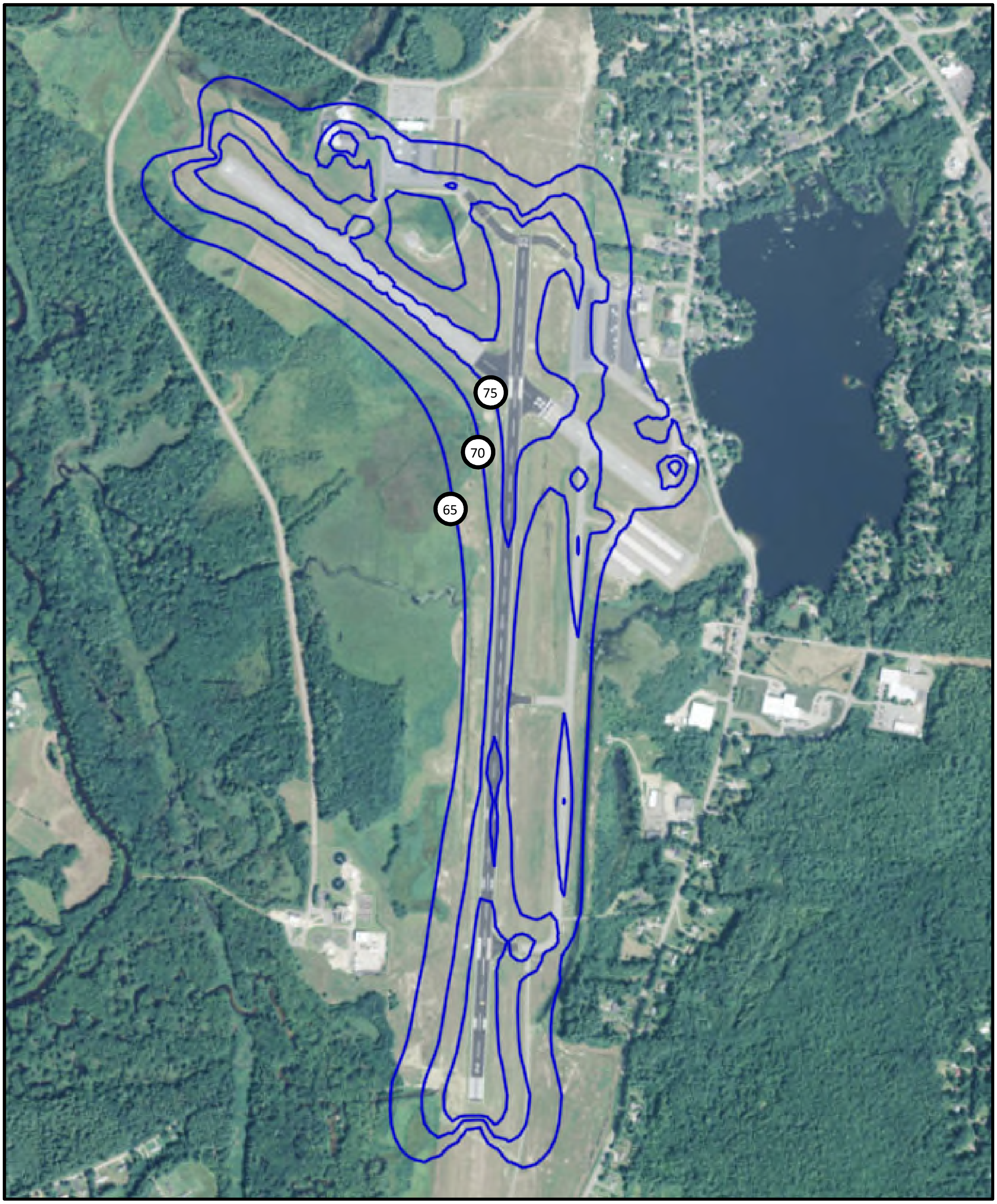


**Figure 16 Future Conditions (2021) 65, 70, 75 dB DNL Contours**

Source: HMMH

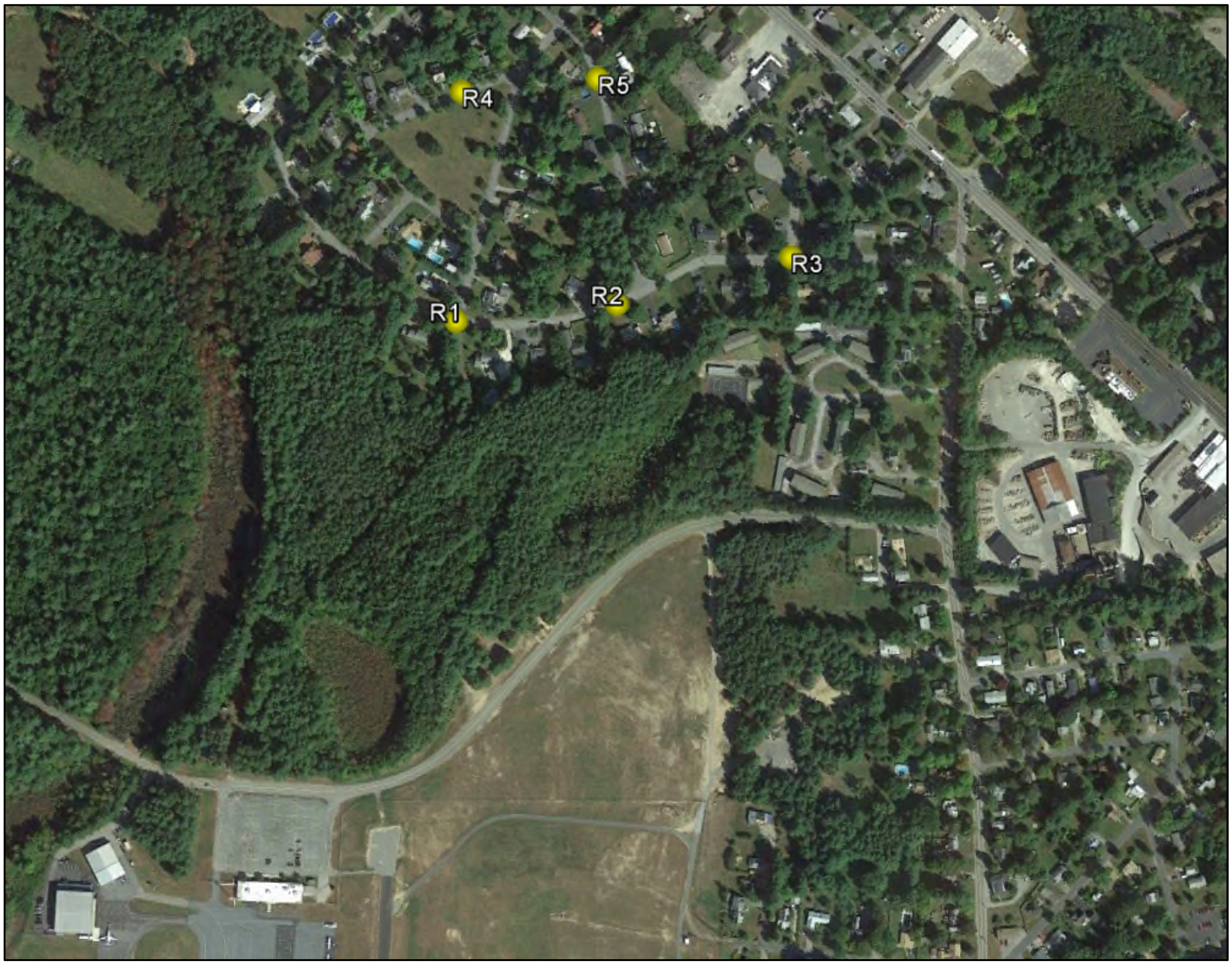


## 3.2 Noise Receptors Analysis

The homes most likely to experience changes in noise levels due to the removal of trees lie to the north of the airport. In order to investigate the potential for changes in noise exposure, five individual receptors were included in the AEDT noise modeling to represent this neighborhood. Figure 17 shows the receptors.

**Figure 17 Noise Receptors**

Source: HMMH




Using AEDT's detailed results calculation mode, the noise exposure at each of these points can be attributed to particular operations, such as arrival, departures, taxiway operations, and run-ups. Table 10 provides the computed DNL at each receptor for 2016. In addition, the table reports the partial DNL separately for aircraft flying overhead (whose noise levels will not be changed by tree removal) and ground operations. Within these broad categories, the results are further broken down. At all locations, the noise from aircraft overhead (Runway 2 departures and Runway 20 arrivals) dominates, contributing 90% to 96% percent of the noise energy. Runway 2 departures are the larger contributor to noise from aircraft in flight.

Note that all other arrival and departure operations are included in the ground category. At their point of closest approach to these five receptors, these operations are on or very near the ground. At all locations, the portion of the ground noise from arriving and departing aircraft is more important to the total DNL than taxi or run-up operations. The most important contributors to the overall ground noise are departures on Runway 14 and Runway 32.

**Table 10 Existing Conditions (2016) Noise Receptor DNL Results**

Source: HMMH

| Receptor | Overflight | | | Ground | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | Runway 2 Departures | Runway 20 Arrivals | All | Other Arrivals and Departures | Taxi | Runup | All | |
| **R1** | 54.6 | 46.5 | **55.2** | 44.6 | 42.4 | 38.3 | **47.2** | **55.8** |
| **R2** | 55.6 | 52.2 | **57.2** | 43.1 | 41.4 | 36.8 | **45.9** | **57.5** |
| **R3** | 53.7 | 44.5 | **54.2** | 41.8 | 40.0 | 34.9 | **44.5** | **54.6** |
| **R4** | 53.8 | 46.2 | **54.5** | 42.4 | 38.6 | 35.0 | **44.4** | **54.9** |
| **R5** | 54.7 | 51.6 | **56.4** | 41.7 | 38.1 | 34.2 | **43.8** | **56.7** |

In summary, examination of the data in Table 10 leads to the following conclusions:

- Noise levels at all five locations are dominated by departures and arrivals overhead
- The contribution of ground noise to the total DNL is relatively small with the total DNL 0.3 dB to 0.6 dB higher than the DNL due to overflight operations only
- This 0.3 dB to 0.6 dB difference is the upper limit of changes to the DNL due to changes in the attenuation along the propagation path.

# 4 Estimated Changes in Single Event Aircraft Ground Noise Levels

The previous section shows that no residences lie within the 65 dB DNL contours and that the potential changes in DNL are capped by the relatively small contribution of ground noise to the total DNL at 0.3 to 0.6 dB, well below the 1.5 dB increase required for a determination of significant impact. However, the noise levels from individual aircraft ground events may change in level or spectrum due to the removal of trees. To assess the potential for these changes, HMMH conducted a measurement program in September of 2016 to measure the existing attenuation of the trees within the proposed removal area.

## 4.1 Measurement Program

The measurement of actual noise reduction or acoustical attenuation provided by the existing forest near EEN was accomplished using a loudspeaker as a sound source under controlled conditions as shown in Figure 18. The loudspeaker projected a constant broadband “white noise” signal. HMMH measured the noise from the loudspeaker starting close to the speaker and then at gradually increasing distances away from the speaker.

The use of a loudspeaker source ensured that the noise is constant. Therefore the measured drop-off with distance reflected the actual effect of distance and the forest. Measured noise levels from actual aircraft on the airfield vary with time due to changes in the level of noise emanating from the source. Additionally, the level of the loudspeaker was set such that the measured levels were well above the ambient sound level to prevent contamination by other sound sources. Finally, wind speed and direction can have a significant effect on sound levels over long distances. The measurement of the loudspeaker at short as well as long distances reduced the effects of wind on sound levels during the measurements.

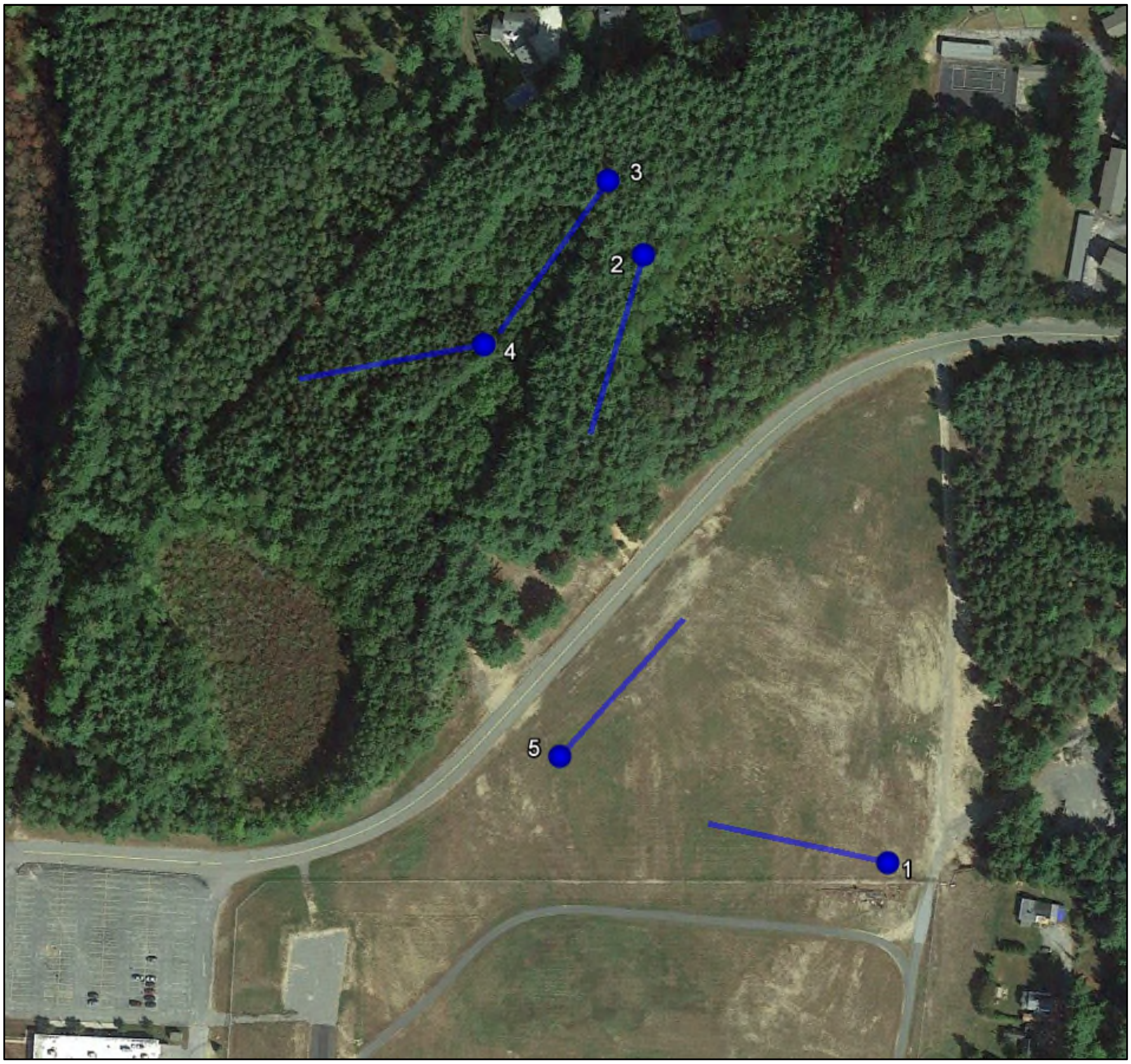
**Figure 18 Loudspeaker Noise Source**

Source: HMMH

In order to isolate the effect of the trees, measurements were made of the noise source over grass in a field near the airport as well. Comparison of the forest and field measurements was then used to estimate the noise reduction provided by the trees alone. In order to have multiple samples of data, measurements were made at three forest and two field locations. Figure 19 shows the five measurement locations. For each position, the location of the loudspeaker is indicated with a blue dot. Octave band sound level measurements were collected at 35, 70, 140, and 280 feet along the blue lines at 5 and 10 feet above ground level. To ensure that the levels emanating from the speaker were not changing throughout the measurement, a reference microphone was positioned at 35 feet on a tripod. The sound level meters are Type I meters and the calibration was checked before and after the measurement session.

## Figure 19 Measurement Locations

Source: HMMH



The characteristics of the forest varied from location to location. Location 2 had mixed pine and hardwood trees, with some understory, as shown in Figure 20. Location 3 had dense immature hardwood trees, as shown in Figure 21. Location 4 was a pine forest with no undergrowth, as shown in Figure 22.

**Figure 20 Measurement Location 2 (Forest)**

Source: HMMH

**Figure 21 Measurement Location 3 (Forest)**

Source: HMMH

**Figure 22 Measurement Location 4 (Forest)**

Source: HMMH

Examination of the measurement data for the three forest and two field locations yielded the following conclusions:

- The measured reductions in sound level with distance were relatively consistent at the three forest locations
- The measured reductions in sound level with distance were relatively consistent at the two field locations
- At very low frequencies (63 Hz), the reduction in sound due to the forest was small, 0.01 dB per meter, and similar to the 0.02 dB per meter published in ISO 9613-2
- At high frequencies (2 kHz-8KHz), the reduction in sound due to the forest was greater, 0.10 to 0.15 dB per meter, similar to the 0.08 to 0.12 dB per meter in ISO 9613-2
- Between 125 Hz and 1kHz the reduction in sound with distance was actually greater over grass than through the forest for some combinations of frequencies and measurement heights, likely due to differences in "ground effect"

Ground effect is the result of the interaction of the direct sound from a source to a receiver with the sound which reflects off of the ground. For hard ground, this generally results in an increase in the overall sound level at the receiver. For soft ground, the ground can be thought of as absorbing certain frequencies of sound resulting in a reduction in the sound level at the receiver. Ground effect can be quite prominent between 125 Hz and 1 kHz.

Figure 23 shows the reduction in noise level between the reference position and the furthest measurement position for each of the measurement locations as a function of frequency for a measurement height of five feet above the ground. Note that at the lowest frequencies, the reduction is only slightly greater in the forest locations when compared to the field locations. At high frequencies, the reductions are greater for forest locations than the field locations.

Figure 24 shows the same thing for a measurement height of ten feet. The forest reduces the sound levels very slightly at low frequencies and much more at high frequencies, as compared to the field. At mid-frequencies, the comparison is mixed at both measurement heights. This may be due to differences in the ground surface in the field and forest (grass vs. leaf litter) and the trees interfering with the ground reflection.

**Figure 23 Reduction in Octave Band Noise Levels from 35 foot Reference Position to 280 foot Measurement Location at a Height of 5 feet**

Source: HMMH

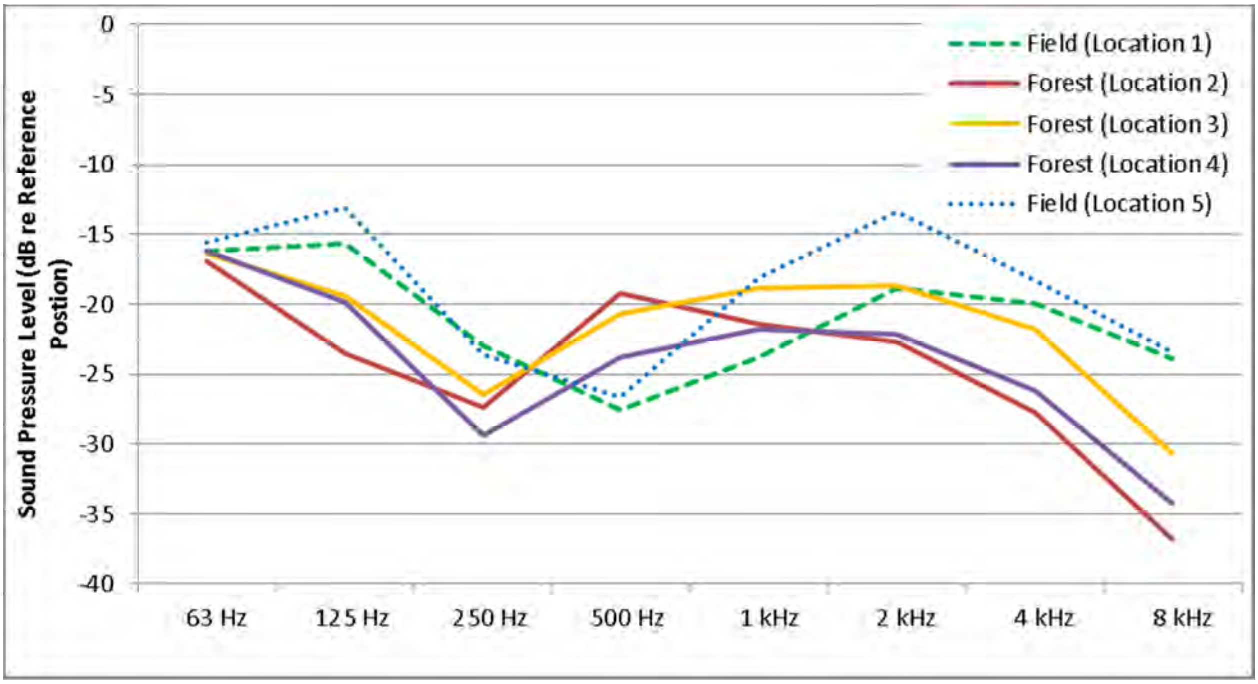
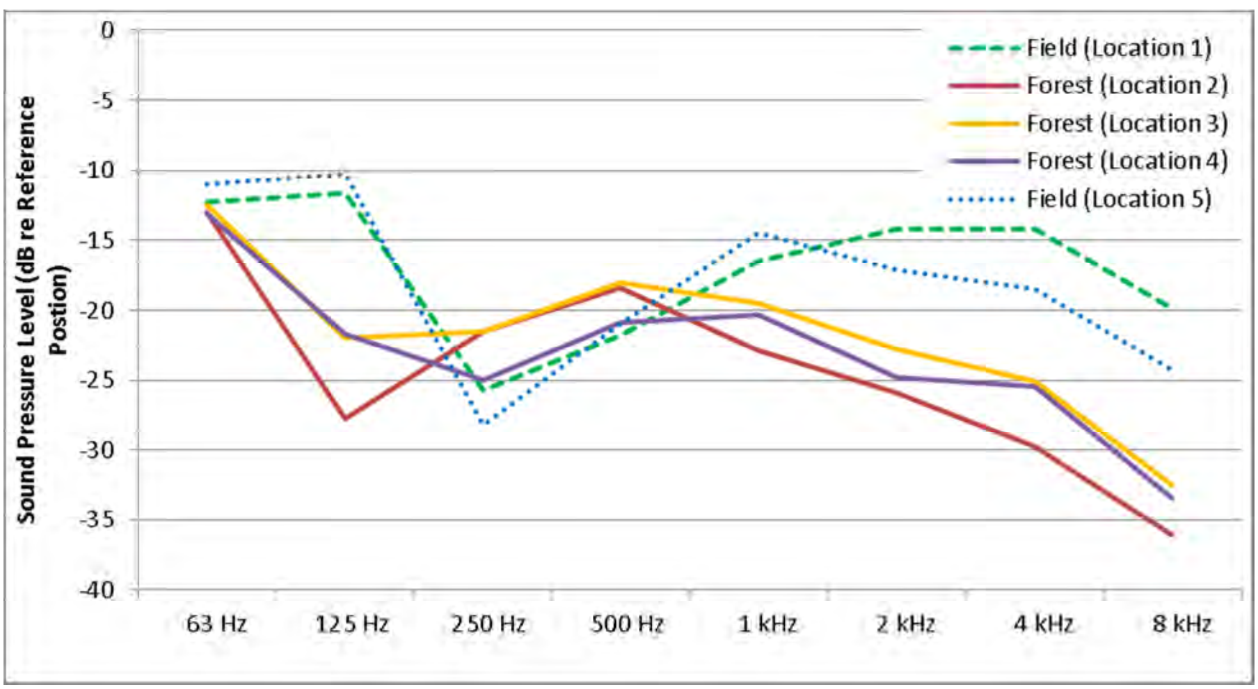



**Figure 24 Reduction in Octave Band Noise Levels from 35 foot Reference Position to 280 foot Measurement Location at a Height of 10 feet**

Source: HMMH



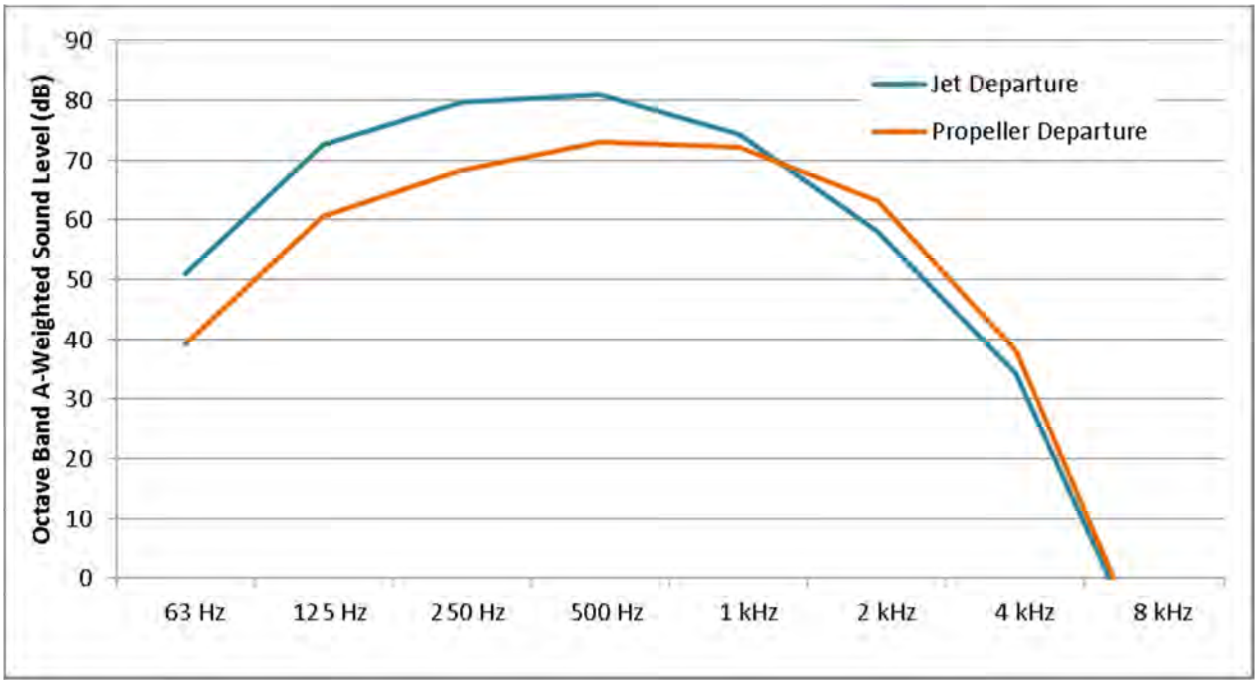
## 4.2 Aircraft Source Spectrum Analysis

Figure 24 shows representative spectra for the most common jet and propeller aircraft in the noise modeling, the CL600 (Jet), BEC58P (MEP), CNA172 (SEP), and CNA208 (Turboprop). The departure spectra were selected to represent the most important contributor to the aircraft ground noise exposure at the receptors, take-off roll on Runway 14, 20, and 32. The spectra were taken from INM 7.0d. Both AEDT and INM use general spectrum shapes called spectral classes to represent multiple aircraft. In this case, the most common propeller aircraft in the noise modeling all shared the same departure spectral class.

The spectra are A-weighted in order to show the most important frequencies for human hearing and the calculation of the overall A-weighted noise level. Additionally, these spectra are adjusted for atmospheric absorption to a distance of 3,000 feet, a representative distance for aircraft on take-off roll to the nearest receptors north of the proposed tree removal. Due to the spectrum of the emitted sound, the roll off of high and low frequencies from A-weighting, and the loss of high frequency sound through atmospheric absorption, the spectra have their highest levels in the mid-frequencies. The jet spectrum has its highest levels between 250 and 500 Hz. The propeller aircraft has its highest levels between 500 Hz and 1 kHz.

**Figure 25 Representative A-Weighted Jet and Propeller Departure Spectra**

Source: FAA, HMMH




By applying the measured differences between the forest and field locations shown in Figure 23 and Figure 24 to the representative aircraft spectra shown in Figure 25, the difference in the total A-weighted sound level can be estimated for the an aircraft noise source under the measurement conditions. This calculation shows that the A-weighted sound level for an aircraft source would be 1 dB to 4dB louder when propagated over a distance of 280 feet through the forest as compared to the same sound source at the same distance over a field of grass. This is due to the fact that most of the noise energy for the aircraft lies within the region where the ground effect is very strong for the field of grass.

## 4.3 Sound Path Analysis

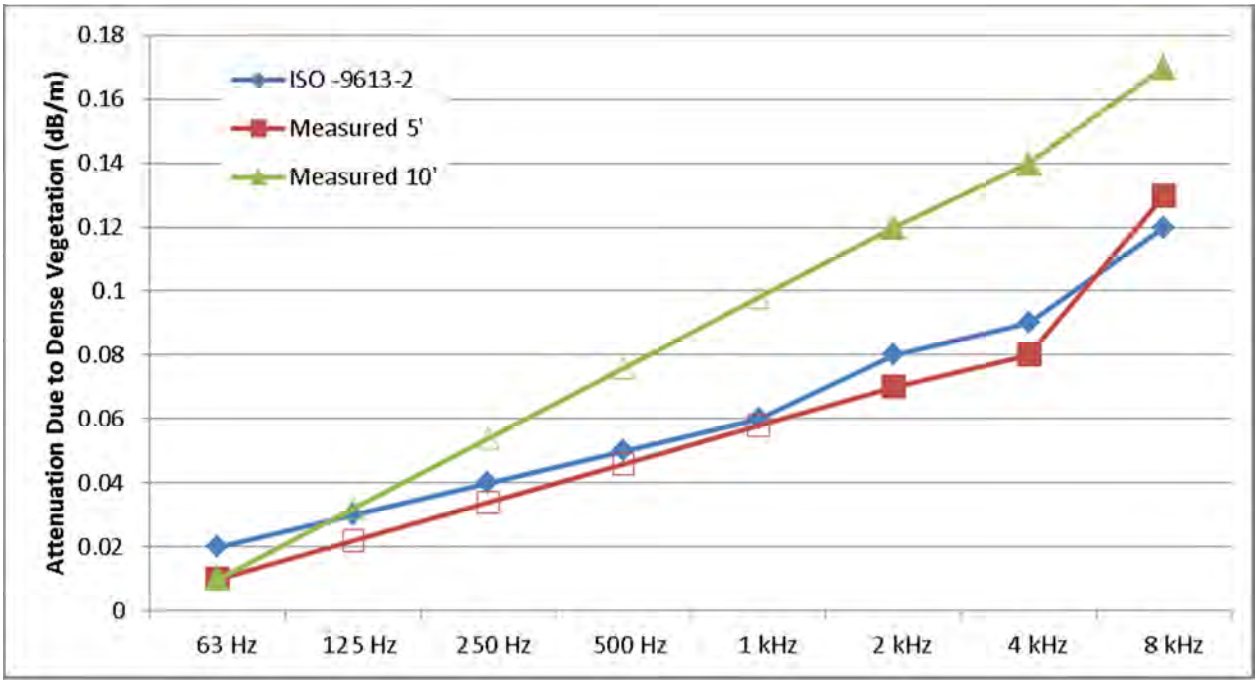
The previous section showed that a strong ground effect can cause noise levels to be lower when the propagation path is over open ground compared to the noise levels when the propagation path is through a forest. However, ground effect varies strongly with changes in source to receiver geometry and other propagation factors, including source and receiver height, source to receiver distance, wind speed and direction, and temperature gradients. Setting aside the differences in ground effect between the forest and field measurements, the effect of the forest can be computed in the high and low frequency regions of the sound spectrum. In between, where differences in ground effect complicated the measurements, the values for tree attenuation can be interpolated.

Figure 26 shows the computed attenuation due to dense vegetation based on the measured difference in sound levels for the field and forest measurement locations. Note that the values for 63 Hz and 2 kHz to 8 kHz are directly computed from the measurements. The values for 125 Hz through 1 kHz are estimated by interpolating between these directly computed values. These interpolated values are shown with open data point markers on the graph.

**Figure 26 Computed Dense Vegetation Attenuation**

Source: ISO 9613-2, HMMH

Note: Values between 125 Hz and 1 kHz are interpolated from directly measured values




The average computed dense vegetation attenuation coefficient for the 500 Hz octave band was 0.06 dB per meter. This band lies in the middle of the jet and propeller spectra shown in Figure 25. Using this representative value and estimates of the length of the sound path through existing and future forest after removal of the trees, HMMH computed potential changes in single event sound levels. Note that these estimated changes are conservatively high because they ignore the possibility that changes in ground effect may offset increases in sound levels due to the removal of trees. Figure 27 provides an example of the analysis of sound paths for operations on Runway 14/32. Each white line represents the sound path from a sound source on Runway 14/32 at its point of closest approach to an individual receiver. As shown in the figure, the sound paths contains varying lengths of open space, wetlands (blue hatching), trees that are proposed to be removed (green shading), and trees which will remain under the Proposed Action.

## Figure 27 Example Sound Path Analysis for Runway 14/32

Source: Stantec, HMMH

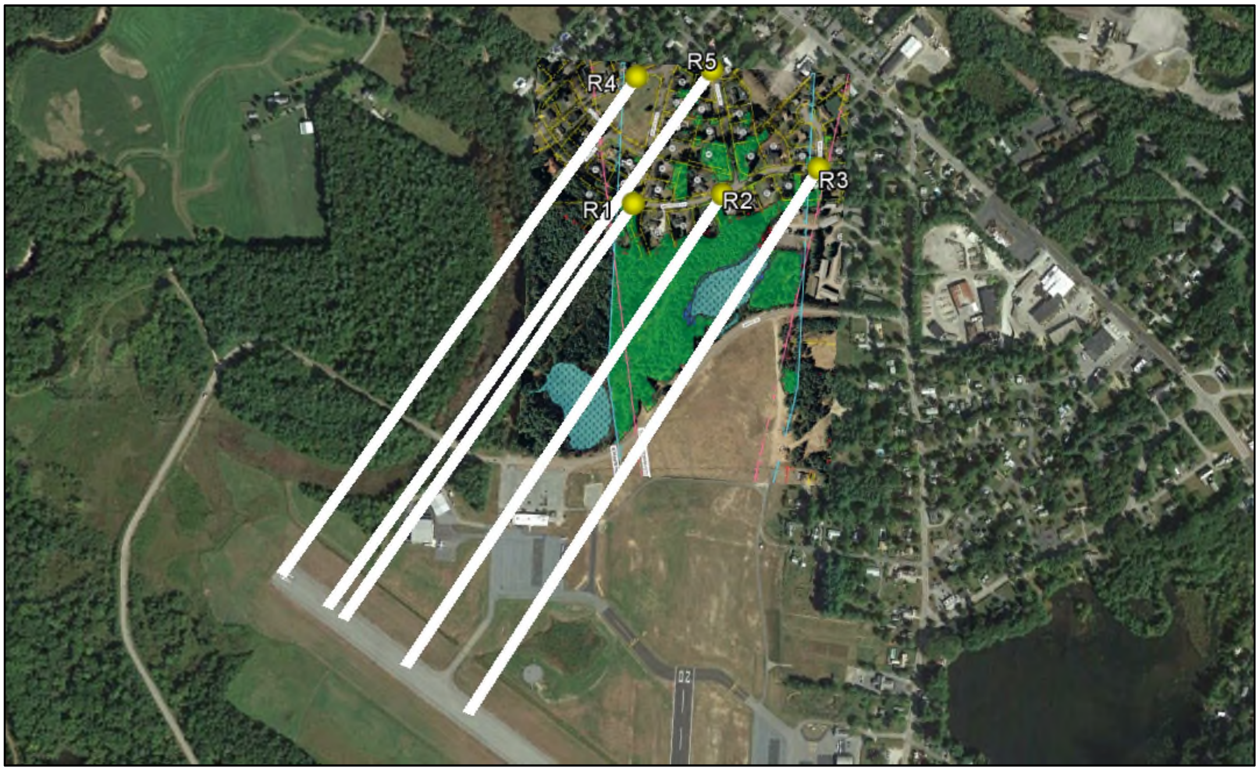



Table 11 summarizes the results of the sound path analysis. It shows results for departures on Runway 14/32 and departures on Runway 20. Note that departures on Runway 14 are the greatest contributor to ground noise in the 2016 and 2021 noise modeling scenarios. A 3 dB change is typically characterized as "perceptible" in real-world conditions, while a 10 dB change is typically described as the sound being "twice as loud."

## Table 11 Single Event Sound Path Analysis Results

Source: HMMH

| Receptor | Departure Runway | Sound Path Length Through Tree Clearing Area (m) | Sound Path Length Through Other Trees (m) | Sound Path Length Through Wetland (m) | Estimated Sound Level Reduction from Existing Trees (dB) | Estimated Sound Level Reduction from Trees after Proposed Action (dB) | Estimated Change in Sound Levels Due to Proposed Action (dB) |
|---|---|---|---|---|---|---|---|
| R1 | 14/32 | 15 | 385 | 0 | -10 | -10 | 0 |
| R2 | 14/32 | 270 | 80 | 90 | -10 | -5 | +5 |
| R3 | 14/32 | 45 | 0 | 115 | -3 | 0 | +3 |
| R4 | 14/32 | 0 | 600 | 0 | -10 | -10 | 0 |
| R5 | 14/32 | 35 | 400 | 0 | -10 | -10 | 0 |
| R1 | 20 | 280 | 0 | 0 | -10 | 0 | +10 |
| R2 | 20 | 105 | 0 | 70 | -6 | 0 | +6 |
| R3 | 20 | 125 | 0 | 0 | -8 | 0 | +8 |
| R4 | 20 | 210 | 0 | 0 | -10 | 0 | +10 |
| R5 | 20 | 125 | 0 | 0 | -8 | 0 | +8 |

The table shows the computed length through the tree removal area and the computed length through trees which will not be removed due to the Proposed Action. Consistent with ISO 9613-2 and other acoustical standards, the attenuation provided by dense vegetation is capped at 10 dB. This cap reflects the fact that some sound will pass over the vegetation regardless of its height or density. Thus in cases where large amounts of vegetation lie along the sound path both before and after the tree removal, the estimated attenuation may be remain unchanged at 10 dB even if some vegetation is removed along the sound path.

Some of the sound paths in the analysis passed through wetland areas which will not be cleared under the Proposed Action. The topography and vegetation in these areas is generally lower that the surrounding areas. However the vegetation may reduce sound levels somewhat, thus the sound path length through the wetland areas is included for informational purposes.

It should be noted that departures on Runway 32 are not typically on the ground at their point of closest approach to the receptors, but a very low altitudes. This will reduce the attenuation provided by the trees somewhat as compared to the values shown in the table. This reduction in the tree attenuation will be greatest for aircraft which climb more quickly.

It must be emphasized that these computed changes in sound level do not reflect the possible complex changes in ground effect discussed in the previous section which may partially or fully offset the computed changes in sound level as evidenced by the results of the measurement program.

## 4.4 Conclusions

Based on general acoustical principles, the measurement results, the location of the tree clearing, the locations of the receptors, and the spectra of the most important ground noise sources, the following conclusions can be made:

- Sound levels for aircraft in flight will not be perceptibly changed by the proposed tree removal
- Under poor propagation conditions (winds from the north) noise levels from ground operations in the neighborhood north of the airport may be quite low
- Under good propagation conditions (winds from the south), the curved sound path for receivers farther than approximately 3,500 feet from ground noise sources will be high enough above the ground at its midpoint to pass over existing trees. For reference, Receptor 5 is approximately 3,500 feet from the centerline of Runway 14/32.
- The sound path between receptors R1, R4, and R5 and the most important ground noise source, start of take-off roll on Runway 14, does not pass through the main area of proposed tree removal, thus no change in single event noise levels are expected.
- The sound path for departures on Runway 14 passes through the main tree removal area for receptors R2 and R3 and increases in single event sound levels of 3 dB to 5 dB may occur at these receptors.
- The sound path for departures on Runway 20 passes through the main tree removal area for all five receptors and increases in single event sound levels of 6 dB to 10 dB may occur at these receptors.
- The estimated increases in single event sound level may be partially or completely offset by changes in ground effect as shown during the measurements.
- To the extent that shorter trees or underbrush is preserved in the tree removal areas, changes in sound levels may be smaller.
- To the extent that trees and underbrush grow over time in the tree removal areas, sound levels may return to existing levels over time.

# 5 Air Quality

Air quality can be described as the concentration of various pollutants in the atmosphere within a given air basin. It is influenced by a combination of factors including the type and amount of pollutants emitted into the atmosphere, the size and topography of the area, and the prevailing climate and meteorology. This section is intended to document the existing air quality conditions within the project area and determine the degree to which the Proposed Action at Dillant Hopkins Airport would result in any effects on ambient air. In 2015, the FAA published Order 1050.1f *Environmental Impacts: Policies and Procedures. O*rder 1050.1F replaces the prior Order 1050.1E, and outlines the agency's policies and procedures for compliance with NEPA and regulations issued by the Council on Environmental Quality (CEQ).

## 5.1 Affected Environment

### 5.1.1 National Ambient Air Quality Standards

Under National Environmental Policy Act (NEPA), Federal agencies must consider changes in air quality, and the effects of such changes on human health and welfare. Potential effects are evaluated against the National Ambient Air Quality Standards (NAAQS). Currently, the Environmental Protection Agency (EPA) regulates six criteria pollutants: ozone, carbon monoxide, nitrogen dioxide ($NO_2$), sulfur dioxide ($SO_2$), particulate matter, and lead (Pb). Particulate matter (PM) is divided into two particle size categories: coarse particles with a diameter less than 10 micrometers ($PM_{10}$) and fine particles with a diameter of less than 2.5 micrometers ($PM_{2.5}$). Table 12 shows the primary and secondary NAAQS for the criteria pollutants. The NAAQS are two-tiered. The first tier (primary) is intended to protect public health; the second tier (secondary) is intended to protect public welfare and prevent further degradation of the environment.

**Table 12 National Ambient Air Quality Standards**

| Pollutant | Averaging Time | Primary Standards [1,2] | Secondary Standards [1,3] |
|---|---|---|---|
| **CO** | 8- hour | 9 ppm (10 mg/m$^3$) | None |
| | 1-hour | **35 ppm** | |
| **Lead** | Rolling 3-Month Average[5] | 0.15 µg/m$^3$ | Same as Primary |
| **$NO_2$** | Annual Arithmetic Mean | 0.053 ppm (100 µg/m$^3$) | Same as Primary |
| | 1-hour | 0.100 ppm[6] | None |
| **$0_3$** | 8-hour (2015 standard)[9] | 0.070 ppm | Same as Primary |
| | 8-hour (2008 standard) | 0.075 ppm | Same as Primary |
| | 8-hour (1997 standard) | 0.08 ppm | Same as Primary |
| **$PM_{2.5}$** | Annual Arithmetic Mean | 12 µg/m$^3$ [4,8] | 15 µg/m$^3$ |
| | 24-hour | 35 µg/m$^3$ | Same as Primary |
| **$PM_{10}$** | 24-Hours | 150 µg/m$^3$ [4] | Same as Primary |
| **$SO_2$** | 1-hour | 75 ppb[7] | None |
| | 3-hour | None | 0.5 ppm |

***Notes:***
*1. National standards (other than ozone, particulate matter, and those based on annual averages) are not to be exceeded more than once per year.*
*2. Primary Standards: Levels necessary to protect public health with an adequate margin of safety.*
*3. Secondary Standards: Levels necessary to protect the public from any known or anticipated adverse effects.*
*4. For $PM_{10}$, the 24-hour standard not to be exceeded more than once per year on average over 3 years. 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.*
*5. National lead standard, rolling three-month average: final rule signed October 15, 2008.*
*6. 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 (effective January 22, 2010).*
*7. Final rule signed June 2, 2010. To attain this standard, the 3-year average of the 99$^{th}$ percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 75 ppb.*
*8. EPA updated the NAAQS for $PM_{2.5}$ to strengthen the primary annual standard to 12ug/m$^3$.*
*9. EPA updated the NAAQS for Ozone to strengthen the primary 8-hour standard to 0.07 ppm on October 1, 2015. An area will meet the standard if the fourth-highest maximum daily 8-hour ozone concentration per year, averaged over three years is equal to or less than 70 ppb.*

Section 176(c) of the Federal Clean Air Act states that Federal agencies cannot engage, support, or provide financial assistance for licensing, permitting, or approving any project that could cause or contribute to the severity and/or number of violations of the National Ambient Air Quality Standards (NAAQS) or could inhibit the expeditious attainment of these standards.

The standards in Table 12 apply to the concentration of a pollutant in outdoor ambient air. If the air quality in a geographic area is equal to or better than the national standard, the EPA will typically designate the region as an attainment area. Areas where air quality does not meet the national standard are typically designated by the EPA as non-attainment areas. Once the air quality in a non-attainment area improves to the point where it meets the standards and the additional requirements outlined in the

CAA, EPA can re-designate the area to attainment upon approval of a Maintenance Plan, and these areas are then referred to as “maintenance areas.” Each state is required to prepare a state implementation plan (SIP) that outlines measures that regions within the state will implement to attain the applicable air quality standard in non-attainment areas, and to maintain compliance with the applicable air quality standard in maintenance areas.

The Clean Air Act Amendments (CAAA) of 1990 requires states to make recommendations to EPA regarding the attainment status of all areas within their borders when EPA finalizes an update to any NAAQS. Under its CAAA authority, the EPA further classifies non-attainment areas for some pollutants such as ozone based on the severity of the NAAQS violation as marginal, moderate, serious, severe, and extreme. In an effort to further improve the nation’s air quality, the EPA lowered the ozone standard in 2015 and is in the process of making attainment/nonattainment designations for a revised standard by late 2017.

### 5.1.2 Attainment Status

Air quality in the Keene, NH area is designated by EPA as attainment for all pollutants[15]. Previously, the area was designated non-attainment for the 1979 1-hour ozone standards. The 1979 1-hour ozone standard was revoked on June 15, 2005. Even though the area is considered attainment with the EPA standards, the airport still conducted a qualitative analysis of emissions from the Proposed Action for comparison with the General Conformity requirements of the Clean Air Act to ensure air emissions due to the Proposed Action are below applicable air quality standards.

### 5.1.3 Representative Monitoring Data

To characterize the background air quality in the vicinity of the Dillant-Hopkins area, air quality data from the EPA air quality data monitor value report[16] was reviewed for the most recent period available (2015). The closest most representative monitoring stations to Dillant-Hopkins were reviewed and summarized to determine representative air quality concentrations of the Keene area.

The closest and most representative monitoring stations to Dillant-Hopkins are the Rockingham County, Peterborough, City of Portsmouth and City of Keene monitor locations which vary by pollutant. For all average periods, the highest yearly observations were selected. A summary of the representative air quality concentrations are presented in Table 13**,** which shows that all monitored values for 2015 were below the NAAQS.

[15] EPA Greenbook, https://www3.epa.gov/airquality/greenbook/anayo_ma.html (page viewed on November 14, 2016)
[16] https://www.epa.gov/outdoor-air-quality-data/monitor-values-report

**Table 13 Representative Monitoring Values**

| Pollutant | Monitor Location | Averaging Period | 2015 Concentrations | NAAQS |
|---|---|---|---|---|
| $NO_2$ (ppb) | Rockingham County | 1-Hour<br>Annual | 38.0<br>3.4 | 100 ppb<br>53 ppb |
| $SO_2$ (ppb) | Peterborough | 1-Hour | 5.4 | 75 ppb |
| CO (ppm) | Peterborough | 1-Hour<br>8-Hour | 0.5<br>0.4 | 35 ppm<br>9 ppm |
| $PM_{10}$ ($\mu g/m^3$) | City of Portsmouth | 24-Hour | 51.0 | 150 $\mu g/m^3$ |
| $PM_{2.5}$ ($\mu g/m^3$) | City of Keene | 24-Hour<br>Annual | 34.8<br>8.7 | 35 $\mu g/m^3$<br>12 $\mu g/m^3$ |
| Ozone (ppm) | City of Keene | 8-hour | 0.068 | 0.075 ppm (2008)<br>0.070 ppm (2015) |

Notes:1. Background values represent overall maximum values.

### 5.1.4 General Conformity

The General Conformity Rule defines a Federal action as any activity engaged in by a department, agency, or instrumentality of the Federal government or any activity that a department, agency, or instrumentality of the Federal government supports in any way, provides financial assistance for, licenses, permits, or approves. The rule, as promulgated in 1993 following the passage of the CAA, mandates that a Conformity analysis be performed when a federal action generates air pollutants in a region that has been designated a non-attainment or maintenance area by EPA for one or more NAAQS pollutants. Even though Dillant-Hopkins is located in an EPA attainment region for all pollutants and General Conformity would not apply, the airport conducted an Air Conformity Applicability analysis to demonstrate construction emissions generated by the Proposed Action would be below the EPA General Conformity *de minimis* levels. EPA *de minimis* threshold represent emission quantities of a NAAQS regulated pollutant or its applicable precursors, in tons per year, over which an action in a nonattainment or maintenance area may cause or contribute to a new or continued violation of the NAAQS[17].

17 https://www.faa.gov/regulations_policies/policy_guidance/envir_policy/airquality_handbook/media/Air_Quality_Handbook_Appendices.pdf

## 5.2 Environmental Consequences

A qualitative air quality assessment was conducted for CO, NOx, $PM_{10}$, $PM_{2.5}$, VOCs and carbon dioxide equivalent ($CO_2e$) emissions generated by the Proposed Action (both direct and indirect). Potential impacts were compared to the EPA *de minimis* levels under the General Conformity Rule (GCR).

### 5.2.1 No Action Alternative

The No-Action Alternative assumes that the Proposed Action would not be implemented and air quality would remain unchanged, therefore no additional air quality impacts would occur.

### 5.2.2 Proposed Action Alternative

The Proposed Action Alternative is expected to result in a temporary increase in air emissions from construction equipment activity associated with material delivery trucks, worker trips and the disturbance of soils during tree removal activities. Construction of the Project will result in a temporary increase in emissions of some pollutants (e.g. PM10/PM2.5 and nitrogen oxides) due to the use of construction equipment powered by diesel fuel along with fugitive emissions from earth-moving equipment. However, emissions from construction activities are estimated to be temporary and are not expected to be a significant (e.g. less than EPA *de minimis* levels) source of air quality emissions based on emission estimates from similar construction operations and duration. Therefore, NAAQS violations are not anticipated with the Proposed Action. It should also be noted that the Proposed Action is needed to enhance safety at the airport by removal of all on and off airport obstructions to critical approach surfaces. The Proposed Action would not increase the number of existing or forecast aircraft operations by time of day, aircraft type, or stage length. The aircraft emissions would be the same for the Proposed Action and the No Action alternatives. Therefore, aircraft emissions associated with the Proposed Action were assumed to be the same for the No Action Alternative.

Construction emissions from the Proposed Action are expected to result in a temporary increase in air emissions from construction equipment activity associated with material delivery trucks, worker trips and the disturbance of soils during tree removal activities. Based on emission estimates from similar construction activities and duration, emissions from the Proposed Action are not expected to be significant and NAAQS violations are not anticipated.

The Proposed Action would not increase the number of existing or forecast aircraft operations by time of day, aircraft type, or stage length, therefore, aircraft emissions associated with the Proposed Action were assumed to be the same for the No Action Alternative.

# 6 Greenhouse Gases and Climate Change

Climate change is a critical national and global concern. Human activity and the burning of fossil fuels in particular, is changing the earth's climate by causing the buildup of heat-trapping greenhouse gas (GHG) emissions in the atmosphere. Carbon dioxide ($CO_2$) is the largest component of human produced emissions; other prominent emissions include methane ($CH_4$), nitrous oxide ($N_2O$) and hydrofluorocarbons (HFCs). Scientist and policy makers are trying to determine how to decrease and mitigate the emission of greenhouse gases, especially carbon dioxide ($CO_2$). These emissions are different from criteria air pollutants since their effects in the atmosphere are global rather than localized, and since they remain in the atmosphere for decades and even for centuries, depending on the pollutant.

Greenhouse gas (GHG) emissions have accumulated rapidly as the world has industrialized, with concentration of atmospheric $CO_2$ increasing from roughly 300 parts per million in 1900 to over 400 parts per million today. Over this timeframe, average temperatures have increased by roughly 1.5 degrees Fahrenheit (1 degree Celsius) on a global basis, and the most rapid increases have occurred over the past 50 years. Scientists have warned that significant and potentially dangerous shifts in climate and weather are possible without substantial reductions in greenhouse gas emissions. The scientific community has regularly cited 2 degrees Celsius (1 degree Celsius beyond warming that has already occurred) as the total amount of warming the earth can tolerate without serious and potentially irreversible climate effects. For warming to be limited to this level, atmospheric concentrations of $CO_2$ would need to stabilize at a maximum of 450 ppm, requiring annual global emissions to be reduced 40-70% below 2010 levels by 2050.[18] State and national governments in many developed countries have set GHG emissions reduction targets of 80 percent below current levels by 2050, recognizing that post-industrial economies are primarily responsible for GHGs already in the atmosphere. As part of a 2014 bilateral agreement with China, the U.S. pledged to reduce GHG emissions 26-28 percent below 2005 levels by 2025; this emissions reduction pathway is intended to support economy-wide reductions of 80 percent or more by 2050.[19]

Forests store large amounts of carbon. In the US, forests make up 90% of the US carbon sink and sequester approximately 10% of US $CO_2$ emissions[20]. Carbon sequestration is a process where $CO_2$ is captured from the atmosphere and stored for a long period of time and is one way to slow or reverse the accumulation of $CO_2$ in the earth's atmosphere. This section presents a summary discussion of GHG and climate, as they relate to the Proposed Action.

## 6.1 Methodology

The CEQ recently provided final guidance for determining meaningful GHG decision-making analysis[21]. The final guidance builds on previous guidance in quantifying projected GHG emissions. CEQ offered guidance that: "when addressing climate change agencies should consider: (1) The potential effects of a proposed action on climate change as indicated by assessing GHG emissions and, (2) The effects of climate change on a proposed action and its environmental impacts".

One noted change was that CEQ removed the quantification threshold and now recommends that agencies quantify direct and indirect GHG emissions whenever the tools, methodologies, and data are available to do so. Previous guidance states that if the proposed action would be reasonably anticipated to cause direct

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[18] IPCC, 2014: Climate Change 2014: Synthesis Report Summary for Policymakers. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.
[19] "U.S.-China Joint Announcement on Climate Change," White House, Office of the Press Secretary, November 11, 2014, on the White House website, https://www.whitehouse.gov/the-press-office/2014/11/11/us-china-joint-announcement-climate-change, accessed June 5, 2015.
[20] http://www.nrs.fs.fed.us/niacs/forests/carbonsequestration/
[21] http://www.energy.gov/sites/prod/files/2016/08/f33/nepa_final_ghg_guidance.pdf

emissions of 25,000 metric tons (MT) or more of carbon dioxide equivalent (CO2e) emissions on an annual basis, agencies should consider this an indicator that a quantitative and qualitative assessment may be meaningful to decision makers and the public. CEQ did not propose this as an indicator of a threshold of significant effects, but rather as an indicator of a minimum level of GHG emissions that may warrant some description in the appropriate NEPA analysis for agency actions involving direct emissions of GHG (CEQ 2010). As the CEQ noted, agencies have discretion in how they tailor their individual NEPA reviews to accommodate the guidance. The 1050.1F Desk Reference provides guidance on how to address climate impacts in a NEPA document.[22] Section 3.3.1 of the Desk Reference describes how and when GHG emissions should be quantified for NEPA reviews. The analysis must consider the potential incremental change in $CO_2$ emissions that would result from the Proposed Action and alternative(s) compared to the No Action alternative. The comparison can be qualitative or quantitative. Consistent with the FAA guidance on considering greenhouse gases and climate under NEPA, the emissions associated with the construction were qualitatively evaluated and compared to U.S. and global levels. Similarly for carbon sequestration, there are no applicable legal or regulatory requirements or established thresholds concerning management of forest carbon or greenhouse gas emissions. The emissions associated with the carbon sequestration were also qualitatively evaluated.

## 6.2 No Action Alternative

The No-Action Alternative assumes that the Proposed Action would not be implemented and GHG emissions would remain unchanged, therefore no additional GHG impacts would occur.

## 6.3 Proposed Action

Construction activities associated with the Proposed Action could result in a temporary increase in equipment usage. Research has shown that there is a direct relationship between the amount of GHG emissions and fuel consumption associated with diesel fuel and gasoline usage to support truck and vehicle trips, as well as construction activity. A temporary increase in GHG emissions from construction activities is expected from gasoline and diesel fuel usage. Currently, there are no significance thresholds for GHG emissions. As discussed earlier, construction-related emissions under the Proposed Action would not exceed applicable *de minimis* thresholds and would not be regionally significant. Similar to the criteria emissions, any GHG emissions increase from construction and operational activity would comprise a very small fraction of the U.S. based emissions of 6,673 million metric tons of carbon equivalents and even less than the 49 gigatons of carbon dioxide equivalent of global GHG emissions[23,24].

The FAA 1050.1f desk reference guidance discusses climate impacts related with fuel burn and does not address carbon sequestration. The Proposed Action would result in a short-term loss of forested area (e.g. 15.31 acres) mostly comprised of white pines, which correlates with some loss of carbon sequestration capacity, or "carbon sink. Carbon sequestration is the capture of carbon dioxide from the atmosphere through photosynthesis which is stored as carbon in the trunks, branches, foliage and roots of trees. The sink of carbon sequestration in forests and wood products helps to offset sources of carbon dioxide to the atmosphere, such as deforestation, forest fires, and fossil fuel emissions.

Research has shown that "sustainable forestry practices can increase the ability of forests to sequester atmospheric carbon while enhancing other ecosystem services, such as improved soil and water quality. Planting new trees and improving forest health through thinning and prescribed burning are some of the ways to increase forest carbon benefits in the long term. Harvesting and regenerating forests can also

[22] FAA Office of Environment and Energy 1050.1F Desk Reference, July 2015.
[23] http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html
[24] http://ipcc.ch/publications_and_data/ar4/syr/en/contents.html

result in net carbon sequestration in wood products and new forest growth"[25]. Under the Proposed Action, carbon stocks and sequestration rates may be reduced in the short term until carbon uptake by new and remaining trees again meets and/or exceeds the sequestration rates of the No Action condition. The strength of the carbon sink would increase as stands continue to develop then gradually decline but remain positive. [26] Carbon stocks would continue to accumulate, although at a declining rate due to maturation of the tree growth.

In the short-term, on-site carbon stocks would be lower under the Proposed Action than under the No Action. The removal of the white pines and the temporary loss of carbon sequestration potential will be gradually offset by the net carbon sequestration from the new forest growth that will result from the thinning of the forest. These changes would be localized and indistinguishable relative to the role the world's forests play in mitigating climate change.

[25] http://www.fs.fed.us/ecosystemservices/carbon.shtml

[26] https://www.researchgate.net/publication/227495435_Carbon_cycling_and_storage_in_world_forests_biome_patterns_related_to_forest_age

## I.2 PUBLIC INFORMATIONAL MEETING MINUTES AND COMMENTS

# PLEASE SIGN IN

January 17, 2017

PLEASE PRINT

| Name | E-Mail Address | Address |
|---|---|---|
| Gregg Cohen | gregg.cohen@stantec.com | Stantec 428 Payne Rd Scarborough ME |
| Jim + Genny Frederiksen | jimgenfred@[illegible] | [illegible] Keene NH |
| Carol Niewola | cniewola@dot.state.nh.us | NHDOT/POB 483/Concord, NH 03301 |
| Janice Bland | Janice.Bland@stantec.com | Stantec 482 Payne Rd. Scarborough, ME |
| Gary Lamoureux | City Councilor At-Large | |
| Dwight & Leanne Anderson | | 103 Greenwood Ave |
| Louis MANIAS | LCMANIAS@AOL.COM | CONCORD NH |
| Richard Lauretti | | FAA |
| Tyson Frazier | tylefrazier@hotmail.com | 2 Lynwood Ave |
| Tim Dunn | moonstruckpress.gmail.com | 1 Riverton St. Keene, NH 03431 |
| CRAIG & ANN SUTTON | | 637 MAIN |
| Brad Nicholas, HMMH | | |

Airport Obstruction Clearing Final Draft EA Public Info Session

# PLEASE SIGN IN

January 17, 2017

PLEASE PRINT

| Name | E-Mail Address | Address |
|---|---|---|
| Dominic Scarano, HMMH | | |
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Airport Obstruction Clearing Final Draft EA Public Info Session

**City of Keene, New Hampshire**
Public Information Session
Airport Obstruction Clearing Final Draft Environmental Assessment
For the Dillant-Hopkins Airport
Tuesday, January 17, 2017
6:00PM to 7:30PM
Council Chambers, 2nd floor of City Hall, 3 Washington Street, Keene, NH

Notes and Public Comments taken from the Public Information Session:

Jack Wozmak, Airport Manager opened the meeting at 6:00 pm. Wozmak encouraged folks to use the public comment forms and to save questions until the end of the meeting. He explained the history behind the reason for this meeting. Areas of impact on property values when avigation easements are acquired include the amount of noise and the air quality – how it is impacted by the removal of the trees. A digital visual rendition of how things will look after the removal of trees has been drafted. This will be available on the website so folks can refer back to it. The report is already in NH Department of Transportation hands as well at the Federal Aviation Administration (FAA). They will determine if the tree clearing results in a significant impact under federal regulations.

<u>Presentations</u>

Property Value Impact – Louis C. Manias, Capital Appraisal Associates

Manias spoke to the issue of existing data in the marketplace to indicate if property value will be impacted. A few hundred properties with avigation easements near general aviation airports in Keene, Lebanon, Nashua, Rochester, and Concord were found. Market data shows a range of 0% to 6% value impact. A purchase of an avigation easement is a private transaction between the airport and the property owner. There aren't any tax stamps associated with the transaction. These factors make it very difficult to assign a value.

Noise - Brad Nichols - Harris Miller Miller & Hanson (HMMH)

Slide show. The full technical report is posted. Brad explained "what is noise". HMMH measured the sound at the airport with a process called A-weighting (measured in decibels). Frequency plays a big part in the sound levels. Sound propagation (the spreading of sound) is affected by two factors known as ground effect and attenuation due to vegetation.

The day-night average sound level (DNL) measures the cumulative noise. It is a metric for planning purposes.

EA Noise modeling – 65 dB DNL Contour does not reach any residential property. Five areas selected for sample did not exceed the 65 dB level. To help understand how the trees help reduce the sound, a number of measurements were taken using "pink noise" at different distances in both field and forest locations.

Single Event Sound Levels – Loudest events are departures and arrivals on runways 2 and 20.

Basically, they measured the effect trees, leaves, grass, etc has on the noise levels.

AIR QUALITY – The proposed action will not affect the air quality.

Greenhouse gas & Climate change – The short term loss in the forested area will rebound with reforestation over time.

Visualization Model - Kevin Stewart, RDV Systems

To address the impact on view sheds RDV created a 3D rendition of the airport and the surrounding neighborhoods to help assess the visual impact.

Question & Answer

Dwight Anderson - 103 Greenwood Ave – Questioning the trees that are shown on the 3D rendition and the trees that are labeled for removal on City property. He also asked how long the City knew about the tree removal. Answer was March of 2012.

Leanne Anderson - 103 Greenwood. She stated that the understory shown is not actually there and that the 3D rendering is not accurate.

James T Dunn – Suggested that even if the trees are removed from Airport Rd the rendition does not show the incline. Jack confirmed the elevation is 20 feet (Greenwood is at 500 and Airport Rd is at 480)

Tyke Frazier – Asked if it would be manual or mechanical cutting. Jack confirmed it would be mechanical (grab the tree, cut it, and lay it down) although there will be several areas of hand cutting.

Mark Meess – 59 Greenwood Avenue – Questioned the non-standard modeling letter he received. Carol Niewola from the NHDOT responded to his question.

Ann Shed – 59 Greenwood Avenue – Would like to address the air quality portion. She is requesting that Keene's climate committee comment on this portion. The airport's carbon emissions on just the jet fuel alone exceeds what the trees can absorb. Ann read a report in regard to $CO_2$ emissions and how it relates to early deaths. She does not agree with the environmental assessment.

Chris Manning Grey – 51 Greenwood Ave – Just wants to thank her neighbors and the City for the civics and history lesson. She has read all the minutes and reports. She says it is a sad tale. She compared the situation to Citizen Kane - which she calls "Citizen Keene" - referring to his abuse of power. It has never been explained why cutting is the FAA's only recommendation when there are other options available, she said.

City Councilor Terry Clark – 14 Barrett Avenue – Told a little history of how the airport has changed over the years. He questions the value of the airport. Look at the airport from the point of view of the average citizen. He asked how many trees need to be cut or not cut before the City has to give back all the grant money.

Chris Alexing spoke as to how long it took him and his wife to find this neighborhood to buy their home. He asked if there was another neighborhood like his in Keene.

Christie Wright – Asked why the special interests of a few outweigh the residents of the neighborhood.

Ed ***Bedss??*** - 114 Greenwood Avenue – Asked if there is limited landing at night using an instrument approach. Jack explained that yes, there are night time instrument landing restrictions on Runway 20 but not on the 02 runway. Mr. ***Bedss*** asked if the trees are cut, would that increase night time landings. Jack explained that landing is up to pilot discretion and wind direction not the trees.

Ann Shedd – Questioned the increase in airport traffic projections. Jack explained that those numbers are based on industry trends with respect to jet traffic seeing an increase while general aviation is seeing a decrease or flat growth trend.

City Councilor Terry Clark asked what happens if the City does not cut the trees.

Joesph Manning Grey asked why cutting trees is the only option. Why not install lights.

Richard Doucette of the FAA explained that now that the trees have penetrated the airspace to this extent, mere lighting is not acceptable.

Leanne Anderson stated that Lebanon is considered a commercial airport.

Dwight Anderson asked the NHDOT Carol Niewola about the wind and the weather station. She explained that there is a known problem and the FAA is aware of it and that this problem, which is longstanding, has caused inaccurate wind measurements at the airport.

Lindsey Cushing - 7 Edgewood Avenue –Stated that she is a new owner in the Edgewood area and that clear cutting will impact the neighborhood's quality of life.

Tyke Frazier asked how much the two studies cost. $220K for phase 1 and $103K for Phase 2. Jack stated that annual airport revenue is around $500,000. He also gave examples of some of the types of flights that go in and out of the airport.

It was asked where the 19 areas of concern are. Jack pointed out on the aerials where some of the cutting will happen and the areas where they will go and cut individual trees.

John Dunnell – The EA2 contains strong language about avigation easements. Jack explained that if the owner gives the City permission to cut trees, then an easement is not necessary.

Jenna Myers asked to see the 3D renderings for her address.

Jim Frederickson – 75 Edgewood - Asked how many years the airport has turned a profit.

Jack explained what the precision approach pattern indicators (PAPI) lights do.

Jerry Frederickson asked why can't you just lop off the tops of the trees?

Leanne Anderson made the comment "Stop changing the story on us Jack", which related to which and how many trees would be cut.

9:00 PM Adjourned

<u>These notes and the resulting public comments are incorporated by reference into these Notes of the Public Information Session.</u>

**John Wozmak**

| | |
|---|---|
| **From:** | Ann Shedd <ladyleafy@gmail.com> |
| **Sent:** | Thursday, January 26, 2017 5:31 PM |
| **To:** | John Wozmak; Carol Niewola; Medard Kopczynski; Rhett Lamb |
| **Subject:** | Correction to draft minutes of 1.17.17 EA hearing |

Hi Jack -
The draft minutes of the recent EA-2 are circulating through the neighborhood, and I note that the summary of my comments eliminates mention of my concern about the content of the AQ evaluation. It is important that this be corrected for the record.
As I was reading from prepared comments, I am sending you a (condensed) version, as well as pasting in the text of the EA relating to AQ:

*The section of the EA dealing with Air Quality has been my greatest concern. <Based on research cited> Emissions from aviation, particularly landing and take-off operations, negatively impact human health both globally and locally, and trees play a role in removing a portion of those pollutants from the air.*

*The EA phase 2 was prepared to address this concern, but answers the wrong question: it limits its scope to the Air Quality impact of the logging operation itself. The EA concludes that there might be a slight but temporary increase in emissions due to the operation of the logging equipment. This does not address potential long-term air quality impacts of losing a vegetated buffer. There were many opportunities for careful, site-specific, evidence-based evaluation of this question. For instance, Keene Sate College has portable air-quality monitoring equipment which has been used in several air-quality studies in Keene – including one published study referenced in the EA.*

*The City does need to remove trees from the Airport approach to comply with FAA safety standards, but should not accept this report on air-quality impact as adequate response to its citizens' sincere concern about potential effects on the health of this and future generations of Keene residents.*

I appreciate your attention to this oversight in the minutes, and remain curious that so much attention in the EA was focussed on quality-of-life impacts (noise, visual) while so little attention was given to potential long-term health-related impact.

Ann Shedd

from the EA: 5.2.2 Proposed Action Alternative The Proposed Action Alternative is expected to result in a temporary increase in air emissions from construction equipment activity associated with material delivery trucks, worker trips and the disturbance of soils during tree removal activities. Construction of the Project will result in a temporary increase in emissions of some pollutants (e.g. PM10/PM2.5 and nitrogen oxides) due to the use of construction equipment powered by diesel fuel along with fugitive emissions from earth-moving equipment. However, emissions from construction activities are estimated to be temporary and are not expected to be a significant (e.g. less than EPA de minimis levels) source of air quality emissions based on emission estimates from similar construction operations and duration.

**John Wozmak**

**From:** Chris Manning-Gray <cmanninggray@gmail.com>
**Sent:** Wednesday, January 25, 2017 5:41 PM
**To:** John Wozmak
**Subject:** Phase II report

Omitted from minutes:

Noise section: it also states that even there will be an increase in noise levels, the FAA will not consider this data.

Air Quality section, it also states it is difficult to determine what impact the airport operations have on air quality and therefore it is difficult to determine what the impact on air quality will be after the cutting.

From Comments: Chris Manning-Gray also stated that contrary to (statements in) Keene's Comprehensive Master Plan, this action will destroy the quality and value of the neighborhood.

Thank you.

**John Wozmak**

| | |
|---|---|
| **From:** | Dwight & Leanne Anderson <dlanderson@ne.rr.com> |
| **Sent:** | Wednesday, January 25, 2017 6:18 PM |
| **To:** | John Wozmak |
| **Cc:** | Rhett Lamb; Councilor Janis Manwaring; edgewoodtrees@gmail.com |
| **Subject:** | RE: EA Phase 2 minutes |

Thank you Jack. I will get this written down tomorrow and send it to you. I'm sure others are finding some of the same and/or different changes/additions they would like submitted so I added edgewood to the cc line. Note: Nowhere in the minutes does it say these are in draft form.
Again, thank you.
Leanne

**From:** John Wozmak [mailto:jwozmak@ci.keene.nh.us]
**Sent:** Wednesday, January 25, 2017 4:21 PM
**To:** Dwight & Leanne Anderson <dlanderson@ne.rr.com>
**Cc:** Rhett Lamb <rlamb@ci.keene.nh.us>; Councilor Janis Manwaring <jmanwaring@ci.keene.nh.us>
**Subject:** RE: EA Phase 2 minutes

Leanne,
As you know, these are the draft minutes from the minute-taker. As these are draft minutes, I would invite you to submit your changes/additions to be appended to the minutes of the meeting. I would suggest that you do this in a letter format, which you can sign. There was no audio recording of this meeting.

Jack Wozmak
Airport Manager
Dillant-Hopkins Airport
80 Airport Road
Keene, New Hampshire 03431
603-357-9835
jwozmak@ci.keene.nh.us
cell: 603-209-1518

**From:** Dwight & Leanne Anderson [mailto:dlanderson@ne.rr.com]
**Sent:** Wednesday, January 25, 2017 1:36 PM
**To:** John Wozmak
**Cc:** Rhett Lamb; Councilor Janis Manwaring
**Subject:** EA Phase 2 minutes

Jack- I have two requests.

1. Would you make a copy of the <u>original</u> audio taping for me? I know that I have to pay $1 for each cd and I am happy to do so.

2. There are some items in the minutes that are represented incorrectly so I will respectively ask that they be corrected and the minutes be sent out to me again reflecting the corrections.

Thank you.

I have 3 items that I noticed right off the bat.

1. Pg. 3 Leanne Anderson stated that Lebanon is considered a commercial airport. (copied directly from the minutes) I **did not** make a statement, I ask a question regarding why runway 2/20 6200 ft. could not be shortened when the length of Lebanon's runway (5496 ft.) and it's considered a commercial airport. Totally miss represents what I ask.

2. I believe it was Chris Alexing who ask the question regarding any additional airport costs to the City and Jack said approx. $90,000. **Not in the minutes at all.** You ask for verification regarding this amount of addition costs from the City officials and employees attending the mtg. (Rhett Lamb, the two councilmembers sitting in the section in front of you) and they agreed with the dollar figure.

3. Dwight and I seem to have misheard the quote of dollars spent on the separate EA reports from both Jack and the Stantec reps. Was it not stated that the first EA report cost over $300,000 and the second EA cost $105,000. I do remember the gasps! This is copied from pg.4 of the minutes $220K for phase 1 and $103K for Phase 2. Different numbers for sure!

I cc'd the following people because they were at the meeting, not sure of the councilmembers name sitting next to Janice.

Thank you for the corrections.

Leanne

January 26, 2017

To Whom It May Concern,

I attended the EA Phase 2 Airport Public Meeting and would like my comments corrected within the meeting minutes.

I stated that we specifically chose to live in Keene and incur the high taxes because of the value we saw within the Edgewood neighborhood. I stated that the impending tree cutting would not only affect my, my husband's, and our future children's quality of life, but it would damage the property value of our newly purchased home.

I stated that when I first began to attend meetings, what I heard from Mr. Wozmak was that the goal of the forest management plan was to reach a compromise that would meet the needs of the community, the requirements of the FAA, and the goals of the airport. There was discussion of selective cutting, or cutting done in phases over a number of years. Since those earlier meetings however, we have now moved into a plan of essentially clear cutting all of the pine trees within that forest. When I asked Mr. Wozmak about this at a recent meeting, he stated that the scientifically-based forest management plan indicated that clearcutting was the best way of encouraging the undergrowth and expediting the development of new forest. I stated that, while I understand that clearcutting the trees allows faster growth, it would devastate the community. I stated that selective cutting, or phased cutting over many years, while perhaps not the most expedient or efficacious method to encourage new growth would be a reasonable compromise between the airport, the FAA, and the community. I stated that even with clearcutting the pines, a true forest would not exist for another 30 years – which is unlikely to benefit the families currently living in the community and would likely deter future buyers.

I stated that an ideal scenario for the community would be the absence of intervention within the forest, but we recognize that compromises must be made; I stated that although airport officials have verbalized the necessity of compromise, they have yet to demonstrate any effort to meet the community halfway. I stated that the current plan to clear cut all of the pine trees is essentially identical to the original plan proposed several years ago.

I stated that it is unfortunate that the city of Keene reneged on its responsibility to maintain the forest over the years, but that the resolution of that mistake should not come at the expense of Keene residents.

I stated that it has become increasingly clear that the desires of the few, specifically those that benefit from the airport, are taking precedent over the needs of the many residents living within Keene and the Edgewood neighborhood.

I staret that I hoped our City Counsel representatives would hear the very reasonable concerns of this community and support their constituents as they have been elected to do.

Sincerely,

Lindsey Cushing

7 Edgewood Avenue

Keene, NH 03431

If I paid money to buy a complete and objective report supposedly designed to fully address the defined issues for citizens' concerns, and got the Phase II report just released, I would ask for my money back. The report is very narrowly constructed and incomplete. Specifically:

2. Socio-economic/Property Value

The report only addresses property encumbered by an avigation easement. It does not address the destruction of the long-standing current visual environment of the Edgewood Neighborhood, with the consequent change in quality and value of the neighborhood. This demonstrates the narrow bias of the report in that the appraiser was not asked to consider this aspect.

The NH Dept. of Revenue's "Understanding NH Property Taxes, The Official New Hampshire Assessing Reference Manual", Chapter 5, Section 3 (pp 62-63) says: "It's often factors outside of the property boundaries that establish value." It further states "There are also value influences that affect individual properties. These can include such things as water frontage, water access, panoramic views, highway views, proximity to industrial or commercial uses, and heavy traffic counts. These property specific influences may be difficult to isolate, but are critical in the development of accurate values."

The Forest Management Plan to more or less clear cut Keene Forestry Park will destroy much of the visual, aesthetic value of the Edgewood Neighborhood. Every residence in the neighborhood will be affected, and therefore the value of every property will be affected. This is not been addressed at all.

3) Noise

The report suggests (p 7) that increased noise levels after the proposed cutting will be ameliorated by new growth and the preservation of underbrush and shorter trees. There is relatively little underbrush in Keene Forestry Park and the Forestry Management Plan is to cut as many pine trees as possible, not to preserve them; plus, the forestry report says the soil type, while good for pines, does not support the growth of hardwoods. If hardwoods do grow, it will be the better part of 20 years before there is significant growth to ameliorate the increased noise.

While the noise level changes do not meet the FAA's current criteria for significance, the report says they will bring a perceptible change. This change is not a positive influence on the environmental quality of the neighborhood.

4. Air Quality

This issue was not addressed, other than to say that the cutting operation would not impact air quality. It consists of statements about how difficult it is to assess or quantify emissions from aircraft operations. No effort was made to answer this question, no studies were done. It does not provide a conclusion, and leaves us with no facts regarding what additional pollutants will be entering the community.

5. Visualization Model: The computer-generated images are creative, especially the 'after' images that show many small trees that do not exist. Maybe 'after' means 10-15 years after the clear cutting. It would have been a more honest representative to leave them out.

Section 6 of Appendix B, Greenhouse Gases and Climate Change (6.3 (p151)) states there will be a drop in carbon stocks and sequestration in the "short term". As it will be at least 30 years to get back to the present levels of carbon stocks and sequestration, it is misleading to describe this as short term. While quoting what sustainable forestry practices can do, the Airport's Forestry Management Plan proposed action is not limited to thinning, nor does it include planting new trees.

Finally, there are at least a couple of references in the report* stating that the project will not alter the number of operations conducted at the airport. While the tree cutting does not change the number of operations, it opens the door wide for the Fixed Base Operator's strongly pursued goal to offer night flight training. While jet night flight training may be offered, piston engine aircraft is more likely the target market. The report states that piston engine emissions are underestimated by existing software modeling as well as readily affected by pilot operating tendencies. This makes the omission of the impact on air quality more significant, as the undetermined increased risk to the health of citizens is unexamined.

Chris manning-Gray
51 Greenwood Avenue Keene

01/19/17
Jack Wozmak

**Re: City of Keene, New Hampshire**
Public Information Session
Airport Obstruction Clearing Final Draft Environmental Assessment
For the Dillant-Hopkins Airport
Tuesday, January 17, 2017
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Council Chambers, 2nd floor of City Hall, 3 Washington Street, Keene, NH

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Thank you for the corrections. Please send me a new copy of the minutes after all the corrections. Just for the record I would again like to ask for an original copy of the audio taping of the meeting. Thank you.

Leanne Anderson

Leanne Anderson
103 Greenwood Ave.
Keene, NH 03431

I would like to make a comment/complaint regarding the Visualization Model created by K. Stewart, of RDV Systems.

This was a totally inaccurate visual model of the Edgewood forested area! I spoke with K. Stewart after the mtg. and he apologized and said it would be corrected. K. Stewart said after listening to all of us he realized this visualization was incorrect and he had already spoke to Jack W. regarding the corrections. He said he took his information from the forester and called Jack regarding the understory. He told us "I was given sketchy information." As per K. Stewart, Jack told him to just fill it all in with understory.

He was surprised about the trees in the neighborhood. He had not been informed that the City planned to cut any of the Edgewood Neighborhood trees.

Leanne Anderson 1/19/17