Waterbury-Oxford Airport
Airport Master Plan Update

FINAL REPORT

Prepared for:

Connecticut Department of Transportation
(ConnDOT)

Prepared by:

CHA
CLOUGH HARBOUR & ASSOCIATES LLP

September 2007

FINAL MASTER PLAN UPDATE

for

WATERBURY-OXFORD AIRPORT

September 2007

Prepared For:
Connecticut Department of Transportation

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Rocky Hill, CT

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FOREWORD

Introduction

A Master Plan provides long-range recommendations for the improvement and development of an airport. This Airport Master Plan Update (AMPU) includes a detailed report and a set of drawings that identify, schedule, and illustrate each project anticipated at the Waterbury-Oxford Airport (OXC) over a 20-year period. This AMPU was prepared for the Connecticut Department of Transportation (ConnDOT), operator of the facility.

The previous OXC Master Plan was completed in 1995, and included many recommended projects. Most of the 1995 recommendations have since been developed, including new hangars of various types, an Air Traffic Control Tower, new taxiways, aircraft parking aprons, Runway Safety Area (RSA) extensions, and the closure of crosswind Runway 13-31.

Much of the data used to develop the previous plan are now outdated, and the community and region the Airport serves today are different from that of 1995. As such, one of the goals of this AMPU is to identify and analyze the socioeconomic changes that have occurred in the Naugatuck Valley Region of Connecticut, and particularly in the immediate area surrounding the Airport in the Towns of Oxford, Middlebury, and Southbury. This information, combined with the current airport condition and activity, serves as the basis for the development of this updated study.


New Control Tower

A primary product of this AMPU is a drawing that illustrates the existing airport features and all recommended developments. This drawing is called the Airport Layout Plan (ALP), which must be formally approved by the State and the Federal Aviation Administration (FAA). The ALP is supported by a number of additional drawings that illustrate surrounding airspace, adjacent land use, and airport property. Combined, these exhibits are termed the ALP Drawing Set.

The AMPU document follows a standard format, and is based on the design criteria outlined in the following guidance materials and regulations:

- FAA Advisory Circular 150/5070-6B, Airport Master Plans
- FAA Advisory Circular 150/5300-13, Airport Design
- Federal Aviation Regulation (FAR), Part 77, Objects Affecting Navigable Airspace

This foreword provides background information on the study's purpose, process, and issues, and is organized into the following sections:

- Study Purpose
- FAA Planning Policy and Process
- Key Study Considerations and Activities
- Public Involvement Activities
- Related Study – Airport Noise and Compatibility Plan
- Study Organization

Study Purpose

The overall purpose of the AMPU is to provide guidelines for future airport developments that satisfy anticipated aviation demand, and are compatible with the environment and consistent with community interests. The AMPU provides an effective graphic presentation of the potential short- and long-term developments of OXC, and establishes a schedule of priorities, while addressing adjacent land use issues and environmental concerns through public and municipal input.

Although the AMPU presents a conceptual development plan covering a 20-year period, it does not represent a commitment by the State to undertake the recommended projects or guarantee financial support for implementation. However, ConnDOT and FAA approval of the AMPU is a prerequisite for pursuit of the recommended projects.

ConnDOT's Bureau of Policy and Planning, in concert with the Bureau of Aviation and Ports, undertook the development of the AMPU to determine the future role of the Airport, and to provide direction for the continuing improvement of the facility, as compatible with the local community. The Master Plan study is evidence that ConnDOT recognizes the importance of aviation in the regional economy and the associated challenges inherent in providing for future aviation needs. Maintaining an airport is a costly investment that demands a sound and realistic master plan. With this AMPU, the Airport can foster its role as both a transportation asset and a centerpiece of the aviation industry in the Central Naugatuck Valley.

FAA Planning Policy and Process

FAA planning policy states that all master plans for public-use airports should cover a long-range (i.e., 20-year) planning horizon, but should be updated on a 10-year basis. As the previous document was completed in 1995, an update is on-schedule in compliance with the policy. The policy is intended to foster a comprehensive approach to airport improvements, establish realistic development goals, and provide a forum for community involvement. The FAA's goal is to ensure that all projects at public-use airports are consistent with an approved long-range plan.

Furthermore, to ensure that airport sponsors regularly update their plans, the FAA requires master plan updates as a prerequisite for receiving federal aid for developments and improvements. Federal aid is administered by the FAA through the Aviation Trust Fund and the Airport Improvement Program (AIP). The AIP is the primary source of grant money for airfield capital projects at the Waterbury-Oxford Airport.

In fact, the AMPU itself was funded by the FAA through the AIP. As a condition of receiving funding for the study, ConnDOT assured the FAA that airport development recommendations would conform to FAA standards. Therefore, this study is prepared in conformance with relevant FAA standards, guidelines, and methodologies. A list of these standards and guidelines is provided in the grant application.

NEPA / CEPA Environmental Process

The National Environmental Policy Act (NEPA) and the Connecticut Environmental Policy Act (CEPA) were established to ensure that federal and state funded projects consider and address environmental issues. As a public-use State-owned airport, NEPA and CEPA are applicable to all developments at OXC. As such, the AMPU includes a chapter dedicated to environmental concerns, covering areas ranging from noise and land use compatibility to wetlands and endangered species. The AMPU reviews each area of concern to help select recommendations that avoid or minimize impacts, or that can be otherwise mitigated.

However, the AMPU document itself does not include the required analysis under NEPA/CEPA, which would likely be the subject of a separate study prior to individual project implementation. Rather, the AMPU identifies potential environmentally sensitive areas and summarizes potential affects that would require future environmental evaluation and approvals.

Study and Airport Funding

As previously discussed, the AMPU study was funded by the FAA through the AIP, with the remaining cost provided by ConnDOT. The FAA grant was accepted in the fiscal year 2003. No municipal funding is used for any projects at OXC.

The AIP defines eligible airports as those considered essential in the national airport system. This is determined by an airports inclusion in the National Plan of Integrated Airport Systems (NPIAS), which is comprised of all commercial service and reliever airports, as well as select general aviation airports. Approximately 3,300 of the 17,000 registered landing sites in the United States are currently included in the NPIAS.

The AIP provides funding for airport safety and capacity projects at public-use airports of all sizes. AIP eligible capital projects include master plans, environmental studies, runway and taxiway development and rehabilitation, airport lighting and security, aircraft parking aprons and access roads, and navigational aids.

As of 2004, a limited component of the AIP program (i.e., Non-Primary Entitlements) may also be used for revenue generating facilities, such as fuel farms and hangars. However, all hangars constructed at OXC in recent years were developed by the private sector through lease agreements with ConnDOT. This process is anticipated to continue at the Airport.

The AMPU identifies a comprehensive list of recommended capital projects over a 20-year planning period, including estimated construction costs. The anticipated funding source is identified for all recommended projects. It should be noted that general airport maintenance and operating expenses are not considered capital projects, and are not currently eligible for AIP funding; those costs are the responsibility of the State.

Key Study Considerations and Activities

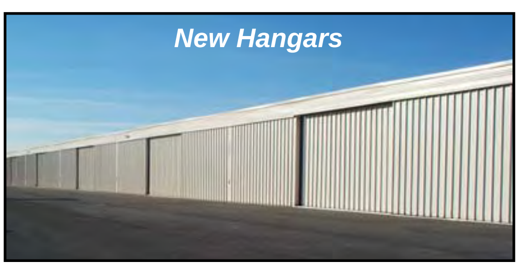
The following issues were identified during the project scoping phase, and provide emphasis and focus for the AMPU. Some of the issues are common to all airport master plans, while others are unique to the Waterbury-Oxford Airport.

- Re-assessment of the Airport's role in serving the Connecticut Naugatuck Valley and wider metropolitan region. An airport user survey is used to identify the mix of both local aircraft owners and operators and non-local users that store aircraft at OXC due to available facilities and services.

- Review the land use, development, and socioeconomic changes that have occurred in the Oxford/Middlebury area over the last decade, as well as the changes and development that have occurred at the Airport.

- Update the noise analysis for the Airport based on current data provided by the new Air Traffic Control Tower. The aircraft noise issue is of high importance to the surrounding towns. AMPU data is also be used in a separate airport noise study (discussed below).

- Utilize the current airport activity data and airport tenant survey data to prepare new long-range activity forecasts for the Airport.



- Provide new airport photography, mapping, and obstruction data (i.e., object heights) for use in all AMPU activities.

- Conduct an updated airspace obstruction evaluation and review the feasibility of eliminating or mitigating object penetrations.

- Identify the benefits, impacts and costs of an Approach Lighting System (ALS) for Runway 36, in association with the relocation or burial of the power lines to the south of the Airport.

- Investigate the feasibility of an Instrument Landing System (ILS) for Runway 18 (without an ALS), including cost, obstruction, and impact considerations.

- Conduct a field review of wetlands located on-airport property, and prepare a comprehensive mitigation plan identifying potential mitigation sites for projects identified in the AMPU.

- Identify the economic impact of the facility in terms of number of jobs, payroll, and economic activity associated with the Airport.

- Review airport operation issues, procedures, and new regulations that may impact the management of the Airport, including the following:

  - Fuel storage procedures
  - Security regulations and procedures
  - Operation of gliders, ultra lights, and parachuting activity
  - Wildlife management procedures
  - Review of tenant leases and associated terms and conditions

Public Involvement Activities

A goal of the AMPU is to consider input from a broad spectrum of the community, including airport users and businesses, local municipalities, regulatory agencies, and the general public. As such, the study included a detailed outreach program that consisted of the following efforts.

Advisory Committee

A study Advisory Committee (AC) was established at the outset of the AMPU whose role it was to provide well-balanced input to the planning process that addressed the concerns of the community and needs of users. Over the course of the study, several AC meetings were held that included both presentations and open discussions. Meeting reports were provided to document the discussion. These meetings were open to the public and the date and time of the meetings was published on the study website. The following organizations were represented on the AC:

- Federal Aviation Administration (FAA)
- Connecticut Department of Transportation (ConnDOT)
- Connecticut Department of Environmental Protection (ConnDEP)
- Connecticut Office of Policy and Management (OPM)
- Council of Governments of the Central Naugatuck Valley (COGCNV)
- Town of Middlebury representative
- Town of Oxford representative
- Town of Southbury representative
- Airport Tenants
- Air Traffic Control Tower (ATCT)

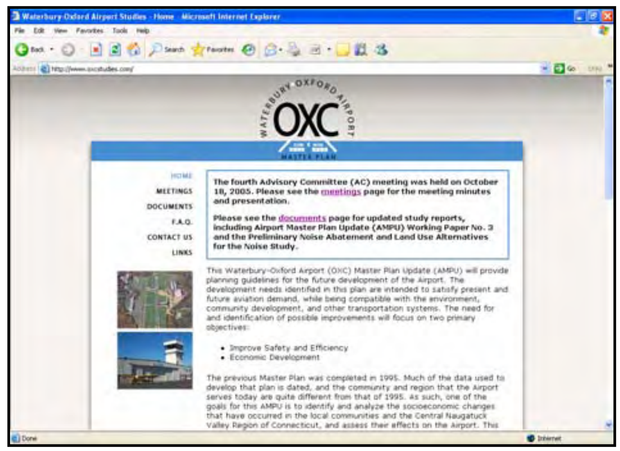
Public Informational Meetings

To ensure the general public had the opportunity to comment on draft AMPU findings, two Public Informational Meetings (PIMs) were held. The first PIM was held at the study mid-point and the second after the release of the draft AMPU.

The PIMs provided an open forum for reviews, questions, and comments from the general public. The meetings had an "Open House" period, a technical presentation, and a question and answer period. Public notice advertisements and a project newsletter were published for each meeting.

Study Web Page

A custom website was designed specifically for the AMPU to provide narrative and graphic information, with regular updates throughout the study duration. The website provides readily accessible information, including project newsletters, meeting announcements and minutes, contact information, related links, draft and final AMPU reports, and photographs. The website also contains an email address for submitting comments. The registered domain is www.oxcstudies.com.



<u>Study Organization</u>

The AMPU is organized into the following report chapters:

- Introduction
- Inventory of Existing Conditions
- Forecasts of Aviation Demand
- Demand/Capacity Analysis & Facility Requirements
- Airport Development Alternatives
- Environmental Overview
- Refinement and Selection of the Recommended Plan
- Airport Layout Plan

<u>Related Study – Airport Noise and Compatibility Plan</u>

In addition to the AMPU, ConnDOT concurrently prepared a detailed *Noise and Land Use Compatibility Plan* for OXC. This study follows procedures established in Federal Aviation Regulations (FAR) Part 150, and is thus commonly referred to as a Part 150 Noise Study. Based on previous studies for the Airport, it is known that the Airport generates off-airport noise in sensitive residential areas. To evaluate and address noise impacts, ConnDOT committed to study airport noise and land use in order to develop a plan that endeavors to better manage and possibly reduce noise exposure in the surrounding communities.

The Part 150 study investigates airport operational procedures and land use planning concepts that may reduce existing and future noise exposure. The objective of the noise study is to prepare a comprehensive Noise Compatibility Plan (NCP) that is intended to manage airport noise and associated impacts. The noise study was funded by the FAA, sponsored by ConnDOT, and is tailored to the specific issues of OXC. The study is structured to be integrated with the AMPU without duplication of services. Information on the Noise Study is available at www.oxcstudies.com.

Runway 18-36
(2003, looking north)

EXECUTIVE SUMMARY

The Waterbury-Oxford Airport (OXC) Master Plan Update (AMPU) provides long-range recommendations for the improvement and development of the Airport. The AMPU includes a detailed report and set of drawings that identify, schedule, and illustrate the projects recommended for OXC during the 20-year planning period. This summary provides an overview of the OXC activity forecasts, facility requirements, and future development recommendations.

Public involvement activities were conducted as part of the AMPU process. A website (www.oxcstudies.com) was developed to provide public access to meeting notices and study materials, and to enable the submission of comments and questions.

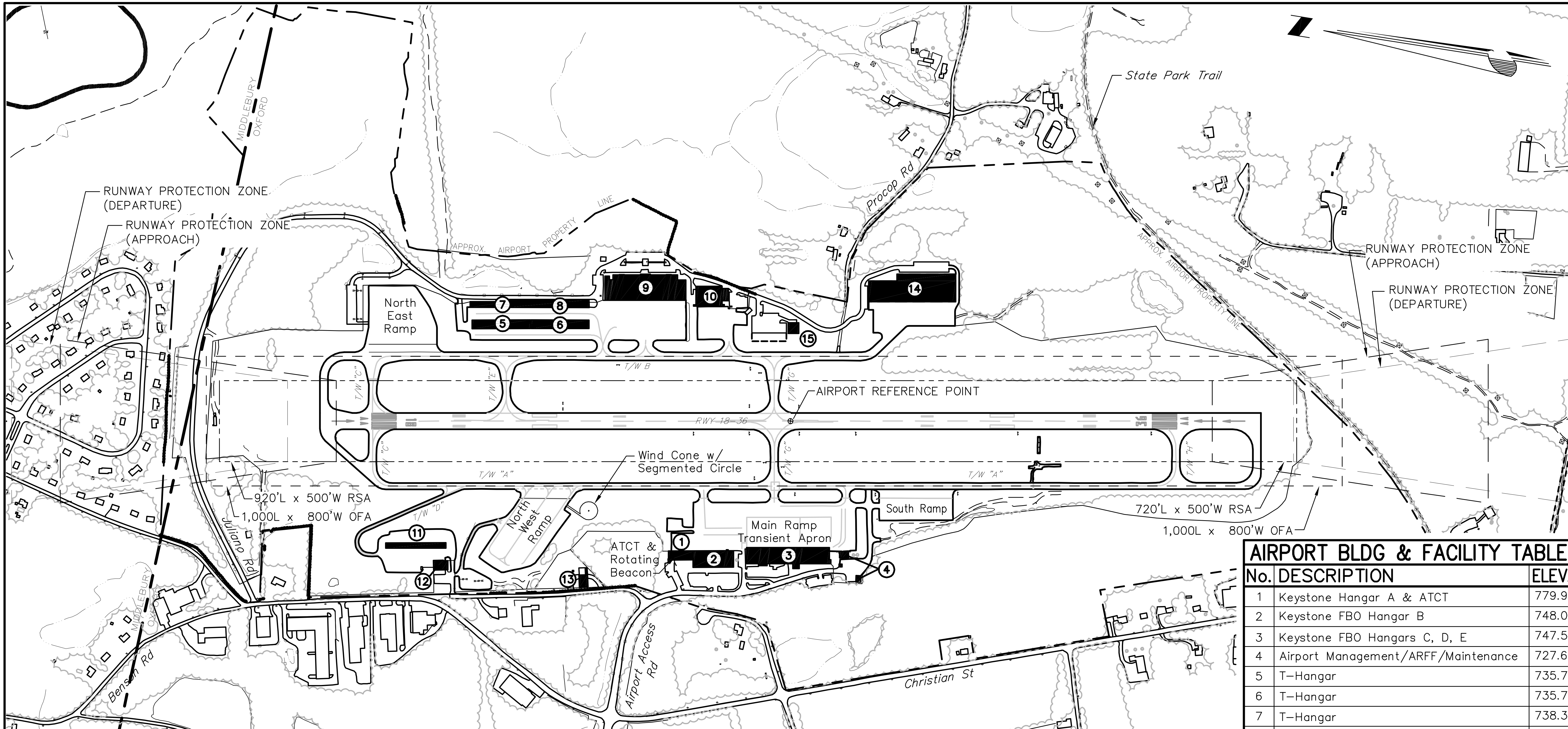
Airport Overview

The Waterbury-Oxford Airport is owned by the State of Connecticut, and is located in the Town of Oxford, approximately seven miles southwest of the City of Waterbury and one mile south of Interstate 84. A small northern portion of OXC is located in the Town of Middlebury.

The Airport does not offer scheduled airline service, but serves many charter, corporate, and personal aircraft users residing in or visiting New Haven, Fairfield, and Litchfield Counties (Connecticut's Naugatuck Valley Region). The Airport serves as a base for over 200 aircraft, including approximately 40 corporate jets. OXC is classified as a "General Aviation" (GA) facility, and is included in the National Plan of Integrated Airport Systems (NPIAS). The Airport is eligible for federal grants under the Airport Improvement Program (AIP).

The Airport was opened on December 15, 1969, and initially featured a 5,000-foot Runway 18-36, with a shorter 1,999-foot crosswind Runway 13-31 built several years later in the early-1970s. However, Runway 13-31 was abandoned in order to pursue further landside development in the early-1990s. Over OXC's 35+ year history, many improvements have been implemented, including the construction of new taxiways, various hangars and aprons, an Air Traffic Control Tower (ATCT), Runway Safety Areas (RSAs), and extensions to both ends of Runway 18-36 (bringing the runway to its current length of 5,800 feet). Runway 36 is equipped with an Instrument Landing System (ILS), which provides added safety and capability for landings during poor weather (IFR) conditions. The existing layout of OXC is illustrated on Figure ES-1.

There are approximately 140 tiedown positions, 64 T-hangar bays, and several large hangars at OXC. Ownership of these facilities is split amongst the Airport's fixed base operator (FBO) and multiple service operators (MSOs), as well as the State of Connecticut. They store aircraft ranging in size from small single-engine Cessna's to large Gulfstream and Global Express corporate jets. There are also three fueling facilities at OXC, with fueling provided by the FBO (Keystone Aviation) and two private MSOs.



AIRPORT BLDG & FACILITY TABLE

No.	DESCRIPTION	ELEV.
1	Keystone Hangar A & ATCT	779.9'
2	Keystone FBO Hangar B	748.0'
3	Keystone FBO Hangars C, D, E	747.5'
4	Airport Management/ARFF/Maintenance	727.6'
5	T-Hangar	735.7'
6	T-Hangar	735.7'
7	T-Hangar	738.3'
8	T-Hangar	738.3'
9	Key Air Hangar F	756.5'
10	Double Diamond	749.1'
11	T-Hangar	714.4'
12	Executive Flight	724.4'
13	Fuel Farm	–
14	Hangar G	739.9'
15	Restaurant	–

Note: Elevations Are Rooftop Elevations

LEGEND

DESCRIPTION	EXISTING	DESCRIPTION	EXISTING
Railroad		Stream/River/Body of Water	
Unpaved road		Airport Property Line	
Paved Areas, Roads		Runway Centerline	
Fence		Building Restriction Line (BRL)	
Treeline		Runway Protection Zone (RPZ)	
Airport Buildings & No.	①	Runway Safety Area (RSA)	
Other Buildings		Runway Object Free Area (OFA)	
Tiedowns			
Potential Wetland			
Utility Poles			

Note: Some Features In The Legend May Not Have Been Used

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DATE: JULY 2006

SCALE: AS NOTED

Figure ES-1

EXISTING AIRPORT LAYOUT

Connecticut Department of Transportation
Waterbury-Oxford Airport Master Plan
Oxford, Connecticut

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Study Issues

Several changes have occurred at OXC in recent years. In addition to the Runway 18-36 extensions, an ATCT and several corporate aircraft hangars were constructed. Development is ongoing at the Airport; however, limited available property, steep terrain, and environmental issues constrain future development options. The AMPU provides an evaluation of the following issues:

- Wetland impacts associated with the recommendations
- Existing Runway Protection Zone (RPZ) impacts
- Noise impact analysis
- Positive economic impact of OXC to the local community

Forecasts

Based aircraft forecasts are important for GA airport studies, as they determine the need for future aircraft storage facilities (i.e., hangars and tiedowns) and FAA design standard requirements. Operations forecasts provide an indication as to whether existing airfield systems (runways and taxiways) can safely sustain future activity levels. The OXC based aircraft and operations forecasts are summarized below.

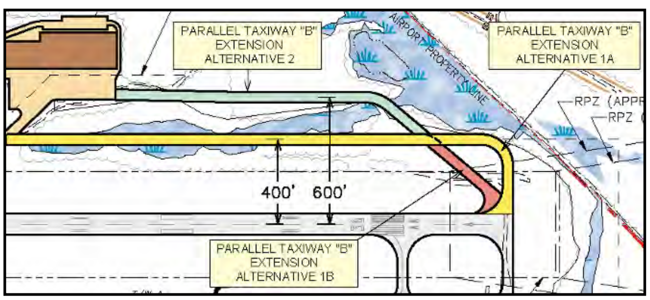
The OXC based aircraft forecasts were developed using the FAA's *Aerospace Forecasts Fiscal Years 2004-2015 (General Aviation Active Fleet Forecasts)*. However, the FAA's forecasts were slightly adjusted to account for the additional corporate jet activity that is anticipated due to ongoing corporate aircraft hangar development. The number of based corporate jets at OXC is forecast to increase from 37 in year 2003 to 72 by year 2023 (see Table ES-1), with total based aircraft increasing from 236 to 287.

The OXC operations forecasts were developed using traffic counts provided by the ATCT (which operates daily between the hours 6:00 a.m. and 9:00 p.m.) and the FAA's *Aerospace Forecasts Fiscal Years 2004-2015 (General Aviation Aircraft Utilization)*. There were a total of 55,172 operations (includes takeoffs and landings) recorded by the ATCT in year 2003. This number was adjusted to 66,000 to account for operations that occurred when the ATCT was closed, and to adjust for runway construction closures in year 2003. Total OXC operations are forecast to increase from 66,000 in year 2003 to 86,500 by year 2023 (see Table ES-1).

TABLE ES-1 – FORECAST SUMMARY					
Aircraft Type	**2003**	**2008**	**2013**	**2018**	**2023**
BASED AIRCRAFT					
Single-Engine/Multi-Engine Piston	188	191	194	197	200
Single-Engine/Multi-Engine Turboprop	10	11	12	13	14
Corporate Jet	37	65	67	69	72
Rotorcraft	1	1	1	1	1
Total	**236**	**268**	**274**	**280**	**287**
OPERATIONS BY FLEET MIX					
Single-Engine/Multi-Engine Piston	58,656	61,884	65,378	68,950	72,600
Single-Engine/Multi-Engine Turboprop	3,120	3,564	4,044	4,550	5,082
Corporate Jet	3,700	6,695	7,169	7,659	8,280
Rotorcraft	473	497	522	548	576
Total	**65,949**	**72,640**	**77,113**	**81,707**	**86,538**

Facility Requirements & Development Alternatives

Based on the OXC forecasts, the AMPU identified facility requirements for the 20-year planning period. The identified airfield facility requirements included a full-parallel taxiway (east side), additional exit taxiways, MALSR approach lighting system, GPS-based LPV approaches, and obstruction removal (electrical towers/lines). The identified landside facility requirements included additional T-hangar bays, conventional hangars, and an equipment building.

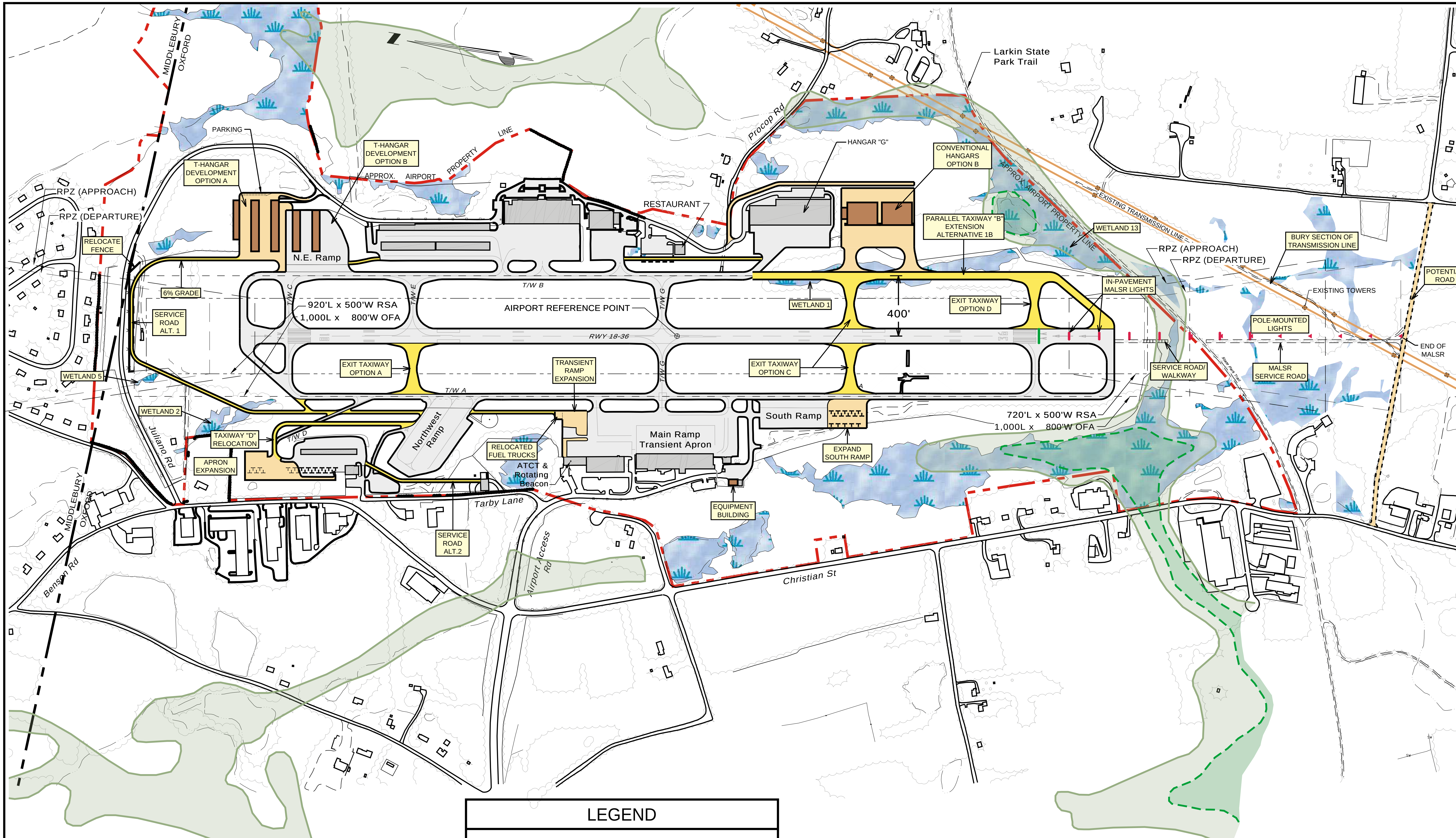


To address the facility requirements, over 20 individual development alternatives were created for OXC. Each alternative was evaluated against a set of criteria, including their environmental impacts, operational efficiency, safety, cost, etc., and several were recommended for development, as discussed below.

Airfield Recommendations

The primary airfield safety improvement for OXC is a full-parallel taxiway for the east side of the runway (Taxiway "B" extension). This is particularly important because Runway 36 is the primary departure runway, and large numbers of based aircraft are located on the east side of the Airport. Although the recommended alignment of Taxiway "B" would result in wetland impacts, they have been reduced by incorporating a 45-degree angled entrance to Runway 36 (see Figure ES-2).

Three exit taxiways are also recommended for the OXC airfield, as well as a service road to separate aircraft and ground vehicles, a MALSR approach lighting system for Runway 36, and obstruction removal (NE Utilities towers/lines and selective trees).



LEGEND

- Wetlands
- 100-Year Floodplain (approx.)
- 500-Year Floodplain Bounday (approx.)

0 600 1,200
Scale in feet

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Figure ES-2

RECOMMENDED PLAN

Connecticut Department of Transportation
Waterbury-Oxford Airport Master Plan
Oxford, Connecticut

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Landside Recommendations

The landside recommendations include the development of 36 T-hangar bays both on and adjacent to the existing Northeast Ramp, an additional conventional hangar adjacent to Hangar "G," apron and tiedown expansion in various locations, and an equipment building (see Figure ES-2).

Airport Capital Improvement Plan

The Airport Capital Improvement Plan (ACIP) lists the recommended projects and associated cost estimates for the 20-year planning period. Grant-eligible projects at OXC may receive 95% federal funding, with ConnDOT responsible for the remaining 5%. These projects include planning and environmental studies, runway and taxiway development/rehabilitation, airport lighting, security enhancements, aircraft parking aprons, access roads, obstruction removal, land acquisition, and navigational aids. In some cases, ConnDOT may fund the total cost of an eligible project with a lower FAA priority (such as an equipment building).

Projects that are ineligible for funding include those that generate revenue and do not directly benefit the general public, such as hangars, fuel farms, and office buildings. A private party/developer (FBO or corporation) may fund and construct grant-ineligible projects under a lease agreement with ConnDOT.

In addition to potential new developments, OXC must also continually rehabilitate its existing airfield facilities and replace maintenance equipment. As such, the ACIP includes these additional costs. Although these items are not considered new capital developments, the associated costs can comprise the majority of an airport's annual capital investment. Recommendations of the OXC FAR Part 150 Noise Study may also require substantial expenditures for a potential multi-year property acquisition and/or noise insulation program. As such, the potential noise mitigation expenditures are also included in the ACIP.

Note that the ACIP does not constitute a commitment on behalf of the FAA or ConnDOT to fund any of the projects. In addition, the ACIP does not imply that the projects would receive environmental approvals. Thus, the ACIP serves as a planning document that must remain flexible. The ACIP should undergo regular updates as project priorities and demands indicate.

Table ES-2 summarizes the 20-year ACIP for OXC, with the AMPU recommendations organized into the following three implementation phases:

<u>Phase I (0 to 5 years)</u>

***1A* -** Extension of parallel Taxiway "B" south to the runway end (design, EA, permitting)
***1B* -** Extension of exit Taxiway "E" on the west side of the runway to Taxiway "A"
***1C* -** Airport service road construction parallel to Taxiway "A" (west side of airfield)
***1D* -** T-hangar development adjacent to the Northeast Ramp
***1E* -** T-hangar construction on the existing Northeast Ramp

1F - Expansion of the South Ramp
1G - Expansion of the Executive Flight Ramp
1H - Equipment Building Construction

Phase II (6 to 10 years)

2A - Extension of parallel Taxiway "B" south to the runway end (wetland mitigation)
2B - Extension of parallel Taxiway "B" south to the runway end (construction)
2C - Airport service road construction parallel to Taxiway "B" (east side of airfield)
2D - Burial/lowering of Northeast Utilities electrical lines and selective tree removal
2E - Expansion of the Transient Apron
2F - Construction of a bi-directional exit taxiway for Runway 18 landings
2G - Installation of MALSR approach lights for Runway 36

Phase III (11 to 20 years)

3A - Extension of exit Taxiway "H" on the east side of the runway to Taxiway "B"
3B - Airport service road construction north of Runway 18
3C - Airport service road construction to the Fuel Farm
3D - Hangar development south of Hangar "G"
3E - Taxiway "D" relocation

TABLE ES-2 – AIRPORT CAPITAL IMPROVEMENT PLAN				
Project	**Total Estimated Cost**	**Anticipated Funding Source**		
		FAA	**State**	**Private**
PHASE I - (0 TO 5 YEARS)				
1.A. Extend Taxiway "B" (Design, EA, Permitting)	**$430,000**	$408,500	$21,500	
1.B. Extend Exit Taxiway "E"	**$325,000**	$308,750	$16,250	
1.C. Service Road Construction (West Side Airfield)	**$300,000**	$285,000	$15,000	
1.D. T-Hangar Development	**$2,300,000**			$2,300,000
1.E. T-Hangar Construction (NE Ramp)	**$860,000**			$860,000
1.F. Expand South Ramp	**$420,000**			$420,000
1.G. Expand Executive Flight Ramp	**$750,000**			$750,000
1.H. Construct Equipment Building	**$450,000**		$450,000	
Equipment & Security Improvements	**$330,000**		$330,000	
Noise Implementation Program	**$500,000**	$475,000	$25,000	
Implementation of Noise Study Recommendations*	**$5,000,000**	$4,750,000	$250,000	
Phase I Subtotal	**$11,665,000**	**$6,227,250**	**$1,107,750**	**$4,330,000**
PHASE II - (6 TO 10 YEARS)				
2.A. Extend Taxiway "B" (Wetland Mitigation)	**$1,600,000**	$1,520,000	$80,000	
2.B. Extend Taxiway "B" (Construction)	**$3,110,000**	$2,954,500	$155,500	
2.C. Service Road Construction (East Side Airfield)	**$200,000**	$190,000	$10,000	
2.D. Burial/Lowering Elec. Lines & Tree Removal	**$5,000,000**	$2,375,000	$125,000	$2,500,000
2.E. Expand Transient Apron	**$170,000**	$161,500	$8,500	
2.F. Exit Taxiway Construction	**$420,000**	$399,000	$21,000	
2.G. Runway 36 MALSR Installation	**$700,000**	$700,000		
Vehicle/Equipment Purchase	**$250,000**	$237,500	$12,500	
Pavement Rehabilitation Projects	**$8,370,000**	$7,951,500	$418,500	
Implementation of Noise Study Recommendations*	**$5,000,000**	$4,750,000	$250,000	
Phase II Subtotal	**$24,820,000**	**$21,239,000**	**$1,081,000**	**$2,500,000**
PHASE III - (11 TO 20 YEARS)				
3.A. Extend Exit Taxiway "H"	**$325,000**	$308,750	$16,250	
3.B. Service Road Construction (North Runway 18)	**$460,000**	$437,000	$23,000	
3.C. Service Road Construction (Fuel Farm)	**$150,000**	$142,500	$7,500	
3.D. Hangar Development	**$10,000,000**			$10,000,000
3.E. Taxiway "D" Relocation	**$1,000,000**	$950,000	$50,000	
Vehicle/Equipment Purchase	**$500,000**	$475,000	$25,000	
Pavement Rehabilitation Projects	**$7,400,000**	$5,291,500	$278,500	$1,830,000
Implementation of Noise Study Recommendations*	**$5,000,000**	$4,750,000	$250,000	
Phase III Subtotal	**$24,835,000**	**$12,354,750**	**$650,250**	**$11,830,000**
GRAND TOTAL	**$61,320,000**	**$39,821,000**	**$2,839,000**	**$18,660,000**

Note: Additional details are provided in the AMPU report.
*This value is a placeholder for long-term planning purposes and does not represent anticipated funding. Preliminary cost estimates are provided in the FAR Part 150 Noise Study. Actual costs would be determined at the time of implementation.

1.0 EXISTING AIRPORT FACILITIES & SETTING

This chapter contains an inventory of existing facilities at the Waterbury-Oxford Airport (OXC). An inventory of airport pavements, buildings, and other structures is presented, as well as a brief summary of the airport location and history, Air Traffic Control (ATC), activity levels, and the environmental overview. The following items are discussed:

- Airport Location, Role, and History
- Airport Facilities
- Airspace, Procedures, and Air Traffic Control
- Airport Activity
- Environmental Overview

1.1 Airport Location, Role, & History

The Waterbury-Oxford Airport is located approximately seven miles southwest of Waterbury and one mile south of Interstate 84 in Oxford, Connecticut (see Figure 1-1). However, a small northern portion of the Airport is located within the Town of Middlebury.

New Haven County, which is home to OXC, consists of 27 towns in south-central Connecticut – the Central Naugatuck Valley. According to the 2000 U.S. Census, 824,000 people inhabit the county year-round. Major industries include manufacturing, retail, trade, and services.

The Airport does not offer scheduled air service. Visitors who fly on airlines into the area arrive primarily at Bradley International Airport and the three New York metro airports, LaGuardia, JFK, and Newark. Several smaller commercial airports are also located within an hour drive of OXC, including Bridgeport, New Haven, and Stewart International Airport in Newburgh, NY. As such, airline service is not needed or anticipated at OXC. However, OXC serves many charter, corporate, and personal aircraft users residing in and visiting New Haven, Fairfield, and Litchfield Counties year-round. The Airport is therefore classified as a "General Aviation" (GA) facility.

A GA Airport serves communities that do not receive scheduled commercial service. Like Waterbury-Oxford Airport, GA airports may be included in the National Plan of Integrated Airport Systems (NPIAS) if they account for sufficient activity (usually at least 10 locally owned aircraft) and are at least 20 miles from the nearest NPIAS airport. The 2,558 general aviation airports in the NPIAS tend to be distributed on a one-per-county basis. These airports, with an average of 32 based aircraft, account for 38 percent of the Nation's general aviation fleet. These airports are the most convenient source of air transportation for about 19 percent of the population.

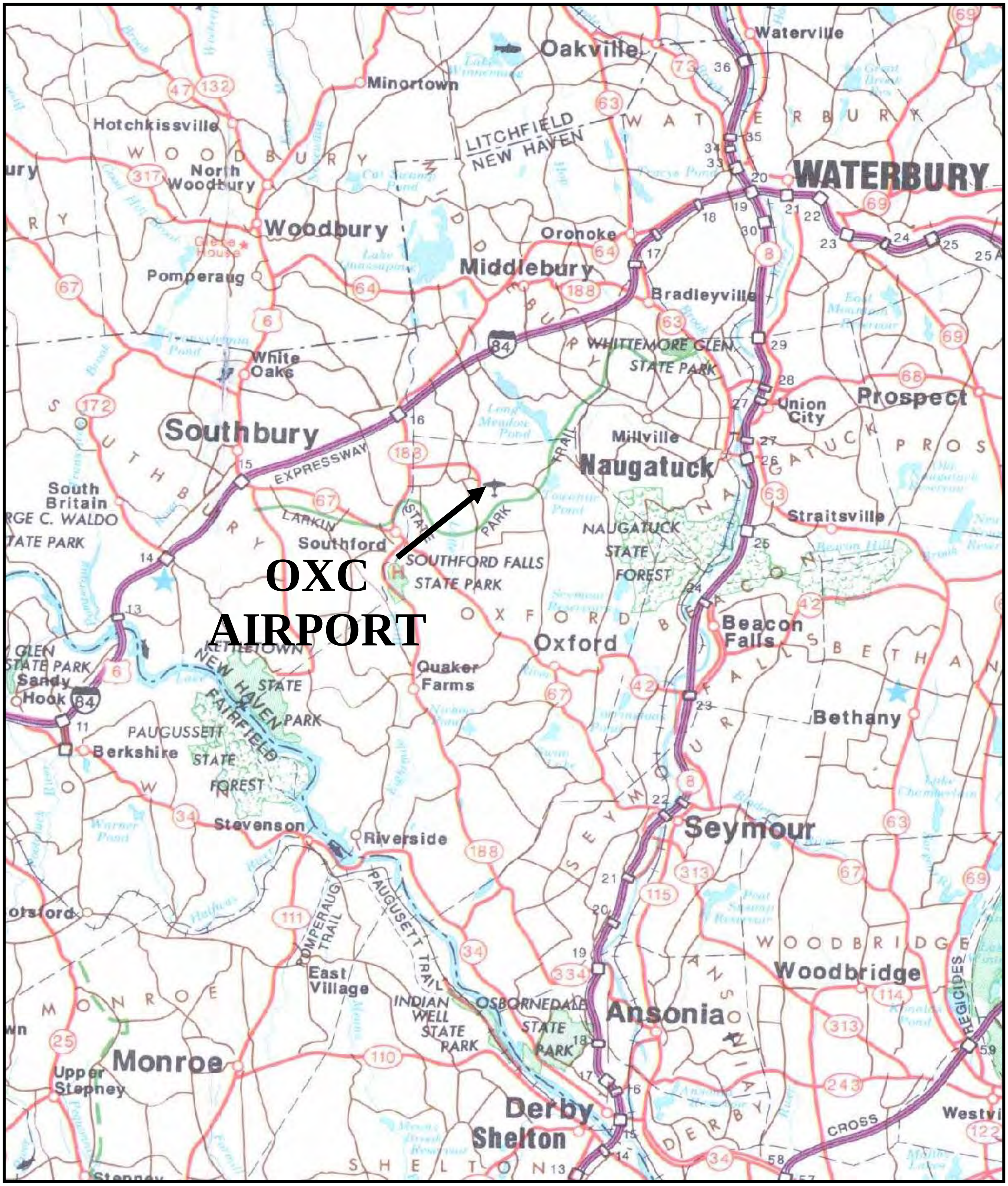

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Figure 1-1
General Location Map

Scale 1" = 2.5 Miles	CHA File No: 12489	Waterbury-Oxford Airport Master Plan Update

Recognizing a need for an airport in the Naugatuck Valley Region, the Federal Aviation Administration (FAA) allocated approximately $1.2 million for the construction of a public-use airport. Construction of the Airport began in May 1968. The Airport was opened for use on December 15, 1969. Initially, the Airport featured a 5,000-foot runway. A shorter 1,999-foot crosswind runway (13-31) was built several years later in the early-1970s.

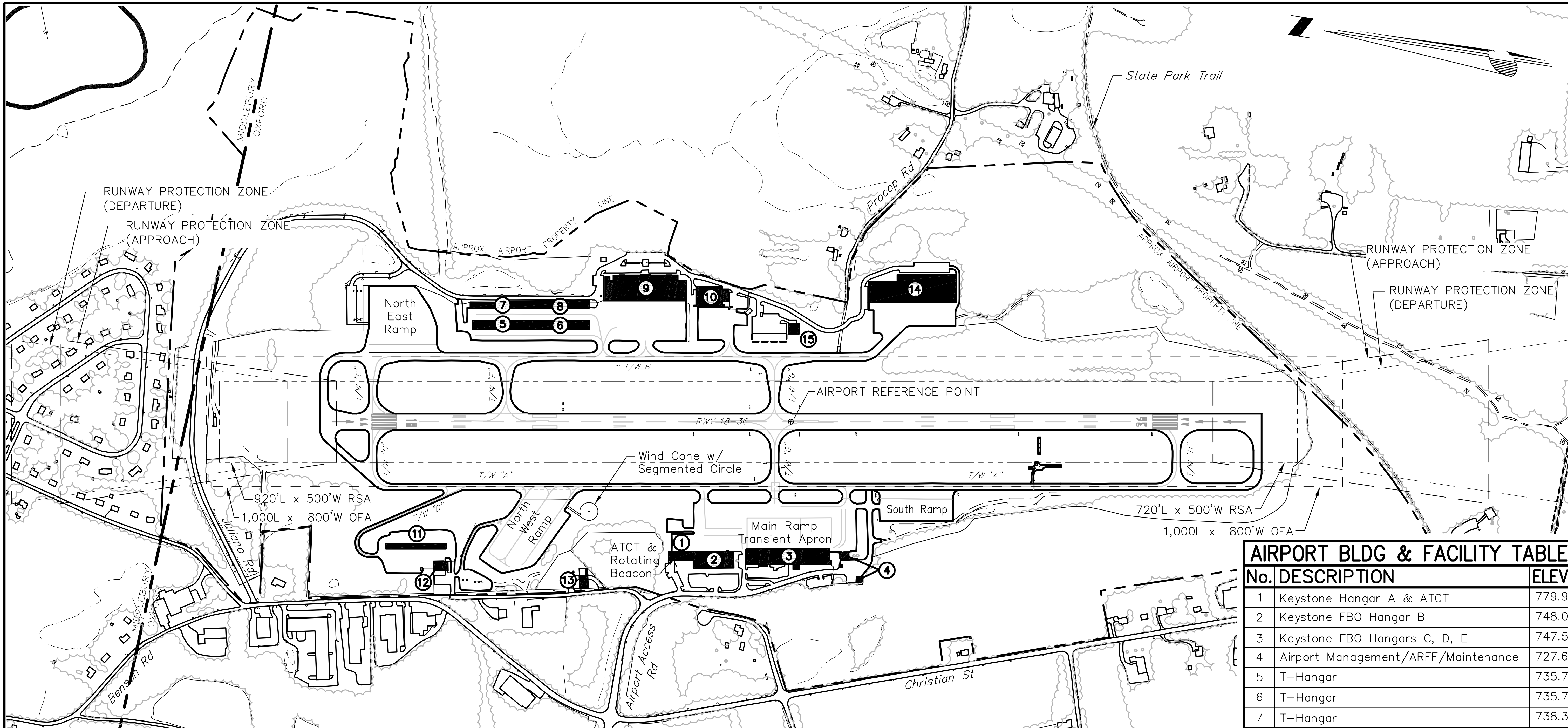
In the early 1990s, Runway 13-31 was abandoned for further airport development. Over the Airport's 35 year history, many improvements have been implemented, including the construction of new taxiways, various new hangars and aprons, an Air Traffic Control Tower (ATCT), Runway Safety Areas (RSAs), and 500-foot and 300-foot runway extensions. A detailed history of OXC is provided in the 1995 Airport Master Plan.

1.2 Airport Facilities

A primary role of master planning is developing a detailed listing of recommended facilities and improvements for implementation over the planning period. As such, the first step in this process is to inventory existing facilities and review their current condition.

Airport facilities are often described as either airside or landside. Airside (or airfield) facilities are those directly used by aircraft, such as runways, taxiways, aprons, lighting and instrumentation. Landside facilities are support buildings and structures, typically with access to the airside, such as the terminal, hangars, maintenance buildings, parking lots, and access roads. As part of this study, all airport facilities were inspected and inventoried, and are described in the sections below. Table 1-1 summarizes basic airport data; Figure 1-2 depicts the existing airport facilities.

TABLE 1-1 – AIRPORT DATA	
Airport Three Letter Identifier	OXC
Airport Owner	Connecticut Department of Transportation
Date Established	December 15, 1969
Airport Category	General Aviation
Airport Acreage	430 acres
Airport Coordinates *	41°-28'-46" N 73°-08'-08."W
Airport Elevation	726 MSL
* Source: Airport Facility Directory 2004	



AIRPORT BLDG & FACILITY TABLE

No.	DESCRIPTION	ELEV.
1	Keystone Hangar A & ATCT	779.9'
2	Keystone FBO Hangar B	748.0'
3	Keystone FBO Hangars C, D, E	747.5'
4	Airport Management/ARFF/Maintenance	727.6'
5	T-Hangar	735.7'
6	T-Hangar	735.7'
7	T-Hangar	738.3'
8	T-Hangar	738.3'
9	Key Air Hangar F	756.5'
10	Double Diamond	749.1'
11	T-Hangar	714.4'
12	Executive Flight	724.4'
13	Fuel Farm	–
14	Hangar G	739.9'
15	Restaurant	–

Note: Elevations Are Rooftop Elevations

LEGEND

DESCRIPTION	EXISTING	DESCRIPTION	EXISTING
Railroad		Stream/River/Body of Water	
Unpaved road		Airport Property Line	
Paved Areas, Roads		Runway Centerline	
Fence		Building Restriction Line (BRL)	
Treeline		Runway Protection Zone (RPZ)	
Airport Buildings & No.	①	Runway Safety Area (RSA)	
Other Buildings		Runway Object Free Area (OFA)	
Tiedowns			
Potential Wetland			
Utility Poles			

Note: Some Features In The Legend May Not Have Been Used

0 600 1,200
Scale in feet

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www.cloughharbour.com

DATE: SEPTEMBER 2005 | SCALE: AS NOTED

Figure 1-2

EXISTING AIRPORT LAYOUT

Connecticut Department of Transportation
Waterbury-Oxford Airport Master Plan
Oxford, Connecticut

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1.2.1 Airside Facilities

This section describes the Airport's runways, taxiways, aprons, lighting, and navigational aids. The conditions reported in this section are based on a review of the Airport's plans and documents, and discussions with the airport manager.

Runway, Taxiways, Lighting, & Aprons

The Waterbury-Oxford Airport consists of approximately 430 acres of property encompassing all airport facilities. The Airport has one paved (bituminous) and lighted runway (18-36). This 5,800-foot long runway with displaced thresholds is oriented on an approximate 180-360 degree magnetic alignment (north to south), and is 100 feet in width. Runway markings are precision, as illustrated on Figure 1-2. The runway is served by a full parallel taxiway to the west and a partial parallel taxiway to the east. Three exit taxiways provide access to the aircraft parking aprons and hangar areas. Runway 18-36 is equipped with High Intensity Runway Lights (HIRLs). On the Runway 18 end, there is a Visual Approach Slope Indicator (VASI-L4) to the left of the runway. On the Runway 36 end, there are Runway End Identifier Lights (REILs) and a Precision Approach Path Indicator (PAPI-L4) to the left of the runway. The Airport is further equipped with a rotating beacon located on the ATCT on the west side of the Airport. The wind direction indicator includes a lighted wind cone with a segmented circle, and is located on the west side of the Airport.

Three tiedown aircraft aprons exist at OXC. The east apron (northeast ramp) contains based aircraft parking at the northeast corner of the Airport. This apron has 40 tiedowns on 100,000 square feet of pavement. The two other tiedown aprons are located on the west side of the Airport, one of which is located at the west end of the old crosswind runway (known as the northwest ramp) and the other to the south of the Airport Management office (known as the south ramp). These aprons consist of 140,000 and 24,000 square-feet of pavement and total approximately 60 tiedowns.

The main FBO apron, occupied Keystone Aviation, is located on the west side of the runway and is 150,000 square-feet. This ramp provides short- and long-term parking, and also serves as a staging area for Hangars A through E. Additionally, approximately 15 tiedowns exist along the east side of the ramp, parallel to Taxiway "A." Executive Flight, north of the northwest ramp, has an apron totaling approximately 20,000 square-feet, with approximately 15 based aircraft located along the apron perimeter and surrounding the T-hangar building.

Key Air and Double Diamond, on the east side of the runway, have an apron in front of their hangars totaling 100,000 and 40,000 square-feet respectively.

Table 1-2 and Figure 1-2 summarizes the existing airfield facilities.

TABLE 1-2 – EXISTING AIRFIELD FACILITIES				
Runway/Taxiway	**Length**	**Width**	**Surface Type**	**Lighting**
Runway 18-36	5,800’	100’	Asphalt Grooved	HIRL Runway 18: VASI Runway 36: REIL, PAPI
Taxiway “A”	6,300’	40’	Asphalt	MITL
Taxiway “B”	3,700’	50’	Asphalt	MITL
Taxiway “C”	300’	40’	Asphalt	MITL
Taxiway “D”	600’	25’	Asphalt	MITL
Taxiway “E”	300’	50’	Asphalt	MITL
Taxiway “G”	750’	40’- 100’	Asphalt	MITL
Parking Aprons	**Total Size**	**Tiedowns**	**Surface Type**	**Users**
Northeast Ramp	100,000 sf	40	Asphalt	Based
Northwest Ramp	140,000 sf	50	Asphalt	Based
South Ramp	24,000 sf	26	Asphalt	Based
Main Ramp	50,000 sf	10	Asphalt	Based/Itinerant
Executive Flight	20,000 sf	12	Asphalt	Based*
Key Air	100,000 sf	Staging	Concrete/ Asphalt	Tenant Use
Double Diamond	40,000 sf	Staging	Asphalt	Tenant Use
Keystone (A, B, C, D)	105,000 sf	Staging	Asphalt	Tenant Use
Transient - Keystone	72,000 sf	Variable	Asphalt	Visitors

Key:
HIRL – High Intensity Runway Lights **VASI** - Visual Approach Slope Indicator
PAPI – Precision Approach Path Indicator **MITL** – Medium Intensity Taxiway Lights **REIL** - Runway End Identifier Lights
* Based aircraft at Executive Flight are located along the perimeter of the apron and surround the T-hangar

Navigational Aids

Navigational Aids (navaids) are radio facilities that provide either enroute or approach guidance information. Navaids are generally used in conjunction with the airport lighting and visual aids (i.e., ALS, VASIs, etc.), and provide visual cues and orientation to the pilot. OXC navaids are described below.

Runway 36 is equipped with an Instrument Landing System (ILS) that is maintained by the FAA. An ILS is considered a precision-approach landing system and consists of a localizer, which provides horizontal guidance to the pilot; a glideslope, which provides vertical guidance; and marker beacons, which identify distance from the runway. OXC is the only GA airport in Connecticut that provides a full ILS. Additionally, RNAV GPS (Global Positioning System) non-precision approaches are available to both runway ends.

The closest long-range electronic navigational aid to OXC is the Bridgeport VOR (Very High Frequency Omni-Directional Range), located approximately 18 nautical miles south of the Airport. There is a VOR non-precision approach to Runway 18.

1.2.2 Landside Facilities

An inventory of the existing landside facilities was conducted through field observations, review of existing airport plans, and discussions with airport management. A description of these facilities is provided below and summarized in Table 1-3.

Hangars

Hangar facilities at OXC include eight conventional (or open-bay) hangars (Hangars A through F, Executive Flight, and Double Diamond) for private and fixed based operations, and five T-hangar buildings. The conventional hangars range from 2,500 to 62,500 square feet, and can house approximately 50 aircraft. The T-hangar buildings accommodate a total of 64 units. Presently under construction is a 62,500 square-foot hanger (Hangar G) on the east side of the Airport.

Fuel

OXC provides aircraft fueling facilities at three locations on the Airport. Keystone and Executive Flight each operate a fuel facility, which are located on the west side of the Airport along Christian Street. Double Diamond has a fuel facility located just south of their hangar. Fuel type and quantity is summarized in Table 1-4. Keystone FBO sells fuel at the Airport, while both Executive Flight and Double Diamond conduct self fueling operations exclusively.

Airport Access & Parking

Roadway access to the Airport's facilities is provided via I-84 Exit 16 (major interstate), to Route 188. Airport Access Road is the main road to the Airport off Route 188 and provides access to many facilities and airport tenants on the west side of the Airport, including the following:

- Keystone Aviation FBO
- Airport Management
- Executive Flight
- West parking aprons and T-hangar

Main access to the east side of the Airport is provided via Airport Access Road, then north on Christian Street and east on Juliano Road, which provides access to the following:

- Key Air
- Double Diamond
- Northeast parking apron and T-hangars
- New Hangar G (scheduled for completion in 2006)
- Restaurant (scheduled for completion in 2006)

Automobile parking is provided in paved lots at each respective tenant facility. The amount of parking space provided is shown in Table 1-4.

Airport Management

Airport Management (ConnDOT) is located on the west side of the Airport, just south of midfield. This office provides day-to-day operations coordination with airport users and tenants, and the local community. Additionally, Airport Management coordinates all airfield maintenance and is the first responder for any on-airport aircraft incidents. Airport Management facilities are summarized in Table 1-3.

Air Traffic Control Tower

The Air Traffic Control Tower (ATCT) is located near midfield on the west side of the Airport. Specifically, the tower cab (i.e., enclosed glass area where the controllers work) is located above Keystone Aviation (Hangar A), and is 49 feet above ground level.

TABLE 1-3 – EXISTING LANDSIDE FACILITIES				
Bldg. Number*	**Facility**	**Area**	**Use**	**Condition**
1	Keystone FBO Hangar A	5,000 sf	Storage, Maintenance	Good
1	ATCT	2,500 sf	Air Traffic Control	Excellent
2 & 3	Keystone FBO Hangar B, C, D, & E	50,000 sf	Storage, Maintenance	Excellent
4	Airport Management/ ARFF/Maintenance	3,500 sf	Operations/Storage	Good
5	T-hangar	17,500 sf 16 units	Storage	Excellent
6	T-hangar	17,500 sf 16 units	Storage	Excellent
7	T-hangar	7,200 sf 6 units	Storage	Excellent
8	T-hangar	17,500 sf 16 units	Storage	Excellent
9	Key Air Hangar F	62,500 sf	Storage, Maintenance	Excellent
10	Double Diamond Hangar	15,000 sf	Storage, Maintenance	Excellent
11	T-hangar	13,000 sf 10 units	Storage	Good
12	Executive Flight Hangar	2,500 sf	Storage, Maintenance	Good
13	Fuel Farm	Three 15,000 gal. tanks	Fuel Storage	Excellent
14	Key Air Hangar G	62,500 sf	Storage, Maintenance	Under Construction
15	Restaurant	4,350 sf	Food Service	Under Construction
* As shown on Figure 1-2				

1.2.3 Services & Primary Tenants

The Waterbury-Oxford Airport serves a variety of general aviation users, including those flying for business, government, and recreational purposes. As such, various types of services are provided to meet the needs of the users, as described below.

Four primary tenants operate at OXC, as illustrated on Figure 1-2 and summarized in Table 1-4.

TABLE 1-4 – AIRPORT SERVICES/TENANT SUMMARY				
Company	**Service Provided**	**Location**	**Fuel (gallons)**	**Parking (spaces)**
Keystone Aviation	Fuel sales, aircraft rental, flight training, aircraft maintenance	West side	45,000 Jet A 12,000 100LL	120
Key Air	Aircraft management, charter	East side	NA	100
Double Diamond	Charter	East side	15,000 Jet A	20
Executive Flight Services	Aircraft sales & maintenance, flight training, charter	West side	8,000 100LL	20
Note: separate auto parking is also provided for the east and west aprons, 50 and 75 spaces respectively				

1.3 Airspace, Air Traffic Control, & Procedures

Aircraft approaching and departing OXC are subject to a system of controls designed to serve the safe separation of aircraft from one another. Aircraft are subject to varying degrees of control depending on the specific airspace and meteorological conditions in which they operate. This system of air traffic control is the responsibility of the FAA. The FAA has the statutory duty to establish, operate, and maintain air traffic control facilities and procedures.

Airspace

There are two basic types of aircraft flight rules recognized by the air traffic control system: those operating under visual flight rules (VFR), and those operating under instrument flight rules (IFR). VFR operations depend primarily on visual conditions. IFR operations depend primarily on radar detection for separation by air traffic controllers. IFR flights are controlled from takeoff to touchdown, while VFR flights are controlled only within the vicinity of airports.

The United States airspace is structured into Controlled, Uncontrolled, and Special Use airspace, as defined below.

- **Controlled Airspace** – Airspace that is supported by ground to air communications, navigational aids, and air traffic services. Controlled airspace is further divided into five different Classes (A, B, C, D, or E). The classification of any airspace is determined by its special location.
- **Uncontrolled Airspace** – All airspace that has not been designated as Controlled or Special Use, and within which Air Traffic Control (ATC) has neither the authority nor the responsibility for control. All uncontrolled airspace is considered Class G.

- **Special Use –** Designated airspace where unique or hazardous situations (e.g., military activities) require special attention and restrictions.

These airspace classifications impose several requirements upon the operations of aircraft, including visibility minimums, cloud clearances, contact with air traffic control, and special aircraft equipment. The classification system is summarized as follows:

- Class A: All airspace above 18,000 feet mean sea level (MSL). Class A airspace contains all high altitude airways – jet-routes.

- Class B and C: The airspace surrounding major commercial airports. To enter this airspace, communication and/or clearances must be received from ATC. The closest Class B airspace surrounds the New York Metropolitan Airports which includes JFK, LaGuardia, and Newark. The closest Class C airspace surrounds Bradley International Airport to the northeast and Islip Airport to the south. Within Class B and C airspace, aircraft are required to communicate with ATC.

- Class D: The terminal area airspace surrounding towered and military airports with a radius of five statute miles. As shown in Figure 1-3, the OXC airspace is classified as Class D from the ground up to 3,200 feet above MSL (2,500 feet AGL). Nearby Danbury Airport to the west, Bridgeport to the south, and New Haven Airports to the southeast are also classified as Class D airspace. Within Class D airspace, aircraft are required to communicate with ATC.

- Class E: General controlled airspace that includes most of the remaining airspace. This airspace contains the low altitude airways. Aircraft operating in Class E must follow the general regulations for Controlled airspace. Class E airspace extends upward to the overlying Class A airspace. Thus, beyond the boundaries of the OXC Class D airspace, Class E airspace begins.

- Class G: Uncontrolled airspace; the airspace below Class E. Aircraft must still follow the specific traffic patterns established for the Airport. OXC becomes Class G airspace when the control tower is closed (9pm to 6am). Meridian Markham Municipal Airport, which has Class G airspace (from the ground up to 700 feet AGL), is the closest facility to OXC, located approximately 13 nautical miles east of OXC.

- Special Use Airspace: An area of special concern or restriction due to unusual hazards (e.g., military activity). Special Use airspace includes designated Prohibited Areas, Restricted Areas, Warning Areas, Military Operation Areas, and Alert Areas. The closest special use airspace is Restricted Area (R-5206), which surrounds the West Point Military Academy, located approximately 38 nautical miles southwest of OXC.

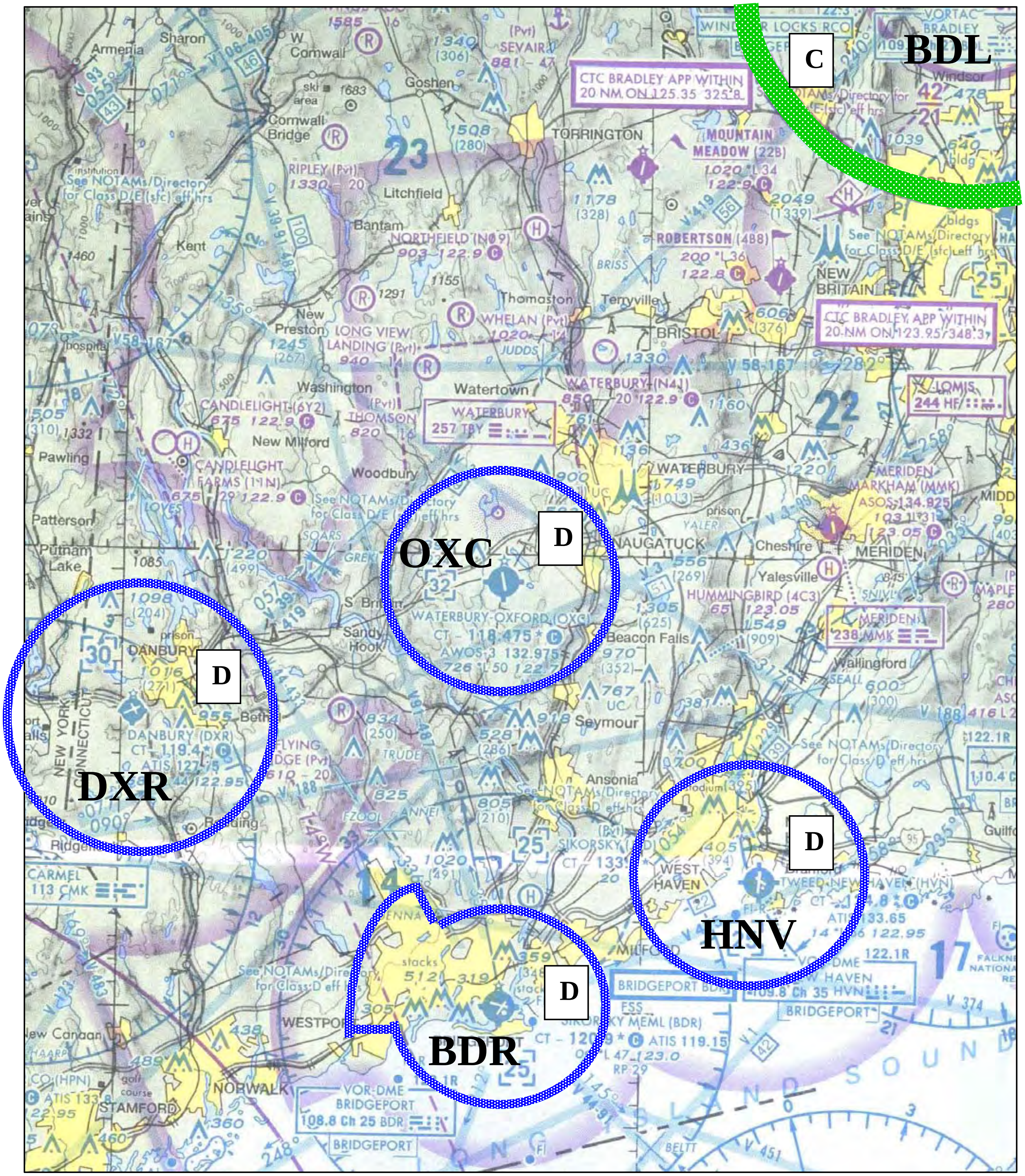

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Figure 1-3
Airspace Map

Scale 1" = 6 Nautical Miles	CHA File No: 12489	Waterbury-Oxford Airport Master Plan Update

In summary, with no nearby Class A, B, C or Special use airspace, the operational environment at OXC is relatively uncongested and unrestricted. VFR aircraft operating to and from OXC must contact the ATCT and follow given instructions. IFR aircraft must follow formal clearances provided by ATC. With the commissioning of the new ATCT, local airspace congestion during busy periods is readily managed by local ATC.

Air Traffic Control

At OXC, local traffic is controlled by the Air Traffic Control Tower (ATCT) that is located on the west side of the Airport just north of midfield. The ATCT was constructed and became fully operational on May 15, 2002.

ATC services are provided by a private company under a contract with the FAA. ATC operates daily from 6am to 9pm. Communications with ATC is via radio on 118.475 (tower) and 121.65 (ground).

Procedures

VFR Flight procedures at OXC follow standard traffic patterns established by the FAA. The patterns include flying straight-in to or straight-out from either runway end, or flying a standard rectangular traffic pattern with all left-hand turns. The full left-hand traffic pattern for aircraft staying in the pattern includes the departure leg, followed by left turns to the crosswind, downwind, base legs, and a turn to final for landing.

Ideally, all takeoffs and landings are conducted into the wind in order to reduce aircraft ground speed and improve safety. Thus, the runway end in use is primarily determined by the current wind. The single north-south runway at OXC mostly experiences winds from the north and northwest. Thus, it is estimated that over 70 percent of the takeoffs and landing occur on Runway 36 – landing from south to north and departing to the north. The 30 percent remainder of the flights would therefore be the opposite on Runway 18 – landing from the north and departing to the south.

During IFR conditions (visibility under 1-mile and cloud ceiling 1,000 feet above ground level), aircraft must file instrument flight plans and obtain “clearances” from ATC. IFR departure procedures all start with straight-out takeoffs, followed by the specific IFR flight clearance (heading and climbing instructions).

IFR approaches or Instrument Approach Procedures (IAP) are written and published by the FAA for specific runway ends. At OXC, the FAA has published a precision IAP to Runway 36 using an Instrument Landing System (ILS). In addition, several non-precision procedures have been published to both runway ends using both satellite based GPS and older ground based systems (e.g., NDB, VOR/DME).

As shown in Table 1-5, the ILS approach to Runway 36 has the lowest (i.e., best) approach minimums of any of the IAP at OXC. The ILS enables descents to 250 above ground level

(AGL), with visibility as low as 1-mile. The theoretical minimums for this approach would be 200 feet AGL and ½-mile visibility. However, such minimums would require installation of an Approach Lighting System (ALS) as well as removal of approach obstructions (e.g., power lines) south of the runway. Thus, an ALS is discussed in later chapters of the AMPU.

TABLE 1- 5 – INSTRUMENT APPROACH PROCEDURES

Instrument Approach Procedure	Aircraft Category	Minimum Decent		Visibility Minimum *(Mile)*
		MSL	*AGL*	
ILS RWY 36	All	971	250	1.0
LOC RWY 36	A & B	1,180	459	1.0
	C	1,180	459	1.25
	D	1,180	459	1.5
GPS RWY 18	A & B	1,220	494	1.0
	C	1,220	494	1.25
	D	1,220	494	1.5
GPS RWY 36	A & B	1,200	479	1.0
	C	1,200	479	1.25
	D	1,200	479	1.5
NDB RWY 18	A & B	1,280	554	1.0
	C	1,280	554	1.5
	D	1,280	554	1.75

Note: Circling minimums are also published for each of the IAP above.
Aircraft Approach Category (approach speed):
A: 0 – 90 Knots B: 91 – 120 knots C: 121–140 knots D: 141 knots and above

As shown in Table 1-5, each of the non-precision IAPs at OXC has higher minimums for decent altitude and equal or higher visibility requirements than the ILS. It is also noted that aircraft in faster approach categories have higher approach minimums. This is due to the reduced pilot reaction time available for aircraft traveling at higher speeds.

The Department of Transportation is currently working with the FAA Air Traffic division to update procedures, equipment, and airspace boundaries that better serve the needs of the airport. Poor radar coverage continues to limit capacity by restricting IFR operations.

1.4 Airport Activity

This section provides a summary of activity as of December 2003 at OXC, which will be used as the base year for this study. This data is incorporated into the forecasts of aviation demand.

1.4.1 Based Aircraft

The number of based aircraft at an airport is used to determine the need for hangars, apron area, and other related facilities. Based aircraft include those owned by individuals, businesses, or organizations that are stored at OXC on a regular basis. At OXC, based aircraft include corporate and private-use aircraft. In 2003, there were 236 based aircraft at the Airport, as listed in Table 1-6.

1.4.2 Operations

Aircraft activity at OXC consists of corporate, charter, and private general aviation use. Table 1-6 shows the number of annual aircraft operations conducted at OXC. An aircraft operation is defined as either a landing or a takeoff. Thus, each flight includes at least two operations – one takeoff and one landing. Aircraft operations are categorized in a number of ways, including:

- Aircraft Type
- Type of operation (local or itinerant)
- Time of day (day or night)
- Type of operating procedure (visual flight rules vs. instrument flights rules)

TABLE 1-6 – EXISTING BASED AIRCRAFT & ACTIVITY

	Single & Multi-Engine Piston	Turboprop	Jet	Rotor	Total
Based Aircraft (Dec. 2003)	188	10	37	1	236
Annual Operations	58,656	3,120	3,700	473	65,949

At OXC, approximately 40% of all operations are local. Local flights are conducted mostly by based aircraft, and include primarily single and multi-engine piston aircraft. Itinerant operations (those arriving from outside the local area) are conducted by a mix of based and transient aircraft. The time of day and instrument flight operations are discussed in Chapter 2.

1.4.3 Existing Service Level & Classification

As discussed in Section 1.1., the Airport does not offer scheduled airline service, nor is it anticipated or pursued. However, OXC serves many charter, corporate, and personal aircraft users residing in and visiting the New Haven County area year-round. The Airport is therefore classified as a "General Aviation" (GA) facility.

Many of the facilitiy requirements at an airport are predicated on the level of activity and the largest or most demanding aircraft forecast to regularly use the Airport (500 or more annual operations), which is referred to as the "design aircraft." Thus, the design aircraft and associated FAA design criteria are defined at the outset of the requirement analysis.

Design Aircraft

The design aircraft is defined as the largest aircraft anticipated to use the airport on a regular basis (at least 500 annual operations). The selection of the design aircraft allows for the identification of the Airport Reference Code (ARC) for the airport. For OXC, the design aircraft is a corporate jet aircraft, such as the Gulfstream series of business jets.

Gulfstream IV

Airport Reference Code

Airport design criteria and dimensional standards for airport facilities are determined by the ARC. The ARC is a coding system used to relate airport design criteria to the operational and physical characteristics of the critical design airplane intended to operate at an airport. The ARC is comprised of two components – the aircraft approach category (an operational characteristic) depicted by a capital letter, and the airplane design group that relates to the airplane wingspan (a physical characteristic) is depicted by a Roman numeral. The ARC components are defined as follows in Table 1-7.

TABLE 1-7 AIRPORT REFERENCE CODE			
Aircraft Approach Category		**Airplane Design Group**	
Category	**Dimension**	**Group**	**Dimension**
A	Speed of less than 91 knots	I	Up to but not including 49’
B	91 knots up to but <121 knots	II	49’ up to but not including 79’
C	121 knots up to but <141 knots	III	79’ up to but not including 118’
D	141 knots up to but <166 knots	IV	118’ up to but not including 171’
E	166 knots or more	V	171’ up to but not including 214’
		VI	214’ up to 262’
Source: FAA Advisory Circular 150/5300-13.			

In the previous OXC Master Plan (1995), the design aircraft was listed as a Gulfstream III, which falls within Airport Approach Category C and Airplane Design Group II, for an ARC C-II (see Table 1-7). Thus, the ARC for OXC was C-II in 1995. The 1995 study forecast that the “new” Gulfstream IV (G450) aircraft would become a regular airport user in the future. The Gulfstream

IV (G450) has a higher approach speed than the Gulfstream III and an ARC of D-II. Therefore, the 1995 Master Plan forecast that the ARC for OXC would change from C-II to D-II.

Since 1995, the Gulfstream IV (G450) aircraft has become a regular user of OXC. In 2003, the FAA recorded 570 itinerant operations of the G450, which is sufficient activity to change the designated ARC. Thus, the current ARC for OXC is now ARC D-II.

1.5 Environmental Overview

This Airport Master Plan Update (AMPU) identifies various potential developments for OXC. However, before projects can be pursued, environmental constraints must be addressed. If not mitigated, environmental impacts can hinder or prohibit the implementation of certain development projects. This section provides an initial review of environmental categories of concern. Note that detailed environmental study, such as an Environmental Assessment/Impact Statement (EA/EIS), would be required prior to the development of any of the substantial project recommendations contained in the AMPU. Major categories include:

- Land Use
- Aircraft Noise
- Natural Environmental Inventory
- Larkin State Park Trail (Bridle Trail)

1.5.1 Land Use

As discussed in Section 1.1, OXC is located in both the Towns of Middlebury and Oxford. The municipal boundary intersects the northern end of the airport property, with a small portion of the Airport in Middlebury. The majority of the Airport is in Oxford. Airport property and town boundaries are illustrated in Figure 1-2.

Airport Land Use

The airside area is defined as that space reserved for the operation of aircraft (runways and taxiways), associated supporting navigational facilities, and Runway Protection Zones (RPZs). The RPZ is a trapezoidal area located beyond each runway end that should ideally be controlled by the airport for the protection of people and property on the ground. This may be achieved through airport property acquisition, easements, or zoning to control development and land use activities. The present airside area consists of Runway 18-36, associated taxiways, and RPZs on each runway end.

The landside area is defined as that space occupied by aircraft aprons, hangars, Fixed Based Operators (FBOs), and other support buildings occupied by Airport Management and ATC personnel. At OXC, landside areas on the east side of Runway 18-36 include the tiedown apron and T-hangars, Key Air hangar and apron, and the Double Diamond hangar and apron. Landside areas on the west side of Runway 18-36 include several tiedown aprons, Executive Flight T-hangar, Keystone hangar and apron, the ATCT, and Airport Management's office and vehicle storage garage.

Surrounding Land Uses

The airport property is surrounded by a mix of open, wooded, residential, commercial, and industrial land uses. The land to the south of the Airport is predominately wooded and/or open, with light industrial establishments along Christian Street and several low density residential areas south of an electrical transmission line. Larkin State Park Trail (state parkland) also exists in this location. A wide mixture of industrial and residential land uses are located to the north and west of the Airport along Route 188 and other roadways. The land to the east is predominately wooded with scattered residential areas.

Residences are scattered along virtually every roadway in the airport vicinity (excluding I-84). The highest density of housing near the Airport is located to the north of Juliano Road and west of Christian Street (e.g., Triangle Blvd.). This area includes approximately 50 single-family homes and is located partly within the RPZ.

In addition to the existing land use patterns, the development of a power plant has been proposed in Oxford, in a location approximately ½-mile to the east of the Airport. The power plant would be constructed within the planned Woodruff Hill Industrial Park, and operated by Calpine/Towantic Energy LLC. Although this development is not associated with the Airport or the Master Plan Update, it has been discussed throughout the process due to concerns regarding the emission of vertical plumes and their associated impact to aviation activity.

Based on these concerns, the FAA has agreed to conduct a "Safety Risk Analysis of Aircraft Overflight of Industrial Exhaust Plumes" for the development of the Calpine facility. The FAA analysis will address the appropriateness of the power plant site from an aviation safety standpoint. Based on their findings, the previous conclusions regarding the power plant may be revised, including re-examination of a 2001 Declatory Ruling for the proposed facility. Furthermore, if the development moves forward, Calpine/Towantic Energy will have to submit an FAA Notice of Actual Construction or Alteration (FAA Form 7460-2), which would prompt the FAA to perform an standard Aeronautical Study of the proposed project addressing airspace and obstruction issues.

1.5.2 <u>Aircraft Noise</u>

Residential, educational, and institutional land uses represent the most sensitive noise receptors. As residential subdivisions are located to the north of the Airport in Middlebury (e.g., Triangle Hills, Steeple Chase, Brookside), and to the south of the Airport in Oxford (e.g., the proposed Glendale and Central Park developments), a FAA FAR Part 150 Noise Study was prepared to evaluate potential aircraft noise impacts in these surrounding communities.

Since incompatible residential development exists within the vicinity of the Airport, the Noise Study evaluated potential measures to reduce or prevent future noise exposure in these areas.

These measures included changes to aircraft/airport procedures (e.g., flight tracks, power settings), and changes to the affected land use (e.g., zoning, soundproofing, purchase of property, avigation easements). Additional noise analysis would also be included in a future environmental study for specific airport improvements.

1.5.3 Natural Environmental Inventory

A brief overview of environmental conditions is provided below. The information in this section was obtained through preliminary research and review of existing studies. A more detailed overview is provided in later sections of the AMPU.

Air Quality

Airborne pollutants created by airports and other human activities are of concern in most urbanized areas. Regulated and monitored air pollutants typically include ozone, nitrogen dioxide, carbon monoxide, sulfur dioxide, and particulate matter. The Connecticut Department of Environmental Protection (ConnDEP) maintains a statewide network of monitoring stations that sample ambient air quality. The pollutant data are used to determine compliance with the National and State Ambient Air Quality Standards.

Recent readings for stations in the vicinity of OXC (Waterbury, New Haven, and Hamden) indicate that the maximum measured concentrations of the criteria air pollutants were well below the applicable national and state standards, with the exception of ozone. Ozone has continued to read in concentrations over air quality standards (i.e., 0.12 parts-per-million for a 1-hour average), which has resulted in New Haven County's classification as a serious nonattainment area for ozone.[1]

Air quality models for general aviation airports typically indicate that the aviation activity itself results in no significant impact to the total pollutant emissions and concentrations in a given area. This is because the number of airport flights is very low compared to ground vehicles and other emissions. For example, OXC currently accommodates less than 100 landings per day, compared to local roads and highways that accommodate tens of thousands of daily vehicle trips in the region. While the Airport and aircraft do contribute to air pollution, past analysis of OXC and general aviation airports as a whole have found no significant air pollution impact.[2]

Ground Water Quality

The ConnDEP administers the State's Water Quality Standards (WQS) for Connecticut's clean water program, and provides classifications for groundwater. The DEP classifications and designated uses for each classification are listed below.

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[1] Information based on the Environmental Protection Agency (EPA) Green Book and 2003 Airport EA
[2] Based on 2003 Airport EA

- Class GAA – Existing or potential public supply of water suitable for drinking without treatment; baseflow for hydraulically-connected surface water bodies
- Class GA – Existing private and potential public or private supplies of water suitable for drinking without treatment; baseflow for hydraulically-connected surface water bodies.
- Class GB – Industrial process water and cooling waters; baseflow for hydraulically-connected surface water bodies; presumed not suitable for human consumption without treatment.
- Class GC – Assimilation of discharges authorized by the Commissioner pursuant to Section 22a-430 of the General Statutes (not suitable for development of public supplies of potable water)

Groundwater on the property of OXC is classified as GA, which includes groundwater suitable for drinking or other domestic uses without treatment for both private and public water supply wells.

A small area east of Christian Street, adjacent to the Airport, is classified as GB/GA. This classification includes groundwater that may not be suitable for direct human consumption without treatment due to off-airport waste discharges, spills, or land use impacts. However, the goal for areas with this classification is to restore the groundwater to drinking water quality. Several private commercial establishments are located within this area.

No State Identified Aquifer Protection Areas are located in the airport vicinity. Most of the development surrounding the Airport, including the Triangle Boulevard neighborhood, remains dependant upon private wells for their drinking water supply.

Surface Water Quality

The DEP inland surface water classifications and designated uses for each classification are listed below.

- Class AA – Existing or proposed drinking water supplies; habitat for fish and other aquatic life and wildlife; recreation; and water supply for industry and agriculture.
- Class A – Habitat for fish and other aquatic life and wildlife; potential drinking water supplies; recreation; navigation; and water supply for industry and agriculture.
- Class B – Habitat for fish and other aquatic life and wildlife; recreation; navigation; and industrial and agricultural water supply.
- Class C – Results from conditions that are usually correctable through implementation of established water quality management programs to control point and non-point sources; may be suitable for certain fish and wildlife habitat, certain recreational activities, industrial use, and navigation.

- Class D – Results from conditions that are not readily correctable through implementation of established water quality management programs to control point and non-point sources; may be suitable for bathing or other recreational purpose, certain fish and wildlife habitat; industrial uses, and navigation.

Airport property does not contain any classified surface water bodies. The closest classified streams are located nearly a mile from OXC, and are classified as B/A.

Small airports in general do not typically impact surface or ground water. Contamination risks include spill of fuel or oil, or runoff contaminated with aircraft deicing fluid. At OXC, chemical deicing of aircraft only occurs within hangars, and the associated runoff is captured in an oil-water separator. Fuel and oil spills are prevented by maintaining and washing aircraft only in hangars that provide floor drains with holding tanks and through secondary containment systems for all stored fuels and petroleum products. During winter storm events, the Airport spreads urea pellets on the runway and other paved surfaces as needed.

OXC has and maintains a Storm Water Pollution Prevention Plan (SWPPP) and a General Permit for Discharge of Storm Water. The permit includes storm water monitoring activities, Best Management Practices and Material Management Practices, and is part of the overall approach to water quality protection. At OXC, three outfall locations are tested biannually to monitor the implementation of the SWPPP.

Wetlands

There are 18 identified wetland areas on the Waterbury-Oxford Airport property. Wetland field investigations were conducted for the AMPU, which included flagging and survey of the various wetlands boundaries between May and August of 2004.

The identified wetland areas consist of poorly drained and very poorly drained soils, and are located in many different areas of the Airport, including the western, southern, southeastern, and eastern edges of the property. The wetlands on the western side of the Airport are hydrologically connected by an unnamed intermittent stream that flows south to Little River. Similarly, the wetlands on the southern and eastern sides of the Airport are hydrologically connected by Little River and a few small, unnamed tributaries that flow into Little River.

Predominate wetland types found at OXC include deciduous wooded swamp, shrub swamp, wet meadow, and open water. Although these wetlands are proximate to the runway and taxiways, they are separated by either vegetated barriers or topographic variation. Nevertheless, some wetland areas are located on property that is otherwise desirable for additional airfield and landside facilities. As such, later sections of the AMPU that address future development incorporate potential wetland impacts as a primary consideration.

Other Natural Environment Items

- Historic and Cultural Resources – No properties or sites listed on the National Register of Historic Places are located on or adjacent to the Airport.
- Endangered and Threatened Species – An initial endangered species review was conducted as part of the 2003 EA using the "Town of Oxford State and Federal Listed Species and Significant Natural Communities" map. No known endangered species or significant natural biotic communities were identified.
- Floodplains – A small area of the airport property contains a flood prone band (i.e., 100-year floodplain). The location is to the southwest of the Runway 36 end, adjacent to the Larkin State Park Trail. This floodplain area is associated with a tributary of the Little River, and is situated at an elevation over 90 feet below the runway end.
- Farmland – The Farmland Protection Policy Act (FPPA) defines Prime Farmland, Unique Farmland, and Farmland of Statewide Importance based on soil type. The soils on airport property are generally classified as Urban Development (UD), which is not suitable for farming and not protected by the FPPA.

1.5.4 Larkin State Park Trail (Bridal Trail)

The Larkin State Park Trail is located directly to the south of the Airport. The trail is mainly used for horse riding with some limited use for hiking and biking. The trail will be avoided to the extent possible by airport projects; however, potential impacts from recommended projects are investigated in later sections of the AMPU.

2.0 FORECASTS

This chapter presents the forecasts of aviation demand for the Waterbury-Oxford Airport (OXC). The forecasts were derived based on a review of historical trends, market analysis, and other techniques, including the application of professional judgment. Forecasts are shown for:

- Based Aircraft
- Aircraft Operations (takeoffs and landings)
- Annual Aircraft Instrument Operations & Approaches
- Peak Hour Operations

Consistent with airport planning practice, forecasts are presented for 5-year intervals (i.e., short-, intermediate-, and long-term), beginning with year 2003.

2.1 Socioeconomic Setting

2.1.1 Airport Service Area

In the beginning months of 2004, the Waterbury-Oxford Airport served as a base for 236 aircraft. The location of aircraft owners helps to define the air service area for the facility. Aircraft basing reflects consideration of such factors as convenience in terms of access, facilities and services available, and operating costs versus those associated with other airports. The Airport draws nearly 55 percent of all based aircraft from owners located in the 13 municipalities comprising the Central Naugatuck Valley Region. Adjacent communities within a driving range of less than 45 minutes from the Airport increase the air service area share of based aircraft owners to nearly 74 percent.

Ownership of the aircraft based at the Airport is comprised of private individuals and businesses. The latter group accounts for several owners located outside the Central Naugatuck Valley Region. These owners primarily operate some of the business jet aircraft based at the Airport and managed by one of the service providers. Therefore, the Airport may be considered to have two service areas. The first related to the traditional general aviation market that includes small piston- and turboprop aircraft used primarily for pleasure and business purposes. The second service area has a greater geographical reach to include aircraft owners opting to base their business jets at the Airport because of the availability of terminal area facilities and the services provided by aircraft management companies located at the Airport.

Based on these factors, the air service area for most general aviation aircraft may be best identified as the Central Naugatuck Valley Region. The state-designated metropolitan planning organization responsible for coordinating transportation planning of local governments within this region is the Council of Governments of the Central Naugatuck Valley (COGCNV). Socioeconomic data for COGCNV were used to represent the characteristics of this traditional general aviation Airport air service area. Economic conditions for the greater Metropolitan area suggest the potential demand for basing business jet aircraft at the Airport.

Principal indicators of the socioeconomic setting of the traditional general aviation airport service area, State of Connecticut and the United States are presented in Table 2-1. Because Waterbury is the primary municipality within the COGCNV, socioeconomic data has been segregated to the extent possible so that the contribution from the relatively more rural and suburban areas in the region can be considered. These areas are growing faster than Waterbury and tend to generate higher demand for air transportation services. Key features of Table 2-1 are:

1. Population growth rate in the traditional general aviation airport service area (with and without data for Waterbury) has been greater than that occurring in Connecticut but less than that in the United States. Expectations are for lower rates of growth for the traditional general aviation airport service area, Waterbury and nationally, and a slightly higher rate of growth in the state population when compared to those experienced between 1990 and 2000. The traditional general aviation airport service area population is projected to increase at a rate less than those expected in the state and United States. When the population projections for Waterbury are excluded from the airport service area, the rate of growth is second to that of the country.[1]

2. The economic base of the traditional general aviation airport service area is generally comparable to that in Connecticut and the United States with a higher proportion of jobs in the manufacturing sector.[2] Other data suggests that there has been a gradual shift away from this sector following a similar pattern in the rest of the state and the country.[3]

3. The median household effective buying income, a measure of disposable income, in the traditional general aviation airport service area is less than that of Connecticut and higher than that in the United States. The percentage of households with effective buying income levels in excess of $50,000, a level that should provide sufficient funds for discretionary purposes such as air transportation, illustrates a similar pattern.[4]

[1] Source: COGCNV; Connecticut Department of Transportation; U.S. Census Bureau.
[2] Source: COGCNV; Connecticut Department of Labor, Office of Research; U.S. Bureau of Labor Statistics.
[3] Source: COGCNV, "A Profile of the CNVR: 2003."
[4] Source: Sales & Marketing Management, "Survey of Buying Power".

TABLE 2-1 – GENERAL AVIATION AIR SERVICE AREA SOCIOECONOMIC CHARACTERISTICS					
	Traditional General Aviation Air Service Area				
	COGCNV	**Waterbury**	**COGCNV less Waterbury**	**Connecticut**	**United States**
POPULATION					
1990	261,081	108,961	152,120	3,287,116	249,623,000
2000	272,594	107,271	165,323	3,407,565	282,125,000
2005	278,240	107,320	170,920	3,475,970	287,716,000
2010	283,870	107,370	176,500	3,544,380	299,862,000
2015*	287,370	107,370	180,000	3,619,670	312,268,000
2020	290,920	107,370	183,550	3,696,560	324,927,000
2025	294,460	107,370	187,090	3,775,995	337,815,000
* Interpolated, except United States					
Average Annual Growth Rate					
1990 - 2000	0.43%	-0.16%	0.84%	0.36%	1.23%
2000 - 2025	0.31%	0.00%	0.50%	0.41%	0.72%
EMPLOYMENT					
Industry Sector - 2001	**Percent Distribution**				
Agriculture	n.a	n.a.	n.a.	n.a.	2.3
Mining	n.a.	n.a.	n.a.	0.1	0.4
Construction	4.5	3.1	5.5	3.9	7.1
Manufacturing	19.5	14.9	22.9	15.1	14.1
Transportation and Utilities	5.4	4.4	6.1	4.7	7.2
Wholesale Trade	5.5	4.0	6.5	4.7	7.2
Retail Trade	17.3	17.6	17.1	16.6	16.7
Finance, Insurance and Real Estate	4.5	5.1	4.1	8.4	6.5
Services	32.0	38.4	27.4	32.0	37.4
Government	11.3	12.5	10.4	14.5	4.5
Total	100.0	100.0	100.0	100.0	100.0
INCOME	**Effective Buying Income (EBI) - 2003**				
	New Haven - Waterbury - Meriden				
Median Household EBI	$42,795			$46,986	$38,035
Households by EBI Group	**Percent Distribution**				
< $20,000	20.5			17.2	22.3
$20,000 - $34,999	19.6			18.3	23.2
$34,999 - $50,000	18.3			17.8	19.5
> $50,000	41.6			46.7	35.0
Total	100.0			100.0	100.0

2.1.2 Regional Economic Considerations

The Waterbury-Oxford Airport is an active general aviation airport that serves two primary operating roles. First, it accommodates the general aviation travel demands generated by aircraft owners located within its traditional general aviation service area. These users typically operate piston and turboprop aircraft. Second, it serves as a base for corporate business jets that transition primarily to either the Westchester County or Teterboro airports for passenger transport to and from their ultimate destinations. This second role is a unique characteristic of the Airport and is nearly entirely dependent on the availability of appropriate hangar storage for these aircraft, which represent sizable capital investments made by aircraft management companies that have selected the Waterbury-Oxford Airport for this purpose.

Economic conditions in a region greater than that of the Airport's traditional general aviation service area can also influence aviation activity levels at the facility. Those airports to which the corporate business jet aircraft transition are located in major economic centers within the New York metropolitan area, one of the strongest markets for nearly every type of business and general consumer in the United States. Although not immune to the effects of economic downturns, this region of the country is one of the leading economies in the nation. General aviation use of corporate business jets has always been high in this region for reasons of convenience, prestige, image and more recently security. Improving economic conditions should continue to fuel the use of corporate business jets for executive travel, including those employed in fractional or other forms of shared ownership and use.

In recent years, the unavailability of adequate hangar storage for these aircraft at their intended or preferred origination airport has generated the rapid growth of the corporate business jet fleet at the Waterbury-Oxford Airport. Operators using the Airport for transition purposes have also realized economic benefits in this type of operation. These are lower hangar rent, flight crew, maintenance, and fuel costs. Thus, even if the Westchester County or Teterboro airports were able to provide additional hangar storage, an event that appears unlikely in significant volume, those business jet aircraft operators using the Waterbury-Oxford Airport as a base are not likely to relocate. This opinion was reflected in response to a based aircraft owner survey, the details of which are presented in Appendix A. Further, the fact that Key Air has completed design and has broken ground on a second 62,500 square-foot hangar to accommodate some 25 additional based jet aircraft by 2006 is an indication of the continued strength of the market.

2.2 Aviation Demand Forecasts

Factors that influence the demand for aviation activity at an airport include the socioeconomic characteristics of the air service area(s), the level of service and facilities provided at the airport versus other airports in the region, and its location with respect to demand generators for originating or transient users.

First-class hangar facilities, combined with one of the longest runway lengths available in the region and major maintenance services attract corporate aircraft to use the Airport as an operations base. The Airport also attracts local aircraft owners to use the facility as a base. These factors, combined with previous capital improvements at the Airport and the socioeconomic characteristics of the air service areas, suggest that the demand for aviation services at the Waterbury-Oxford Airport is being sustained and has the potential for growth.

The population growth of the air service area and the continued diversification of the economy and disposable income levels, support the continued reliance on the Waterbury-Oxford Airport to provide air transportation services. This is especially relevant when the economic centers are distant from one another or involve excessive travel times to enable same-day ground transportation trips. General aviation air travel supports this user demand. Longer passenger processing times associated with scheduled airline travel have contributed to the increased awareness and utility of general aviation aircraft and the airports they utilize. The attractiveness of fractional ownership of business aircraft, both in jet and turboprop families, further supports this trend. Availability of land for the construction of hangar facilities at the Airport is a primary factor contributing to the continued attraction of aircraft to the facility. Barring an economic scenario that suggests poor performance in the dominant area businesses, both in the traditional general aviation air service area and the New York metropolitan area, use of the Waterbury-Oxford Airport is likely to continue and experience increasing frequency.

From a facilities perspective, the Waterbury-Oxford Airport is well maintained and offers certain advantages over other area airports, as highlighted in Table 2-2. Waterbury-Oxford Airport draws pilots and aircraft owners primarily from areas to its north, west and south based on the addresses of aircraft owners. Potential users in areas east of the Airport tend to operate from airports in the Hartford area for reasons of accessibility and available facilities.

TABLE 2-2 – COMPARISON WITH OTHER AREA AIRPORTS

Airport	Number of Paved Runways and Longest Length	Instrument Approach Capability	Aviation Fuel Availability	Fixed Base Operator Services
Waterbury-Oxford	1 – 5,800’	Precision	100 LL, Jet-A	Major, Hangar, Tiedown
Danbury Municipal	2 – 4,422’	Nonprecision	100 LL, Jet-A	Major, Hangar, Tiedown
Meriden-Markham Municipal	1 – 3,100’	Nonprecision	100 LL	Major, Hangar, Tiedown
Robertson Field	1 – 3,612’	None	100 LL, Jet-A	Major, Hangar, Tiedown
Sikorsky Memorial	2 – 4,761’	Precision	100 LL, Jet-A	Major, Hangar, Tiedown
Tweed-New Haven Regional	2 – 5,600’	Precision	100 LL, Jet-A	Minor, Hangar, Tiedown
Westchester County	2 – 6,548’	Precision	100LL, Jet-A	Major, Hangar, Tiedown
Hartford-Brainard	2 – 4,418’	Nonprecision	100LL, Jet-A	Major, Hangar, Tiedown

Of the other airports, only the Meriden-Markham Municipal Airport is actively working toward providing a new 10-unit T-hangar. However, this facility will be owned by pilots currently basing small piston and turboprop aircraft at the Airport and will not result in an increase in the based aircraft total other than those that might assume the vacated tiedown spaces. Overall, the prospect for future aviation activity at the Waterbury-Oxford Airport is considered positive and should advance at rates comparable to those expected nationally.

Bradley International, Westchester County, Tweed-New Haven Regional and Stewart International airports all have scheduled airline or commuter service. The proximity of these airports, each within a 90-minute drive time from the Waterbury-Oxford area, restricts the introduction of scheduled airline or commuter service at OXC.

Post September 11, 2001 combined with a weakening economy has led to reductions in aviation travel. However, the "hassle factor" associated with scheduled airline travel, especially for frequent flyers, has stimulated additional interest in the general aviation industry. Corporate travelers have realized the convenience and improved affordability of using chartered general aviation aircraft or have joined fractional aircraft ownership programs. Fractional aircraft ownership involves the purchase of a predetermined share of an aircraft, which is then maintained and operated by a management company. These programs, initially involving business jet aircraft, now offer participation in turboprop aircraft such as the Beechcraft King Air. The ability of these aircraft to operate at airports located closer to the passengers' homes and suburban office locations have contributed to the success of these programs. As the economy improves, these positive forces are expected to return and stimulate the demand for this type of general aviation activity. This expectation is mirrored in the national forecasts of general aviation activity presented by the FAA in its "Aerospace Forecasts Fiscal Years 2004 – 2015" (prepared March 25, 2004).

Contributing to this prospect for growth will be the introduction of lightweight, low noise, new technology personal and corporate jet aircraft. An example is the Eclipse 500 twin-engine jet. This aircraft has a maximum gross takeoff weight of 4,700 pounds and can transport 4 passengers and a crew of 2 some 1,600 nautical miles nonstop. The aircraft sells for about $1 million and should be operational by early 2006. The twinjet aircraft is specifically designed to operate from general aviation airports with runway lengths of at least 2,600 feet, thus making it attractive for use at most general aviation airports.

2.2.1 Summary of Forecast Methodology

The forecasts were derived from an assessment of survey activities of based aircraft and aircraft operations (Appendix A), on-going and planned terminal area improvements, anticipated trends in the general aviation market, and physical constraints of existing developable land resources at the Airport. These findings are coupled with consideration of causal relationships as reflected in supply (competition) and demand (population, employment and income) factors. This forecast approach allows for differing projections of demand that could be anticipated at the Airport. Initially, the forecasts address two key projections – based aircraft and aircraft operations – from which a series of derivative forecasts can be generated. The specific methodology for each is documented in the sections below.

2.2.2 Based Aircraft

National projections of the active general aviation aircraft fleet prepared by the Federal Aviation Administration (FAA) indicate average annual growth rates during the next 11 years, as presented in Table 2-3.

TABLE 2-3 – NATIONAL GENERAL AVIATION AIRCRAFT FLEET PROJECTIONS

	Average Annual Growth Rate (percent)					
Period	**Single-Engine Piston**	**Multi-Engine Piston**	**Multi-Engine Turboprop**	**Turbojet**	**Rotorcraft**	**All**
2004 – 2015	0.32	-0.50	1.49	5.45	0.70	1.07

Source: FAA, "Aerospace Forecasts Fiscal Years 2004 – 2015", March 25, 2004

These forecast growth rates reflect a trend toward larger aircraft in the general aviation fleet, notably those powered by turboprop and turbojet engines. In absolute numbers of aircraft nationally, however, the smaller piston-powered active aircraft greatly exceed these larger aircraft by a ratio of more than 10:1 today. Over time, this ratio may decrease to nearly 7:1.

These same trends and characteristics can be expected at the Waterbury-Oxford Airport inasmuch as the socioeconomic characteristics of the traditional general aviation service area and the New York metropolitan area support such growth. The resultant projection of based aircraft reflecting national growth rates is presented in Table 2-4.

TABLE 2- 4 – BASED AIRCRAFT FORECASTS – NATIONAL GROWTH RATES

Year	Single-Engine/ Multi-Engine Piston	Single-Engine/ Multi-Engine Turboprop	Business Jets	Rotorcraft	Total
2003	188	10	37	1	236
2008	191	11	48	1	251
2013	194	12	63	1	270
2018	197	13	82	1	293
2023	200	14	107	1	322

The use of the Airport by large, corporate business jets has reflected a market demand situation that is unlike that observed at most general aviation airports in the country. As presented in the inventory chapter, the historical count of business jets based at the Airport exhibited little growth until significant private development was made in hangar facilities to fill an unserved market demand at New York metropolitan area airports.

This action is about to be repeated in the near-term when a planned 62,500 s.f. hangar becomes available. The $10 million private investment in "Hangar G" is being heavily promoted and may be expected to be filled with some 25 business jets by 2006. The impact of this event is likely to result in an acceleration of the number of based business jets in the earlier years of the forecast period, but culminating in the same total demand by the end of the forecast horizon, as presented in Table 2-5.

TABLE 2-5 – BASED AIRCRAFT FORECASTS – ADJUSTED FOR AN ADDITIONAL BUSINESS JET HANGAR FACILITY

Year	Single-Engine/ Multi-Engine Piston	Single-Engine/ Multi-Engine Turboprop	Business Jets	Rotorcraft	Total
2003	188	10	37	1	236
2008	191	11	65	1	268
2013	194	12	80	1	287
2018	197	13	87	1	298
2023	200	14	107	1	322

At this juncture, the introduction of physical constraints associated with the limited amount of developable land area at the Airport should be introduced. A review of the existing land resources for the suitable location and construction of hangar facilities suggests a build-out capacity to accommodate as many as 72 business jet aircraft (approximately double the 2003 level). The growth in piston and turboprop aircraft is expected to be satisfied primarily by the facilities currently available. This aircraft basing limitation could well mean that the potential demand for 107 business jets at the Airport cannot be realized. Vacant land areas at the Airport are primarily characterized as wetlands or would require extensive fill in order to achieve suitable building sites. The resultant site improvement costs may result in hangar rental rates that are not economically viable.

Consequently, the excess business jet demand would be accommodated at other airports in the region. This potential outcome has occurred at Waterbury-Oxford Airport in the past, and illustrates the natural tendency for the demand to be accommodated at other airports located more distant from the demand generator. Airports such as Stewart International in Newburgh, New York and R.J. Miller Airport in Toms River, New Jersey are just two potential candidates with available land area to absorb this unsatisfied demand should the airport owners or the private sector opt to provide the required facilities to service these aircraft.

Alternatively, forecast methodology utilizing trend analysis of historical counts of based aircraft was considered. The total number of aircraft based at the Airport has exhibited a steadily increasing trend since 1985. At that time, there were 161 aircraft based at the Airport, none of which were business jets. A trend analysis can be interpreted to reflect the host of economic, operational and qualitative factors that influence the demand for aircraft ownership. Linear regression of the total number of based aircraft and business jets at the Airport generate year 2023 demand levels of 269 and 51, respectively. However, statistical measures of the reliability of the relationship between the data points and their use for projections were relatively low (correlation coefficient on the order of 0.60 for total based aircraft and 0.71 for business jets). The closer such measures are to 1.00 the higher the reliability and level of confidence that can be assigned to their use. Thus, the reliance that can be placed on these trend forecasts is similarly low.

The economics of operating a business jet for corporate travel is complex. Thus, it is useful to consider the market dynamics and financial factors that have contributed to the attractiveness of these aircraft to OXC since the construction of first-class hangar facilities and the provision of aircraft management services. Average hangar rents for a large business jet aircraft are nearly $20,000 per month at Westchester County Airport and about $15,000 monthly at Teterboro Airport, due in large part to the high land values in these built-up urban locations close to major population and business centers. The average monthly rental for the same type of aircraft at the Waterbury-Oxford Airport is about $6,000. The savings in rental fees is offset by the higher operating cost to transition the aircraft from OXC to the facility that is closest to the origination point of the passengers. Further, operating conditions at OXC are comparatively more favorable in terms of uncongested airspace (i.e., reduced potential for departure and arrival delays), less aircraft apron congestion and the availability of at least one new hangar facility.

These same economic and operational factors would become evident at other outlying airports having equal or better runway facilities and instrument approach capabilities to serve the operational needs of business jets. Thus, there is a the real potential for that portion of the demand for business jets at OXC to shift to other airports when space is no longer available and economics support the transfer.

As such, the forecast of based aircraft for OXC recommended for planning purposes reflects the case where the demand for based business jets is constrained by the availability of suitable hangar facilities. This forecast is presented in Table 2-6.

TABLE 2-6 – BASED AIRCRAFT FORECASTS – CONSTRAINED DEMAND

Year	Single-Engine/ Multi-Engine Piston	Single-Engine/ Multi-Engine Turboprop	Business Jets	Rotorcraft	Total
2003	188	10	37	1	236
2008	191	11	65	1	268
2013	194	12	67	1	274
2018	197	13	69	1	280
2023	200	14	72	1	287

The projections in Table 2-6 for business jets were segregated by maximum gross takeoff weight (MGTW), and are presented in Table 2-7. These commonly-used informal designations are later utilized for space planning purposes, but do not represent any regulatory or design standard category. As used in this report, small business jets are defined as having a MGTW of 25,000 pounds or less. Medium business jets have a MGTW of between 25,001 pounds and 60,000 pounds. Large business jets are those with MGTW equal to or more than 60,001 pounds.

- Small jets, often called light jets, includes the Cessna Citations and Lear Jets
- Medium jets, often called mid-size business jets, includes most Hawkers and Falcons

- Large jets, often called full-size jets, includes the Gulfstream series and the Global Express

TABLE 2-7 – BASED BUSINESS JET FORECAST – CONSTRAINED DEMAND				
	Business Jets			
Year	**Small ≤ 25,000 lbs.**	**Medium 25,001 lbs. - 60,000 lbs.**	**Large > 60,000 lbs.**	**Total**
2003	1	15	21	37
2008	2	27	36	65
2013	2	27	38	67
2018	2	28	39	69
2023	2	28	42	72

2.2.3 Aircraft Operations

Aircraft operations were developed based on traffic counts provided by the FAA contract air traffic control tower, which operates between the hours of 6:00 a.m. and 9:00 p.m. daily. The tower presents this information by type of operation (local or itinerant). Year 2003 was the first year of complete recording of aircraft operations and the total was 55,172 movements (takeoffs and landings). Of these recorded operations, 23,754 were local and 31,418 were itinerant. This level of activity, although accurate for the recording period, does not include or make allowance for aircraft operations that occur when the tower is closed. Further, the activity records reflect a constrained airport operation between the months of June and November when the runway was closed intermittently for Runway Safety Area (RSA) construction activities. Consequently, it was appropriate to make an upward adjustment to the recorded tower activity data to account for these two conditions.

The adjustment to the tower counts of activity considered historical fuel deliveries as reported in the total numbers of gallons delivered in the two years prior to the runway construction period and the volumes during the months of June through November. These records confirmed that total fuel deliveries had been increasing during those years at an annual rate of nearly 8.7 percent. Additionally, fuel deliveries during the months of the RSA construction were down nearly 22 percent from the same period in the previous year. Based on this data and allowing for the growth rate in fuel deliveries, it was concluded that the aircraft movements during the months of June through November 2003 were understated by nearly 26 percent, or 7,519 operations.

Additionally, an allowance was made for aircraft operations occurring when the air traffic control tower is closed. Given the aircraft transitioning activity that is a unique characteristic of operations at the Waterbury-Oxford Airport, it was conservatively estimated that such operations were itinerant in nature and represented 10 percent of the total activity, adjusted for the understatement due to the RSA construction period, or 3,258 operations. Accordingly, the adjusted annual total aircraft operations are 65,949 in the year 2003. Of these, 30,110 are local and 35,839 are itinerant. By comparison, a review of FAA-generated data from filed flight plans (Extended Traffic Management System Counts - ETMSC) that cover a 24-hour period of each day in 2003 indicates that 8.3 percent of all aircraft operations occur when the air traffic control tower is closed between 9:00 p.m. and 6:00 a.m. Because not all aircraft file flight plans, use of a 10 percent factor is a reasonable estimate for planning purposes.

Future aircraft operations were projected on the basis of slightly increased aircraft utilization rates expressed in terms of operations per based aircraft as projected for the constrained demand scenario in Table 2-6. These utilization rates considered FAA projections of hours flown by category of aircraft and were adjusted to account for slightly increasing stage lengths for all categories of aircraft except business jets. Because the primary flight mission of the corporate business jets based at the Airport is to transition to another airport, it is expected that their flight frequencies would increase from an annual average of 100 operations per based business jet, to 115 operations during the course of the forecast horizon (as determined from a review of flight operations data for 15 of the current based jets). All business jet aircraft operations total 3,700 movements, a value that compares favorably with the FAA from flight plans data for OXC. The ETMSC flight plan data identified a total of 3,713 business jet aircraft operations at OXC during 2003, including night operations. The ETMSC data also provided an indication of the mix of business jet operations. These values were used in the forecasting methodology, which provides for a slightly increasing share of the business jet activity to be conducted by large aircraft. The resulting forecast of aircraft operations is presented in Table 2-8.

TABLE 2-8 – AIRCRAFT OPERATIONS FORECAST

			Business Jets					
Year	**Single-Engine/ Multi-Engine Piston**	**Single-Engine/ Multi-Engine Turboprop**	**Small ≤ 25,000 lbs.**	**Medium 25,001 lbs. - 60,000 lbs.**	**Large > 60,000 lbs.**	**Total Jet**	**Rotorcraft**	**Total**
2003	58,656	3,120	970	1,380	1,350	3,700	473	65,949
2008	61,884	3,564	1,741	2,444	2,511	6,695	497	72,640
2013	65,378	4,044	1,828	2,581	2,760	7,169	522	77,113
2018	68,950	4,550	1,915	2,719	3,025	7,659	548	81,707
2023	72,600	5,082	2,029	2,898	3,353	8,280	576	86,538

2.2.4 Local & Itinerant Operations

Local operations are performed by aircraft that:

- Operate in the local traffic pattern or within sight of an airport,
- Are departing for or arriving from flight in a local practice area located within a 20-mile radius of the airport, or
- Are conducting simulated instrument approaches or low pass at an airport.

Itinerant operations are all other operations. The local and itinerant split at OXC in 2003 is estimated at 46 percent local and 54 percent itinerant operations. Table 2-9 depicts the local/itinerant split expected to occur at OXC through the planning period. The itinerant percentages are anticipated to increase slightly over time as more business activity occurs.

TABLE 2-9 – LOCAL & ITINERANT OPERATIONS				
Year	**Local**	**Itinerant**	**Total**	**Percent**
2003	30,110	35,839	65,949	46/54
2008	31,540	41,100	72,640	43/57
2013	32,863	44,250	77,113	43/57
2018	34,207	47,500	81,707	42/58
2023	35,338	51,200	86,538	41/59

2.2.5 Instrument Operations & Approaches

Instrument operations and approaches include flights and procedures that are activity directed by air traffic control personnel in order to provide appropriate aircraft separation during reduced visibility conditions. An instrument operation is any aircraft operation conducted in accordance with an instrument flight rule (IFR) flight plan or an operation where IFR separation is provided by a terminal control facility or air route traffic control center (ARTCC). Instrument operations also include overflights through terminal airspace, including flights that transit through the Class D airspace of OXC. Instrument operations are reported on the basis of the controlling facility that separates the counts as primary, secondary or overflights. Primary instrument operations are those that take place at the reporting airport, while secondary instrument operations are those performed at other airports (towered or nontowered) that are controlled by the primary facility. Therefore, all instrument operations at OXC are reported as primary.

In contrast to an instrument operation, an instrument approach is an approach made to an airport by an aircraft on an IFR flight plan, when the visibility is less than three miles or the ceiling is at or below the minimum control approach altitude. This definition has three elements – (1) an instrument approach is specifically limited to those approaches when the aircraft is on an IFR flight plan; (2) weather conditions play an important part in determining if the IFR arrival qualifies as an instrument approach; and (3) instrument approaches are credited to the airport of destination with a published instrument approach procedure. With regard to establishing the need for additional instrument approach procedures, the number of existing instrument approaches is the key element of consideration.

The instrument operations forecast for OXC are based on a percentage of the itinerant operations. Historical data presented in the latest FAA Terminal Area Forecast indicates that the instrument operation activity level is about 17 percent of total itinerant activity and remains constant through the forecast period. Forecasts of instrument approaches were derived from the number of instrument operations utilizing a ratio reflecting activity characteristics and the occurrence of IFR conditions for the Boston and New York ARTCCs. This ratio indicates that slightly more than 24 percent of all instrument operations are instrument approaches. Application of this forecast methodology results in the projections of instrument operations and approaches presented in Table 2-10.

TABLE 2-10 – ANNUAL AIRCRAFT INSTRUMENT OPERATIONS & APPROACHES		
Year	**Instrument Operations**	**Instrument Approaches**
2003	6,123	1,491
2008	6,989	1,702
2013	7,524	1,832
2018	8,084	1,968
2023	8,708	2,120

2.2.6 Peak-Hour Aircraft Operations

Hourly activity data recorded by the air traffic control tower was used to identify the existing level of peak-hour air traffic at the Airport. Data for visual flight rule (VFR) conditions during the months of January 2004 through May 2004 was available for evaluation. The peak-hour was defined as the highest average of two consecutive hourly periods. This data supported that peak hourly traffic generally occurred during the weekends when pilots were primarily conducting touch-and-go operations. The VFR peak-hour activity level was determined to be 60 aircraft operations. The hourly demand for IFR activity was estimated as three times the average hourly traffic based on a 250 business-day year and 16-hour day. This generates a current IFR hourly demand of five operations.

The forecast of peak-hour traffic levels takes into account the condition that as annual activity levels increase, the percentage of activity that occurs during the peak-hour decreases, due to peak operating periods spreading out during the day. This trend is more evident when the peak-hour traffic begins to approach airfield capacity. Table 2-11 presents the resulting forecasts of VFR and IFR peak-hour aircraft operations. During VFR peak-hour conditions, the aircraft mix will be dominated by single-engine piston aircraft. IFR peak-hour aircraft operations will feature the larger aircraft types operating at the Airport, especially in the early morning and evening hours when the business jets are transitioning to and from other area airports.

TABLE 2-11 – VFR & IFR PEAK-HOUR AIRCRAFT OPERATIONS		
Year	**Peak-Hour Aircraft Operations**	
	VFR	**IFR**
2003	60	5
2008	65	5
2013	69	6
2018	72	6
2023	75	7

2.3 Comparison with Other Forecasts

The projections of based aircraft and aircraft total operations derived in the preceding sections were compared to those generated by the FAA in its Terminal Area Forecast (TAF), and the values are summarized in Table 2-12 and Table 2-13, respectively.

TABLE 2-12 – BASED AIRCRAFT FORECAST COMPARISON

Year	Master Plan Recommendation					FAA Terminal Area Forecast			
	Piston	Business Jet	Other	Total		Piston	Business Jet	Other	Total
2003	188*	37*	11*	236*		181**	31**	30**	242**
2008	191	65	12	268		193	33	32	258
2013	194	67	13	274		207	35	34	276
2018	197	69	14	280		221	38	36	295
2023	200	72	15	287		236***	40***	39***	315***

* Existing aircraft in year 2003.
** FAA Terminal Area Forecast based on year 2002 and earlier data.
*** Extrapolated value.

The forecasts of total based aircraft differ by only nine percent in 2023. However, there are some differences in the two projections that are worth noting. The master plan forecasts of total based aircraft demonstrate an overall average annual growth rate of 0.98 percent and reflect a demand level that is constrained by developable airport property. The TAF of total based aircraft equates to an average annual growth rate of 1.33 percent, which is higher than that anticipated nationally (1.07 percent) for the active general aviation fleet. The mix of based aircraft in each forecast differs primarily in the numbers of single-engine piston and business jet aircraft. The TAF utilizes an average annual growth rate for single-engine piston aircraft of 1.34 percent, a rate that is more than four times that used in the national forecast and for this Master Plan. The number of business jets in the TAF increases from 31 to 40 (extrapolated) representing an average annual growth rate of 1.28 percent, or about four times less than that expected nationally. Further, the year 2023 TAF projection is predicated on a level of 31 business jets versus the 37 that were based at the Airport in 2003. The variance in the resultant numbers for each category of aircraft tends to offset one another and yield a total number of based aircraft that is generally consistent with that proposed herein.

Aircraft operations forecasts differ in absolute numbers because the TAF is based on the records obtained from the part-time Air Traffic Control Tower. However, the two forecasts may be compared on the basis of average annual growth rates and in the average number of operations per based aircraft. The master plan forecasts indicate an average annual growth rate of 1.37 percent compared to the TAF rate of 0.97 percent. The lower rate of growth in the TAF activity is reflected in the calculation of the number of operations per based aircraft. The master plan data suggests that this ratio will increase from 279 to 302 over the 20-year period. The TAF values generate a decreasing trend in this ratio of aircraft operations per based aircraft from 231 to 215. The decrease implies that the average aircraft will be used less frequently over time, a characteristic that is contrary to that reflected by the FAA's national forecasts.

TABLE 2-13 – AIRCRAFT OPERATIONS FORECAST COMPARISON		
Year	**Master Plan Recommendation**	**FAA Terminal Area Forecast***
2003	65,949	55,814
2008	72,640	58,759
2013	77,113	61,705
2018	81,707	64,652
2023	86,538	67,648**

* Excludes traffic occurring when the air traffic control tower is closed (9:00 p.m. to 6:00 a.m.)
** Extrapolated value.

It is recommended that the Master Plan forecasts be utilized in the planning process because the base year (2003) takes into account activity occurring when the Air Traffic Control Tower is closed as well as those flights not operated during the construction program in that year. Additionally, these forecasts utilize 2003 actual based aircraft by type data and reflect a slight increase in aircraft utilization. Finally, the airport master planning process has the benefit of using surveys of airport users and interviews with airport management, key tenants, and air traffic control personnel. For these reasons, the Master Plan data reflects a more current snapshot of the Airport and its use, than the input utilized as part of the FAA TAF process.

2.4 Future Design Aircraft

Frequency of use is the key factor in defining the "critical" or "design" aircraft for an airport. As discussed in Chapter 1, accepted industry practice is to select the Airport Reference Code (ARC) based on the most demanding aircraft that generates, or is expected to generate, at least 500 annual itinerant aircraft operations. Occasional use by aircraft larger in size or faster in approach speed does not overly influence the design of an airport.

In the previous Waterbury-Oxford Airport Master Plan (1995), the design aircraft was listed as a Gulfstream III, which falls within ARC C-II (see Table 1-7). Thus, the ARC for OXC in 1995 was C-II. The 1995 study forecast that the "new" Gulfstream IV (G450) aircraft would become a regular airport user in the future. The Gulfstream IV (G450) has a higher approach speed than the Gulfstream III and an ARC of D-II. Therefore, the 1995 Master Plan forecast that the ARC for OXC would change from C-II to D-II.

Since 1995, the Gulfstream IV (G450) aircraft has become a regular user of OXC. In 2003, the FAA recorded 570 itinerant operations of the G450, which is sufficient activity to change the designated ARC. Thus, the current ARC for OXC is now ARC D-II.

The business jet fleet at OXC is continually being upgraded, with additional changes anticipated through the year 2023. It is forecast that more Gulfstream V (G550) and Global Express aircraft (shown below) operations will occur at OXC, as these aircraft are now based at the Airport. The new G550 and Global Express aircraft have slightly larger wingspans than the G450, which place them in ARC D-III. In 2003, the FAA recorded 260 itinerant operations at OXC by these two aircraft types, and over 600 annual itinerant operations are forecast by 2023. Thus, for planning purposes, ARC D-III is used as the future ARC for Waterbury-Oxford Airport.

Gulfstream V	**Global Express**
	

2.5 Forecast Summary

Table 2-14 presents a summary of the forecasts for Waterbury-Oxford Airport over the planning period. The forecasts as presented in this chapter will be used throughout the remainder of this report.

TABLE 2-14 – FORECAST SUMMARY					
	2003	**2008**	**2013**	**2018**	**2023**
Based Aircraft					
Single-Engine/Multi-Engine Piston	188	191	194	197	200
Single-Engine/Multi-Engine Turboprop	10	11	12	13	14
Business Jet	37	65	67	69	72
Rotorcraft	1	1	1	1	1
Total	236	268	274	280	287
Operations by Fleet Mix					
Single-Engine/Multi-Engine Piston	58,656	61,884	65,378	68,950	72,600
Single-Engine/Multi-Engine Turboprop	3,120	3,564	4,044	4,550	5,082
Business Jet	3,700	6,695	7,169	7,659	8,280
Rotorcraft	473	497	522	548	576
Total	65,949	72,640	77,113	81,707	86,538
Local and Itinerant Operations					
Local	30,110	31,540	32,863	34,207	35,338
Itinerant	35,839	41,100	44,250	47,500	51,200
Annual Aircraft Instrument Operations & Approaches					
Instrument Operations	6,123	6,989	7,524	8,084	8,708
Instrument Approaches	1,491	1,702	1,832	1,968	2,120
Peak Period Hour Operations					
VFR	60	65	69	72	75
IFR	5	5	6	6	7

3.0 FACILITY REQUIREMENTS

This chapter identifies the facility requirements necessary to meet existing and forecast airport requirements, satisfy FAA design standards, and improve safety. The facility analysis is consistent with the guidelines and standards established in FAA Advisory Circulars.

The analysis includes the following components:

- Airfield Capacity
- Airport Design Standards
- Runway Requirements
- Taxiway Requirements
- Instrument Approach Procedures
- Landside Facilities
- Support Facilities
- Airport Roadways and On-Airport Access
- Airport Staffing

The feasibility and impacts associated with providing the identified facilities is evaluated in subsequent chapters, prior to the development of the recommended plan.

3.1 Airfield Capacity

This section reviews the airfield capacity of OXC, evaluates any capacity surpluses or deficiencies, and identifies airfield improvements that may be required during the 20-year planning period. Airfield capacity is defined as the maximum rate that aircraft can arrive and depart an airfield with an acceptable level of delay. It is a measure of the number of operations that can be accommodated at an airport during a given time period, which is determined based on the available airfield system (runways, taxiways, navaids, etc.) and airport activity characteristics.

The current technique employed by the FAA to evaluate airfield capacity is described in Advisory Circular (AC) 150/5060-5, *Airport Capacity and Delay*. This procedure identifies Hourly Airfield Capacity and Annual Service Volume (ASV).

- Hourly Airfield Capacity: The maximum number of aircraft operations that can take place on the runway system in one hour. As airport activity occurs in certain peaks throughout the day, accommodating the peak hour activity is most critical.

- Annual Service Volume: The annual capacity or the maximum level of annual aircraft operations that can be accommodated on the runway system with an acceptable level of delay. The ASV considers peaking characteristics in its calculation. As such, an airport's ASV would increase without any system or physical airfield improvements if activity became more evenly spread throughout the day, week, and/or year. The opposite would occur if operations became more pronounced into peak periods.

For airports that have multiple runways, air traffic controllers have multiple operating procedures to handle air traffic (e.g., landing on one runway with departures on another). However, as OXC has a simple airfield configuration with a single runway, the airfield capacity does not depend upon various operating configurations. Therefore, the simplified method as provided in FAA AC 150/5060-5 was used to estimate capacity. The AC provides tables of estimated capacity based upon characteristics of the airport. For OXC, the following characteristics and assumptions are applicable:

- The percentage of operations of aircraft over 12,500 pounds is currently 6%, but is forecast to increase to 10% by 2023.
- No operations of aircraft over 300,000 pounds will occur at OXC.
- OXC will remain a general aviation facility with no scheduled commercial service.
- OXC has an ILS, an ATCT, and no airspace limitations.
- Touch and goes (i.e., local operations) will remain under 50% of the total operations.
- Landings generally equal takeoffs during peak periods.
- Monthly peaking is significant (due to summer training activity).
- Hourly peaking is significant (due to touch and go training operations).

Based on the assumptions above, the estimated airfield capacity of OXC is as follows:

- VFR Hourly Capacity: 98 Operations
- IFR Hourly Capacity 59 Operations
- Annual Service Volume 230,000 Operations

Table 3-1 provides a comparison of airfield capacity to airport activity.

TABLE 3-1 – HOURLY CAPACITY ESTIMATE			
		2003	**2023**
a) Peak Hour Operations – VFR		60	75
b) Peak Hour Operations – IFR		5	7
c) Total Annual Operations		66,000	87,000
Source: Activity Forecasts, Chapter 2			
d) Peak Hour Capacity – VFR		98	98
e) Peak Hour Capacity – IFR		59	59
f) Annual Service Volume		230,000	230,000
Source: FAA AC 150/5060-5			
VFR Hourly Capacity Ratio	%(a/d)	61%	77%
IFR Hourly Capacity Ratio	%(b/e)	9%	12%
Annual Capacity Ratio	%(c/f)	29%	38%

As identified in Table 3-1, the airfield currently provides ample capacity to accommodate existing and future operations, with the VFR hourly capacity reaching only 77% during the 2023 peak hour.

Note that the above capacity analysis assumes that full parallel taxiways are provided to prevent unnecessary runway crossing. Currently, a runway crossing is required each time an aircraft based on the east side of the Airport taxis to Runway 36 for takeoff. The lack of an east side full parallel taxiway requires these departing aircraft to cross the runway and utilize Taxiway “A” to access the departure end of Runway 36. Additionally, aircraft making full stop landings on Runway 18 that are headed to east side facilities often need to back-taxi on the runway or conduct a runway crossing after exiting the runway onto Taxiway “A.” This situation will be exacerbated as additional development occurs on the east side of the Airport. These runway crossings may reduce the VFR hourly capacity by as much as 20 percent. Thus, peak hour operations may approach capacity by 2023, resulting in delays to aircraft operations.

In summary, OXC generally provides adequate airfield capacity for existing and future activity; however, runway crossings are currently needed for some operations and will increase in the future. Airfield hourly capacity would be enhanced by the provision of a full parallel taxiway on the east side of the runway. Annual capacity at OXC will continue to be adequate throughout the planning period.

3.2 Airport Design Standards

As discussed in the previous chapter, the Airport's design aircraft is currently a Gulfstream IV (Model G450), which falls within Airport Reference Code (ARC) D-II. Several G450 aircraft are currently based at OXC, and the FAA has recorded over 500 annual itinerant operations of these aircraft since 2001. However, as more Gulfstream V (Model G550) and Bombardier Global Express aircraft continue to be based and operate at OXC, these aircraft are anticipated to become the future design aircraft for OXC. These newer aircraft fall within ARC D-III due to their larger wingspans (i.e., 94 feet). Table 1-7 provides the characteristics that define an airport's ARC.

The projected change in the ARC for OXC has the potential to create new airport facility requirements, as the larger wingspans of the newer aircraft determine the required offsets and dimensions for the Airport. Table 3-2 lists several of the required offsets and FAA design standard changes that occur when the ARC increases from D-II to D-III.

Key airfield design standards include the Runway Safety Area (RSA), Runway Object Free Area (OFA), Runway Protection Zones (RPZ), and several runway and taxiway offsets (i.e., separation standards). The three standards defined below consist of two-dimensional ground surfaces established to protect the safety of aircraft operations and/or people on the ground. These standards must be reviewed as part of the Airport Master Plan Update (AMPU).

TABLE 3-2 – AIRPORT DESIGN STANDARDS				
Design Criteria	**FAA Design Standard**		**Current Condition**	**Deficits** (per D-III)
	ARC D-II	**ARC D-III**		
Runway Safety Area (RSA)				
Width	500 feet	500 feet	500 feet	- - -
Length Beyond Runway End	1,000 feet	1,000 feet	720-920 feet[1]	80-280 feet[1]
Object Free Area (OFA)				
Width	800 feet	800 feet	800 feet	- - -
Length Beyond Runway	1,000 feet	1,000 feet	1,000 feet	- - -
Runway Protection Zone (RPZ) [2]				
Inner Width	500 feet	500 feet	500 feet	Contains
Outer Width	1,010 feet	1,010 feet	1,010 feet	homes north
Length	1,700 feet	1,700 feet	1,700 feet	of runway
Runway Width	100 feet	100 feet	100 feet	- - -
Taxiway Width	35 feet	50 feet	40-50 feet	0-10 feet
Runway Centerline To:				
Edge of Aircraft Parking	400 feet	500 feet	475 feet	25 feet
Parallel Taxiway Centerline	300 feet	400 feet	400 feet	- - -
Taxiway Centerline To:				
Fixed or Moveable Object	65.5 feet	93 feet	75 feet	18 feet[3]
Parallel Taxilane Centerline	105 feet	152 feet	130 feet[4]	22 feet

[1]The current RSA dimensions are the result of a 2004 improvement project to extend the RSA to better meet FAA standards. The current RSA dimensions remain non-standard, but have been approved by the FAA.
[2]RPZ dimensions for the existing 1-mile IFR visibility minimum. RPZ dimensions increase with any reduction in the IFR visibility minimums.
[3]Taxiway centerline offset for parked aircraft on the Northeast Ramp, Northwest Ramp, and South Ramp.
[4]Offset dimension for the parallel taxilane located along the T-Hangars parallel to Taxiway "B."
Notes:
FAA Advisory Circular 150/5300-13 (Changes 1-8)
Complete list of airport design standards is found in Appendix B

- Runway Safety Area (RSA) – A defined surface surrounding a runway prepared for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway. This area must also support snow removal equipment, aircraft rescue, and fire fighting equipment. The RSA should be free of objects, except for those objects that must be located in the area because of their function.

- Runway Object Free Area (OFA) – A ground area surrounding the RSA and runway that should be clear of objects, except for objects that need to be located in the area for aeronautical purposes.

- Runway Protection Zone (RPZ) – Trapezoidal areas located beyond the runway ends that should be controlled by the airport for the protection of people and property on the ground. This is achieved through airport property acquisition, easements, or zoning to control development and land use activities.

As indicated in Table 3-2, several features of the Airport do not meet existing and/or future FAA design standards. As the AMPU is a long-range study, satisfying future requirements is an important consideration. The discussion below addresses each of the deficits identified in Table 3-2.

The standard dimensions of the RSA are the same for the existing and future ARC. However, the actual dimensions will remain nonstandard even in light of the recent 2004 RSA expansion project.

The FAA standard length of 1,000 feet beyond the north end of the runway is not feasible due to the drop-off in topography, the location of Juliano Road, and the high development costs for the final 80 feet of RSA. Beyond the south end of the runway, the Larkin State Park Trail, topography, and private property hinder a full length RSA. Nevertheless, the 2004 RSA improvement project provided additional safety for all aircraft operations, even though it did not provide full FAA standards. The project extended the length of the RSA beyond both runway ends as indicated in Table 3-3. Figure 1.2 in Chapter 1 depicts the 2004 RSA dimensions.

TABLE 3-3 – RSA DIMENSIONS			
Runway End	**Length beyond Runway End**		
	Previous RSA	**2004**	**FAA Standard**
Runway 18	300 feet	920 feet	1,000 feet
Runway 36	500 feet	720 feet	1,000 feet
Note: RSA extension project completed in 2004			

The RPZ on the southern end of the Airport does not contain any residential or commercial development, and satisfies FAA criteria. However, much of the RPZ property is not owned by the State. Ideally, State control of the RPZ, either through easement or acquisition, is desirable to prevent future development and clear tree obstructions.

Although the RPZ is primarily designated to protect people and property on the ground, the FAA considers the clearing of all objects within the RPZ a safety benefit, particularly objects that obstruct the runway approach surface. On the southern end of the Airport, a major 115 K.V. transmission line traverses the RPZ (see Figure 1.2) and obstructs the approach to Runway 36. The utility company that owns the line, Northeast Utilities, is proposing a new electrical substation within the RPZ. ConnDOT is working with Northeast Utilities on this issue in an effort to potentially lower or bury the power line in the area of the RPZ and improve land use compatibility. This issue is further discussed in later chapters of the AMPU.

The RPZ on the north end of the Airport contains 32 homes. The FAA classifies residential development as a non-compatible land use within an RPZ. The homes were developed during the same time as the Airport. The State does not own any interest in the properties containing the homes, and thus does not control the land use in the RPZ. Nevertheless, later chapters of the AMPU and the separate FAR Part 150 Noise Study address alternatives for improved land use compatibility in the RPZs.

The remaining design standard deficiencies at OXC are associated with the anticipated change in the ARC from D-II to D-III. This change affects the required taxiway width, as well as the separation standards for taxiways, taxilanes, aircraft parking, and other objects. The current width of Taxiway "A," while Taxiway "B" and all exit taxiways are 50 feet wide. As such, widening of Taxiway "A" or another alternative may be necessary.

The ARC change would also increase the required distance between the following:

- Runway centerline and the aircraft parking aprons (i.e., tiedowns located on the Northeast Ramp, and potentially on the Northwest Ramp and South Ramp) from 400 to 500 feet.

- Taxiway centerline and the aircraft parking aprons (i.e., tiedowns located on the Northeast Ramp, and potentially on the Northwest Ramp and South Ramp) from 65.5 to 93 feet.

- Parallel Taxiway "B" centerline and the parallel taxilane centerline located along the T-hangars from 105 to 152 feet.

These dimensional changes would result in minor clearance deficits of 18 to 25 feet. Remedies for such conditions may include tiedown relocations, use restrictions, or the application of "modifications-to-standards." Each of these alternatives is discussed in later chapters of the AMPU.

Overall, OXC currently meets most FAA design standards for both the current and future ARC. The existing runway width, parallel taxiway offsets, and recent RSA improvements have positioned the Airport well for accommodating aircraft in ARC D-III. The previous 1995 Master Plan Study anticipated these newer and slightly larger aircraft to be the ultimate business users of OXC. However, note that no additional change in the ARC beyond D-III is anticipated during or after the planning period. In other words, ARC D-III is anticipated to be the final classification of Waterbury-Oxford Airport.

3.3 Runway Requirements

The 2004 runway and RSA extension project essentially completed the final runway development anticipated for OXC in the foreseeable future. The surrounding topography, existing development, and limited availability of property would make additional runway expansion difficult. As such, only a brief review of runway requirements for OXC is provided below.

3.3.1 Runway Length

Runway length requirements are based on the most demanding aircraft group anticipated to utilize the runway on a regular basis. For OXC, this group includes the large business jets based at the Airport with maximum gross takeoff weights of over 60,000 lbs. (e.g., Gulfstream IV & V, and Bombardier Global Express). In 2003, over 20 such aircraft were based at OXC, with more anticipated during the short-term planning period.

FAA Advisory Circular (AC) 150/5325-4A, *Runway Length Requirements for Airport Design*, requires the use of aircraft manufacturer manuals to determine runway requirements for these aircraft. A brief review of aircraft manuals indicated that the required runway takeoff length for these aircraft is between 5,500 and 6,100 feet under standard temperatures and conditions and full payload. Under higher temperatures, the required runway length for each aircraft would exceed 6,000 feet. Thus, a runway longer than the current length at OXC is justified. However, it was previously determined that no additional runway length is feasible at OXC due to site conditions and available property. Thus, the current runway length of 5,800 will be maintained throughout the planning period.

At OXC, full use of the 5,000 feet of runway between the landing thresholds is available for all users and operations. The 2004 runway and RSA improvements provided an additional 300 feet on Runway 18 and 500 feet on Runway 36 for use on takeoff. The 2004 project paved portions of the RSA as runway to provide a total length of 5,800 feet. This additional runway pavement provides flexibility in payload and range to jet operators. However, most operators of jets over 60,000 lbs. still need to limit their payloads at OXC based on current conditions and aircraft performance capability.

The available runway lengths at OXC are as follows:

	Runway 18	Runway 36
• Takeoff Run Available (TORA)	5,800 feet	5,800 feet
• Accelerate-to-Stop-Distance Available (ASDA)	5,300 feet	5,500 feet
• Landing Distance Available (LDA)	5,000 feet	5,000 feet

Note that the TORA is generally used by propeller driven aircraft only. The TORA includes the entire length of the runway that is suitable for takeoff run requirements. Jet aircraft, which predominately operate under more stringent FAR Part 135, typically can only use the runway length declared available for Accelerate-to-Stop-Distance purposes. The ASDA is the portion of the runway available for aircraft to accelerate to near takeoff speed, then to decelerate to a full stop. For OXC, the ASDA is less than the TORA in order to provide an adequate RSA length beyond the runway end.

3.3.2 Runway Orientation

The ideal orientation of a runway is a function of wind speed and direction, and the ability of aircraft to operate under crosswind conditions. As a general rule, the primary runway at an airport should be oriented as closely as practical in the direction of the prevailing winds. This enables aircraft to takeoff and land in the direction of the wind, which improves safety. The most ideal runway alignment provides the highest wind coverage percentage. The desired wind coverage for the runway system is set by the FAA at 95 percent, and assumes that small aircraft can handle crosswinds of no greater than 10.5 knots (12 mph). This is the crosswind component.

To determine the wind coverage at OXC, wind data between 1988 and 1994 was collected from the OXC Airport Weather Observation System (AWOS) as part of the 1995 master plan. That analysis indicated that the most prevalent wind direction is north-northwest and northwest. As such, the existing runway is well oriented with the prevailing winds as it contains an orientation of nine degrees west of true north (i.e., North 9^{o} West - true). This orientation provides approximately 96 percent wind coverage for a 10.5-knot crosswind component. The wind coverage is higher for larger aircraft that can handle stronger crosswinds of 13 to 16 knots.

Nevertheless, approximately four percent of the time, strong crosswinds at OXC make runway operations difficult, particularly for lighter aircraft. These crosswinds are typically from the west and west-northwest, and generally occur in winter months. Due to these crosswinds, the Airport previously provided a crosswind runway. However, the available property and topography did not enable an adequate runway length with a standard Runway Safety Area. Furthermore, OXC has a high demand for additional landside facilities. As such, the crosswind runway was decommissioned and the property was redeveloped for hangars, aprons, and vehicle parking.

3.3.3 Lighting, Marking, & Signage

Runways that provide an Instrument Landing System (ILS) precision approach should be provided with several standard items. For OXC, these items include High Intensity Runway Lights (HIRL) and precision runway markings to improve pilot reference during low visibility conditions and at night; grooved pavement to enhance braking for heavier aircraft over 12,500 pounds; and required FAA signage. OXC currently provides each of these facility requirements.

On individual runway ends, a Visual Glide Slope Indicator (VGSI) provides lights that guide the pilot to the appropriate approach slope to the runway touchdown point. These systems improve safety and help to standardize approach altitudes. At OXC, two different VGSI systems are provided. A Precision Approach Path Indicator (PAPI) is installed on the Runway 36 end and a Visual Approach Slope Indicator (VASI) is provided on the Runway 18 end.

Runway End Identifier Lights (REIL) consist of two high intensity flashing white lights installed at the runway end and directed toward the approach zone. The REIL enable pilots to identify the threshold of a usable runway from a distance and in reduced visibility conditions. The FAA recommends REIL for runway ends that provide instrument approach capability. At OXC, REIL are provided on the Runway 36 end, and should also be provided on the Runway 18. REIL are considered a low-cost approach lighting system.

The standard approach lighting system for airports with an ILS is a Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR). A MALSR is standard equipment on FAA-owned and maintained Instrument Landing Systems. Although OXC has an ILS on Runway 36, only REIL are currently provided. The addition of a MALSR would significantly enhance pilot reference during low visibility conditions and is recommended for OXC. If existing Runway 36 approach obstructions could be removed, the MALSR would also enable reduced visibility minimums on the published ILS approach.

However, due to limited property, the Larkin State Trail, steep topography, and other site conditions, a MALSR system would be difficult to install on Runway 36, and thus, has not been initiated in the past. The alternative evaluation of this study further addresses the need, cost, and impacts of providing a MALSR system on Runway 36.

Table 3-4 provides a summary of the existing and recommended runway facilities at OXC.

TABLE 3-4 – RUNWAY LIGHTING & FACILITIES

	Existing 2003	**Required 2023**	**Deficit**
Runway 18-36	HIRL Precision Markings Grooved Pavement Standard Signage	HIRL Precision Markings Grooved Pavement Standard Signage	- - -
Runway End 18	VASI	VASI/PAPI REIL	REIL
Runway End 36	PAPI REIL	VASI/PAPI MALSR	MALSR

Notes:
VASI – Visual Approach Slope Indicator
PAPI – Precision Approach Path Indicator
REIL – Runway End Identifier Lights
MALSR – Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights

In summary, the runway at OXC currently provides most required facilities, and few additional items will be considered in this AMPU. However, the potential development of an approach lighting system (i.e., MALSR) on the Runway 36 end should be considered.

3.4 Instrument Approach Procedures

OXC is currently served with instrument approaches to each runway end. Both precision and nonprecision instrument approaches are available to Runway 36, while Runway 18 is served with only nonprecision approaches. Table 1-5 previously provided a listing of the existing Instrument Approach Procedures (IAP) available at OXC.

By definition, a precision instrument approach provides lateral and vertical guidance to landing aircraft whereas a nonprecision approach offers only lateral guidance. Given the types of aircraft utilizing OXC on a daily basis, it would be desirable to provide precision approaches to both runway ends. Although Runway 36 has this capability using an ILS, approach obstructions and the lack of an approach lighting system limits the visibility minimum to 1 statute mile. Consideration to installing a MALSR, which is the least complex system compatible with a Category I precision approach, was given previously to lower the visibility minimum. Under ideal conditions, the visibility minimum could be reduced to ½-mile.

An instrument approach procedure to Runway 18 that provides vertical guidance can be achieved without the use of ground-based navigational aids such as an ILS. Satellite-based navigation using the Global Positioning System (GPS) in concert with the Wide Area Augmentation System (WAAS) can be employed to generate an instrument approach with Lateral Precision with Vertical guidance (LPV) minimums.[1] Such a procedure is recommended for Runway 18, and can be provided with or without a MALSR.

Similarly, there is a safety benefit to providing a GPS-based instrument approach with lateral and vertical guidance to Runway 36 in the event that the existing ILS (i.e., localizer and/or glide slope) is temporarily out of service. The publication of a RNAV (GPS) procedure with LPV minimums to Runway 36 would provide this capability without the need for the existing ground-based terminal navigational aids. The term RNAV denotes area navigation and reflects the FAA's shift to instrument approach technology that embraces the concept of required navigation performance (RNP). RNAV will eventually apply to all approaches that have an area navigation avionics capability and will be included in all approach procedure titles. Those approaches that utilize GPS for navigation and which were referred to as stand-alone GPS are the first to be renamed as RNAV (GPS).

To provide for nonprecision approaches, the FAA has already published RNAV (GPS) with LNAV (lateral navigation) minimums to both Runways 18 and 36. These procedures are an improvement over the older nonprecision approaches at OXC, and are flown using the ground-based Waterbury NDB, as a result of the more precise positioning data offer by the satellite system. The addition of an approach lighting system for the nonprecision procedures could also result in lower visibility minimums.

A summary of the existing IAP at OXC and the facility requirements is provided in Table 3-5.

[1] Until WAAS reaches full operational capability, minimums for LPV will be limited to 250-½ and LPV is considered a quasi-precision approach. Thereafter, minimums as low as 200-½ are possible and the FAA may designate a new acronym for the procedure. Approach lighting will be needed for the ½ minimum.

TABLE 3-5 – INSTRUMENT APPROACH PROCEDURE REQUIREMENTS				
		Existing 2003	**Required 2023**	**Deficit**
Runway 18	Precision	None	RNAV (GPS) LPV	LPV
	Nonprecision	RNAV (GPS) LNAV NDB	RNAV (GPS) LNAV	- - -
Runway 36	Precision	ILS	ILS RNAV (GPS) LPV	LPV
	Nonprecision	RNAV (GPS) LNAV	RNAV (GPS) LNAV	- - -
ILS – Instrument Landing System (using ground based localizer and glide slope electronic equipment) LPV – Lateral Precision with Vertical guidance, using WAAS LNAV – Lateral Navigation NDB – Non-Directional Beacon				

The ability to achieve these instrument approach procedures is addressed in a subsequent chapter of this report. These analyses are conducted in accordance with IAP design criteria that consider a host of factors in the ability to provide a stabilized instrument approach to a runway end.

3.5 Taxiway Requirements

A taxiway system enables safe and efficient access between the runway and landside areas. At OXC, current taxiways include connector, exit, and parallel taxiways. This section describes the existing taxiway system and identifies necessary facility improvements.

Parallel Taxiway "A" was constructed on the west side of the runway at the time of the Airport's initial development, with an exit taxiway provided at mid-field. At the time, all hangars and facilities were located on the west side of the Airport and the taxiway system was adequate. Airport activity and based aircraft have grown over the years, and now include a mixture of over 200 based aircraft, ranging from two-seat trainers to large business jets weighing nearly 100,000 lbs.

In 1993, development on the east side of the Airport began with the Northeast Ramp and partial parallel Taxiway "B." In late 1990s, crosswind Runway 13-31 was closed because it did not provide an adequate length or RSA, as well as to enable additional landside development on the east side of the Airport to accommodate new users and tenants. Since then, development has continued on the east side of the runway, and has included seven new hangars (including Hangar G in 2005) and associated aprons and taxilanes.

A clear need exists for a full parallel taxiway on the east side of the runway, which is the highest priority airfield facility requirement for OXC. A full parallel taxiway could be provided by extending Taxiway "B" to the Runway 36 end.

Full parallel taxiways are of critical importance to airports with significant levels of activity. They provide for aircraft ingress and egress at the ends of the runway, and therefore:

- Prevent the need for aircraft to back-taxi on the runway
- Eliminate most runway crossings
- Reduce taxi time and operational delays
- Reduce controller and pilot workload

Based on each of the above items, parallel taxiways are a critical element of airfield systems as they improve safety by reducing the risk of runway incursions. An incursion generally occurs when an aircraft on the ground creates a loss of separation or collision hazard with another aircraft that is landing or departing. More specifically, an incursion occurs any time one aircraft is within the runway holdline while another aircraft is landing or departing. Incursions also include vehicles, equipment, or people on the ground that interfere with an aircraft operation.

Although incursions always involve some degree of human error, the primary means for general aviation airports to reduce the number of incursions is to provide an efficient and logical taxiway layout that reduces back-taxiing, runway crossings, and taxi time. From a safety standpoint, reducing runway incursions is a high priority of the FAA and National Transportation Safety Board (NTSB), second only to RSA improvements.[2]

To support the parallel taxiway system, exit taxiways are needed along the length of the runway. Although there is no FAA requirement for the number or location of exit taxiways, guidelines are provided in AC 150/5300-13 for planning exit taxiway locations. Suitably-located exit taxiways improve both efficiency and safety by minimizing runway occupancy time. At OXC, if landing aircraft overrun the existing midfield exit taxiway (i.e., Taxiway “G”), they must continue on the runway for another 2,500 feet to reach the next exit location.

FAA data indicates that most light aircraft should not overrun the Taxiway “G” exit, but only 10 percent of large aircraft (over 12,500 lbs.) will exit the runway by Taxiway “G,” which is located 2,500 feet from the landing thresholds. However, over 80 percent of large aircraft could exit the runway if an exit taxiway was located 3,500 to 4,000 feet from the landing threshold.

Therefore, to enable more efficient runway use, three additional exit taxiways are recommended for OXC; one on the east side of the runway and two on the west side. This recommendation would double the number of exit taxiways and could reduce runway occupancy time by about 30 seconds per landing for aircraft that currently overrun exit Taxiway “G.” The recommended locations of the additional exit taxiways are identified in later chapters of the AMPU.

Connector Taxiway “D” also warrants consideration. This taxiway is 20 feet in width, and serves a 10-bay T-hangar, apron tiedown for 15 aircraft, and a maintenance hangar (Executive Flight Services). Taxiway “D” connects this development area to Taxiway “A.” As the hangars are located approximately 20 feet below Taxiway “A,” Taxiway “D” requires a non-standard

[2] FAA Runway Incursion Airport Assessment Report, Technology Assessment Team (TAT), December 2002.

longitudinal grade of approximately three percent to reach the apron elevation of the development area.

Taxiway “D” serves small aircraft under 12,500 pounds that fall within ARC B-I. For these type of light aircraft, the FAA maximum grade for taxiways is two percent, with a minimum width of 25 feet (per FAA AC 150/5300-13). As such, connector Taxiway “D” does not satisfy FAA design standards. Thus, the AMPU should investigate alternatives to improve these deficiencies.

In summary, the taxiway facility requirements for OXC include the following:

- Extend Taxiway “B” to the end of Runway 36 to provide a full parallel taxiway on the east side of the runway.
- Provide three additional exit taxiways (1 on the east side; 2 on the west side)
- Upgrade Taxiway “D” to meet FAA standards for grade and width (if feasible).

3.6 Landside Facility Analysis

This section describes the guidelines and methodologies used to develop landside facility requirements for OXC. The identified requirements are based on industry planning standards and FAA guidelines. The following categories were examined as part of this AMPU:

- Hangar Requirements
- Aircraft Apron Requirements
- Fueling Facility Requirements
- Airport Administration/Maintenance/ARFF Facilities
- Service Road Requirements
- Land Acquisition

3.6.1 Hangar Requirements

Hangar requirements for a general aviation airport are a function of the number of based aircraft, type and relative value of aircraft to be accommodated, owner preferences, and area climate. Requirements for hangar space were estimated from industry planning standards, and through discussions with airport tenants and management. In general, owners/operators of large corporate aircraft prefer conventional hangar storage, which provides heating, security, office space, and enables maintenance and other services. Owners of light piston-powered aircraft generally prefer low cost T-hangars or apron tiedowns.

Hangar space requirements for OXC were calculated using the following assumptions:

Aircraft Type	Desired Type of Storage	Area Requirement
Piston (single & multi)	50% T-Hangar	1,200 sf / aircraft
	50% Apron Tiedown	300 sy / aircraft
Turboprop & Rotorcraft	100% Conventional Hangar	1,600 sf / aircraft
Turbo-Jet	100% Conventional Hangar	2,500 sf / aircraft

These space planning assumptions were applied to the 2003 based aircraft and 2023 forecasts listed in Table 3-6.

TABLE 3-6 – BASED AIRCRAFT SUMMARY

Aircraft Type	2003	2023
Piston (single & multi-engine)	188	200
Turboprop & Rotorcraft	11	15
Jet	37	72
Total	**236**	**287**

Source: Chapter 2, Table 2-5
Note: Helicopters are included with turboprops for landside planning purposes.

Existing and future hangar requirements are shown in Table 3-7. Conventional hangar space for turboprop and jet aircraft was estimated for 2003 and 2023. Existing and future T-hangar bays and tiedown requirements for piston-powered aircraft were also estimated.

TABLE 3-7 – BASED AIRCRAFT HANGAR & APRON REQUIREMENTS				
Facility by Aircraft Type	**2003**		**2023**	
	Aircraft	**Area**	**Aircraft**	**Area**
Conventional Hangar				
Turboprop / Rotorcraft	11	17,600 sf	15	24,000 sf
Jet	37	92,500 sf	72	180,000 sf
Sub Total	**48**	**110,100 sf**	**87**	**204,000 sf**
Existing Availability[1]		108,000 sf		108,000 sf
Surplus (Deficit)		(2,100 sf)		(96,000 sf)[2]
Piston Aircraft				
T-Hangars	**94**	**112,800 sf**	**100**	**120,000 sf**
Existing T-Hangars[3]	64	76,800 sf	64	76,800 sf
Surplus (Deficit)	(30)	(36,000 sf)	(36)	(43,200 sf)
Apron Tiedowns (minimum)	**94**	**28,200 sy**	**100**	**30,000 sy**
Apron Tiedowns (+10%)[4]	103	30,900 sy	110	33,000 sy
Existing Apron Tiedowns	138	41,400 sy	138	41,400 sy
Surplus (Deficit)	35	10,500 sy	28	8,400 sy
Total Based Aircraft	**236**	**---**	**287**	**---**

Notes
[1]Estimate based on 80% of the combined conventional hangar space in Buildings 1-3, 9, 10 & 12 (assumes 20% of hangar space is used for aircraft maintenance and equipment).
[2]A 62,500 sf hangar is schedule for completion in 2006, which will reduce the future demand to an estimated 33,500 sf (see discussion below).
[3]Sum of all T-hangar bays in Buildings 5-8 & 11.
[4]The tiedown requirement is increased by 10% to account for seasonal fluctuations in based aircraft.

The current available conventional hangar storage space at OXC is approximately 108,000 square feet, compared to the approximately 110,000 square feet of estimated demand. Thus, the requirements for conventional hangar space are generally satisfied in 2003. However, note that the requirements can change based on specific aircraft models and the percentage of aircraft on overnight trips. Furthermore, available space can vary with the amount of hangar area used for maintenance. Thus, the calculations for Table 3-7 represent current practices at OXC.

In 2023, due to the number of additional anticipated turboprop and jet aircraft, a deficit of 96,000 square feet of conventional hangar space would occur if no additional hangars were constructed. Key Air is in the process of developing Hangar G, with a storage area of 62,500 square feet. Once complete, this new conventional hangar would reduce the future deficit to approximately 33,500 square feet, but additional conventional hangar space will still be necessary during the planning period.

Piston-powered aircraft rely primarily on T-hangars and apron tiedown storage. As shown above, OXC provides a total of 64 T-hangar bays in five buildings. The current T-hangar demand is estimated at 94. Thus, a T-hangar deficit of 30 bays may presently exist. By 2023, the deficit is anticipated to grow to 36. At present, no T-hangar developments are planned at OXC.

3.6.2 Aircraft Apron Requirements

Aircraft aprons provide maneuvering and tiedown space (i.e., parking positions) for based and transient aircraft, as well as staging areas for aircraft stored in conventional hangars. The apron area requirements for based aircraft differ from that of transient aircraft. Both requirements are described below.

Based Aircraft Requirements

Table 3-7 indicates that apron tiedowns are needed for 103 piston aircraft to accommodate the 2003 demand. However, this requirement assumes that all required T-hangar bays are provided. As this is not the case, the number of tiedowns must also accommodate the current deficit of 30 T-hangar bays, resulting in a 2003 total tiedown demand of 133.

Currently, there are 126 tiedowns available for based aircraft at the four aircraft parking aprons at OXC. There are also an additional 12 State tiedowns at the Executive Flight facility, for a total of 138 tiedowns.

- Northeast Ramp: 40
- Northwest Ramp: 50
- Main Ramp: 10
- South Ramp: 26
- Executive Flight: 12

Total: 138

With a total 2003 apron tiedown demand of 103 and 138 tiedowns currently available, based aircraft tiedowns are adequate to satisfy the demand. However, considering the current T-hangar deficit of 30 bays, the effective tiedown demand is 133 (i.e., 103 + 30). Thus, capacity is just adequate at 138 tiedowns to satisfy the 2003 requirements of 133.

In 2023, assuming that additional T-hangars are ultimately provided at OXC, 110 based aircraft tiedowns would be needed. With 138 tiedowns available today, no tiedown shortfall is anticipated. However, if no additional T-hangars are provided at OXC, the forecast of piston-powered based aircraft would require 146 tiedowns (110 tiedowns, plus the 36 bay T-hangar deficit = 146), which is eight more than currently available. In summary, surplus tiedown positions are currently providing for the deficit of T-hangar bays; however, during the planning period a deficit of both tiedowns and T-hangars will occur if additional facilities are not provided.

Transient Aircraft Requirements

Transient aircraft include visiting corporate and private general aviation aircraft, and aircraft using maintenance, training, or other local services. Transient aircraft parking is needed on a short-term basis, typically from a few hours to several nights. The size of the apron required to meet future transient aircraft demands was estimated from the forecast number of itinerant operations using the following procedure:

- Using the forecast level of itinerant activity (Table 2-9), calculate the average number of daily itinerant landings.
- Assume a busy day is 10 percent busier than the average day.
- Assume that one-third of the itinerant landings are conducted by transient aircraft needing apron parking (two-thirds are returning based aircraft).
- Calculate the transient ramp requirements using a factor of 500 sy per aircraft to accommodate a wide range of aircraft sizes.

Applying this approach to the itinerant operations forecast yields the apron demand shown in Table 3-8. Currently 18 transient parking positions totaling 9,000 square yards of space are needed at OXC. In 2023, 26 transient parking positions totaling 13,000 square yards of space will be needed to accommodate future demand.

TABLE 3-8 – TRANSIENT AIRCRAFT APRON REQUIREMENTS

	2003	**2023**
Annual Itinerant Operations	35,839	51,200
Busy Day Itinerant Landings	54	77
Transient Tiedowns Required	18	26
Transient Apron Area Required	9,000 sy	13,000 sy
Existing Transient Apron	8,000 sy	8,000 sy
Surplus (Deficit)	(1,000 sy)	(5,000 sy)

Source: Annual Itinerant Operations: Table 2-9
Note: Busy Day Itinerant Landings = [(Annual Itinerant Operations / 365) / 2]*1.1

At OXC, the only apron designated for transient aircraft is a small portion of the Main Ramp located directly in front of the Keystone FBO facility (Building 2 on Figure 1-2). This portion of the ramp includes an area of about 225 feet by 320 feet or approximately 8,000 square yards. The remainder of the Main Ramp is leased by Keystone for hangar staging, and for 10 based aircraft tiedowns.

Table 3-8 identifies that with only 8,000 square yards of transient apron available, a current deficit of 1,000 square yards exists today. This deficit will grow to 5,000 square yards by 2023.

Keystone currently leases the majority of the Main Apron and is allowing transient aircraft to utilize their leased portion of the apron for aircraft parking. This accommodates the current deficit in the transient apron area.

3.6.3 Fueling Facility Requirements

There are two different types of fuel operators at OXC. Keystone Aviation operates a traditional fuel service, providing both Jet-A and Avgas (i.e., 100 octane low lead) fuel to the traveling public. Double Diamond and Executive Flight are private operators and store and dispense fuel strictly for the use of their own operations and clients. All three operators build, maintain, and operate their fueling facilities on land leased from ConnDOT.

Keystone Aviation and Executive Flight operate fuel facilities on the west side of the Airport along Christian Street. Double Diamond has a fuel facility located just south of their hangar. Table 3-9 summarizes fuel type and quantity for each operator. All tanks are self-contained and above-ground.

TABLE 3-9 – AIRCRAFT FUEL STORAGE

OXC Tenant	**Fuel Storage Capacity**	
	Avgas	**Jet A**
Keystone Aviation	12,000 gal. tank	Three 15,000 gal. tanks
Executive Flight	8,000 gal. tank	- - -
Double Diamond	- - -	15,000 gal. tank
Total Capacity	**20,000 gal.**	**60,000 gal.**


Keystone Aviation


Executive Flight


Double Diamond

According to Keystone Aviation, the fuel storage capacity at OXC currently meets requirements, and adequate space is available at the main fuel farm location for two additional 15,000-gallon tanks. Thus, the Airport's Jet-A storage capacity could be increased by 50 percent. These additional tanks could be installed when needed, and should satisfy demand throughout the planning period. Note that additional operators/tenants are not restricted from selling fuel at OXC should that operator meet all federal, state, and local requirements.

3.6.4 Airport Administration/Maintenance/ARFF Facilities

A single Airport Management/Maintenance/ARFF facility is provided at OXC. The main two-story building contains the ARFF bay and airport offices on the upper apron-level, with vehicle maintenance bays below and to the rear of the building. The facility provides approximately 2,400 square feet of space per level. A separate 1,200 square-foot garage and ¼-acre outdoor parking area are also provided for airport vehicles.

As several pieces of airport equipment are currently stored outdoors at OXC, a second garage/equipment building should be provided. Garage storage reduces maintenance costs by protecting equipment from the elements. The additional building should be sized to accommodate future airport needs. An area of 2,400 square feet will be used for planning purposes.

3.6.5 Service Road Requirements

Airport service roads or perimeter roads are used by airport personnel and fixed based operators to transport fuel trucks, snow plows, and other service vehicles throughout the Airport property. Service roads are ideally located inside the airport perimeter fence, but clear of all airport operational areas (i.e., runways, taxiways, and safety areas). A service road layout should enable vehicles to operate safely, without interference to aircraft, or the need for communication with the Air Traffic Control Tower (ATCT). At OXC, no airport service roads are provided. Thus, fuel trucks and service vehicles operate on the active airfield, and must maintain contact and obtain clearances from the ATCT.

The National Transportation Safety Board (NTSB) and the FAA have placed increased emphasis on reducing runway incursions as airport activity has increased nationwide.[3] As such, one initiative is to reduce the need for vehicles to drive across runways. At OXC, maintenance vehicles and mobile fuelers must currently cross the runway to access the east side of the field. Most fuelers and other vehicles cannot drive around the Airport on public roads, as they are non-licensed vehicles. Thus, airport vehicles share the existing taxiways with aircraft, and cross the runway at the north end or on Taxiway "G."

As such, construction of a service road at OXC is considered a high priority requirement. Due to the physical constraints on the Airport (i.e., wetlands, excessive grades), the location of a service road is difficult to site.

3.6.6 Land Acquisition

Ideally, an airport should own the area within the RPZs, OFAs, and the defined Building Restriction Line. This ownership provides control over the placement of airport facilities and adjacent development.

[3] As documented in FAA's Runway Incursion Airport Assessment Report (December 2002), NTSB has included reducing runway incursions on its "most wanted" list of safety improvements since 1990.

With a total of 430 acres, the OXC property occupies the majority of these areas, with the exception of the outer portions of the RPZs. On the north side of the Airport, the Triangle Boulevard residential development occupies approximately 20 acres of the 30 acre RPZ. As this property is fully-developed and occupied, acquisition would require residential relocations and may not be feasible. On the south side of the Airport, a State Park Trail and privately-owned commercial property occupy most of the RPZ (approximately 26 of the 30 acre RPZ).

As such, while full ownership of all property in the RPZs is desirable, it is not anticipated in the foreseeable future. Thus, easements over these areas should be considered to protect the Airport from future non-compatible development. The easements would prohibit additional residential development, as well as enable the control of object and vegetation heights.

3.7 Airport Staffing

During the AMPU process, an ongoing airport staffing shortfall was raised by tenants and airport personnel. The staffing shortfall is most pronounced during weekends and nights, when airport staff are not scheduled and only available on-call. Furthermore, during snow and occasional emergency events, all available staff are directed from their management and operational duties to maintenance and response. One of the most common problems is bird and animal control in the early mornings before business hours and on weekends when significant flight training activity occurs. The staffing shortfall is acknowledged here in the AMPU, but will be reviewed and addressed separately from this study effort by ConnDOT.

3.8 Facility Requirements Summary

The preceding sections have identified a variety of facility requirements for the Waterbury-Oxford Airport. Table 3-10 compares the existing facilities to the ultimate requirements, and identifies deficits that are anticipated during the planning period.

TABLE 3-10 – FACILITY DEFICIT SUMMARY			
Facility	**Existing**	**2023 Requirement**	**2023 Deficit**
DESIGN STANDARDS			
RSA Length Beyond Runway End			
Runway 18	920'	1,000'	80'
Runway 36	720'	1,000'	280'
Taxiway Width	40-50'	50'	0-10'
Runway Centerline To:			
Edge of Aircraft Parking	475 feet	500 feet	25 feet
Parallel Taxiway Centerline	400 feet	400 feet	- - -
Taxiway Centerline To:			
Fixed or Moveable Object	75 feet	93 feet	18 feet
Parallel Taxilane Centerline	130 feet	152 feet	22 feet
Taxiway "D"			
Grade	3%	2%	1%
Width	20'	25'	5'
AIRFIELD			
Runway Lighting			
Runway 18	VASI	VASI/PAPI, REIL	REIL
Runway 36	PAPI, REIL	PAPI, MALSR	MALSR
Taxiway "B"	Partial Parallel	Full Parallel	Full Parallel
Exit Taxiways			
East Side	2	3	1
West Side	1	3	2
LANDSIDE			
Conventional Hangar	108,000 sf	204,000 sf	96,000 sf[1]
T-Hangar Bays	64 Bays	100 Bays	36 Bays
Apron Tiedowns	138 Tiedowns	110 Tiedowns	None[2]
Transient Apron Area	8,000 sy	13,000 sy	5,000 sy
Maintenance Garage	3,600 sf	6,000 sf	2,400 sf[3]
Service Road	None	Service Road[4]	Service Road[4]
Land Acquisition			
Owned in Fee	420 acres	420 acres	0 acres
Easement	0 acres	46 acres[5]	46 acres[5]

Notes:
[1]A 62,500 sf hangar is schedule for completion in 2006, which will reduce the future demand to an estimated 33,500 sf (see discussion below).
[2]A tiedown deficit will occur if adequate T-hangar bays are not provided
[3]Vehicle garage for storage of snow plows and maintenance vehicles and equipment.
[4]Service road to connect the landside facilities on the east and west sides of the Airport.
[5]Acquire easements for the off-airport property located within the Runway Protection Zones

4.0 DEVELOPMENT ALTERNATIVES

This chapter identifies various airport development alternatives for the Waterbury-Oxford Airport (OXC) that would satisfy the airfield and landside facility requirements identified in Chapter 3. The alternative identification and evaluation process is consistent with FAA guidelines and standards, and considers a variety of screening criteria. The major additional facility requirements for OXC include the following:

- Parallel Taxiway “B” Extension
- Additional Exit Taxiways
- Airport Service Road
- Obstruction Removal
- Approach Lighting System
- Additional T-hangar (36 bays)
- Additional Conventional Hangar Space (96,000 square feet)
- Maintenance Garage

The goal is to develop a recommended plan that improves airfield facilities and accommodates landside development that would meet user demands. As such, various development alternatives were identified and evaluated based on a range of criteria, including operational efficiency and safety, environmental impacts, and cost. Note that this Master Plan Update represents a preliminary evaluation of the potential impacts associated with each alternative. Before project development, environmental studies and permitting (appropriate to the specified project) would be required.

This chapter includes the following components:

- Airfield Alternatives
- Landside Alternatives
- Recommended Development Concept

4.1 Airfield Alternatives

Various airfield development alternatives were identified to satisfy the facility requirements presented in Chapter 3. The airfield alternatives focus on providing additional taxiway and lighting facilities, and improving operations and safety. No change or expansion to the current runway was considered in this study. The airfield alternatives under consideration are illustrated on Figures 4-1 through 4-4.

4.1.1 Parallel Taxiway "B" Alternatives

Several possible alignments were identified to provide a full parallel taxiway on the east side of the airfield. The alignments would extend parallel Taxiway "B" to the end of Runway 36, and would reduce runway crossings and occupancy time. As a taxiway extension would impact freshwater wetlands, various alignments were developed in an attempt to balance operational considerations with environmental concerns. Each alternative is illustrated on Figure 4-1.

- **Alternative 1A** – Provides the standard 400-foot runway-taxiway offset for Airport Reference Code (ARC) D-III, and extends Taxiway "B" on its current alignment. This alternative is ideal from an operational and safety standpoint by providing a straight taxiway with no interference to other airport facilities. The alignment would impact five to six acres of wetlands, and would require significant filling to raise the area to grade.

- **Alternative 1B** – A modification of Alternative 1A that would reduce wetland impacts by incorporating an acute angle entrance taxiway at the end of Runway 36. The angle would reduce the fill and embankment required in the wetlands located along the Airport's southeastern property line. The configuration would be similar to that currently provided on the northwest end of Runway 18.

- **Alternative 2** – Attempts to reduce wetland impacts by using an expanded 600-foot runway-taxiway offset, which circumvents much of the wetland area. This offset could reduce wetland impacts by over 50% compared to Alternative 1A. However, the layout would retain a forested wetland within the airfield, raising the chance for wildlife-aircraft strikes and introducing line-of-sight concerns. The layout connects to the proposed Hangar G development, forcing aircraft to taxi through a privately-leased apron area. The associated clearances of the Taxiway Object Free Area (TOFA) would occupy most of the Hangar G apron, create conflicts with tenant activities, and eliminate the ability to park business aircraft with wingspans over 49 feet. As such, the TOFA would functionally eliminate the use of the apron and impact hangar access. The layout also would increase the taxiway length and number of turns, resulting in an awkward airfield configuration.

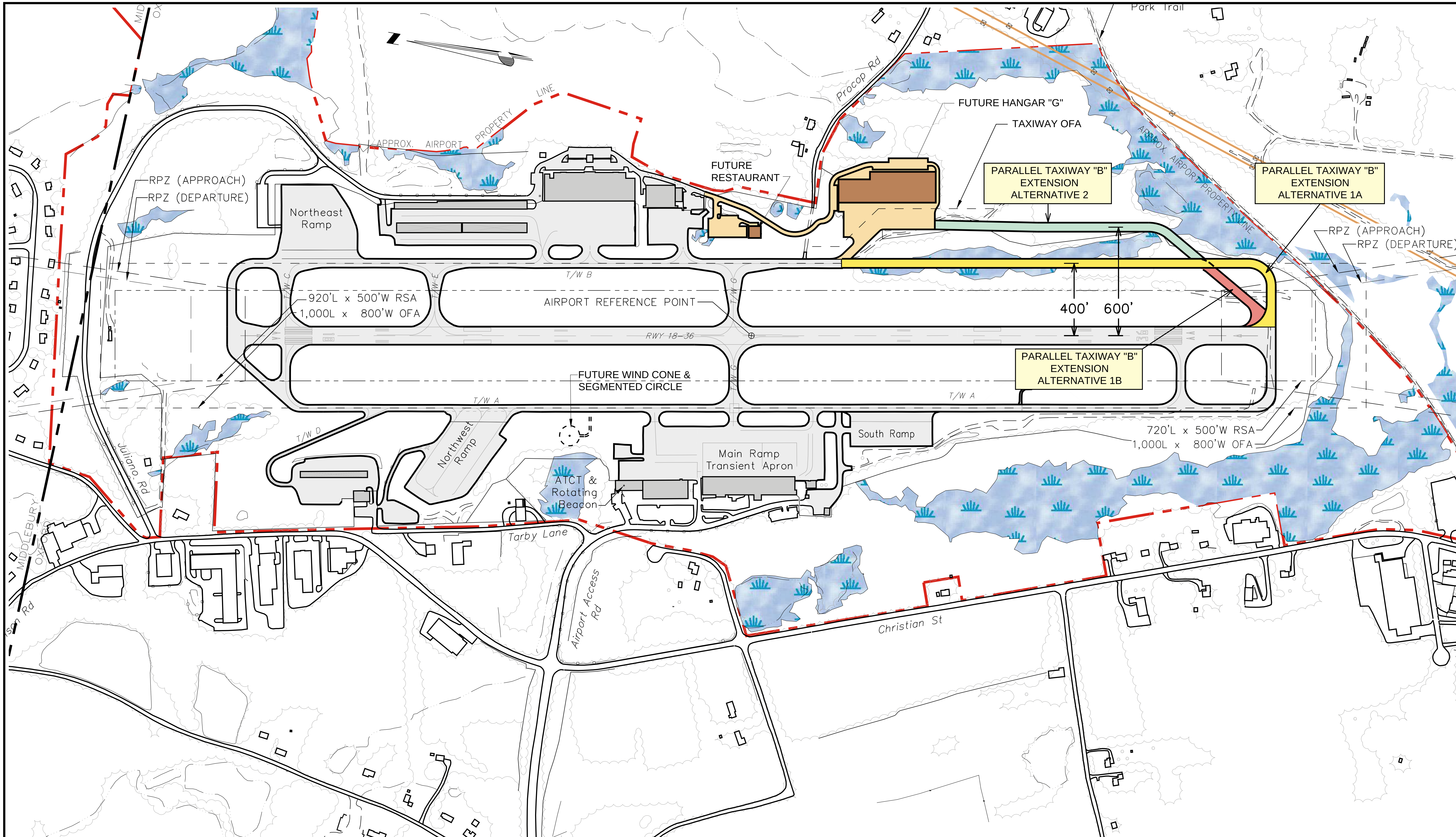

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Figure 4-1

PARALLEL TAXIWAY ALTERNATIVES

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Waterbury-Oxford Airport Master Plan
Oxford, Connecticut

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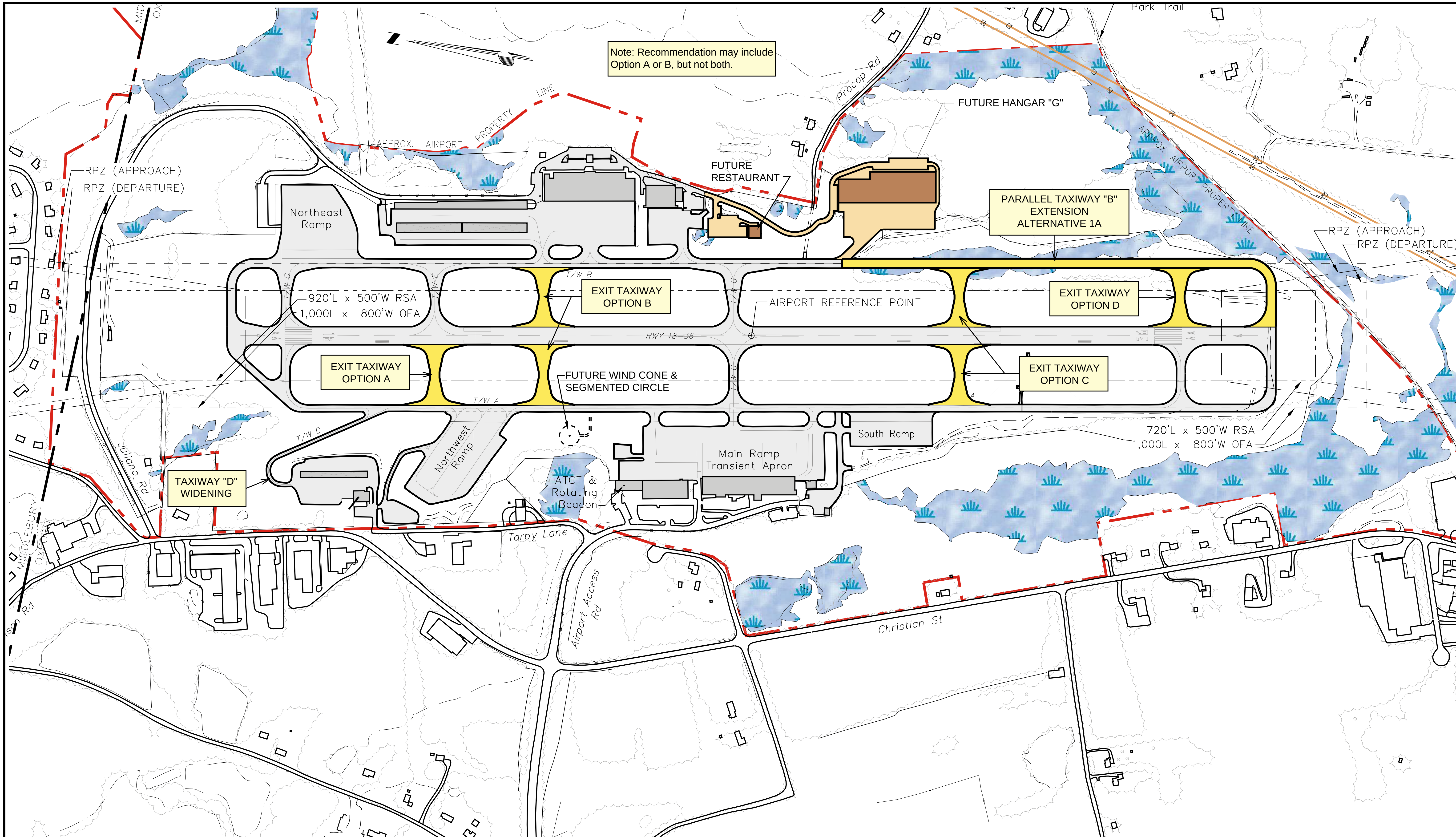

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Figure 4–2

EXIT TAXIWAY ALTERNATIVES

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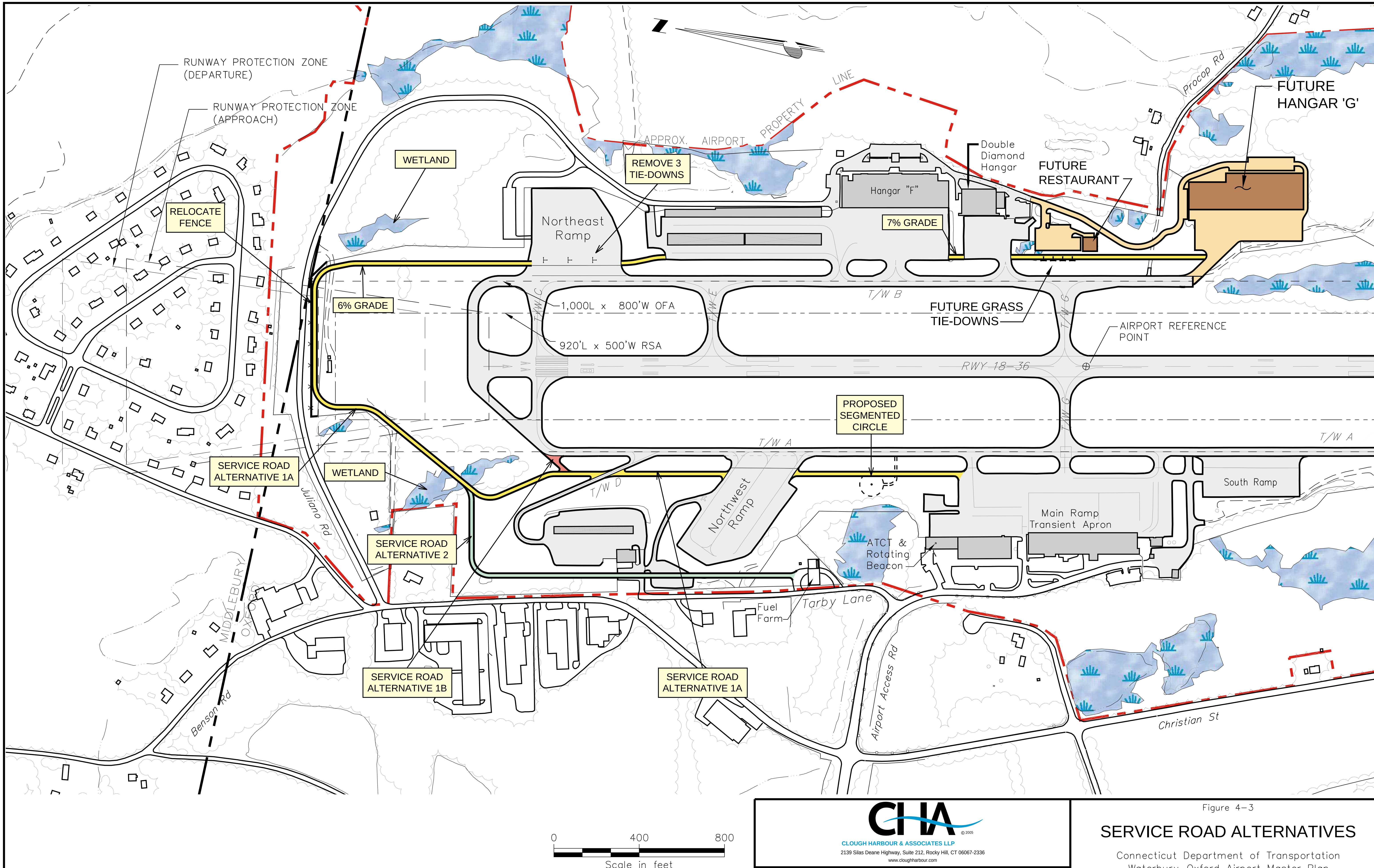

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Figure 4-3

SERVICE ROAD ALTERNATIVES

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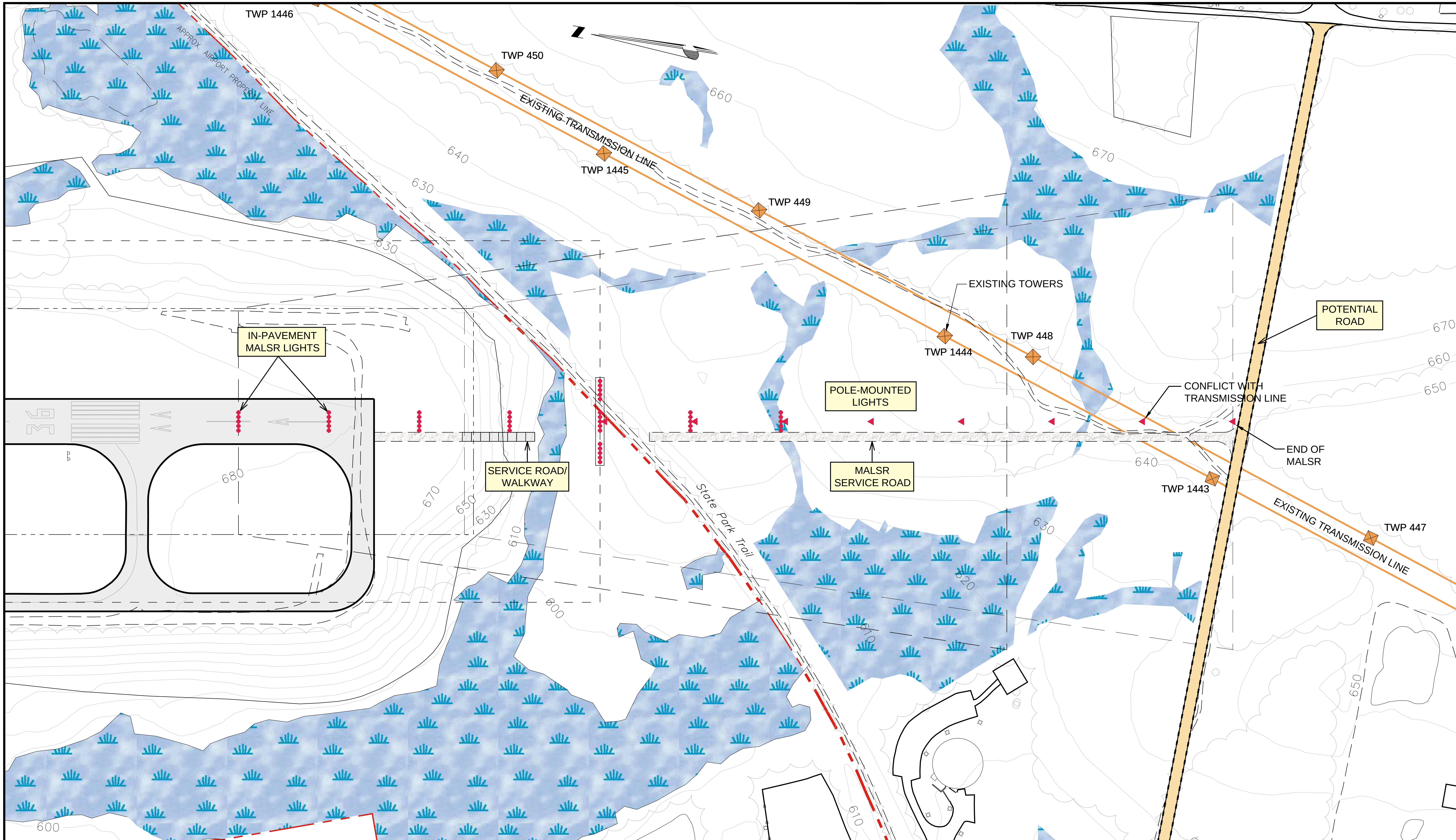

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Figure 4-4

MALSR DEVELOPMENT

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Waterbury-Oxford Airport Master Plan
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4.1.2 Exit Taxiway Alternatives

To satisfy the facility requirements, several exit taxiway locations were identified. If provided, these additional exits would reduce runway occupancy time and improve operational efficiency and safety for all users of the Airport. Exit taxiway locations were identified along several portions of the runway, as summarized below and illustrated on Figure 4-2. As multiple taxiway layouts may be recommended, they are referred to as options instead of alternatives.

- **Option A –** The highest demand for an additional exit taxiway is on the west side of the runway, between Taxiways "C" and "G." This location is the rollout point for landings on the predominately used Runway 36. Aircraft rollouts that bypass exit Taxiway "G" must currently travel an additional 2,500 feet for a west-side runway exit. Option A is located 1,600 feet beyond Taxiway "G" in order to be positioned opposite Taxiway "E." As such, Option A would also enable runway crossings.

- **Option B –** Functionally, Option B serves the same purpose as Option A, but is located equidistant between existing Taxiways "C" and "G," which would further reduce runway occupancy time. However, as there is no corresponding exit on the east side of the runway, Option B would require construction on both sides of the runway to provide a runway crossing point.

- **Option C –** This option would provide both east- and west-side exits for landings on Runway 18. The depicted location is equidistant between the runway midpoint and the Runway 36 end, optimally positioned for landings that bypass Taxiway "G." An additional benefit of Option C is its location just north of the electronic glide slope antenna, which would avoid the glide slope critical area to the south, enabling use of the taxiway without interfering with ILS use. Note that the east-side exit would connect with an extension of parallel Taxiway "B." Thus, the parallel taxiway extension must be constructed prior to Option C.

- **Option D –** This option would provide an east-side exit taxiway opposite the existing west-side exit near the south end of the runway. The location would provide a symmetrical exit layout while reducing development costs. However, the location of Option D is 2,500 feet from Taxiway "G," and would therefore not substantially reduce runway occupancy time.

Note that Options A and B would provide an exit taxiway for Runway 36 landings, while Options C and D would provide an exit for Runway 18 landings. A recommendation for each runway end is desirable. Either Option A or B would provide adequate functionality; however, Option A provides an efficient layout with minimum cost. For Runway 18 activity, only Option C would satisfy the facility requirements.

4.1.3 Service Road Alternatives

An on-airport service road would be used by Airport and Fixed-Based Operator (FBO) personnel for the operation of fuel trucks, snow plows, and other service vehicles. The service road should be located clear of operational areas (i.e., runways, taxiways, and safety areas) to prevent interference with aircraft. Due to the Airport's physical constraints (i.e., wetlands, excessive grades), the alignment of any service road has several shortcomings. Three alternatives were investigated for the AMPU. Each alternative is illustrated on Figure 4-3.

- **Alternative 1A –** Provides a bi-directional service road around the north end of the airfield that remains outside of the RSA. Starting at the main ramp, the service road would run parallel to Taxiway "A" at an offset of 93 feet (the standard for ARC D-III, see Appendix B, *Taxiway Centerline to Movable Object*). To the north of Taxiway "D," the road would descend and cross a small wetland. The service road then continues around the north end of the Airport, requiring the relocation of the Airport security fence, and then turns south and up a 6% grade to the Northeast Ramp. On the east side of the runway, the service road would require the removal of three tiedowns, necessitate a 7% grade between the Hangar F and Double Diamond ramps, and conflict with proposed grass tiedowns adjacent to the proposed restaurant. In addition, Alternative 1A would traverse the relocated segmented circle (to the west of Taxiway "A"). The individual segments would therefore be converted from raised snow-shedding panels to flush/painted segments on pavement. This would require the area around the segmented circle to be plowed during each snow event.

  The advantage of Alternative 1A is its location outside the airfield operational areas. Disadvantages include the overall length, cost, number of turns, steep grades, and wetland impacts.

- **Alternative 1B –** An essentially scaled-back version of Alternative 1A that eliminates the service road section around the north end of the airfield. Alternative 1B would still separate vehicles from aircraft on parallel Taxiways "A" and "B," but would require vehicles to cross the north end of the runway. Vehicle operators would be required to obtain clearance from Air Traffic Control (ATC) for runway crossings. Alternative 1B avoids wetland impacts and reduces construction costs, but does not have the safety advantage of Alternative 1A. Alternative 1B could be developed in the near-term, with the remaining sections of Alternative 1A added in the future.

- **Alternative 2 –** This alternative would provide the bi-directional service road around the north end of the airfield that remains outside of the RSA. The service road would start at the fuel farm along Tarby Lane and follow the property line before joining the alignment of Alternative 1A. This alternative provides direct access to the fuel farm and the east side of the Airport. Access to the ramps on the west side of the runway would be provided by the existing access road to the Northwest Ramp.

Both Alternatives 1A and 2 have safety benefits; however, high costs and operational and environmental impacts would be created. Alternative 1B could be pursued in the near-team, providing some of the desired benefits of a service road. Note that each alternative would have some steep grades that may be difficult for fuel trucks to negotiate.

4.1.4 Obstruction Removal

As discussed in Chapter 3, the Runway Protection Zone (RPZ) is primarily designated to protect people and property on the ground; however, the FAA considers the clearing of all objects within the RPZ a safety benefit, particularly objects that obstruct the FAR Part 77 Approach Surface.

Beyond the southern end of the Airport, a major 115 K.V. transmission line traverses the existing RPZ, as illustrated on Figure 4-4. The line contains four circuits on a set of parallel utility towers (with two circuits per tower in a vertical configuration). Towers 448, 1443, and 1444 are located within the existing RPZ, and Towers 448, 449, and 1444 penetrate the 50:1 Approach Surface by over 30 feet, and also penetrate the steeper 34:1 surface.

Northeast Utilities owns the line and is considering service upgrades in the vicinity of the RPZ. ConnDOT is working with Northeast Utilities on the obstruction issue in an effort to potentially lower or bury the power line. Such a project would improve safety and land use compatibility in the area south of Runway 36.

Three potential options to eliminate the Approach Surface obstructions and improve safety include:

- Complete relocation of the utility line
- Reconfiguration of the towers into a system with four parallel lines on towers with significantly lower heights
- Burying the section of the line within the RPZ and Approach Surface (approximately 0.4 of a mile)

The first two options to relocate or lower the line would require significant right-of-way acquisition to accommodate the relocated or additional required towers. Due to the inherent difficulty of property acquisition and impacts to affected land owners, burying the lines is typically the preferred option in similar cases. This is also the preferred option from an aeronautical perspective, as the lines are completely eliminated from the Approach Surface and RPZ.

Unfortunately, burial of a 115 K.V. line is very expensive, with an order of magnitude cost of $4 million for well under a mile of line. Although the safety benefit of line burial is clear, funding availability is a significant challenge to be addressed by the FAA and ConnDOT.

4.1.5 Approach Lighting System

Chapter 3 recommended a Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR) for Runway 36 at OXC. MALSR systems extend 2,400 feet from the associated runway end, and include a series of lights mounted at 200-foot increments. The lights are intended to be placed at the same elevation as the runway end, but may extend upward at a maximum slope of 2% (50:1) where necessary. The basic MALSR layout for Runway 36 is illustrated on Figure 4-4.

As the terrain beyond the end of Runway 36 drops from 680 feet MSL to 610 feet MSL, a MALSR tower system would be required. This would consist of a system of individual tower/pole mounted lights along an unpaved service road. Property easements would be required to install the system.

As shown on Figure 4-4, the MALSR installation would conflict with the existing electrical transmission line discussed above. Furthermore, the existing utility towers are higher than the maximum allowable height of the MALSR system. As such, burial of the utility line, as discussed in Section 4.1.4, is considered a prerequisite to the installation of the Runway 36 MALSR. The light towers and service road may impact some wetland areas and could conflict with the State Park Trail.

From an aeronautical perspective, the MALSR is recommended as it would significantly enhance pilot reference during low visibility conditions and could reduce the approach visibility minimum to as low as ½ mile. An initial Benefit/Cost Analysis (B/CA) was prepared due to the cost of the MALSR system, which identified a favorable B/C ratio of slightly over 1.0 (see Appendix C). A ratio of 1.0 or higher is typically required for FAA funding consideration.

4.1.6 Airport Design Standards

As discussed in Chapter 3, a few design standard deficiencies will occur at OXC due to the anticipated change in the ARC from D-II to D-III. This change affects the standard taxiway width and separation (i.e., offset) from parallel taxiways, taxilanes, and aircraft parking. Four deficiencies were previously identified for OXC, as listed in Table 4-1.

TABLE 4-1 – DESIGN STANDARD DEFICIENCIES			
Design Criteria	**Existing**	**Standard** *ARC D-III*	**Offset per Design Aircraft***
Runway Centerline to Aircraft Parking	475 feet	500 feet	400 feet
Taxiway "A" Width	40 feet	50 feet	39 feet
Taxiway Centerline to Aircraft Parking	75 feet	93 feet	75 feet
Taxiway Centerline to Taxilane Centerline	130 feet	152 feet	122 feet
*Offsets calculated per FAA AC 150/5300-13, and the specific undercarriage width and wingspan of the future Design Aircraft. Also see Appendix B.			

Table 4-1 also identifies the calculated requirement for the future design aircraft at OXC (i.e., the Gulfstream V) per FAA Advisory Circular 150/5300-13. As shown for each deficient item, the Airport currently provides an adequate offset for the Gulfstream V. This is due to the relatively narrow undercarriage width and wingspan of the future design aircraft, in comparison to most aircraft in ARC D-III. Additional details are provided below.

- The runway centerline to aircraft parking offset should ideally be 500 feet to keep parked aircraft outside the Primary Surface. However, allowances for reduced apron offsets are common and typically do not cause safety concerns. A 400-foot offset prevents aircraft from parking within the Runway Object Free Area (ROFA) and may be adequate at OXC.

- The width of Taxiway "A" is 40 feet. For the undercarriage width of the Gulfstream V, a taxiway width of only 39 feet would provide adequate safety (16.3-foot undercarriage width x 1.15 + 20 feet = 39 feet).

- The taxiway centerline offset to aircraft parking on the Northeast, Northwest, and South Ramps is currently 75 feet. This offset is adequate for the 93-foot wingspan of the Gulfstream V [(93 feet x 1.4 + 20 feet] / 2 = 75 feet).

- The Taxiway "B" centerline to the parallel taxilane centerline (along the T-hangars) is currently 130 feet. For the design aircraft, the calculated offset required is 122 feet (93 foot wingspan x 1.2 + 10 feet = 122 feet)

The above calculations identify that OXC currently provides a reasonable level of safety for the future design aircraft without relocating existing facilities. Thus, no alternatives were developed for the relocation of these facilities. However, as each of these offsets are less than the formal Design Standard, an FAA Modifications-to-Design-Standard is required. As such, these pre-existing "nonconforming conditions" must be listed and approved by the FAA on the OXC Airport Layout Plan (ALP).

4.2 Landside Alternatives

This section describes the landside alternatives developed for OXC to satisfy the facility requirements presented in Chapter 3. The alternatives consist of T-hangar, conventional hangar, and maintenance garage developments – the primary landside deficits identified for OXC. The landside alternatives under consideration are illustrated on Figures 4-5 and 4-6.

4.2.1 T-Hangar Options

The OXC requirements for T-hangar space were estimated from industry planning standards and through discussions with airport tenants and management. The analysis identified a current deficit of 30 T-hangar bays, which is anticipated to increase to 36 by 2023. To satisfy the facility requirements, several development locations and configurations were identified, as summarized below and illustrated on Figure 4-5. As multiple layouts could be recommended, they are referred to as options instead of alternatives.

- **Option A –** This option provides three new T-Hangar buildings adjacent to the Northeast Ramp, and could accommodate up to 36 bays. The area contains an existing parking lot, with descending grades and adjacent wetlands. Option A would require substantial filling and embankment to raise the area up to the grade of the Northeast Ramp (over 100,000 cubic yards of fill may be required). Construction procedures could be implemented to avoid impacts to the adjacent wetland. The automobile parking lot located at this site would be relocated.

- **Option B –** This option includes the redevelopment of the existing Northeast Ramp to provide up to 30 T-hangar bays. The development would remove all but six of the existing tiedowns. As such, the development essentially replaces tiedowns with T-hangars. As the Airport has a tiedown surplus and T-hangar deficit, this option would provide an overall benefit to Airport tenants. The existing grade and drainage system of the Northeast Ramp could accommodate T-hangars with little re-grading necessary.

- **Option C –** This option is similar to Option B in that it would replace existing tiedowns with T-hangars. The Northwest Ramp could accommodate up to 32 T-hangar bays with some minor re-grading. Parking and airfield access is readily available at this site, which significantly reduces development costs.

- **Option D –** This final option would completely reconstruct the area adjacent to the Northwest Ramp. Option D would relocate or replace existing hangars and tiedowns, provide additional T-hangars bays, and eliminate Taxiway "D." The development would include approximately 150,000 cubic yards of fill to raise the area to the elevation of the Northwest Ramp. The new apron could accommodate 46 T-hangar bays and 20 tiedowns, for a net increase of 36 bays and 5 tiedowns. A new auto parking lot would be constructed with a new access road from Tarby Lane. The option has the benefit of large size and integration with the Northwest Ramp. Cost would be the primary disadvantage. Depending on the unit cost for fill, the grading alone could exceed $1 million.

With a surplus of approximately 35 tiedowns, some of the existing tiedown positions could be converted to T-hangars, as included under Options B and C. However, as discussed in Chapter 3, some new apron development would be required for T-hangars and/or tiedowns in order to avoid an ultimate deficit of both storage methods.

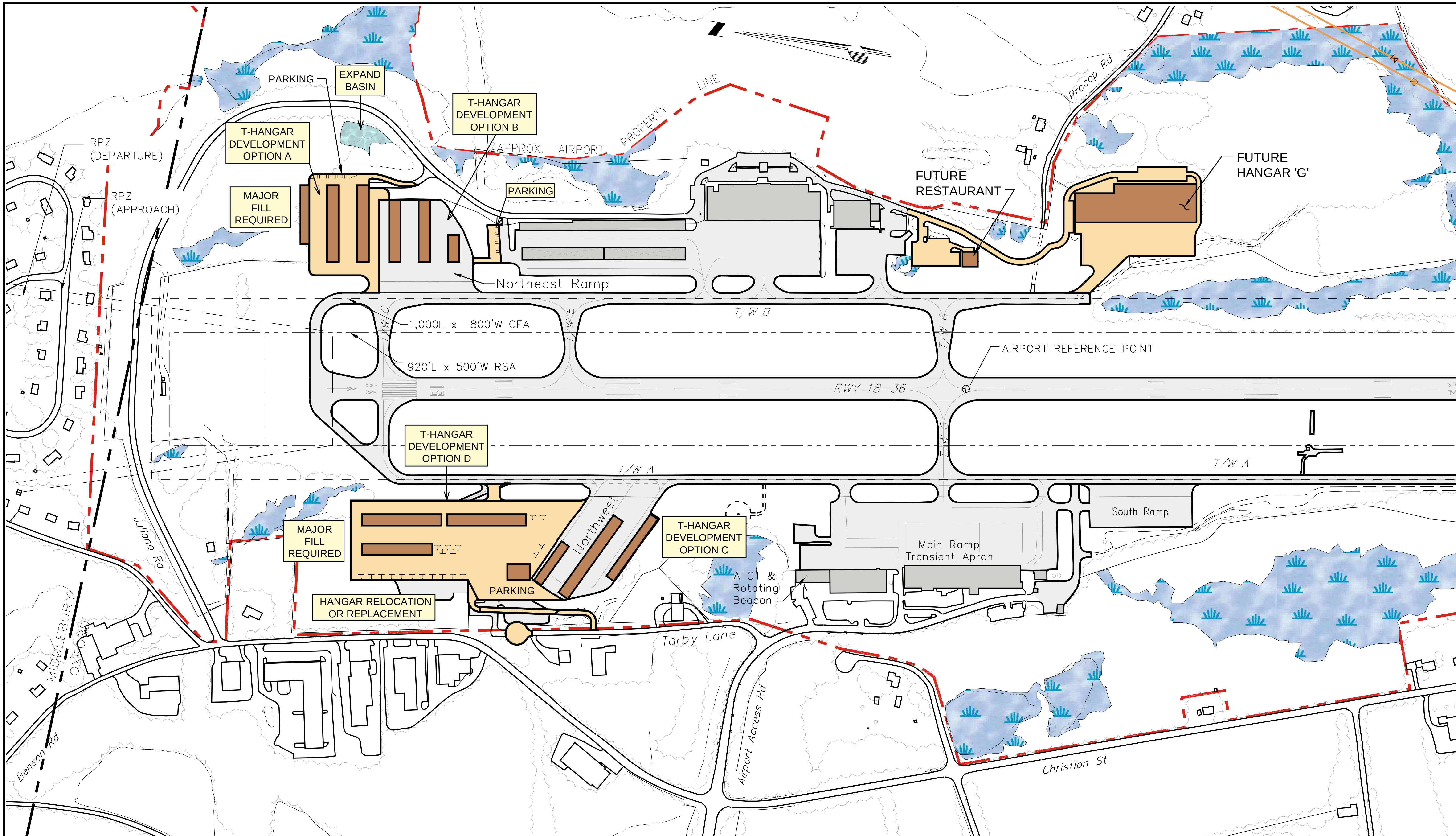

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Figure 4-5

T-HANGAR DEVELOPMENT OPTIONS

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Waterbury-Oxford Airport Master Plan
Oxford, Connecticut

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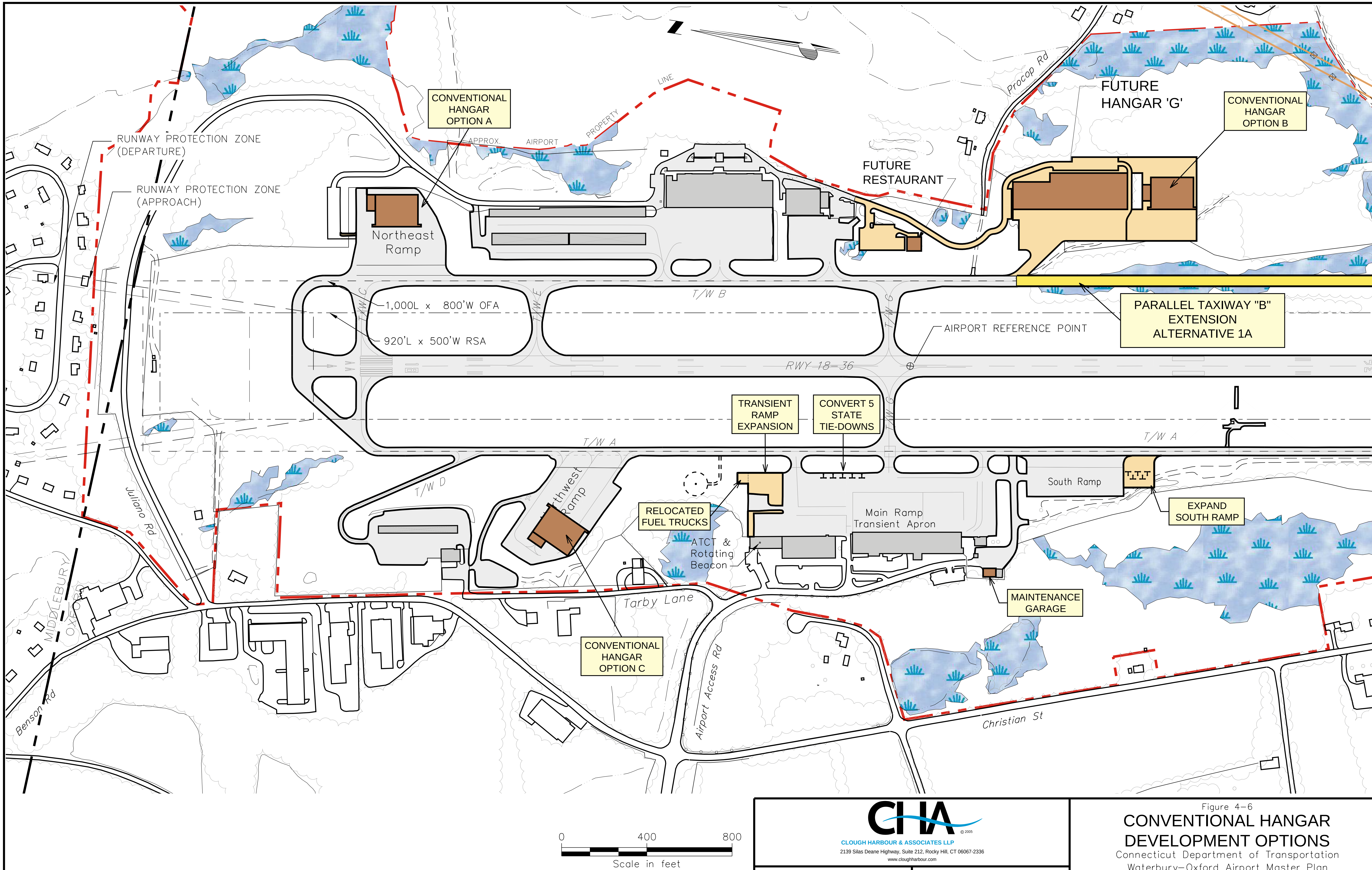

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Figure 4–6

CONVENTIONAL HANGAR DEVELOPMENT OPTIONS

Connecticut Department of Transportation
Waterbury–Oxford Airport Master Plan
Oxford, Connecticut

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4.2.2 Conventional Hangar Options

The requirements for conventional hangar space at OXC include a long-range (e.g., 2023) deficit of 96,000 square feet. With the construction of Hangar G, the deficit would be reduced to approximately 33,500 square feet. Three development options were identified to provide for the remaining hangar area. Note that two of the three sites are also the subject of one of the T-hangar development options discussed above.

- **Option A –** Conventional Hangar Option A includes the redevelopment of the existing Northeast Ramp to provide a 25,000 to 35,000 square-foot hangar facility. The development would displace all 40 existing tiedowns on this ramp, requiring replacement of at least some of these parking positions to accommodate light aircraft. The existing grade, drainage, access, and adjacent automobile parking make the Northeast Ramp an ideal location for hangar development. However, note that the conversion of tiedown positions to conventional hangars typically displaces the light aircraft tenant, as conventional hangars traditionally serve turboprop and jet aircraft. Conversely, the conversion of tiedowns to T-hangars is often an upgrade in storage type, as tiedowns and T-hangars typically serve the same light aircraft tenants.

- **Option B –** This option includes a new hangar development area adjacent to proposed Hangar G, and is essentially an expansion of the Hangar G project with an additional 30,000 square foot hangar. However, with additional fill and grading, this site could accommodate up to 60,000-square-feet of hangar, which would integrate well into the current planned development. However, costs would be substantially higher than Option A, as all new site work would be required. Note that this site is located nearly two miles from the Airport Access Road.

- **Option C –** This option includes the redevelopment of the existing Northwest Ramp. Similar to Option A, this development would displace all 50 existing tiedowns on the ramp. The existing grade is well-suited for hangar development; however, the adjacent automobile parking is located at an elevation 30 feet below the apron. No pedestrian access is currently provided between the parking and development site.

Based on current on-airport land use, and to prevent displacement of light aircraft tenants, Option B is considered the best alternative for additional conventional hangar storage at OXC. For both conventional and T-hangar development, the existing topography and other site conditions at OXC create challenges for all future hangar developments.

4.2.3 Transient Apron Expansion

The requirement analysis for the transient apron indicated a current 1,000 square yard deficit. The deficit is anticipated to increase to 5,000 square yards by 2023. A single option to expand the existing transient airport is depicted on Figure 4-6. The expansion includes:

- 3,300 square yards of new apron

- Relocation of the fuel truck parking
- Conversion of five State tiedowns to transient parking (1,700 square yards)
- Expansion of the South Ramp to accommodate the converted tiedowns

Together, these items would provide an additional 5,000 square yards of apron for transient parking, for a total area of approximately 13,000 square yards.

4.2.4 Maintenance Garage/Equipment Building

The airport facility requirements include an additional vehicle garage/equipment building of 2,400 square feet. A location for the garage/building is currently reserved adjacent to the existing garage, as illustrated on Figure 4-6.

4.3 Recommended Airfield Concepts

An evaluation of the airfield development alternatives provided several short-term (within the next 5 years) and long-term (within the next 6 to 20 years) recommendations for implementation at OXC, as summarized in Table 4-2. Each of these recommendations would improve the operational safety and efficiency of the OXC airfield, and would also reduce delays. Recommendations are provided for new taxiways, a service road, obstruction removal, and approach lights, as illustrated on Figure 4-7 (last page of Chapter 4).

4.3.1 Taxiway Recommendations

The primary airfield safety improvement for OXC is a full parallel taxiway for the east side of the runway (i.e., extension of Taxiway "B"). Of the several possible alignments, Alternative 1B provides the best balance between operational considerations and environmental concerns, and is therefore recommended for implementation.

Alternative 1B provides the standard 400-foot runway-taxiway offset for Airport Reference Code (ARC) D-III, extending Taxiway "B" on its current alignment to provide a straight taxiway with no interference to other airport facilities. The alignment would impact Wetland #1 (i.e., 3.8 acres), as filling the area would be required to match the grade of the existing airfield. However, Alternative 1B avoids impacts to the larger Wetland #13 by incorporating an acute angle entrance taxiway at the end of Runway 36. The angle would reduce the fill and embankment required along the Airport's southeastern property line, and would be a similar configuration to that currently provided on the northwest end of Runway 18.

Wetland #1 is the closest wetland to the runway and runs parallel to the airfield for its entire length. Wetlands can be safety hazards due to their attraction to wildlife (FAA Advisory Circular 150/5200-33A). As such, removal of Wetland #1, with off-site mitigation, could have a potential safety benefit for the Airport. A Conceptual Wetland Mitigation Plan was developed (Appendix D) due to the significant wetland impacts associated with this recommendation.

Alternative 2, which avoids most of Wetland #1, could create a potential safety hazard by incorporating a wildlife attractant within the operational airfield. That configuration could cause taxiing aircraft to flush birds and mammals into the path of arriving and departing aircraft. FAA Advisory Circular 150/5200-33A, *Hazardous Wildlife Attractants on or Near Airports*, provides guidelines to reduce such wildlife hazards.

In addition to extending Taxiway "B," several exit taxiway locations are also recommended to enable aircraft to efficiently exit the runway, thereby minimizing occupancy time. In the short-term, Exit Taxiway Option A is recommended, as it provides an additional exit for landings on Runway 36, the more frequently used runway end. It would also be beneficial to provide additional exits for aircraft landings on Runway 18 (i.e., Options C and D), which are recommended in the long-term. Option C would enable aircraft landings on Runway 18 to exit either to the left or right. Option D would provide an east-side exit for landings on Runway 18, as well as a secondary/bypass entrance and holding location for Runway 36 departures.

TABLE 4-2 – EVALUATION OF AIRFIELD ALTERNATIVES					
Alternative/ Option	**Environmental Impact**	**Operational Efficiency**	**Safety**	**Cost***	**Recommended**
EXTEND PARALLEL TAXIWAY "B"					
Alt 1A	4.3 acres of wetland	Straight taxiway with standard 400-foot ARC D-III offset - no other facility impacts.	Reduces runway crossings & occupancy time. Wetland removal may reduce potential airfield wildlife hazard (would include off-site mitigation).	$5,200,000	No
Alt 1B	3.8 acres of wetland	Similar to Alt 1A, with a 45-degree angled entrance to Runway 36. No impacts to other facilities.		$4,300,000	Yes - Short-Term[1]
Alt 2	1.5 acres of wetland	Requires taxiing through privately-leased apron area & includes multiple turns.	Reduces runway crossings & occupancy time, but includes potential airfield wildlife attractant.	$3,600,000	No
EXIT TAXIWAYS					
Option A	N/A	Provides exit for landings on Runway 36 at rollout point.	Reduces runway occupancy time, increasing airfield safety & efficiency for all Airport users.	$325,000	Yes - Short-Term
Option B	N/A	Provides exits for landings on Runway 36 equidistant between Taxiways "C" & "G."		$420,000	No
Option C	N/A	Bi-directional exits for landings on Runway 18.		$420,000	Yes - Long-Term
Option D	N/A	East-side exit for landings on Runway 18, entrance/holding area for Runway 36 takeoffs.		$325,000	Yes - Long-Term
SERVICE ROAD					
Alt 1A	< 0.5 acres of wetland	Full service road that remains clear of the operational airfield & RSA, includes several turns & steep grades.	Full separation of aircraft & ground vehicles.	$1,400,000	Yes - (As Modified) Long-Term
Alt 1B	Avoids wetland impacts	Partial service road that crosses the north end of the airfield (instead of remaining outside the RSA), still requiring ATC clearance.	Partial separation of aircraft & ground vehicles.	$500,000	Yes - Short-Term[2]
Alt 2	Avoids wetland impacts	Provides access to fuel farm within security area.	Partial separation of aircraft & ground vehicles, avoids fuel truck use of public roads.	$360,000	Yes - (As Modified) Long-Term

TABLE 4-2 – EVALUATION OF AIRFIELD ALTERNATIVES (CONTINUED)					
Alternative/ Option	**Environmental Impact**	**Operational Efficiency**	**Safety**	**Cost***	**Recommended**
OBSTRUCTION REMOVAL					
Utility Tower/Tree Removal	< 0.1 acres of wetland (estimated)	Enables landings on Runway 36 during poor weather conditions.	Clears obstructions from FAR Part 77 Approach Surface.	$5,000,000	Yes - Long-Term
MALSR					
Installation of MALSR (Runway 36)	< 0.1 acres of wetland (estimated)	Reduces the approach visibility to as low as ½ mile for Runway 36.	Enhances runway visibility for pilots.	$700,000	Yes - Long-Term
*Planning level estimates [1]Design, EA, and permitting would occur in the short-term; wetland mitigation and construction would occur in the long-term. [2]The portion on the west side of the airfield would be constructed in the short-term; the portion on the east side of the airfield would be constructed in the long-term.					

After presenting the airfield alternatives to the Study Advisory Committee, it was suggested that alternatives also be considered to reduce the non-standard 3% grade of Taxiway “D.” The FAA recommends that taxiways have no more than a 2% grade for small aircraft.[1] Due to large elevation differences between Taxiway “A” and the Executive Flight Services Ramp, Taxiway “D” cannot be reconstructed on its current alignment to enable an acceptable grade. Thus, a new alignment is recommended (see Figure 4-7). The recommended alignment connects Taxiway “D” to the Northwest Ramp, eliminating the current connection to Taxiway “A.” This would include the construction of approximately 1,100 feet of new taxiway, and enable a taxiway grade of 2%. Removal of the existing taxiway pavement is also recommended. Due to the significant amount of fill required for this project, the total cost is estimated to be approximately $1 million.

4.3.2 Service Road Recommendation

An on-airport service road is recommended to segregate airport vehicles from the operational airfield. Based upon the many development issues described previously, it is likely that a service road would be built in phases as funding becomes available. In general, a modification of Service Road Alternatives 1A and 1B is recommended (see Figure 4-7). The sections of the road parallel to the runway could be implemented in the short-term, and the section around the north end of the runway could be constructed in later phases of the planning period. The section around the north end of the runway has been refined to reduce the number of turns, thereby providing a more efficient layout; however, minor impacts to Wetlands #2 and #5 (up to 0.1 acres total) would be unavoidable.

[1]The FAA recommends a maximum taxiway grade of 2% for Categories A & B aircraft, which are the primary users of Taxiway “D.” For larger aircraft (Categories C & D), the FAA recommends a maximum taxiway grade of 1.5% - this would apply to the parallel and exit taxiways at OXC.

4.3.3 Obstruction Removal

To improve safety within the RPZ and remove obstructions to the Approach Surface, burial of the Northeast Utilities electrical transmission lines and removal of the associated towers is recommended. This project would improve safety and land use compatibility, but would require several million dollars in construction costs. This project is recommended in the long-term; however, funding could be a primary issue for its implementation.

In addition, trees located in undeveloped areas off airport property penetrate the Approach Surface. If the utility towers are removed, trees would become the controlling obstruction. As such, the feasibility of selectively removing trees should also be considered as part of any project to bury the utility line. The Airport Layout Plan (ALP) drawing set depicts the identified tree obstructions.

4.3.4 Approach Lighting System

From an aeronautical perspective, the MALSR is recommended, as it would significantly enhance pilot reference during low visibility conditions, potentially reducing the approach visibility minimum to as low as ½ mile. The Benefit/Cost Analysis (B/CA) for the MALSR system identified a favorable B/C ratio of slightly greater than 1.0 (see Appendix C). As discussed above, the transmission line obstructions must be addressed prior to construction of the MALSR. Therefore, this project is recommended in the long-term planning horizon. Potential MALSR impacts are addressed in Chapter 5.

4.3.5 Airfield Recommendation Summary

The airfield recommendations for OXC include the following:

Short-Term
- Parallel Taxiway Alternative 1A
- Exit Taxiway Option A
- Airport Service Road (section west of runway)

Long-Term
- Exit Taxiway Option C and D
- Airport Service Road (sections east of runway, north of runway, and to fuel farm)
- Obstruction Removal (electrical transmission towers and trees)
- Runway 36 Approach Lights (i.e., MALSR)
- Taxiway "D" Relocation

4.4 Recommended Landside Concepts

An evaluation of the landside development alternatives provided several short-term (within the next 5 years) and long-term (within the next 6 to 20 years) recommendations for implementation at OXC, many with modifications and refinements, as summarized in Table 4-3. In general, these recommendations would improve and expand the facilities used for the storage/maintenance of aircraft and airport equipment. The recommendations are illustrated on Figure 4-7 (last page of Chapter 4).

4.4.1 T-Hangars & Apron Tiedowns

The identified requirement for T-hangar space includes the addition of 36 bays, without converting a significant number of existing tiedown spaces into T-hangar development (i.e., maintaining the current number of tiedowns throughout the planning period). To satisfy this requirement, the recommendations include a mix of new T-hangar development (i.e., Option A) and T-hangar construction on existing aprons (i.e., Option B) with the replacement of converted tiedowns in alternate locations.

Both T-hangar Options A and B are recommended, with some refinements. Option A could provide up to 36 bays adjacent to the Northeast Ramp, which would satisfy the long-term facility requirement. As the Option A development area requires substantial filling and embankment, this option could be scaled back during the design phase in order to reduce development costs. Thus, Option B is also recommended to support the T-hangar demand (short- or long-term), and could be more readily implemented, as it involves the construction of T-hangars on the existing Northeast Ramp.

Implementation of Options A and B would consolidate all recent and future T-hangar development in the vicinity of the Northeast Ramp. As Option B would eliminate up to 30 tiedowns, locations for tiedown replacement are also identified on Figure 4-7. Note that the construction of the Northeast Ramp was funded by FAA grants, and was last resurfaced in 1992. As such, the Northeast Ramp must remain available as public use tiedowns for a fixed period of time (typically 20 years). Development of T-hangars prior to 2012 could require reimbursement of a portion of the grant funding, or replacement of the tiedowns in another location (without FAA funding assistance).

TABLE 4-3 – EVALUATION OF LANDSIDE ALTERNATIVES					
Alternative/ Option	**Aircraft Storage Provided (maximum)**	**Facility Impacts**	**Environmental Impacts**	**Cost***	**Recommended**
T-HANGAR - 36 Bays Required by 2023					
Option A	36 Bays	Parking lot removed/relocated	Measures to prevent wetland impacts could be implemented	$2,300,000	Yes - Short-Term
Option B	30 Bays	Approx. 30 tiedowns removed	None - redevelopment of existing Northeast Ramp	$860,000	Yes - Short-Term
Option C	32 Bays	50 tiedowns removed	None - redevelopment of existing Northwest Ramp	$920,000	No
Option D	46 Bays, 20 Tiedowns	Existing facilities replaced. Net increase of 36 bays, 5 tiedowns.	Measures to prevent wetland impacts could be implemented	$4,100,000	No
CONVENTIONAL HANGAR - 33,500 sf Required by 2023					
Option A	35,000 sf	40 tiedowns removed	None - redevelopment of existing Northeast Ramp	$2,900,000	No
Option B	60,000 sf	None, new development	Measures to prevent wetland impacts could be implemented	$4,500,000	Yes - Long-Term
Option C	35,000 sf	50 tiedowns Removed	None - redevelopment of existing Northwest Ramp	$2,900,000	No
*Planning Level Costs					

The two recommended locations for additional/replacement tiedowns include expansions of the South Ramp and Executive Flight Ramp. The terrain adjacent to both of these ramps descends quickly beyond the edge of pavement, and would therefore require filling activities to accommodate new tiedowns. By limiting the size of the expansion to approximately 15 new tiedowns in each area, the fill required and associated costs could be kept at a moderate level.

In summary, the recommendations for T-hangars and apron tiedowns incorporate several areas of the Airport and maximize development flexibility. The recommended plan includes two locations for new T-hangars and two locations for additional tiedowns. These new facilities would be developed privately through leasing agreements with ConnDOT. Thus, the multiple locations would provide the flexibility that is critical to developers that typically customize layouts to accommodate their specific needs.

4.4.2 Conventional Hangars

The requirement for conventional hangar space at OXC includes approximately 33,500 square feet of additional area after 2015. Although three development options were identified, only

Conventional Hangar Option B avoids significant displacement of existing tiedowns. Option B would also consolidate all new conventional hangar development along Taxiway "B," segregating corporate activity from transient and light aircraft. Although significant fill and grading would be necessary, the site of Option B could accommodate all anticipated long-term requirements. Development would require associated supporting facilities (i.e., access road, parking, apron, and connector taxiway). It is also noted that the extension of parallel Taxiway "B" would be a prerequisite to the development of this hangar option.

4.4.3 Landside Recommendation Summary

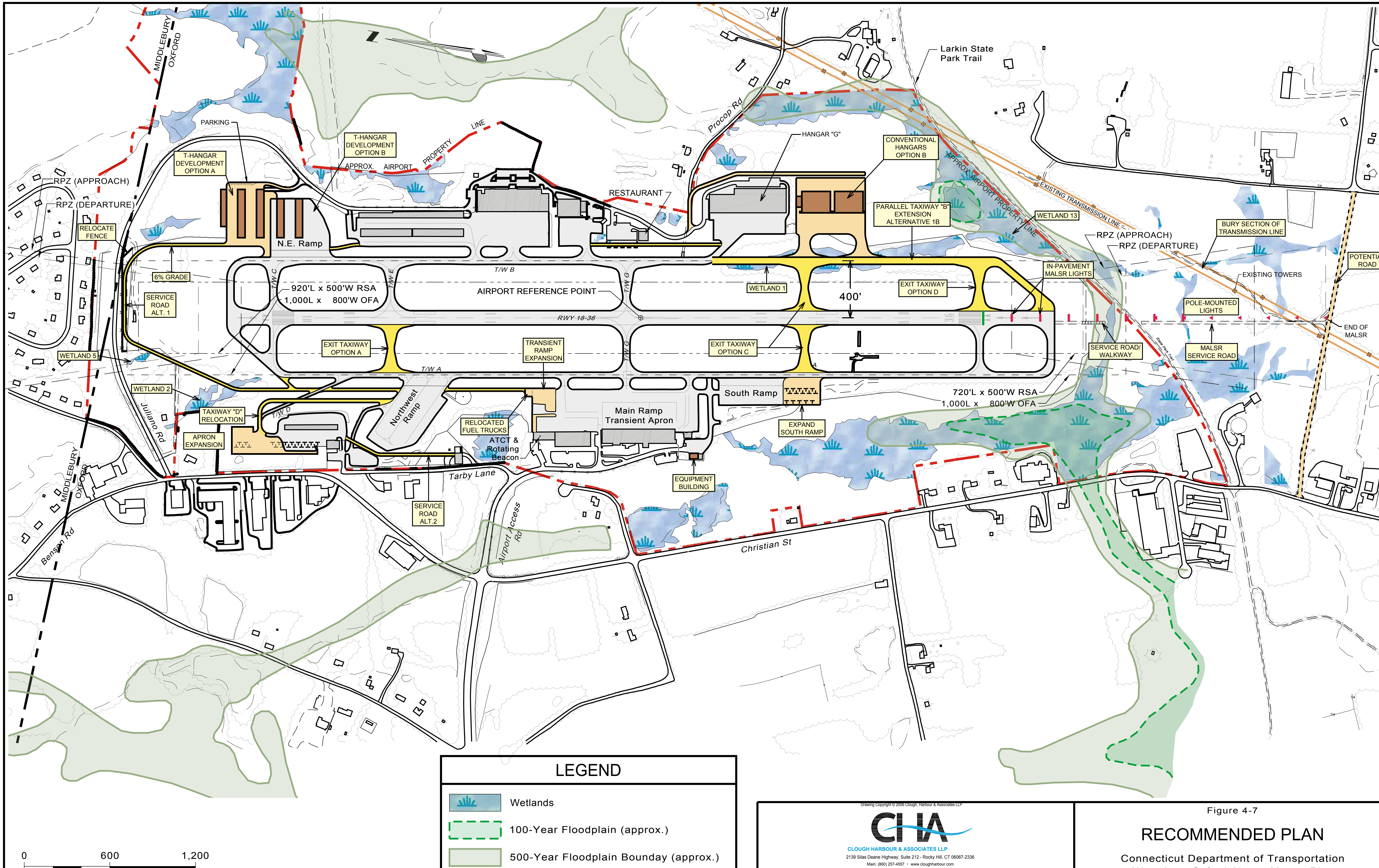
In addition to the options listed above, other recommendations include an expansion of the transient apron and the construction of an equipment building (see Figure 4-7). Overall, the landside recommendations provide for additional hangar development on the east side of the airfield, with incremental apron and tiedown expansion on the west side of the airfield. The landside recommendations for OXC include the following:

Short-Term
- A Combination of T-Hangar Options A and B
- Expansion/Additional tiedowns on the South Ramp*
- Expansion/Additional tiedowns at the Executive Flight Ramp*
- Construction of an equipment building

*Potentially required if T-Hangar Option B is implemented

Long-Term
- Conventional Hangar Option B
- Expansion of the Transient Apron

The specific configuration of any hangar development would be refined during the design process. The layout illustrated on Figure 4-7 provides a logical configuration of the position and size of future facilities, and their integration with the airfield.



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DATE: JULY 2006 | SCALE: AS NOTED

Figure 4-7

RECOMMENDED PLAN

Connecticut Department of Transportation
Waterbury-Oxford Airport Master Plan
Oxford, Connecticut

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5.0 ENVIRONMENTAL OVERVIEW

This section presents an overview of the environment surrounding the Waterbury-Oxford Airport (OXC) and highlights potential impacts associated with the recommended plan. The information herein was considered during the development of the alternatives, as well as the recommendations. Note that a more detailed environmental study, such as an Environmental Assessment (EA), would be required prior to the development of the substantial recommendations contained in this Master Plan Update. The overview identifies the environmental categories of greatest concern based upon initial investigation. The overview can also be used during the scoping process for a future environmental study. Figure 4-7 (last page of Chapter 4) illustrates the development recommendations for OXC.

As indicated in the sections below, the implementation of the recommended developments would involve evaluation of several standard impact categories, with emphasis on aircraft noise, compatible land use, social impacts, water quality, wetlands, cultural resources, and secondary and cumulative impacts.

This overview was prepared following the guidelines of FAA Order 5050.4A, "*Airport Environmental Handbook*," which requires a review of each of the following categories:

- Aircraft Noise
- Compatible Land Use
- Social Impacts
- Induced Socioeconomic Impacts
- Air Quality
- Water Quality
- USDOT Section 4(f)
- Cultural Resources
- Biotic Communities
- Threatened & Endangered Species
- Secondary and Cumulative Impacts
- Wetlands
- Floodplains
- Coastal Zone Management Program*
- Coastal Barriers*
- Wild and Scenic Rivers*
- Farmland
- Energy Supply & Natural Resources
- Light Emissions
- Solid Waste
- Construction Impacts

*Not applicable at Waterbury-Oxford Airport

The information in this chapter was obtained through field work, agency coordination, and review of existing studies for the Airport, including:

- *Federal Environmental Assessment, Connecticut Finding of No Significant Impact for Airport Master Plan Projects at Waterbury-Oxford Airport* (1995), ConnDOT.
- *Final Environmental Assessment/Final Environmental Impact Evaluation for Extension of Runway 18-36 at Waterbury-Oxford Airport* (2003), USDOT, FAA.
- Various environmental documents published by federal and state agencies (i.e., ConnDEP, USACOE, USFWS, etc.)

Following the Master Plan Update process, a comprehensive EA for the projects anticipated at the Airport will be conducted, and may focus on the first five years of the implementation plan. A federally- and state-approved EA would enable OXC to pursue the design and permitting for each project. An EA would include a public involvement process and public hearing to satisfy environmental regulations, and would also consider the cumulative impacts of past airport-related developments.

The sections below provide a summary of future required environmental analysis, potential impact categories, and anticipated permits regarding the Master Plan Update recommendations.

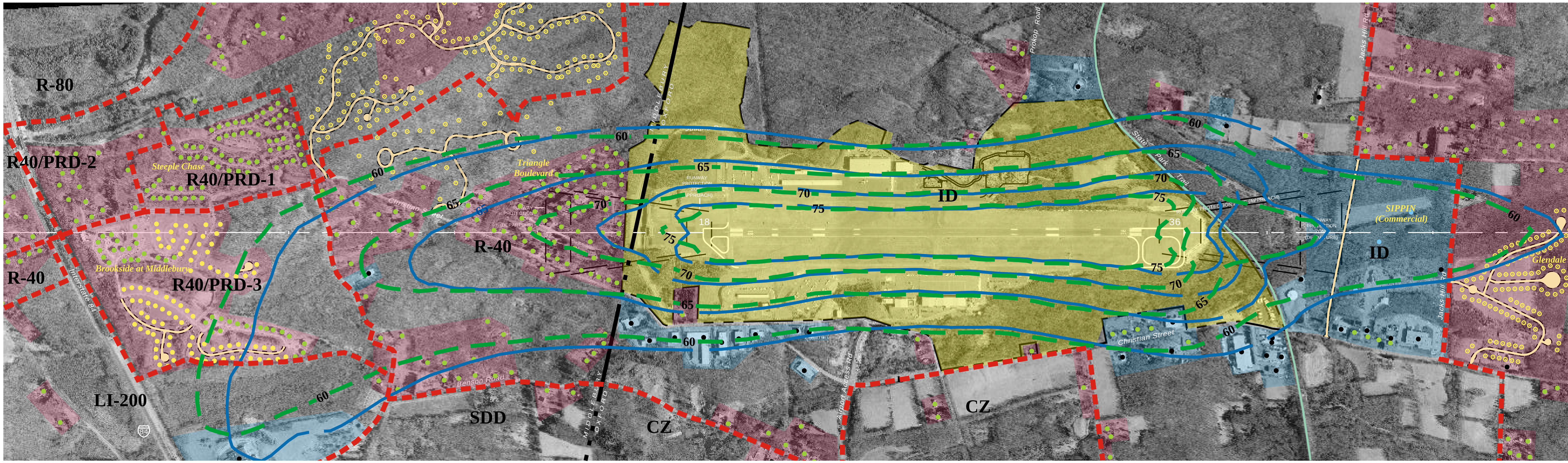
5.1 Aircraft Noise

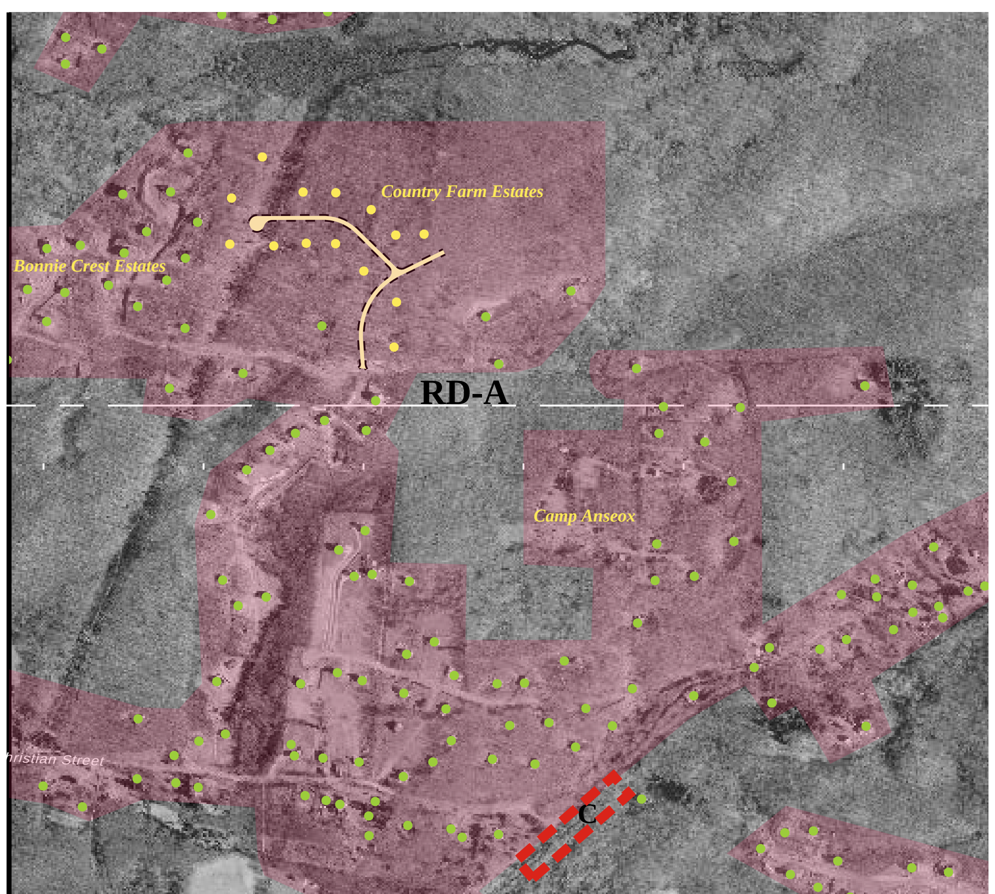
Residential, educational, and institutional land uses represent the most sensitive noise receptors. As residential subdivisions are located to the north of the Airport in Middlebury (e.g., Triangle Hills, Steeple Chase, Brookside), and to the south of the Airport in Oxford (e.g., the proposed Glendale and Central Park developments), a FAA FAR Part 150 Noise Study was prepared to evaluate potential aircraft noise impacts in these surrounding communities.

When evaluating aircraft noise impacts, the FAA requires the use of the Day-Night Average Noise Level (DNL) metric, which represents the total accumulation of aircraft noise spread uniformly throughout the day. To compensate for the added annoyance created by nighttime aircraft activity, the DNL metric applies a 10-decibel multiplier (i.e., a penalty) to operations that occur between 10:00 PM and 7:00 AM. The FAA considers average noise levels greater than 65 DNL to be incompatible with residential development.

As illustrated on Figure 5-1, DNL noise contours were generated for OXC activity levels in 2003 and forecast conditions in 2008. These contours were created for the Noise Study using the FAA's Integrated Noise Model (INM). Under the 2003 conditions, 64 homes are located within the 65 DNL contour and 20 homes are located within the 70 DNL contour. Under the forecast 2008 conditions, 53 homes are located within the 65 DNL contour and 5 homes are located within the 70 DNL contour. In both years, all of the affected homes are located in the Town of Middlebury. The reduction in noise exposure from 2003 to 2008 in Middlebury is caused by the recent extension of Runway 36, which shifted takeoffs 500 feet further south, as well as by the anticipated phase out of many of the noisiest jets in use at OXC by 2008.

Since incompatible residential development exists within the vicinity of the Airport, the Noise Study evaluated potential measures to reduce or prevent future noise exposure in these areas. These measures included changes to aircraft/airport procedures (e.g., flight tracks, power settings), and changes to the affected land use (e.g., zoning, soundproofing, purchase of property, avigation easements). Additional noise analysis would also be included in a future environmental study for specific airport improvements.





0 1,200 2,400

Scale in feet

ZONING

Runway Alignment (Marks every 1,000')

Town Boundary

Approx. Airport Property Line

Zoning Limit

Town of Oxford

ZONE	Description
C	Commercial
CZ	Corporate Zone
ID	Industrial District
RD-A	Residential District - A

Source:Oxford Zoning Map

Town of Middlebury

ZONE	Description
R-40	Residential
R-80	Residential
R-40/PRD-1	Planned Residential Development
R-40/PRD-2	Planned Residential Development
R-40/PRD-3	Planned Residential Development
LI	Light Industry
SDD	Special Development District

Source:Official Middlebury, CT Zoning Map - May 1, 2003

LAND USE

- Airport Property
- Undeveloped, Open, Wooded
- Residential
- Commercial/Industrial
- State Park Trail
- Single family, Existing
- Single family, Post 2003
- Single family, Future*
- Commercial, Existing
- Commercial, Future*

*Per approved Site Plans provided by the Towns of Oxford and Middlebury

Miscellaneous

- 65 — 2003 Noise Contour with dB Level in DNL
- 65 — 2008 Noise Contour with dB Level in DNL

DNL = Day-Night Average Noise Level

Note:
No schools, churches, medical facilities or multi-family dwellings are located within the photo area

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Figure 5-1

NOISE EXPOSURE & LAND USE

Connecticut Department of Transportation
Waterbury-Oxford Airport Master Plan
Oxford, Connecticut

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5.2 Compatible Land Use

The Waterbury-Oxford Airport is located in both the Town of Oxford and the Town of Middlebury. The municipal boundary intersects the northern portion of the airport property adjacent to Runway 18. The majority of the Airport is in Oxford. Airport property boundaries and existing land use are also illustrated on Figure 5-1.

Surrounding Land Use

Airport property is surrounded by a mix of open, wooded, residential, commercial, and industrial land uses. The land to the south of the Airport is predominately wooded and/or open, with light industrial establishments along Christian Street and several low density residential areas south of an electrical transmission line. The Larkin State Park Trail is located just south of Runway 36. A wide mixture of industrial and residential land uses are located to the north and west of the Airport along Christian Street, Route 188, and other roadways. The land to the east is predominately wooded with scattered residential areas.

Residences are scattered along virtually every roadway in the airport vicinity (excluding I-84). The highest density of housing near the Airport is located to the north of Juliano Road and west of Christian Street (e.g., Triangle Hills.). This area includes over 50 single-family homes and is located one-quarter mile north of the runway.

To control land use immediately beyond runway ends, the FAA recommends easements or acquisition of the property within the Runway Protection Zones.

As discussed in Chapter 1, the development of a power plant has been proposed in Oxford, in a location approximately ½-mile to the east of the Airport. The power plant would be constructed within the planned Woodruff Hill Industrial Park, and operated by Calpine/Towantic Energy LLC. Although this development is not associated with the Airport or the Master Plan Update, it has been discussed throughout the process due to concerns regarding the emission of vertical plumes and their associated impact to aviation activity.

Based on these concerns, the FAA has agreed to conduct a "Safety Risk Analysis of Aircraft Overflight of Industrial Exhaust Plumes" for the development of the Calpine facility. The FAA analysis will address the appropriateness of the power plant site from an aviation safety standpoint. Based on their findings, the previous conclusions regarding the power plant may be revised, including re-examination of a 2001 Declatory Ruling for the proposed facility. Furthermore, if the development moves forward, Calpine/Towantic Energy will have to submit an FAA Notice of Actual Construction or Alteration (FAA Form 7460-2), which would prompt the FAA to perform an standard Aeronautical Study of the proposed project addressing airspace and obstruction issues.

Zoning

Zoning in the immediate vicinity of the airport is primarily industrial. However, areas to the north are zoned residential.

The Town of Oxford Zoning Regulations, last amended in February 2004, is the official zoning regulations for the Town. Lands located adjacent to the airport property are zoned Corporate, Industrial, or Residential District A. Land uses within the Corporate District include business or corporate offices, research and development facilities, data processing facilities, and manufacturing facilities. Land uses that are permitted in the Industrial District include professional offices, banks and financial industries, professional and corporate offices, and manufacturing and assembly facilities. Residential District A permits land uses consisting of single-family dwellings, offices or shops in single family dwellings, elder care facilities, farms, governmental buildings, and similar uses.

The Town of Middlebury Zoning regulations, last amended in March 2004, is the official zoning regulations for the Town. In Middlebury, land near the airport is zoned as Light Industry (LI-200), Residential (R-40, R-80 and R-40/PRD), and Special Development (SDD). The LI-200 district consists of lots larger than 200,000 square feet that can be used for executive or business offices, light manufacturing, warehousing, public utility substations, or other similar uses. Residential District R-40 consists of residential lots with a minimum lot size of 40,000 square feet. Residential District R-80 consists of residential lots with a minimum lot size of 80,000 square feet. Residential District R-40/PRD consists of residential lots with a minimum lot size of 40,000 square feet. The R-40/PRD District is intended to enable higher development densities in clusters, in order to protect sensitive environmental areas and enable more efficient construction.

5.3 Social & Induced Socioeconomic Impacts

Social and induced socioeconomic impacts are typically defined by disruptions to surrounding communities, such as shifts in patterns of population movement and growth, changes in public service demands, loss of tax revenue, and changes in employment and economic activity stemming from airport development. These impacts may result from the closure of roads, increased traffic congestion, acquisition of business districts or neighborhoods, and/or by disproportionately affecting low income or minority populations.

The recommended airport developments do not include projects with the potential for these types of broad impacts. Past FAA studies have identified that social and induced socioeconomic impacts are not normally significant unless substantial impacts are anticipated in other categories (e.g., noise, land use, property acquisition).

As part of the recommendations of the noise study and final recommendations of the Master Plan, voluntary acquisition of homes will be an available option. An EA would address the social impacts associated with implementation of voluntary home acquisition.

Although any affected homeowners would be fairly compensated and provided with related assistance, acquisition and removal/relocation of homes can also affect the neighborhood as a whole. Thus, such community/social impacts would also be evaluated.

5.4 Air Quality

The U.S. Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) for six air pollutants (i.e., ozone, carbon monoxide, particulates, sulfur dioxide, nitrogen dioxide, and lead). States must identify geographic areas, termed "nonattainment" areas, which do not meet the NAAQS. Areas that meet the NAAQS are termed "attainment" areas.

Federal regulations specify that an air quality analysis is not required if the project is located within an attainment area, and at a general aviation airport with less than 180,000 forecast operations. If these criteria are met, it is concluded that the proposed project would not cause significant air quality impacts.

The 2003 EA conducted an air quality analysis in accordance with National Environmental Policy Act requirements as specified in the Council on Environmental Quality's regulations, the Federal Aviation Administration's (FAA's) Order 5050.4A, Airports Environmental Handbook, and the FAA's Air Quality Procedures for Civilian Airports & Air Force Bases. The EA concluded there would not be an impact to air quality as a result of the Runway 18-36 extension.

The EPA classifies all of New Haven County as a Serious nonattainment area for 1-hour ozone, and a Moderate nonattainment area for 8-hour ozone, and a nonattainment area for Particulate Matter (PM-2.5). Therefore, an air quality analysis would potentially be required as part of an Environmental Assessment (EA) for OXC. Air quality impacts are not anticipated from the projects recommended in the AMPU.

5.5 Water Quality

Airport activities that can potentially impact surface water and groundwater include aircraft fueling, fuel storage, and aircraft maintenance. The addition of pavement (i.e. impervious surface) can also impact water quality at airports.

Surface water features in the vicinity of the Airport include a network of streams, wetlands, and floodplains that flow/drain south and west as part of the Little River watershed (see Figure 4-7). Little River itself is located south of the Airport and flows in a southerly direction to the Naugatuck River. The Connecticut DEP Aquifer Protection Program has determined that there are no State Identified Aquifer Protection Areas in the project area.

The proposed developments would result in an increased amount of impervious surface. Without mitigation measures, this new impervious surfacing could result in a variety of water quality impacts. Stormwater management during construction would conform to the "Best Management Practices" for control of erosion, sedimentation, and stormwater runoff, and would be incorporated into the construction specifications. In addition, a Stormwater Pollution Control Plan for the project would be developed as part of the application to ConnDEP for a General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities. The plan would include a description of the erosion and sedimentation controls to be used on the site, the management of dewatering wastewaters, the measures that would be installed to ensure post construction stormwater management, the disposal of waste at the site, and the practices to be followed to minimize off-site vehicle tracking of sediments and the generation of dust. As a result of these control measures during construction, no significant impact to stormwater management due to construction activities is expected. Both during and after construction, the Airport would continue operating in accordance with its existing stormwater permit (General Permit for Industrial Activities).

The plan would identify measures to avoid or minimize impacts to surface waters and groundwater at the site both during and after construction activities. The specific measures included in the Stormwater Pollution Control Plan would be determined during the design phase, and could consist of the installation of infiltration swales, vegetated buffer strips, silt fencing around the project area, vegetated open channels, hay bales and temporary slope drains, and/or a piped stormwater collection and conveyance system.

An EA would identify the total acreage of new pavement at OXC based on the project design and the potential water quality impacts associated with the impervious surface. Subsequently, with the required permits and standard safeguards described above employed during construction, impacts to water quality are not anticipated.

5.6 USDOT Section 4(f)

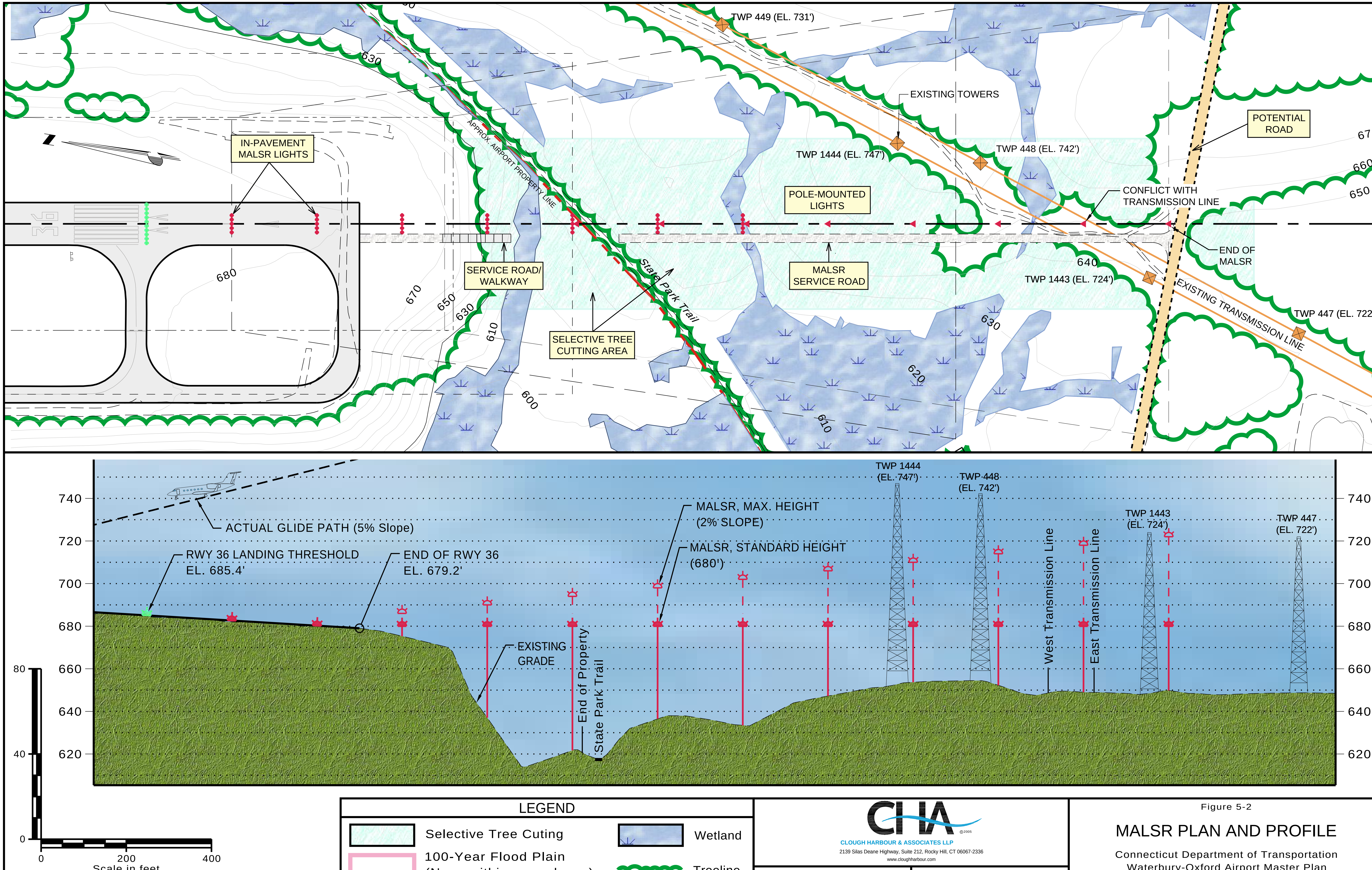
The U.S. Department of Transportation (USDOT) regulations prevent transportation projects from developing or taking publicly-owned land from a public park, recreational area, wildlife or waterfowl refuge, or historic site unless there are no feasible alternatives, and planning to minimize harm and mitigation measures have been incorporated.

Larkin State Trail (south of OXC)

The Larkin State Trail, located beyond the southern boundary of the airport property, is an 11 mile multi-use recreational trail that connects the towns of Southbury, Oxford, Middlebury, and Naugatuck. The trail is located on top of a former New Haven Railroad corridor, has a 100-foot wide right-of-way, and has a conglomerate surface of gravel, ballast, and cinder. The trail is owned and maintained by the Connecticut DEP State Parks Division. Due to proximity, the Trail is directly associated with and monitored by the Southford Falls State Park in Southbury. The Connecticut DEP permits the following recreational activities; walking, horseback riding, cross country skiing, and mountain biking. Given the level and types of public use of the trail, the trail is considered a Section 4(f) resource.

Larkin State Trail at power line crossing

Specifically, the recommended plan for OXC would include development of an approach lighting system that crosses the trail. The pole mounted lights would be located near the trail right-of-way, but positioned to avoid any direct impact (see Figure 5-2). No lighting impacts are anticipated since the trail is not open after dusk. A Section 4(f) resource evaluation would potentially be required as part of an Environmental Assessment (EA) to determine any visual impacts on the trail. The lighting system itself is not likely to directly impact the trail or affect its use.



LEGEND

Selective Tree Cuting	Wetland
100-Year Flood Plain (None within area shown)	Treeline

CLOUGH HARBOUR & ASSOCIATES LLP
2139 Silas Deane Highway, Suite 212, Rocky Hill, CT 06067-2336
www.cloughharbour.com

DATE: SEPTEMBER 2005
SCALE: AS NOTED

Figure 5-2

MALSR PLAN AND PROFILE

Connecticut Department of Transportation
Waterbury-Oxford Airport Master Plan
Oxford, Connecticut

File: U:\12489\ACAD\MC_PLAN-PROFILE12489.DWG Saved: 8/23/2005 8:21:54 AM User: Medina, Perry

5.7 Cultural Resources

According to correspondence contained in the 2003 EA, the Connecticut State Historic Commission (SHPO) determined that the recent runway extension project would have no effect on historic, architectural, or archaeological resources listed on or eligible for the National Register of Historic Places. The SHPO recommends that concerned citizens be afforded the opportunity to review and comment upon future proposed undertakings in accordance with the National Historic Preservation Act of 1966 and the Connecticut Environmental Policy Act. Thus, as part of a future EA further coordination with the SHPO and potential cultural resource investigation would be required. However, based on the location and moderate level of recommended development, no cultural impacts are anticipated from the Master Plan's implementation.

5.8 Biotic Communities

According to a 2003 consultation with the DEP Natural Diversity Data Base (from an earlier EA), wildlife habitat in the project area includes upland deciduous forest with areas of fallow field, treed swamp, and limited open wetland. The airport property area is maintained as open, mowed fields. These communities are described below:

- **Deciduous Forested –** broad leaf trees such as Hickory, Oak, Maple, and Sumac Basswood. The understory consists of Redbud, Spicebush, and Buttonbush.

- **Treed Swamp –** forest swamp species such as Ash, Red Maple, Alders, and Yellow Birch, and shrubs including spicebush, arrowwood, and sweet pepperbush.

- **Wetlands –** areas of land with hydric soil, hydrophytic vegetation (plant types adapted to living in saturated soils), and ground or surface water for a significant part of the growing season.

- **Maintained Field –** open, successional fields that are periodically mowed and maintained.

An EA would evaluate the areas of potential disturbance and impacts to biotic communities. Based on past studies, impacts to the above communities would not typically be considered significant, with the exception of the wetland communities, as discussed in section 5.10.

5.9 Threatened & Endangered Species

Correspondence with the US Fish and Wildlife Service was conducted most recently in October 2001 to request information regarding the presence of federally-listed and proposed, endangered or threatened species. The response to the inquiry indicated that no federally-listed threatened or endangered species are known to occur in the project area. However, the US Fish and Wildlife Service has acknowledged the occurrence of occasional transient bald eagles. Furthermore, the "Town of Oxford State and Federal Listed Species and Significant Natural Communities" map indicates that the Airport is not located within an endangered species/communities area.

Updated correspondence with the U.S. Fish & Wildlife Service (FWS) and Connecticut Department of Environmental Protection (CT DEP) would be obtained as part of an EA. If necessary, field surveys during nesting and other periods would be conducted to identify the presence or absence of critical species and assess the suitability of the habitat to support the species. Field surveys can identify the activities of any threatened and endangered species in the project area, which can then be used to devise mitigation measures for identified impacts.

5.10 Wetlands

The Town of Oxford regulates activities within the wetlands of its municipal boundaries, pursuant to the Inland Wetlands and Watercourses Act of the Town of Oxford. However, since the Airport is located on State property, the Connecticut Department of Environmental Protection oversees activities that impact the identified wetlands. There are wetlands located on airport property within the Town of Middlebury, but these areas are not under consideration for development.

A wetland delineation on airport property identified 18 wetland areas in the immediate vicinity of Runway 18-36. Wetlands were delineated based on federal and state definitions, and are located on the western, southern, southeastern, and eastern edges of the airport. Based on medium intensity soil mapping from the Soil Conservation Service (SCS) Soil Survey Maps for New Haven County, the following wetland soil series occur on the airport property: Ridgebury, Leicester, and Whitman Complex. There are also Aquents, which are disturbed wetland soils, on the airport property. The following upland (non-wetland) soil series occur on the airport property: Charlton, Charlton-Hollis Complex, Hollis-Charlton Complex, and Udorthents (made land). Figure 4-7 illustrates the location of existing wetlands. This detailed figure illustrates federally-regulated and state-regulated wetlands.

Little River wetlands
(southeast border of airport property)

The Little River system comprises the backbone of all of the wetlands on the airport property. Little River originates in Oxford and flows in a southerly direction to the Naugatuck River, which in turn drains into the Housatonic River and ultimately into Long Island Sound near Bridgeport.

The wetlands on the western side of the airport are hydraulically connected by an unnamed intermittent stream that flows south to Little River. The wetlands on the southern and eastern sides of the airport are part of the Little River system and are hydraulically connected by the Little River and some small, unnamed tributaries that flow south into Little River. The wetland types include deciduous wooded swamp, shrub swamp, wet meadow, and open water. These wetland types are interspersed throughout the property and, in most cases, are directly associated with or adjacent to upland wooded areas. Although these wetlands are proximate to airport runways and taxiways, they are separated from the airport elements by areas of upland vegetation or topographic variation.

The most dominant wetland type in the vicinity of the airport is deciduous wooded swamp, comprised primarily of red maples (*Acer rubrum*). Other common vegetation that can be observed in the area includes: green ash (*Fraxinus pennsylvanica*), oak species (*Quercus spp.*), spicebush (*Lindera benzoin*), multiflora rose (*Rosa multiflora*), jewelweed (*Impatiens capensis*), skunk cabbage (*Symplocarpus foetidus*), common cattail (*Typha latifolia*), common reed grass (*Phragmites australis*), and reed canary grass (*Phalaris arundinacea*). The largest concentrations of red maple swamp are on the eastern, southern, and southwestern fringes of the Airport. Beavers are very active in the area. Many of the wetlands located within as well as beyond the airport perimeter fence have pockets of standing water that have been created by beaver activity.

Red maple swamp on airport property (adjacent to southeastern end of Runway 36)

Beaver dam (southern end of airport property).

The primary functions of the subject wetlands are sediment/toxicant retention, as they trap sediments and toxicants in runoff from the nearby airport before the runoff enters adjacent streams, and wildlife habitat, since the diverse wetland types, vegetation, and water regimes provide a wide variety of food sources and habitat features. The areas surrounding the airport are mostly undeveloped, and the density and cover of vegetation provide ideal corridors and habitats for a wide variety of wildlife species anticipated to include (but not be limited to:) beaver, deer, coyote, mustelids (weasel, mink), lagomorphs (rabbits), amphibians, and woodland songbirds. Some of the secondary functions associated with the wetlands include flood storage of the Little River system, which occurs in the flatter, vegetated wetlands, and fish habitat in some of the many beaver ponds and larger streams.

Most of the recommendations for OXC would involve the development of new facilities on upland areas surrounding the airfield, and new taxiways within the existing airfield area.

However, two of the projects include development in locations that contain areas of regulated wetlands. The extension of Parallel Taxiway "B" Alternative 1B would likely impact all (approximately 3.8 acres) of Wetland #1 since it would require filling the area to raise the grade to match the elevation of the existing airfield. The on-airport service road Alternative 1A would impact up to 0.1 acres of Wetlands #2 and #5.

Required mitigation would involve wetland re-creation of approximately eight acres, ideally within the same drainage system. A review of suitable uplands on airport property revealed a lack of continuous acreage for on-site wetland re-creation. As such, off-site mitigation areas within the immediate area would have to be reviewed for suitability of wetland re-creation. Appendix D consists of a Conceptual Wetland Mitigation Plan, which discusses potential on- and off-airport locations for wetland mitigation. The wetland impact and re-creation would require a U.S. ACOE Wetland Permit and ConnDEP Inland Wetlands Permit.

5.11 Floodplains

The Federal Emergency Management Agency (FEMA) publishes Flood Insurance Rate Maps (FIRMs) that depict 100-year and 500-year floodplains in many areas throughout the country. A 100-year floodplain is an area that has a 1% chance of being flooded in any given year. A 500-year floodplain is an area that has a 0.2% chance of being flooded in a given year.

Review of the FEMA Flood Insurance Rate Map indicates that 100-year and 500-year floodplains (tributaries of Little River) are located within OXC property near the Runway 36 end, as illustrated on Figure 4-7. The recommended MALSR development may require that one pole be located within the 500-year floodplain, but only minimal impervious surface would be included. As such, no significant impacts to the 500-year floodplain are anticipated with the MALSR development. No other floodplain impacts are anticipated with the recommended developments.

5.12 Coastal Zone Management Program & Coastal Barriers

The Waterbury-Oxford Airport is not located within a coastal zone and is not within the jurisdiction of the Coastal Zone Management Program.

5.13 Wild & Scenic Rivers

No state- or federally-designated wild or scenic rivers are present within the airport vicinity.

5.14 Farmland

The Natural Resource Conservation Service (NRCS), within the United States Department of Agriculture (USDA), has established guidelines under the Farmland Protection Policy Act (FPPA) for federal activities that involve directly undertaking, financing, or approving a project that would convert farmland soils. The guidelines recognize that the quality of farmland varies based on soil conditions, and places higher value on soils with high productivity potential. To preserve these highly productive soils, the NRCS classifies soils types as prime and statewide important. The NRCS requires that soils in these categories be given proper consideration before they are converted to non-farming uses by federal programs.

The airport property is primarily composed of Urban Development soil type (UD). The north end of the airport at the Oxford-Middlebury Town line contains a soil of Statewide Importance, Paxton fine sand loam (PbC). This soil has 8 to 15 percent slopes. The area has been cleared and graded, and contains buildings or is forested. Farming is not an activity in the area, and is not expected to be used for future farming activity.

The majority of the recommended developments would not impact farmland soils. However, the construction of a service road through the northern portion of the airport property would occupy PbC for nonagricultural uses. As such, coordination with the NRCS and completion of a Farmland Conversion Impact Rating Form (Form AD-1006) may be required as part of an EA. As these locations contain no farming operations and cannot be used for agricultural purposes under any foreseeable scenario, Form AD-1006 would indicate no anticipated impacts.

5.15 Energy Supply & Natural Resources

Proposed developments, such as taxiways, hangars and lighting, and an increase in airport activity at OXC would result in additional use of energy and resources. An EA would evaluate impacts to the local energy supply. As all of the recommended projects would have low to moderate energy requirements, no significant impacts are anticipated.

5.16 Light Emissions

Chapter 4 recommended the development of a Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR) at Runway 36 (See Figure 5-2).

The MALSR would consist of both steady burning and flashing lights. The first seven light poles (extending 1,400 feet beyond Runway 36) would consist of the steady burning lights, which are not generally known to cause disturbance to nearby residents and property owners. The last five light poles (extending an additional 1,000 feet) of the proposed MALSR system would contain flashing lights, which are more conspicuous than the steady burning lights. These lights have the potential to disturb nearby residents.

Although the MALSR would cross the Larkin State Trail, no lighting impacts are anticipated since the trail is not open after dusk. Additionally, since no residences are located nearby Runway 36 and a dense area of trees is located within the area of the proposed MALSR system, no lighting impacts on residences are anticipated. The MALSR system is consistent with the industrial zoning of the area. In order to install and operate the MALSR system, selective tree removal would be required within 200 feet of the MALSR centerline. A gravel service road and associated right-of-way would also be needed.

The MALSR system would enable aircraft to land at OXC during low visibility conditions and improve safety by enhancing visual reference to pilots. However, the system does not change or reduce the height or angle of the flight path to the runway end. The approach path and angle to the runway would continue to be controlled by the existing visual and electronic glide slopes (i.e., Precision Approach Path Indicator and Instrument Landing System).

5.17 Solid/Hazardous Waste

The 2003 EA identified no hazardous waste disposal sites on or in the vicinity of airport property. However, fuel is stored at the airport by Keystone Aviation, ConnDOT, Double Diamond Aviation, and Executive Flight Services. Keystone Aviation maintains four 20,000 gallon double-walled above ground storage tanks on the western side of the airport north of the control tower. ConnDOT stores fuel in two 1,000-gallon double-walled above ground (self contained) tanks. Both tanks are located south of the airport manager's office. Double Diamond Aviation and Executive Flight Services each maintain one double-walled fuel tank, 15,000 and 8,000 gallons, respectively.

5.18 Construction Impacts

Construction projects can produce temporary environmental disturbances, such as noise from equipment, air quality impacts from dust, soil erosion, and sedimentation, and disruption of off-site and local traffic patterns. These impacts can be mitigated through careful planning and consideration, as well as quality construction supervision.

Noise impacts from construction equipment can be lessened through the use of properly mufflerized vehicles. Enforcing the contractor to conduct activities within the daytime work hours would prevent nighttime noise impacts.

The construction specifications for the recommended projects at OXC would incorporate the appropriate "Best Management Practices" for control of erosion, sedimentation, and storm water runoff. In addition, a Stormwater Pollution Control Plan for the projects would be developed as part of the application to ConnDEP for a General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities. The plan would identify measures to avoid or minimize impacts to surface waters and groundwater at the site both during and after construction activities. The specific measures included in the plan would be determined during the design phase, and could consist of the implementation of infiltration swales, vegetated buffer strips, vegetated open channels, and/or a piped stormwater collection and conveyance system. The goal of the plan would be to minimize runoff and replicate pre-construction hydrology. Temporary disturbance areas would be re-seeded and stabilized following construction. Post construction controls would be maintained on a regular basis.

The proposed developments would require the importation of construction materials from off site locations. A designated haul route would be supplied to the contractor, and the contractor would repair any damage to roadways at the end of construction.

With the standard safeguards described above, significant construction impacts are not anticipated.

5.19 Secondary & Cumulative Impacts

Secondary impacts occur when one project fosters, encourages, and/or enables another project with environmental impacts. Cumulative impacts consider past, present, and reasonably foreseeable actions, based on the fact that environmental impacts can accumulate over time. The recommended developments at OXC would not change the general character of the area. Nevertheless, an EA would be required to evaluate the secondary and cumulative impacts associated with the recommendations from this Master Plan Update and recent or planned projects in the vicinity of the Airport.

5.20 Potential Environmental Permits

If developments are pursued, the following environmental permits could potentially be required during the project design phase:

- U.S. ACOE Wetland Permit
- ConnDEP Section 401 Water Quality Certification
- ConnDEP Inland Wetlands Permit
- ConnDEP Stormwater and Dewatering Wastewaters from Construction Activities Permit

6.0 RECOMMENDED PLAN

This chapter presents the Airport Layout Plan (ALP) for the recommended developments at Waterbury-Oxford Airport (OXC), and the associated Airport Capital Improvement Plan (ACIP). The ALP illustrates the recommended future airport layout, and serves as the official development plan for the Airport. A number of additional drawings that illustrate surrounding airspace and adjacent land use support the ALP. The combined set of drawings is termed the ALP Drawing Set, and is provided in Appendix E.

This chapter contains the following sections:

- Summary of the Recommended Plan
- Airport Capital Improvement Plan
- Airport Layout Plan

6.1 Summary of the Recommended Plan

Chapter 4 presented the overall recommended airport development plan for OXC. The plan contains recommendations for airfield and landside development, which have been organized into three implementation phases. The recommendations include the following:

Phase I (0 to 5 years)

1A **-** Extension of parallel Taxiway "B" south to the runway end (design, EA, permitting)
1B **-** Extension of exit Taxiway "E" on the west side of the runway to Taxiway "A"
1C **-** Airport service road construction parallel to Taxiway "A" (west side of airfield)
1D **-** T-hangar development adjacent to the Northeast Ramp
1E **-** T-hangar construction on the existing Northeast Ramp
1F **-** Expansion of the South Ramp
1G **-** Expansion of the Executive Flight Ramp
1H **-** Equipment Building Construction

Phase II (6 to 10 years)

2A **-** Extension of parallel Taxiway "B" south to the runway end (wetland mitigation)
2B **-** Extension of parallel Taxiway "B" south to the runway end (construction)
2C **-** Airport service road construction parallel to Taxiway "B" (east side of airfield)
2D **-** Burial/lowering of Northeast Utilities electrical lines and selective tree removal
2E **-** Expansion of the Transient Apron
2F **-** Construction of a bi-directional exit taxiway for Runway 18 landings
2G **-** Installation of MALSR approach lights for Runway 36

Phase III (11 to 20 years)

3A **-** Extension of exit Taxiway "H" on the east side of the runway to Taxiway "B"
3B **-** Airport service road construction north of Runway 18

3C - Airport service road construction to the Fuel Farm
3D - Hangar development south of Hangar "G"
3E - Taxiway "D" relocation

With the exception of the parallel Taxiway "B" extension, the recommended projects are not anticipated to result in significant environmental impacts. The Environmental Overview (Chapter 5) identified nearly four acres of wetland impacts resulting from the parallel Taxiway "B" extension, which would likely require offsite mitigation/replacement (see Appendix D). Due to the cost and complexity of this extension, it has been divided into three separate projects in Phases I and II of the ACIP (i.e., Projects 1A, 2A, and 2B).

6.2 Airport Capital Improvement Plan

The Airport Capital Improvement Plan (ACIP) lists the recommended projects and associated cost estimates for the 20-year planning period. Grant-eligible projects at OXC may receive 95% federal funding; ConnDOT would be responsible for the remaining 5%. Grant-eligible capital projects include planning and environmental studies, runway and taxiway development/rehabilitation, airport lighting, security enhancements, aircraft parking aprons, access roads, obstruction removal, land acquisition, and navigational aids.

Projects that are ineligible for funding include those that generate revenue and do not directly benefit the general public, such as hangars, fuel farms, and office buildings. A private party/developer (e.g., FBO or corporation) may fund and construct grant-ineligible projects under a lease agreement with ConnDOT. In some cases, ConnDOT may fund the total cost of an ineligible project, or an eligible project with a lower FAA priority (e.g., vehicle garage).

In addition to the potential new airport developments, the Airport must also continually rehabilitate existing airfield facilities (e.g., pavement rehabilitation typically occurs every 20 years) and replace maintenance equipment (e.g., snow plows). As such, the ACIP includes these additional items. Although these items are not considered new capital developments, the associated costs can comprise the majority of an airport's annual capital investment. Additionally, recommendations of the OXC FAR Part 150 Noise Study may require significant expenditures for a potential multi-year property acquisition and/or a noise insulation program. As such, potential noise mitigation expenditures are also included in the ACIP.

Note that the ACIP does not constitute a commitment on behalf of the FAA or ConnDOT to fund any of the projects. In addition, the ACIP does not imply that the projects would receive environmental approvals. Thus, the ACIP serves as a planning document that must remain flexible. The ACIP should undergo regular updates as project priorities and demands indicate.

Table 6-1 provides the 20-year ACIP for OXC, organized into the following three phases:

- Phase I (0 to 5 years)
- Phase II (6 to 10 years)
- Phase III (11 to 20 years).

TABLE 6-1 – AIRPORT CAPITAL IMPROVEMENT PLAN				
Project	**Total Estimated Cost**	**Anticipated Funding Source**		
		FAA	**State**	**Private**
PHASE I - (0 TO 5 YEARS)				
1.A. Extend Taxiway "B" (Design, EA, Permitting)	**$430,000**	$408,500	$21,500	
1.B. Extend Exit Taxiway "E"	**$325,000**	$308,750	$16,250	
1.C. Service Road Construction (West Side Airfield)	**$300,000**	$285,000	$15,000	
1.D. T-Hangar Development	**$2,300,000**			$2,300,000
1.E. T-Hangar Construction (NE Ramp)	**$860,000**			$860,000
1.F. Expand South Ramp[1]	**$420,000**			$420,000
1.G. Expand Executive Flight Ramp[1]	**$750,000**			$750,000
1.H. Construct Equipment Building	**$450,000**		$450,000	
Generator for State Building	**$300,000**		$300,000	
Signage Upgrades	**$30,000**		$30,000	
Security Improvements	**--**		UNDISCLOSED	
Noise Implementation Program	**$500,000**	$475,000	$25,000	
Implementation of Noise Study Recommendations (Multi-Year)[2]	**$5,000,000**	$4,750,000	$250,000	
Phase I Subtotal	**$11,665,000**	**$6,227,250**	**$1,107,750**	**$4,330,000**
PHASE II - (6 TO 10 YEARS)				
2.A. Extend Taxiway "B" (Wetland Mitigation)	**$1,600,000**	$1,520,000	$80,000	
2.B. Extend Taxiway "B" (Construction)	**$3,110,000**	$2,954,500	$155,500	
2.C. Service Road Construction (East Side Airfield)	**$200,000**	$190,000	$10,000	
2.D. Burial/Lowering Elec. Lines & Tree Removal[3]	**$5,000,000**	$2,375,000	$125,000	$2,500,000
2.E. Expand Transient Apron	**$170,000**	$161,500	$8,500	
2.F. Exit Taxiway Construction	**$420,000**	$399,000	$21,000	
2.G. Runway 36 MALSR Installation[4]	**$700,000**	$700,000		
Vehicle/Equipment Purchase	**$250,000**	$237,500	$12,500	
Rehabilitate/Resurface Main/Transient Ramp[5]	**$1,900,000**	$1,805,000	$95,000	TBD
Rehabilitate/Resurface Runway 18-36	**$4,000,000**	$3,800,000	$200,000	
Rehabilitate/Resurface NE Ramp	**$930,000**	$883,500	$46,500	
Rehabilitate/Resurface South Ramp	**$540,000**	$513,000	$27,000	
Rehabilitate/Resurface NW Ramp	**$1,000,000**	$950,000	$50,000	
Implementation of Noise Study Recommendations (Multi-Year)[2]	**$5,000,000**	$4,750,000	$250,000	
Phase II Subtotal	**$24,820,000**	**$21,239,000**	**$1,081,000**	**$2,500,000**

TABLE 6-1 – AIRPORT CAPITAL IMPROVEMENT PLAN (CONTINUED)				
Project	**Total Estimated Cost**	**Anticipated Funding Source**		
		FAA	**State**	**Private**
PHASE III - (11 TO 20 YEARS)				
3.A. Extend Exit Taxiway "H"	**$325,000**	$308,750	$16,250	
3.B. Service Road Construction (North Runway 18)	**$460,000**	$437,000	$23,000	
3.C. Service Road Construction (Fuel Farm)	**$150,000**	$142,500	$7,500	
3.D. Hangar Development[5]	**$10,000,000**			$10,000,000
3.E. Taxiway "D" Relocation	**$1,000,000**	$950,000	$50,000	
Vehicle/Equipment Purchase	**$500,000**	$475,000	$25,000	
Rehabilitate/Resurface Taxiway "A"	**$1,900,000**	$1,805,000	$95,000	
Rehabilitate/Resurface Taxiway "B"	**$2,300,000**	$2,185,000	$115,000	
Rehabilitate/Resurface Taxiway "C"	**$290,000**	$275,500	$14,500	
Rehabilitate/Resurface Taxiway "E"	**$290,000**	$275,500	$14,500	
Rehabilitate/Resurface Taxiway "G" (East Half)	**$160,000**	$152,000	$8,000	
Rehabilitate/Resurface Key Air Apron	**$740,000**			$740,000
Rehabilitate/Resurface T-Hangar Taxi Lanes	**$780,000**			$780,000
Rehabilitate/Resurface Double Diamond Apron	**$310,000**			$310,000
Rehabilitate/Resurface Executive Flight Ramp[6]	**$630,000**	$598,500	$31,500	TBD
Implementation of Noise Study Recommendations (Multi-Year)[2]	**$5,000,000**	$4,750,000	$250,000	
Phase III Subtotal	**$24,835,000**	**$12,354,750**	**$650,250**	**$11,830,000**
GRAND TOTAL	**$61,320,000**	**$39,821,000**	**$2,839,000**	**$18,660,000**

Note: Actual costs to be determined based upon final design
[1]Privately funded if conducted in coordination with project 1E
[2] This value is a placeholder for long-term planning purposes and does not represent anticipated funding. Preliminary cost estimates and schedule are provided in the FAR Part 150 Noise Study. Actual costs would be determined at the time of implementation.
[3]NE Utilities may fund some of the project cost
[4]Assumed FAA installation
[5]May involve private funding for leased portion of apron
[6]Cost would depend on hangar size/layout

6.3 Airport Layout Plan

The ALP drawings illustrate all development projects identified for OXC throughout the 20-year planning horizon. Upon approval by ConnDOT and the FAA, the ALP becomes the official development document for the Airport. The FAA requires that all new airport facilities be consistent with the ALP. As such, keeping the drawings accurate and up to date is a high priority. FAA policy now requires that the ALP be updated at least every five years.

Although the ALP is the only drawing that is signed by the FAA, it is part of a larger drawing set that includes the sheets listed below.

DRAWING INDEX		
Sheet No.	**Sheet Title**	**Drawing No.**
	Cover Sheet & Drawing Index	---
1	Existing Airport Layout	ALP-1
2	Airport Layout Plan	ALP-2
3	Data Sheet	ALP-3
4	Inner Approach Surface Drawing - Runway 18-36	ALP-4
5	Airport Airspace Plan	ALP-5
6	Land Use Plan	ALP-6
7	Airport Property Plan	ALP-7
Note: The ALP Drawing Set is provided in Appendix E.		

6.3.1 Existing & Proposed Airport Layout Plan

The first sheet of the drawing set (ALP-1) illustrates the existing airport layout. This sheet depicts the Airport as it exists today. The drawing identifies key FAA airfield design standards (e.g., Runway Safety Areas, Object Free Areas, Runway Protection Zones), and illustrates existing landside facilities. Key information, such as runway end elevations and runway-taxiway offsets, is illustrated on ALP-1.

The proposed ALP (ALP-2) includes all features of ALP-1, and illustrates each recommended facility for OXC. Several offices within the FAA review this drawing for consistency with airport design standards, flight procedures, surrounding airspace, and environmental requirements. Approval of ALP-2 represents the acceptance of the general location of future facilities. However, prior to the development phase of each project, ConnDOT is required to submit the final locations, heights, and exterior finish of each proposed structure for approval. ALP approval does not represent environmental clearance under the National Environmental Policy Act (NEPA) or Connecticut Environmental Policy Act (CEPA), or compliance with permit requirements. Such approvals must be obtained prior to development, and are not part of the ALP process.

It is also noted that ALP approval does not represent a commitment on behalf of ConnDOT, the FAA, or others to fund or pursue the projects depicted. Rather, the Master Plan Update and associated ALP represent the first products of the planning and development process, and are intended to depict a broad and long-range view of the potential improvements to the Airport.

The ALP drawings were prepared in accordance with FAA design standards for Airport Reference Code (ARC) D-III. Aircraft within ARC D-III include the Gulfstream V and Global Express, which are based at OXC.

The following publications were used during the drawing preparation:

- FAA Advisory Circular 150/5300-13, *Airport Design*
- FAA Advisory Circular 150/5070-6B, *Airport Master Plans*
- Federal Aviation Regulations, Part 77, Objects Affecting Navigable Airspace

The major proposed facilities on the ALP include taxiway improvements, a service road, apron expansion, and hangars. A substantial amount of pavement rehabilitation and maintenance is also incorporated into the ACIP. Finally, it is worth highlighting that no new runway or runway extension is included on the ALP.

Currently, Runway 36 has a precision instrument approach using an Instrument Landing System (ILS). To provide the lowest visibility minimums possible for a precision approach (½ mile is the lowest visibility minimum for a standard "Category I" procedure), the runway end must be equipped with an Approach Lighting System (ALS). Runway 36 currently provides Runway End Identifier Lights (REILs), which consist of strobe lights at the runway end. However, the standard lighting system for airports with an ILS is a Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR), and is recommended for Runway 36. If the MALSR is installed, and all critical obstructions are removed, the visibility minimums for the Runway 36 ILS would decrease to ½ mile.

Currently, Runway 18 has a non-precision instrument approach, with no runway approach lighting. During the planning period, it is recommended that the FAA publish an LPV approach using satellite-based GPS on Runway 18. Although runway approach lighting is not required for this approach, REIL installation is recommended. An LPV approach is also recommended on Runway 36 to provide a backup system for the ILS.

The Runway Protection Zone (RPZ) is a ground area that underlies the inner portion of each runway approach. The purpose of the RPZ is to provide land use protections beneath the inner portion of the approach surface, thereby enhancing the protection of people and property on the ground. The dimensions of the OXC RPZs are listed in Table 9-2 below.

TABLE 6-2 – RUNWAY PROTECTION ZONE DIMENSIONS				
Runway End – Current	**Visibility Minimum**	**Inner Width**	**Outer Width**	**Length**
Runway 18 (Non-Precision)	1-mile	500’	1,010’	1,700’
Runway 36 (Precision)	1-mile	500’	1,010’	1,700’
Runway End – Proposed	**Visibility Minimum**	**Inner Width**	**Outer Width**	**Length**
Runway 18 (LPV)	1-mile	500’	1,010’	1,700’
Runway 36 (Precision w/MALSR)	½-mile	1,000’	1,750’	2,500’

The lower visibility minimum that would be enabled by the Runway 36 MALSR would change the size of the Runway Protection Zone (RPZ), as depicted on ALP-2. The MALSR installation would first require removing or lowering the Northeast Utilities electrical towers located beyond the runway end, as well as burying or lowering the associated lines.

6.3.2 Airport Airspace Plan

The next two sheets of the ALP Drawing Set (ALP-4 and 5) illustrate the airspace requirements described in Federal Aviation Regulations (FAR) Part 77, Objects Affecting Navigable Airspace. Part 77.23 identifies a series of geometric planes (i.e., imaginary surfaces) that extend outward and upward from the Airport’s runways and define the obstruction clearing requirements. These surfaces identify the maximum acceptable height of objects by defining three-dimensional surfaces surrounding all sides of the airfield. When an object penetrates an imaginary surface, it is considered an airspace obstruction, and may present a hazard to air navigation.

The height and dimensions of the imaginary surfaces are determined by the airfield elevation, design aircraft, and the type of approach to each runway end. The specific surfaces for OXC are described below.

Primary Surface: A surface longitudinally centered at the runway elevation extending 200 feet beyond each runway end. The width of the primary surface is 1,000 feet for precision instrument Runway end 36 and 500 feet for non-precision Runway end 18. However, the primary surface of a runway is defined as the largest width required by either runway end, and therefore, the width of the entire Runway 18-36 primary surface is 1,000 feet.

Horizontal Surface: A horizontal plane 150 feet above the airport elevation. The elevation of OXC is 725 feet above mean sea level (MSL); therefore, the horizontal surface at OXC is situated at 875 feet above MSL. The shape of the surface is created using radial arcs of 10,000 feet from the ends of the primary surface, connected by lines tangent to the arcs.

Conical Surface: A surface extending outward and upward from the periphery of the horizontal surface at a slope of 20 to 1, for a horizontal distance of 4,000 feet. At OXC, the elevation of the outer edge of the conical surface is 1,075 feet above MSL.

Approach Surface: Surfaces longitudinally centered on the extended runway centerlines, extending outward and upward from the ends of the primary surface. For OXC, the dimensions and slopes of the approach surfaces are listed below.

TABLE 6-3 – APPROACH SURFACE DIMENSIONS				
Runway End – Current	**Inner Width**	**Outer Width**	**Length**	**Slope**
Runway 18 (Non-Precision)	1,000’	3,500’	10,000’	34:1
Runway 36 (Precision)	1,000’	16,000’	50,000’	50:1 & 40:1*
Runway End – Proposed	**Inner Width**	**Outer Width**	**Length**	**Slope**
Runway 18 (LPV)	1,000’	3,500’	10,000’	34:1
Runway 36 (Precision)	1,000’	16,000’	50,000’	50:1 & 40:1*
*50:1 for the first 10,000 feet, then 40:1 thereafter.				

Transitional Surface: Surfaces extending outward and upward at right angles from the sides of the primary and approach surfaces at a slope of 7 to 1. The transitional surfaces terminate at the overlying horizontal surface.

Objects that penetrate into an imaginary surface are depicted on ALP-4 and ALP-5.

Sheet 4, the Inner Approach Surface Plan and Profile Drawing, provides greater detail regarding the close-in airspace obstructions, particularly to the inner portions of each approach surface. For each obstruction, the height, penetration, ownership, and proposed action/disposition are indicated in the associated tables.

A few close-in trees penetrate the primary and transitional surfaces on the south end of the airfield. These include several trees within the wetland east of Runway 18-36, as well as other sporadic trees near the edges of the primary surface. Removal of these trees, which are located on airport property, is recommended, as illustrated on ALP-4.

Several trees penetrate the precision approach surface to Runways 36. However, many of these obstructions are mitigated by a 500-foot displaced threshold. As such, the obstruction analysis also included the Threshold Siting Surface (TSS), as depicted on ALP-4. The TSS identified a scatter of tree penetrations located approximately 2,000 feet southeast of Runway 36 on undeveloped industrially-zoned property. Although Runway 36 approach surface obstructions remain undesirable, operational safety would be provided by clearing the TSS to the displaced threshold. Clearing of these trees would require easements from the property owners.

In addition to the tree penetrations in the Runway 36 approach surface, several Northeast Utilities electrical transmission towers are located within the RPZ, and penetrate the 50:1 approach surface and the 34:1 TSS. Although these towers are equipped with obstruction lighting, removal or lowering of the towers and burial or lowering of the associated lines is recommended to improve safety. This should be done prior to the tree removal discussed above, as the towers are the current "controlling" obstruction. Note that the tower removal is required in order to install the recommended MALSR.

No approach surface penetrations have been identified for non-precision Runway 18. However, RPZ issues have been identified for Runway 18, as described in the Section 6.3.3.

Sheet 5, Airport Airspace Plan, illustrates the overall dimensions of the Part 77 surfaces, and highlights penetrations to the outer surfaces. As shown, there are only a handful of identified penetrations to the outer portions of the imaginary surfaces. These include trees and towers, which range in height from 900 to 964 feet MSL. Obstruction lighting is provided on all but one of the identified tower penetrations.

6.3.3 Land Use Plan

Airport property is surrounded by a mix of open, wooded, residential, commercial, and industrial land uses, as depicted on ALP-6, Land Use Plan. The land to the south of the Airport is predominately wooded and/or open, with light industrial establishments along Christian Street, and several low density residential areas south of an electrical transmission line. The Larkin State Park Trail is located just south of Runway 36. A wide mixture of industrial and residential land uses are located to the north and west of the Airport along Christian Street, Route 188, and other roadways. The land to the east is predominately wooded with scattered residential areas.

Residences are scattered along virtually every roadway in the vicinity of the Airport (excluding I-84). The highest density of housing near the Airport is located to the north of Juliano Road and west of Christian Street (i.e., the Triangle Hills neighborhood). This area includes over 50 single-family homes and is located one-quarter mile north of the runway. In this vicinity, an additional 19 homes are located along Christian Street.

To control land use immediately beyond runway ends, the FAA recommends easements or acquisition of the property within the RPZs. Approximately 31 residences exist within the RPZ north of the runway in the Triangle Hills neighborhood. Voluntary acquisition of homes within this RPZ is recommended, particularly with additional consideration of their exposure to aircraft noise. South of the runway, the Airport does not control all land within the existing or future RPZ, but no development currently exists. For this industrially-zoned area, easements are recommended to control development. Areas of suggested property acquisition and easement are illustrated on the ALP drawings.

Other than the RPZ issues described above, land use compatibility is primarily related to airport noise exposure. The residential area that would experience the highest noise levels would continue to be north of the Airport in and near the Triangle Hills neighborhood. Many of these houses are within the 65 and 70 DNL contours (described in Chapter 5), which could make them eligible for a property acquisition or insulation program.[1]

[1] With approval of the ongoing FAA Part 150 Noise Study and Noise Compatibility Plan

The FAA uses a DNL of 65 dB to determine if non-compatible activities exist in the vicinity of an airport. For this Master Plan Update, noise contours were prepared for forecast year 2008 using the FAA Integrated Noise Model (INM). The associated noise contours are illustrated on ALP-6. The noise contours indicate that airport noise would continue to be incompatible with residential areas north of Runway 18-36 in the Town of Middlebury, with less residential disturbance south of the runway in the Town of Oxford.

The Land Use Plan depicts the current zoning districts in the Towns of Middlebury and Oxford. The Plan depicts municipal zoning, general land use, and future airport noise contours in order to provide guidance for future development in the vicinity of the Airport. The land use plan also identifies the airport property owned by ConnDOT. ALP-7 provides a more detailed Airport Property Map, including the acquisition history.

As discussed in Chapter 1, the development of a power plant has been proposed in Oxford, in a location approximately ½-mile to the east of the Airport. The power plant would be constructed within the planned Woodruff Hill Industrial Park, and operated by Calpine/Towantic Energy LLC. Although this development is not associated with the Airport or the Master Plan Update, it has been discussed throughout the process due to concerns regarding the emission of vertical plumes and their associated impact to aviation activity.

Based on these concerns, the FAA has agreed to conduct a “Safety Risk Analysis of Aircraft Overflight of Industrial Exhaust Plumes” for the development of the Calpine facility. The FAA analysis will address the appropriateness of the power plant site from an aviation safety standpoint. Based on their findings, the previous conclusions regarding the power plant may be revised, including re-examination of a 2001 Declatory Ruling for the proposed facility. Furthermore, if the development moves forward, Calpine/Towantic Energy will have to submit an FAA Notice of Actual Construction or Alteration (FAA Form 7460-2), which would prompt the FAA to perform an standard Aeronautical Study of the proposed project addressing airspace and obstruction issues.

Appendix A

BASED AIRCRAFT OWNER SURVEY

A survey questionnaire was mailed to each of the 236 owners of aircraft based at the Waterbury-Oxford Airport in January 2004. The mailing list was provided by Airport management. A copy of the survey form is presented at the end of this appendix. Survey respondents were provided with a stamped, self-addressed envelope to facilitate the return of the form.

The purpose of the survey was to solicit comments about aircraft usage, reasons for basing the aircraft at the Airport, and suggested facility improvements. Opportunity was also afforded for the respondent to provide additional comments or suggestions. The response rate of 57 percent is considered excellent for a mail-out survey without follow-up.

The tables that follow present the raw data results for each of the nine questions on the survey. The responses to the first eight questions are segregated by type aircraft in order to gain an enhanced perspective on the subject topic. Key responses are highlighted in each table. Responses to the open-ended Question 9 are listed for the reader's information.

Questions 1 Through 8

The following general observations may be made from the survey results to the first eight questions.

1. The dominant type of aircraft based at the Airport is the single-engine piston used for recreation and training.

2. Those aircraft used primarily for business operate about twice as much as those used for recreational purposes.

3. Aircraft owners base at the Airport because it is convenient to their point of origin.

4. Aircraft owners like the availability of hangar and tiedown space and the instrument landing system (ILS).

5. Turbojet aircraft operators are most likely to transition to other airports to pickup and discharge passengers.

6. Relatively few aircraft owners would relocate to another airport, even if that airport had the facilities they most favor.

7. There seems to be consensus among all aircraft owners that the Airport could better serve based and transient aircraft users if there was a restaurant, crosswind runway, and more hangar space available.

8. Turbojet aircraft owners would promote additional precision instrument approaches complemented with approach lights and the removal of the nearby powerlines. These facility improvements emphasize aircraft operational factors.

9. Aside from the expressed need for a crosswind runway, owners of aircraft that are primarily used for recreational purposes favor facility improvements that emphasize the terminal area – restaurant, hangar space and aircraft wash areas.

Table A-1
RESPONSE RATE

Aircraft Type	Based	Responses	Response Rate (%)
Single-Engine Piston	155	101	58
Single-Engine Turboprop		1	
Multi-Engine Piston	10	7	20
Multi-Engine Turboprop		2	
Turbojet	37	23	62
Rotorcraft	1	1	100
Total	236	135	57

Table A-2
STORAGE TYPE

	Storage Type (%)			
Aircraft Type	**Tiedown**	**T-Hangar**	**Common Hangar**	**Private Hangar**
Single-Engine Piston	63	27	1	9
Single-Engine Turboprop	0	0	0	100
Multi-Engine Piston	29	57	0	14
Multi-Engine Turboprop	0	0	100	0
Turbojet	0	0	91	9
Rotorcraft	0	100	0	0

Table A-3
AIRCRAFT ACTIVITY

Aircraft Type	Average Annual Flights (Operations)
Single-Engine Piston	77
Single-Engine Turboprop	50
Multi-Engine Piston	58
Multi-Engine Turboprop	250
Turbojet	103
Rotorcraft	100

Table A-4
PURPOSE OF FLIGHT

	Purpose of Flight (%)					
Aircraft Type	**Training**	**Business**	**Recreational**	**Emergency**	**Medical**	**Other**
Single-Engine Piston	9	10	79	0	2	0
Single-Engine Turboprop	50	0	50	0	0	0
Multi-Engine Piston	4	36	60	0	0	0
Multi-Engine Turboprop	5	83	12	0	0	0
Turbojet	1	98	0	0	0	1
Rotorcraft	25	50	25	0	0	0

Table A-5
RANKING OF REASONS BASED AT AIRPORT

	Ranking of Reason by Aircraft Type					
Reason for Basing	**Single-Engine Piston**	**Single-Engine Turboprop**	**Multi-Engine Piston**	**Multi-Engine Turboprop**	**Turbojet**	**Rotorcraft**
Proximity to Origin	1	1	1, 2	2	6	2
Fuel Price	8	6	6	6	2	-
Hangar Space	3	2	3	1	8	-
Hangar/Ground Fee Rate	7	-	7	5	1	1
Tiedown Space	2	-	8	-	-	-
ILS	4	3	1, 2	3	5	-
FBO	6	5	5	7	3	-
R/W Length	5	4	4	4	4	-
Pavement Strength	9	-	9	8	7	-
Other	10	-	-	-	9	-

Table A-6
REGULARLY TRANSITION TO OTHER AIRPORTS

	Regularly Transition to Other Airports				
Aircraft Type	**No**	**Yes**	**Which Airport**	**Reason**	**Frequency**
Single-Engine Piston	103	13	Various within 100 nm	2nd home, Closer to home	< 20 flights annually
Single-Engine Turboprop	0	1	VRB, BID	NA	NA
Multi-Engine Piston	7	0	NA	NA	NA
Multi-Engine Turboprop	1	1	HPN, TEB	Passenger-related	90%
Turbojet	1	22	HPN, TEB	Passenger-related	54%
Rotorcraft	1	0	NA	NA	NA

Table A-7
POTENTIAL FOR RELOCATION

	Potential for Relocation		
Aircraft Type	**No**	**Yes**	**Which Airports**
Single-Engine Piston	65	27	DXR, HPN, others < 50 nm
Single-Engine Turboprop	7	0	NA
Multi-Engine Piston	5	2	BDR, DXR
Multi-Engine Turboprop	2	0	NA
Turbojet	18	4	TEB, MMU, Unsure
Rotorcraft	1	0	NA

Table A-8
TOP 3 FACILTIY IMPROVEMENT NEEDS

	Ranking of Facility Needs		
Aircraft Type	**1**	**2**	**3**
Single-Engine Piston	Restaurant	Crosswind Runway	Hangars
Single-Engine Turboprop	Wash Area, Better Fuel Prices		NA
Multi-Engine Piston	NA	NA	NA
Multi-Engine Turboprop	Crosswind Runway	Turbine Maintenance, Hangars	
Turbojet	ILS 18, Remove Powerlines		Approach Lighting System (18 and 36)
Rotorcraft	Hangars	Restaurant	NA

Question 9

Responses to Question 9 were grouped by aircraft type in order to maintain the confidentiality of the respondent. The responses are unedited, listed in no particular order and address a wide range of topics. Several respondents offered similar comments and these have been repeated within each grouping.

Single-Engine Piston, Single-Engine Turboprop and Rotorcraft

- Open a restaurant with a large transient ramp; have an airport day; have some fun again.
- OXC is a great facility and a pleasure to fly out of.
- Fly less now due to ATCT.
- Restaurant, avionics shop.
- Job well done by Airport Manager.
- ATCT staff good; Airport Manager communicates well, I know what is going on.
- ATCT is a huge improvement.
- Runway snow clearing is at times slow.
- Not sure there is enough traffic for an ATCT.
- Self-serve fuel for better pricing.
- Turf strip.
- ATCT crew great to work with.
- ATCT is the best thing to happen; now need reliable, professional airport maintenance facility.
- Lovely airport; positive experience.
- Put a light in NW corner of NW ramp; its dark and dangerous if vehicles not close by.
- Tenants should have tag/card to park up to 8 hours on ramp; no overnight.
- Wonderful management and ATCT personnel.
- Wish we had not lost the crosswind runway which favored the winds.
- Great FBO; Keystone wonderful.
- Nice airport; good manager; good e-mails. Improvements tend to favor BJs and not light aircraft.
- Well run; no issues.
- Keep homes away from the airport.
- Get professional FBOs for GA. Authorized GA aircraft dealers. Activities to promote aviation to kids.
- The pilots and tower need a system to allow both to know where each is.
- Phone at tiedown ramp areas.
- Small out-building with restrooms, phone and planning room.
- Excellent service from Keystone.
- Don't like communicating with ATCT.
- More accurate wind data; change AWOS accordingly, more often.
- Rental storage space/locker for cleaning supplies, oil, headsets, etc.
- Inclined auto ramps at access gates should have in-pavement heaters.

- Lower fuel prices.
- Secure parking for NE ramp; move gate.
- Self-serve fuel for a reasonable price.
- ATCT not needed.
- Cost of hangars and then not owning them at end of ground lease.
- R/W 13-31 should not have been removed.
- Open hangars to purchase.
- Stairway from parking area at NW ramp. Roadway slippery.
- Park in tiedown area if not a security issue.
- Larger run-up area at each R/W end.
- Oxford much improved.
- Run-up and clearance pick-up area at R/W ends.
- Aircraft maintenance monopoly exists; prices are "ridiculous" and quality of work is substandard.
- Pilots should be permitted to park vehicles at tiedowns; do not permit overnight parking. Have flown less due to this situation.
- Airport management should be promoting Airport for its economic benefits to local towns.
- Since ATCT operational, Airport is safer.
- Excellent Airport management services.
- R/W did not need lengthening. It needed wider and stronger taxiways.
- Another full-service FBO.

<u>Multi-Engine Piston and Multi-Engine Turboprop</u>

- Good communication by Airport Manager.

<u>Turbojet</u>

- Stop development of houses on ILS approaches.
- Good job at airport management level.
- Reduce slope of runway.
- Extend T/W B.
- Customs service.

<u>Rotorcraft</u>

- None.

WATERBURY-OXFORD BASED AIRCRAFT OWNER SURVEY

Dear Based Aircraft Owner,

Program Support Services is assisting the Connecticut Department of Transportation in determining usage characteristics and user opinions concerning the Waterbury-Oxford Airport. Your responses will greatly aid the Department in defining the future role and needs of the Airport, and planning potential future improvements during the development of an updated Airport Master Plan. All responses will be kept confidential and the data released in aggregate format.
To ensure that your input is taken into full consideration, please respond by January 31, 2004. Thank you.

1. What type of aircraft do you base at the Waterbury-Oxford (OXC) Airport?
(If you base more than one aircraft at the Airport, please respond for each aircraft on this form)

_____ Single-engine piston
_____ Multi-engine piston
_____ Turbojet
_____ Single-engine turboprop
_____ Multi-engine turboprop
_____ Rotorcraft

2. How is your aircraft stored at OXC Airport?

_____ Tiedown space
_____ T-Hangar space
_____ Common hangar space
_____ Private hangar space

3. How many flights do you make from OXC Airport annually? (a roundtrip is 2 flights)

_____ Flights annually

4. What are the percentage uses of your flights? (total should add to 100%)

_____ Training
_____ Business
_____ Recreational
_____ Emergency (search / rescue, disaster, etc.)
_____ Medical airlift
_____ Other (specify) ______________________________

5. Please rank the reasons that you base your aircraft at OXC Airport (1 is top-ranked, 2 is second-ranked, etc.)

_____ Proximity to home / office / passenger base
_____ Fuel price
_____ Availability of hangar space
_____ Hangar rental fee or ground lease rate
_____ Availability of tiedown space
_____ Category I ILS
_____ FBO services
_____ Runway length
_____ Runway pavement strength
_____ Other (specify) ______________________________

6. Do you base your aircraft at OXC Airport and transition to another airport on a regular basis?

_____ Yes
_____ No

If Yes, which airport? ______________________________
And, why is transitioning required? ______________________________
And, how often does this occur? ______________________________

7. If the top three services / features in Question 5 were available at another airport, would you base your aircraft at that airport?

_____ Yes
_____ No

If Yes, which airport? ______________________________

8. What do you believe are the most pressing facility improvement needs at OXC Airport, in rank order?

1 ______________________________
2 ______________________________
3 ______________________________

9. Do you have other comments or suggestions to offer?

____
____
____

10. Please identify the respondent to this survey questionnaire (optional)

Name ______________________________
Address ______________________________
Telephone ______________________________

Please return this survey to us at the address below in the stamped, self-addressed envelope provided.
Thank you for your participation. **Questions? Call us at 203-438-2520**

Program Support Services
16 Banks Hill Place
Ridgefield, Connecticut 06877

Appendix B

AIRPORT DESIGN STANDARDS

2003 Existing FAA Design Standards
ARC D-II – Gulfstream IV

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  AIRPORT DESIGN AIRPLANE AND AIRPORT DATA (FAA Airport Design Program
Output)

  Aircraft Approach Category D or E
  Airplane Design Group II
  Airplane wingspan . . . . . . . . . . . . . . . . . . . . .    78.99 feet
  Primary runway end approach visibility minimums are not lower than 1 mile
  Other runway end approach visibility minimums are not lower than 1 mile
  Airplane undercarriage width (1.15 x main gear track) . . .    18.60 feet
  Airport elevation . . . . . . . . . . . . . . . . . . . . .      725 feet

          RUNWAY AND TAXIWAY WIDTH AND CLEARANCE STANDARD DIMENSIONS

                                                           Airplane Group/ARC
Runway centerline to parallel runway centerline simultaneous operations
   when wake turbulence is not treated as a factor:

   VFR operations with no intervening taxiway . . . . . . . . . .    700 feet
   VFR operations with one intervening taxiway  . . . . . . . . .    700 feet
   VFR operations with two intervening taxiways . . . . . . . . .    705 feet
   IFR approach and departure with approach to near threshold 2500 feet less
      100 ft for each 500 ft of threshold stagger to a minimum of 1000 feet.

Runway centerline to parallel runway centerline simultaneous operations
   when wake turbulence is treated as a factor:

   VFR operations . . . . . . . . . . . . . . . . . . . . . . . .   2500 feet
   IFR departures . . . . . . . . . . . . . . . . . . . . . . . .   2500 feet
   IFR approach and departure with approach to near threshold . .   2500 feet
   IFR approach and departure with approach to far threshold   2500 feet plus
      100 feet for each 500 feet of threshold stagger.
   IFR approaches . . . . . . . . . . . . . . . . . . . . . . . .   3400 feet

Runway centerline to parallel taxiway/taxilane centerline . 289.5    300 feet
Runway centerline to edge of aircraft parking . . . . . . . 400.0    400 feet
Runway width  . . . . . . . . . . . . . . . . . . . . . . . . . .    100 feet
Runway shoulder width . . . . . . . . . . . . . . . . . . . . . .     10 feet
Runway blast pad width  . . . . . . . . . . . . . . . . . . . . .    120 feet
Runway blast pad length . . . . . . . . . . . . . . . . . . . . .    150 feet
Runway safety area width  . . . . . . . . . . . . . . . . . . . .    500 feet
Runway safety area length beyond each runway end
   or stopway end, whichever is greater . . . . . . . . . . . . .   1000 feet
Runway object free area width . . . . . . . . . . . . . . . . . .    800 feet
Runway object free area length beyond each runway end
   or stopway end, whichever is greater . . . . . . . . . . . . .   1000 feet
```

Clearway width		500 feet
Stopway width		100 feet
Obstacle free zone (OFZ):		
Runway OFZ width		400 feet
Runway OFZ length beyond each runway end		200 feet
Inner-approach OFZ width		400 feet
Inner-approach OFZ length beyond approach light system		200 feet
Inner-approach OFZ slope from 200 feet beyond threshold		50:1
Inner-transitional OFZ slope		0:1
Runway protection zone at the primary runway end:		
Width 200 feet from runway end		500 feet
Width 1900 feet from runway end		1010 feet
Length		1700 feet
Runway protection zone at other runway end:		
Width 200 feet from runway end		500 feet
Width 1900 feet from runway end		1010 feet
Length		1700 feet
Departure runway protection zone:		
Width 200 feet from the far end of TORA		500 feet
Width 1900 feet from the far end of TORA		1010 feet
Length		1700 feet
Taxiway centerline to parallel taxiway/taxilane centerline	104.8	105 feet
Taxiway centerline to fixed or movable object	65.3	65.5 feet
Taxilane centerline to parallel taxilane centerline	96.9	97 feet
Taxilane centerline to fixed or movable object	57.4	57.5 feet
Taxiway width	33.7	35 feet
Taxiway shoulder width		10 feet
Taxiway safety area width	79.0	79 feet
Taxiway object free area width	130.6	131 feet
Taxilane object free area width	114.8	115 feet
Taxiway edge safety margin		7.5 feet
Taxiway wingtip clearance	25.8	26 feet
Taxilane wingtip clearance	17.9	18 feet

Future FAA Design Standards
ARC D-III – Gulfstream V (1 mile visibility Minimum)

AIRPORT DESIGN AIRPLANE AND AIRPORT DATA

Aircraft Approach Category D or E
Airplane Design Group III

Airplane wingspan	94.00 feet

Primary runway end approach visibility minimums are not lower than 1 mile
Other runway end approach visibility minimums are not lower than 1 mile
Airplane maximum certificated takeoff weight is 150,000 lbs or less
Airplane wheelbase is less than 60 feet

Airplane undercarriage width (1.15 x main gear track)	18.60 feet
Airport elevation	725 feet

RUNWAY AND TAXIWAY WIDTH AND CLEARANCE STANDARD DIMENSIONS

Airplane Group/ARC

Runway centerline to parallel runway centerline simultaneous operations when wake turbulence is not treated as a factor:

VFR operations with no intervening taxiway		700 feet
VFR operations with one intervening taxiway		800 feet
VFR operations with two intervening taxiways		952 feet

IFR approach and departure with approach to near threshold 2500 feet less 100 ft for each 500 ft of threshold stagger to a minimum of 1000 feet.

Runway centerline to parallel runway centerline simultaneous operations when wake turbulence is treated as a factor:

VFR operations		2500 feet
IFR departures		2500 feet
IFR approach and departure with approach to near threshold		2500 feet
IFR approach and departure with approach to far threshold 2500 feet plus 100 feet for each 500 feet of threshold stagger.		
IFR approaches		3400 feet

Runway centerline to parallel taxiway/taxilane centerline	297.0	400 feet
Runway centerline to edge of aircraft parking	400.0	500 feet
Runway width		100 feet
Runway shoulder width		20 feet
Runway blast pad width		140 feet
Runway blast pad length		200 feet
Runway safety area width		500 feet
Runway safety area length beyond each runway end or stopway end, whichever is greater		1000 feet
Runway object free area width		800 feet
Runway object free area length beyond each runway end or stopway end, whichever is greater		1000 feet
Clearway width		500 feet
Stopway width		100 feet

Obstacle free zone (OFZ):

Runway OFZ width		400 feet
Runway OFZ length beyond each runway end		200 feet
Inner-approach OFZ width		400 feet
Inner-approach OFZ length beyond approach light system		200 feet
Inner-approach OFZ slope from 200 feet beyond threshold		50:1
Inner-transitional OFZ slope		0:1

Runway protection zone at the primary runway end:

Width 200 feet from runway end		500 feet
Width 1900 feet from runway end		1010 feet
Length		1700 feet

Runway protection zone at other runway end:

Width 200 feet from runway end		500 feet
Width 1900 feet from runway end		1010 feet
Length		1700 feet

Departure runway protection zone:

Width 200 feet from the far end of TORA		500 feet
Width 1900 feet from the far end of TORA		1010 feet
Length		1700 feet

Taxiway centerline to parallel taxiway/taxilane centerline	122.8	152 feet
Taxiway centerline to fixed or movable object	75.8	93 feet
Taxilane centerline to parallel taxilane centerline	113.4	140 feet
Taxilane centerline to fixed or movable object	66.4	81 feet
Taxiway width	38.7	50 feet
Taxiway shoulder width		20 feet
Taxiway safety area width	94.0	118 feet
Taxiway object free area width	151.6	186 feet
Taxilane object free area width	132.8	162 feet
Taxiway edge safety margin		10 feet
Taxiway wingtip clearance	28.8	34 feet
Taxilane wingtip clearance	19.4	22 feet

Future FAA Design Standards
ARC D-III – Gulfstream V (Category I ILS visibility Minimums)

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   AIRPORT DESIGN AIRPLANE AND AIRPORT DATA

Aircraft Approach Category D or E
  Airplane Design Group III
  Airplane wingspan . . . . . . . . . . . . . . . . . . . . .   93.00 feet
  Primary runway end approach visibility minimums are not lower than CAT I
  Other runway end approach visibility minimums are not lower than CAT I
  Airplane maximum certificated takeoff weight is 150,000 lbs or less
  Airplane wheelbase is less than 60 feet
  Airplane undercarriage width (1.15 x main gear track) . . .   18.60 feet
  Airport elevation . . . . . . . . . . . . . . . . . . . . .     725 feet
  Airplane tail height  . . . . . . . . . . . . . . . . . . .   25.20 feet

          RUNWAY AND TAXIWAY WIDTH AND CLEARANCE STANDARD DIMENSIONS

                                                          Airplane  Group/ARC
Runway centerline to parallel runway centerline simultaneous operations
   when wake turbulence is not treated as a factor:

   VFR operations with no intervening taxiway . . . . . . . . . .    700 feet
   VFR operations with one intervening taxiway  . . . . . . . . .    800 feet
   VFR operations with two intervening taxiways . . . . . . . . .    952 feet
   IFR approach and departure with approach to near threshold  2500 feet less
      100 ft for each 500 ft of threshold stagger to a minimum of 1000 feet.

Runway centerline to parallel runway centerline simultaneous operations
   when wake turbulence is treated as a factor:

   VFR operations . . . . . . . . . . . . . . . . . . . . . . . .   2500 feet
   IFR departures . . . . . . . . . . . . . . . . . . . . . . . .   2500 feet
   IFR approach and departure with approach to near threshold . .   2500 feet
   IFR approach and departure with approach to far threshold   2500 feet plus
      100 feet for each 500 feet of threshold stagger.
   IFR approaches . . . . . . . . . . . . . . . . . . . . . . . .   3400 feet

Runway centerline to parallel taxiway/taxilane centerline . 296.5    400 feet
Runway centerline to edge of aircraft parking . . . . . . . 400.0    500 feet
Runway width  . . . . . . . . . . . . . . . . . . . . . . . . . .    100 feet
Runway shoulder width . . . . . . . . . . . . . . . . . . . . . .     20 feet
Runway blast pad width  . . . . . . . . . . . . . . . . . . . . .    140 feet
Runway blast pad length . . . . . . . . . . . . . . . . . . . . .    200 feet
Runway safety area width  . . . . . . . . . . . . . . . . . . . .    500 feet
Runway safety area length beyond each runway end
   or stopway end, whichever is greater . . . . . . . . . . . . .   1000 feet
Runway object free area width . . . . . . . . . . . . . . . . . .    800 feet
Runway object free area length beyond each runway end
   or stopway end, whichever is greater . . . . . . . . . . . . .   1000 feet
Clearway width  . . . . . . . . . . . . . . . . . . . . . . . . .    500 feet
Stopway width . . . . . . . . . . . . . . . . . . . . . . . . . .    100 feet
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Obstacle free zone (OFZ):

Runway OFZ width		400 feet
Runway OFZ length beyond each runway end		200 feet
Inner-approach OFZ width		400 feet
Inner-approach OFZ length beyond approach light system		200 feet
Inner-approach OFZ slope from 200 feet beyond threshold		50:1
Inner-transitional OFZ height H	50.1	47.7 feet
Inner-transitional OFZ slope		6:1

Runway protection zone at the primary runway end:

Width 200 feet from runway end		1000 feet
Width 2700 feet from runway end		1750 feet
Length		2500 feet

Runway protection zone at other runway end:

Width 200 feet from runway end		1000 feet
Width 2700 feet from runway end		1750 feet
Length		2500 feet

Departure runway protection zone:

Width 200 feet from the far end of TORA		500 feet
Width 1900 feet from the far end of TORA		1010 feet
Length		1700 feet

Taxiway centerline to parallel taxiway/taxilane centerline	121.6	152 feet
Taxiway centerline to fixed or movable object	75.1	93 feet
Taxilane centerline to parallel taxilane centerline	112.3	140 feet
Taxilane centerline to fixed or movable object	65.8	81 feet
Taxiway width	38.7	50 feet
Taxiway shoulder width		20 feet
Taxiway safety area width	93.0	118 feet
Taxiway object free area width	150.2	186 feet
Taxilane object free area width	131.6	162 feet
Taxiway edge safety margin		10 feet
Taxiway wingtip clearance	28.6	34 feet
Taxilane wingtip clearance	19.3	22 feet

REFERENCE: AC 150/5300-13, Airport Design.

Appendix C

INSTRUMENT APPROACH PROCEDURE ANALYSIS

Introduction

The evaluation of instrument approach procedures was conducted in accordance with guidance presented in FAA Order 8260.3B, "United States Standard for Terminal Instrument Procedures (TERPS)" and FAA Order 8260.50, "United States Standard for Wide Area Augmentation System (WAAS) LPV Approach Procedure Construction Criteria". The term LPV refers to an approach with localizer precision combined with vertical guidance. The following sources were used to identify potential obstacles to the TERPS surfaces:

- Mapping and survey data produced for the Airport Master Plan Update (AMPU)
- The National Aeronautical Charting Office Digital Obstacle File
- National Geodetic Survey Obstruction Chart
- FAA Form 8260-9, "Standard Instrument Approach Procedure Data Record" for the existing procedures to the runways.

The analysis represents a partial design of the potential procedures, intended to determine their feasibility and possible approach minimums. These findings are intended to be presented to the FAA Flight Procedures Office at the New England Region Office for their consideration in finalizing recommended procedure(s) for formal establishment and publication as determined as part of the AMPU.

The TERPS evaluation was conducted for the following scenarios:

1. Installation of a MALSR on Runway 36.
2. Establishment of LPV minimums to the existing Runway 36 RNAV (GPS) procedure.
3. Establishment of LPV minimums to the existing Runway 18 RNAV (GPS) procedure.
4. Scenario 3 above with the addition of a MALSR.
5. Installation of ODALS on Runway 18 to complement the existing RNAV (GPS) procedure published with LNAV minimums.

LPV approaches rely on the use of the WAAS, which was commissioned on July 10, 2003 by the FAA. Aircraft must be equipped with a Class 3 or Class 4 TSO C-146 WAAS receiver, which is available for purchase from avionics manufacturers. Initial acquisition of these receivers is expected by airlines operating under FAR Part 121 and FAR Part 135 and corporate business jets used for charter or private service. As sales of these receivers increase, costs will likely decrease, making the units more affordable to the general aviation fleet. Currently, the lowest LPV minimums that will be authorized by the FAA are 250-foot ceiling and ¾-mile visibility. The addition of an appropriate approach lighting system may reduce the visibility component to ½-mile when other standards are met regarding the approach procedure. Lower LPV minimums (200-½) may be authorized in the future based on the established performance record of the WAAS.

The TERPS analyses were conducted for Approach Category D aircraft, which meets the existing and future ARC classification for the Airport. Table C-1 identifies the obstacle controlling the approach minimums for each existing instrument approach procedure.

TABLE C-1 – CONTROLLING OBSTACLE
EXISTING INSTRUMENT APPROACH PROCEDURES

Procedure	Type	Latitude & Longitude		Elevation (MSL)	Accuracy Code**
		Lat. (N)	Long. (W)		
Category I ILS 36	Transmission Tower	41^{o} 28' 01"	73^{o} 07' 55"	747	1A
LOC 36	Transmission Tower	41^{o} 27' 20"	73^{o} 08' 03"	786	1A
RNAV (GPS) 36 – LNAV	Lookout Tower	41^{o} 24' 43"	73^{o} 07' 46"	919	1A
	Tree*	41^{o} 29' 20"	73^{o} 07' 28"	964	2C
NDB 36	100' Tree	41^{o} 28' 23"	73^{o} 05' 48"	929	2C
RNAV (GPS) 18 – LNAV	Tree	41^{o} 29' 07"	73^{o} 08' 12"	960	2C
NDB 18	Tree	41^{o} 29' 20"	73^{o} 07' 28"	964	2C

* Penetrates missed approach surface by 20'
** Accuracy Code refers to the source of the position and elevation of the reported object. Position (latitude and longitude) accuracy is represented by a number (1 = highest accuracy). Elevation accuracy is represented by a letter (A = highest accuracy). Accuracy codes of 2C or higher are acceptable for assessing TERPS surfaces.

The data in Table C-1 presents two situations that warrant further investigation by the ConnDOT and FAA. First, the 150-foot lookout tower that is one of the obstacles that influences the determination of the approach minimums for the RNAV (GPS) 36 with LNAV minimums procedure is sufficiently distant (21,712 feet) from the landing threshold. This situation suggests that a stepdown fix may be incorporated into the procedure to achieve a lower ceiling minimum. Second, based on the latitude and longitude coordinates recorded, the tree controlling the RNAV (GPS) 18 with LNAV minimums procedure is located within a 20-foot radius of the landing threshold. This tree was likely removed during the runway safety area improvement project at the Airport. Certification to the FAA that this specific or possibly group of trees do not exist should result in their re-evaluation of the published approach procedure that could yield a lower ceiling minimum.

Install MALSR on Runway 36

The installation of a MALSR, which is the simplest level of approach lighting system to complement a Category I Instrument Landing System (ILS), could result in a lower visibility component to the approach minimums. In order to install the MALSR and meet its applicable siting standards, it is assumed that the series of transmission line towers that are in a generally northeast-southwest alignment and pass through the approach to Runway 36 would be buried or relocated as part of a separate obstruction removal project. This would allow the Category I ILS approach minimums to be reduced to the lowest achievable for this type of approach (200-½).

In order to assess whether it is cost-justifiable to make an investment to install and maintain a MALSR, a present value, life-cycle benefit/cost analysis (BCA) was performed. Table C-2 summarizes the key issues pertinent to the evaluation.

The BCA is based on the use of a present value analysis that discounts future benefits and costs at the seven percent discount rate required by the U.S. Office of Management and Budget for such analyses. A 20-year period of time was selected as the evaluation period. Establishment and discounted annual operating and maintenance costs are offset by operational and safety benefits achieved through the reduction of the approach minimums. Benefit values for avertable flight disruptions and safety by type of aircraft activity as identified in the FAA publication, "Establishment and Discontinuance Criteria for Precision Landing Systems" were updated to current levels and the evaluation process adapted to meet the needs of this specific improvement scenario.

The analysis essentially translates the incremental number of annual instrument approaches on the runway end that can be realized as a consequence of the lower approach minimums over a 20-year period. This activity is then allocated as either air taxi, which for the Airport was selected as all operations conducted by business jet and turboprop aircraft, or other general aviation operations. Discounted unit benefit values for each type of aircraft approach are then applied to determine the total 20-year benefit associated with the lower approach minimums. A benefit/cost ratio of 1.00 or greater suggests a project worth pursuing.

In this scenario, installation of a MALSR on Runway 36 to complement the existing ILS yields a benefit/cost ratio of 1.03. This is sufficient to warrant further investigation into investment in the MALSR.

TABLE C-2 INSTALL MALSR ON RUNWAY 36 BCA	
Evaluation Factor	**Value**
Existing Approach Minimums	250-1
Potential Approach Minimums	200-½
20-Year Discounted Benefit Value ($)	**1,003,518**
MALSR Installation Cost ($)	700,000
20-Year Discounted Operations and Maintenance Cost ($)	274,016
Total Life-Cycle Cost ($)	**974,016**
Benefit / Cost Ratio	**1.03**

Note: Costs listed are estimated and will vary depending on the construction type, cost for right-of-way/easements, and environmental permitting. Relocation/burial of the transmission line is a prerequisite for MALSR development.

RNAV (GPS) 36 with LPV Minimums

TERPS evaluation criteria for RNAV (GPS) procedures with LPV minimums differ from those applicable to traditional ground-based Category I ILS. The evaluation determined that:

1. Obstacles do not penetrate the glidepath qualification surface (GQS) based on the 3.00-degree glidepath angle (GPA). Thus, removal of the transmission tower lines and burial of the power lines is not a prerequisite for developed of a RNAV (GPS) LPV approach to Runway 36. In order to proceed to the TERPS analysis, the GQS must be clear of penetrations. As such, the clear GQS enables the TERPS analysis to continue, and consider the obstacle clearance surface (OCS) and achievable approach minimums.

2. The controlling obstacle to the OCS is Transmission Tower 1444 at an elevation of 747’ MSL with a 1A accuracy code located at latitude 41^{o} 28’01.51629”N and longitude 73^{o} 07’55.44686”W. The tower penetrates Section 1 of the OCS by 61.6 feet.

3. Penetration of the OCS in Section 1 requires, in order of preference, the removal of the obstacle, reduction of the obstacle height, or an increase to the decision altitude (DA) or approach ceiling. In the event the tower and those to which it is linked cannot be removed or reduced in elevation, the DA is increased from 200’ to 259’ above the Runway 36 touchdown zone elevation of 721’ MSL. Thus the DA would be 980’ MSL (259’ + 721’). The visibility will be limited to 1-mile without the installation of a MALSR.

4. Transmission Tower 1444 penetrates the 34:1 obstacle identification surface applied to the visual portion of the final approach segment by 9.7 feet. Therefore, the tower must be marked and lighted (as is currently the case) and the visibility minimum limited to not less than ¾-mile.

5. Removal of the transmission line towers and burial of the power lines can yield approach minimums of 259-¾. The addition of a MALSR can yield minimums of 259-½. Once the FAA deems the WAAS fully operational, these approach minimums can be expected to be lowered to 209-¾ or 209-½, without and with a MALSR, respectively.

6. Publication of an RNAV (GPS) 36 with LPV minimums provides Airport users with an alternate approach with lateral and vertical guidance in the event the existing Category I ILS is out of service. There is no cost to establish this procedure, without a MALSR. As such, no cost-benefit review is applicable.

RNAV (GPS) 18 with LPV Minimums

The evaluation of a RNAV (GPS) procedure to Runway 18 with LPV minimums assumed that the previously mentioned tree at elevation 960' MSL located within 20 feet of the landing threshold does not exist. The evaluation determined that:

1. The GQS is clear of obstacles and thus the OCS may be evaluated and approach minimums determined.

2. Another tree or group of trees at elevation 881' MSL and located at latitude 41^{o} 30'01.29"N and longitude 73^{o} 08'23.55"W with an accuracy code of 1A penetrates Section 2 of the OCS by 38.42'. Penetration in this section of the OCS may be addressed by first attempting to remove or reduce the elevation of the obstacle. When these actions are not feasible, the GPA can be increased to provide the required obstacle clearance, or as a last measure the DA can be adjusted.

3. Removal or reduction in elevation of the tree or trees is not considered feasible as they are located off-airport property and not controlled by ConnDOT.

4. The GPA would need to be increased to 3.99 degrees, a value that exceeds the maximum allowable for approaches conducted by approach C and higher aircraft. This is not an acceptable outcome for the purposes of this analysis.

5. The DA can be increased to 1140' MSL, which yields a height of 414' MSL above the touchdown zone elevation of 726' MSL.

6. The 34:1 slope surface of the visual approach portion of the final approach segment is not penetrated and thus visibility minimums can be as lows as ¾-mile.

7. The resulting approach minimums for all approach category aircraft are 414-1 without an approach lighting system. This is an improvement over the existing approach minimums of 494-1½ for Approach Category D aircraft.

8. The present value, life-cycle benefit-cost ratio for this procedure need not be evaluated because there is no establishment, maintenance or operating costs.

9. This procedure enables the Airport to provide an alternate approach with lateral and vertical guidance in the event the Category I ILS serving Runway 36 is out of service. It also yields lower approach minimums than those presently available and enhances the potential utilization of the Airport at no capital cost.

RNAV (GPS) 18 with LPV Minimums and MALSR

The addition of a MALSR to the RNAV (GPS) 18 with LPV minimums scenario results in a reduction in the approach minimums to 414-½ for all approach categories of aircraft. As illustrated in Table C-3 below, the present value, life-cycle benefit/cost ratio is 0.64. This result suggests that the installation of the MALSR to gain a ½-mile reduction in the approach visibility minimum is not cost-beneficial.

TABLE C-3
INSTALL MALSR ON RUNWAY 18 BCA

Evaluation Factor	Value
LPV Approach Minimums	414-1
Potential Approach Minimums	414-½
20-Year Discounted Benefit Value ($)	**618,547**
MALSR Installation Cost ($)	700,000
20-Year Discounted Operations and Maintenance Cost ($)	274,016
Total Life-Cycle Cost ($)	**974,016**
Benefit / Cost Ratio	**0.64**

Note: Costs listed are highly generalized. Actual costs would depend on the selected construction alternative. Costs do not including property acquisition or environmental permitting.

RNAV (GPS) 18 with LNAV Minimums and ODALS

This scenario considers the installation of ODALS to complement the existing RNAV (GPS) with LNAV minimums to Runway 18. The ODALS is the least sophisticated level of approach lighting system that can usually yield a ¼-mile reduction to the visibility minimums. The present value, life-cycle benefit/cost analysis for this scenario is summarized in Table C-4 and illustrates that the installation of the ODALS is not cost-beneficial.

TABLE C-4 INSTALL ODALS ON RUNWAY 18 BCA	
Evaluation Factor	**Value**
Existing Approach Minimums	494-1½
Potential Approach Minimums	494-1¼
20-Year Discounted Benefit Value ($)	**252,645**
ODALS Installation Cost ($)	250,000
20-Year Discounted Operations and Maintenance Cost ($)	109,606
Total Life-Cycle Cost ($)	**359,606**
Benefit / Cost Ratio	**0.70**

Note: Costs listed are highly generalized. Actual costs would depend on the selected construction alternative. Cost does not including property acquisition or environmental permitting.

Summary

Five scenarios were evaluated to enhance the use of the Airport during poor weather conditions by achieving lower instrument approach minimums.

The installation of a Runway 36 MALSR and associated reduction in minimums appears to be cost-beneficial and is recommended. However, this assumes that the transmission towers beyond the runway end can first be removed as a separate project.

Notwithstanding the outcome of the Runway 36 MALSR installation, the publication of RNAV (GPS) procedures with LPV minimums is recommended for both runway ends. There is no capital cost associated with this type of procedure at the Airport (without the MALSR) and they offer an operational benefit should the existing Category I ILS be out of service. The RNAV (GPS) 18 with LPV minimums can also yield lower approach minimums than those presently available for those aircraft equipped with the required avionics.

The final two scenarios associated with a MALSR or ODALS installation on Runway 18 do not appear to be cost-beneficial, and are not recommended.

Appendix D

CONCEPTUAL WETLAND MITIGATION PLAN

Introduction

During the formulation of the OXC Airport Master Plan Update (AMPU), wetland mitigation options were explored in order to help streamline future project reviews and attain regulatory compliance. The study purpose was to devise a wetland mitigation strategy that would adequately compensate for unavoidable wetland impacts from the AMPU recommendations and, secondarily, conduct a preliminary search for potential mitigation areas. Initial options for the conceptual wetland mitigation plan included on-airport and off-airport locations for wetland creation or enhancement, as well as lands that could be counted toward wetland mitigation through preservation/acquisition. These options were explored and are described herein.

Summary of Wetland Impacts

Anticipated impacts to wetlands over the course of the 20-year improvement plan are shown in Table D-1. The largest single impact will result from the proposed Taxiway "B" Extension, considered to be one of the most needed improvements at the Airport. The impact from this individual project will be approximately 3.8 acres to Wetland #1. Impacts to wetlands from all recommended improvement plan projects will total approximately 4.0 acres. Refer to Figure 4-7 of the AMPU for the location of recommended development in relation to on-site wetlands.

TABLE D-1 – ANTICIPATED WETLAND IMPACTS FROM OXC AMPU

Wetland No.	Wetland Acreage	Impact (Acres)	Wetland Type	Major Functions	AMPU Project	Timeframe
1	3.77	3.77	Forested	Sed/tox retention and wildlife habitat	Taxiway "B" Extension	5-Year
2	0.89	0.15	Forested/ Scrub-shrub	Sed/tox retention	Service Road	20-year
5	0.11	0.05	Forested/ Scrub-shrub	Sed/tox retention	Service Road	20-year
Total		3.97				

Over 90 percent of wetland impacts (Wetland #1) occur in deciduous forested (red maple) wetlands (Photo 1). Wetland #1 lies parallel to the runway and captures runoff from the runway surfaces, thereby performing a major function of sediment/toxicant retention. Wetland #1 also has well developed vegetative structure and diversity, and a variety of water regimes, thereby also providing good wildlife habitat. The other impacted wetlands are forested/scrub-shrub wetlands located adjacent to paved surfaces, and so also have a primary function of sediment/toxicant retention. Due to their small overall sizes, proximity to disturbed land, and lack of diverse vegetation, they have only a minor value for wildlife habitat.

Photo 1 – Red maple swamp representative of forested wetlands on Airport (view of wetlands adjacent to southeastern end of Runway 36)

<u>Conceptual Wetland Mitigation Strategy</u>

In evaluating the types of impacts to wetlands from the AMPU, this mitigation scheme was formulated to address two objectives: 1) maintain the sediment/toxicant retention functions of the existing wetlands (to be impacted) and 2) replace the wildlife habitat functions (to be impacted). At the same time, the concept needs to be compatible with FAA guidelines for preventing hazardous wildlife attractants (including wetlands) on or near airports (FAA Advisory Circular 150/5200-33A July 2004).

Taking a proactive approach, ConnDOT proposes to mitigate for the sum of the 20-year wetland impacts associated with the recommended development in a comprehensive fashion, rather than impact by impact. Assuming a 2:1 wetland replacement ratio, commonly required by regulatory agencies for forested wetland impacts, approximately 8.0 acres of wetland mitigation have been assumed necessary to compensate for the approximately 4.0 acres of wetland impacts that would result from the recommended development.

While replacement of wetlands and their functions on-site (i.e., within Airport property), close to the areas of impact, is generally the first choice for wetland mitigation, it was found that 8.0 acres of mitigation could not be accommodated on site and that a lesser acreage would only be possible if distributed around the Airport property in very small (functionally ineffective) patches. These site conditions, in combination with FAA guidelines relative to wildlife attractants, make on-site mitigation impracticable and potentially impossible. Therefore, off-site options were explored, with the caveat that the existing water quality functions (receiving and pre-treating runoff from Airport surfaces) be mitigated on-site through structural means during engineering design of the new taxiway and in accordance with the Connecticut Department of Environmental Protection (DEP) *2004 Stormwater Quality Manual*.

Research Efforts

Given the need for off-site mitigation, preliminary research was conducted to identify potential sites in proximity to the impacted wetlands, which would have the greatest potential to restore and maintain the values and functions of the wetland systems to be impacted. The research efforts and results are described below. The search for off-site mitigation sites was guided by the following assumptions:

- 8.0 contiguous acres
- Within the local drainage basins of the impacted wetlands or within a one-and-one half mile radius of the Airport
- Publicly owned land or existing conservation lands would be best due to ease of acquisition or use
- Disturbed or degraded sites, upland or wetland, with currently reduced function/value as habitat
- Sites with relatively easy access for the purpose of mitigation site preparation/construction

Research thus entailed review of aerial photos to identify degraded lands, review of property ownership maps to identify publicly owned lands, contacts with state and local agencies/organizations to inquire about potential mitigation sites, and windshield inspections to evaluate conditions near the Airport.

<u>Aerial Photographic Review:</u> Review of aerial photos did not reveal any obviously degraded or excavated lands in proximity to OXC Airport. Lands around the Airport appeared to be relatively intact forested and agricultural lands.

<u>Review of Property Ownership Maps:</u> Initial findings identified several publicly owned properties or properties in conservation use near the Airport. These included the Southford Falls State Park, Larkin State Park Trail, and a variety of properties owned or used by the Seymour Fish & Game Club. The DEP Parks Division and the Seymour Fish & Game Club were therefore contacted, as was the Town of Oxford, regarding potential mitigation sites, as described below.

<u>Contacts with State and Local Agencies/Organizations:</u> The DEP Parks Division, the Seymour Fish & Game Club and the Town of Oxford were contacted by telephone to inquire about potential wetland mitigation sites on the lands in their purview. The conversations are documented by memoranda included at the end of this appendix and summarized below:

- The DEP noted that approximately ¼ acre on the edge of a pond at Southford Falls State Park is in a degraded condition and would have potential for wetland enhancement (M. Rickert, personal communication). Additionally, there are some trails near the pond that are becoming degraded and will eventually be sources of erosion and sedimentation into the pond, so trail reconstruction/maintenance would benefit the pond and associated wetlands. The other state-owned park lands are along the Larkin State Park Trail and DEP noted that wetlands are being modified/degraded by ongoing and aggressive activities by a local beaver population.
- The Seymour Fish & Game Club leases the lands they use and when the leases expire, they do not plan to renew them.
- The Town of Oxford did not identify any lands suited for wetland mitigation.

The results of these contacts indicate that it may be difficult to find an ideal publicly-owned mitigation site, close to the Airport, large enough (8.0 acres) to fulfill the wetland mitigation needs for the AMPU recommended development. They suggest that mitigation may need to be a combination of small efforts in several locations – possibly farther from the airport – and possibly a combination of creation, enhancement, and conservation/acquisition.

Windshield Survey: Since a review of aerial photos/maps and personal contacts failed to identify any potential mitigation sites in close proximity to the Airport, a windshield survey was conducted. Using a cursory GIS screening, potential mitigation areas were located within the local drainage basins of the major wetlands to be impacted, which include the Little River and Eightmile Brook basins, located east, south, and southwest of the Airport. High points and elevated terraces were eliminated from consideration, as were lands in the Runway Protection Zones (RPZs) located directly north and south of the runway. Lowland areas adjacent to streams or existing wetlands were selected for inspection, with the goal of identifying degraded wetlands or wetland-upland interfaces that would be enhanced by wetland expansion and/or creation. Four areas (sites) were identified for windshield survey and inspected on August 9, 2005. These sites and the locations of photographs taken at these sites are shown on Figure D-1.

The windshield survey confirmed the conclusions from the aerial photographic review, that the lands around the Airport are a mix of relatively undisturbed wetlands and uplands. No deteriorated or degraded lands in association with wetlands were located. The overall vicinity is assessed to have existing high capacities for sediment/toxicant retention, wildlife habitat, and many other wetland functions/values.

The characteristics of each surveyed site are described below.

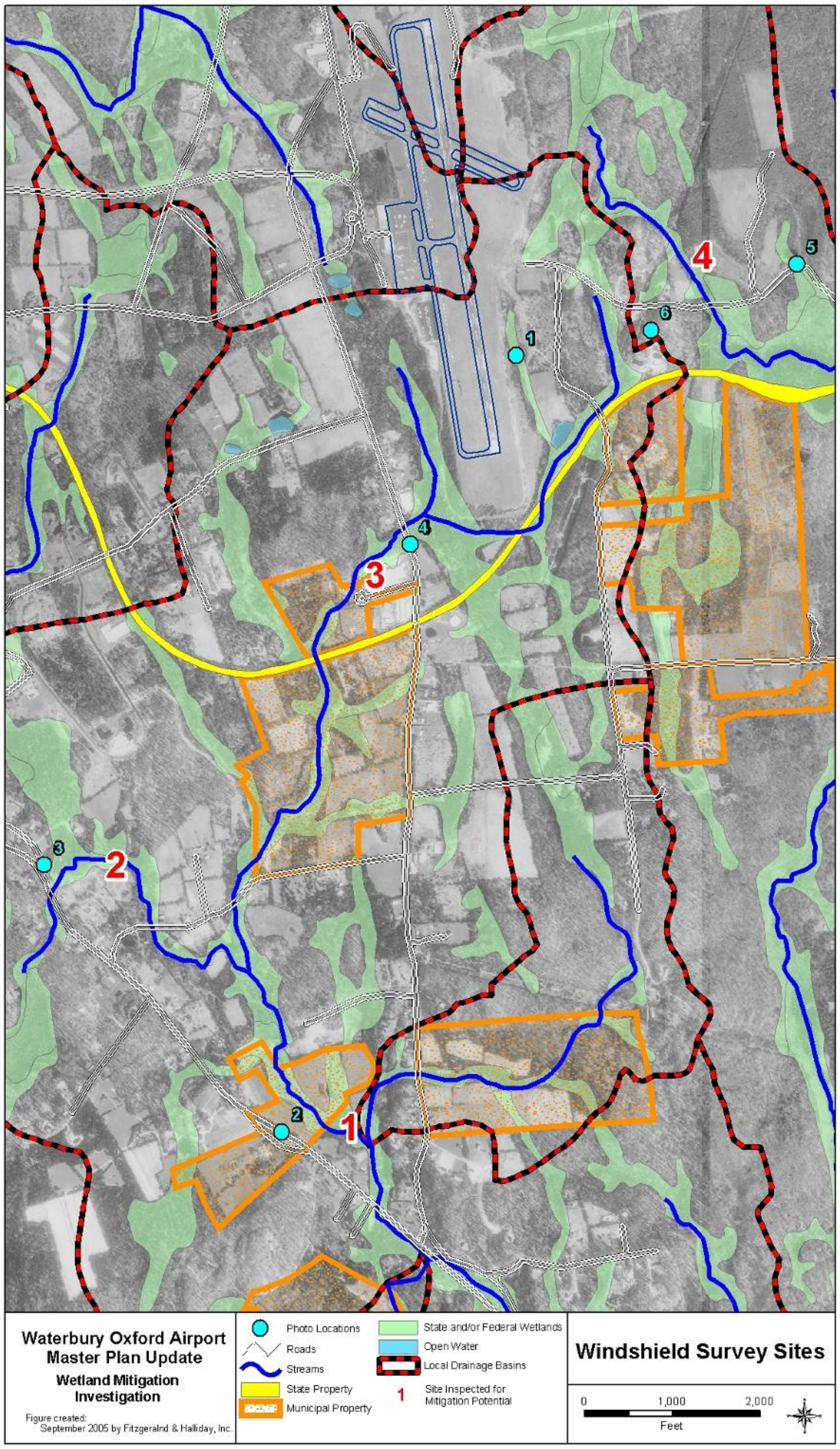


FIGURE D-1 – WINDSHIELD SURVEY SITES

Site 1

Site 1 is located on the east side of Oxford Road between Christian Street and Perry Lane. This site consists of a large open field which is bisected by a narrow, sinuous stream and also contains a small pond a short distance from the stream. The stream and pond are intermittently flanked by red maples and shrubs (see Photo 2). The wetlands are generally in a linear configuration associated with the stream. The surrounding uplands are a mix of mowed field and upland forest which are relatively undisturbed (other than by mowing) and free of invasive species.

This site is currently functioning to provide good quality sediment/toxicant retention and wildlife habitat. Although this site is mapped as municipal property by DEP GIS data, information at the Oxford assessor's office indicates it is privately owned.

Photo 2 – Site 1, looking east across property

<u>Site 2</u>

Site 2 is located at the northeast corner of Oxford Road and Towner Lane. At the core of this site is a forested wetland with some emergent wetland pockets associated with a narrow stream (see Photo 3). The wetlands are bordered by upland forests that are similar in structure to the forested wetland, with well developed tree, shrub and herbaceous layers. Along the roads are a few scattered residences with large open lawns.

The undeveloped areas of this site showed no signs of disturbance or intervention by people. Similar to Site 1, the vicinity of this site was free of invasive species and supports water quality and wildlife habitat functions.

Photo 3 – Site 2, looking southeast across red maple swamp

<u>Site 3</u>

Site 3 is located on the east side of Christian Street between the Larkin State Park Trail and Hawley Road, at the southwest corner of the OXC Airport. This site is in an area with a mix of heavily wooded lands, patches of old field, and some mowed (agricultural) fields. The forested wetland at the core of this site is a red maple swamp (see Photo 4), flanked on the north and west by dense upland woods.

The only area of noticeable disturbance in the vicinity of this site is the fringe of wetlands located directly along the State Park trail. Ponding along the trail has resulted from beaver activity and there are beaver lodges and evidence of predation of small saplings. Although the hydrology and vegetation of the wetlands are being altered by beaver, they are still in a "natural" condition and predominantly free of invasive species. These wetlands continue to maintain and support sediment/toxicant retention and wildlife habitat.

Photo 4 – Site 3, looking east from commuter parking lot into red maple swamp

<u>Site 4</u>

Site 4 is located on both sides of Prokop Road just east of the Airport. The wetlands at the core of this site are forested wetlands containing a narrow stream and several small ponds (see Photo 5). The wetlands are comprised of high-diversity and well developed native plant communities. The lands surrounding the wetlands are primarily dense upland forests, although there are several large open lawns/fields with houses and a cleared area of several acres located directly adjacent to its western side (see Photo 6), which appears to be a gravel and/or fill materials storage area. Other than this clearing, there are no disturbed areas within or adjacent to Site 4.

Photo 5 – Site 4, looking north across small pond

Photo 6 – Site 4, looking southeast across storage yard to forested wetland

Conclusions

The preliminary research undertaken as part of the AMPU to develop a wetland mitigation concept has resulted in the following findings:

- On-airport mitigation appears to be neither appropriate nor feasible; however, water quality functions (receiving and pre-treating runoff from Airport surfaces) should be mitigated on-site through structural means during engineering design of the Taxiway "B" Extension. Dry basins may be an option for detaining stormwater and carrying out sediment/toxicant retention functions. Whatever measures are chosen will be designed in accordance with the Connecticut Department of Environmental Protection *2004 Stormwater Quality Manual*.

- No potential mitigation sites (of a disturbed or degraded nature) large enough (8.0 acres) to fulfill the wetland mitigation needs for the AMPU recommended development were identified within approximately one to one and a half miles of the Airport. The vicinity of the airport is remarkably rural, undeveloped and in a naturalistic condition. The lower elevations with the best potential for wetland mitigation are comprised of a network of wetlands, upland forests, and old field, which already perform the functions of sediment/toxicant removal and wildlife habitat that need to be provided by the Airport wetland mitigation plan.

- There appears to be very little development pressure in the vicinity. Some industrial park development south of the Airport is occurring; however, its location for wetland mitigation could conflict with FAA guidelines for separation of hazardous wildlife attractants from the nearest air operations area, which have a minimum separation distance of 5,000 feet (for piston-powered aircraft).

Based on these findings, further study of a recommended wetland mitigation concept would include the following:

- Investigation of purchase of development rights, conservation easements, or outright acquisition of future proposed development sites in the Little River and Eightmile Brook watersheds.
- Investigation of potential mitigation sites farther downstream in the affected watersheds, or across watershed boundaries, where lands may have been disturbed by development. This effort would be compatible with a mitigation banking approach, whereby Airport mitigation requirements may be consolidated with mitigation efforts of other agencies or organizations, at a distance from the Airport that would conform to FAA separation criteria.
- Exploring a wetland mitigation package that might include some of the improvements needed at the DEP state park properties, wetland enhancement on these properties, and wetland creation at one or more sites (to be determined).

- More detailed discussions with the Town of Oxford to identify potential wetland mitigation activities that may complement mitigation efforts on private development sites, as the Town receives future development proposals.

U.S. Department
of Transportation
Federal Aviation Administration

New England Region

12 New England Executive Park
Burlington, MA 01803-5299

September 10, 2007

Mr. David Head
Transportation Supervising Planner
Connecticut Department of Transportation
2800 Berlin Turnpike
Newington, Connecticut 06131

Dear Mr. Head:

This letter acknowledges the acceptance of the Airport Master Plan Update prepared for the Connecticut Department of Transportation on behalf of the Waterbury Oxford Airport. In addition, the Airport Layout Plan is approved subject to the following conditions:

1) The plan recognizes that achieving basic approach minimums of 200 feet above ground level (AGL) and one half mile visibility, while desirable, would require the airport to fund the site prep for the approach light system. State or local relocation or burial of the powerlines in the approach to Runway 36 is a prerequisite for the development of the Medium Intensity Approach Light System (MALSR)

2) Ensure that the appropriate signs to protect the ILS are installed when the extension to taxiway Bravo is under construction.

3) There are six non-conforming conditions on the ALP including two for safety area determinations previously approved in 2003. The other four accepted non-conforming conditions correspond to requirements to meet offsets and taxiway width for D-III aircraft, which were resolved in this case using the critical aircraft for OXC. Additional supporting documentation can be found in the Master Plan Update and will be attached to the FAA file copy of this ALP approval letter.

Before any development on the ALP is initiated, it must be environmentally approved by the Federal Aviation Administration (FAA) in accordance with FAA Order 5050.4B, Environmental Handbook unless it is categorically excluded by paragraph 23 of that Order.

Review of the Master Plan Update has been with respect to safety, efficiency and utility. It does not represent a commitment to provide financial assistance to implement the proposed plan. This letter also concludes the FAA formal review of the plan under FAA Non-rulemaking Airspace case number 2007-ANE-78.

Thank you.

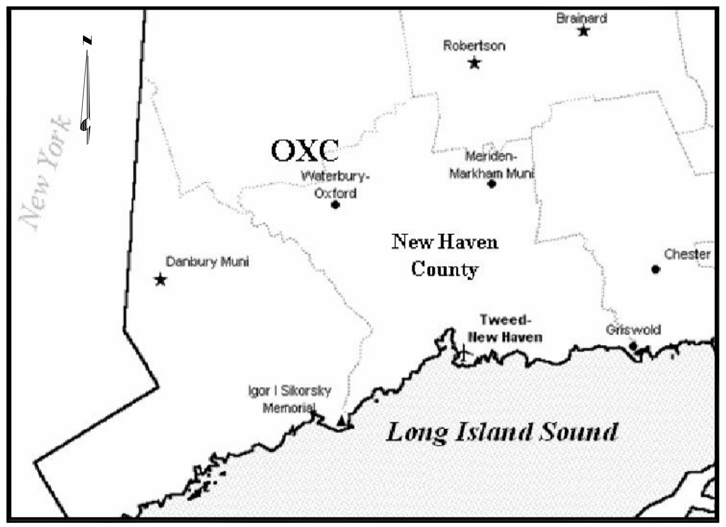
Sincerely,

Gail Lattrell
Planner

FINAL AIRPORT LAYOUT PLAN UPDATE

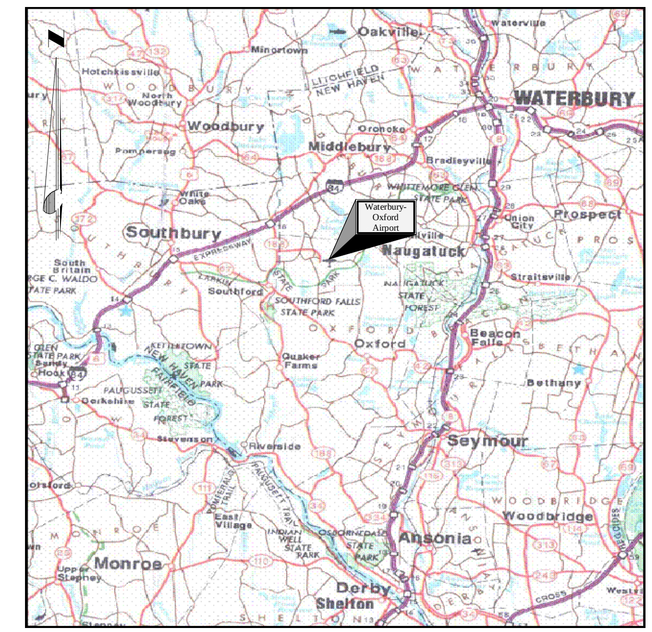
for the

WATERBURY-OXFORD AIRPORT (OXC)



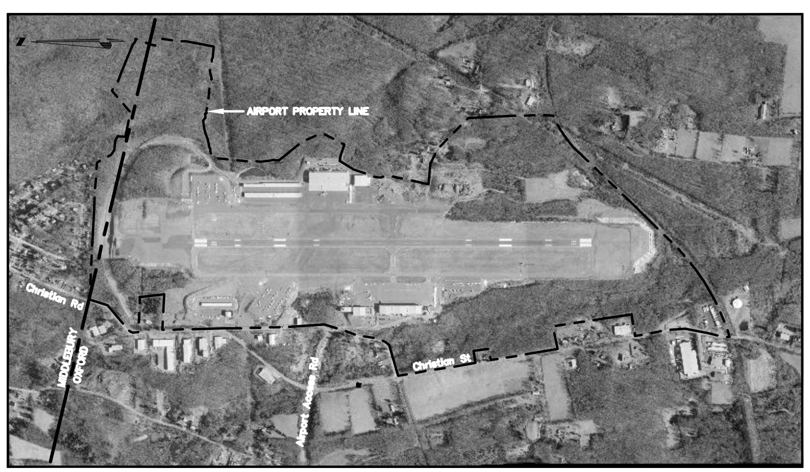
Project Location Map

F.A.A. Project No. 3-23-0017-09-03
State Project No. 107-154



Vicinity Map

DRAWING INDEX		
SHEET No.	TITLE	DWG. No.
–	COVER	
ALP-1	EXISTING AIRPORT LAYOUT	1
ALP-2	AIRPORT LAYOUT PLAN	2
ALP-3	DATA SHEET	3
ALP-4	INNER APPROACH SURFACE DRAWING	4
ALP-5	AIRPORT AIRSPACE PLAN	5
ALP-6	LAND USE PLAN	6
ALP-7	PROPERTY PLAN	7



WATERBURY–OXFORD AIRPORT

Towns of
Oxford and Middlebury
Connecticut

CONNECTICUT DEPARTMENT OF TRANSPORTATION

WATERBURY OXFORD AIRPORT
OXC
MASTER PLAN

SEPTEMBER 2007

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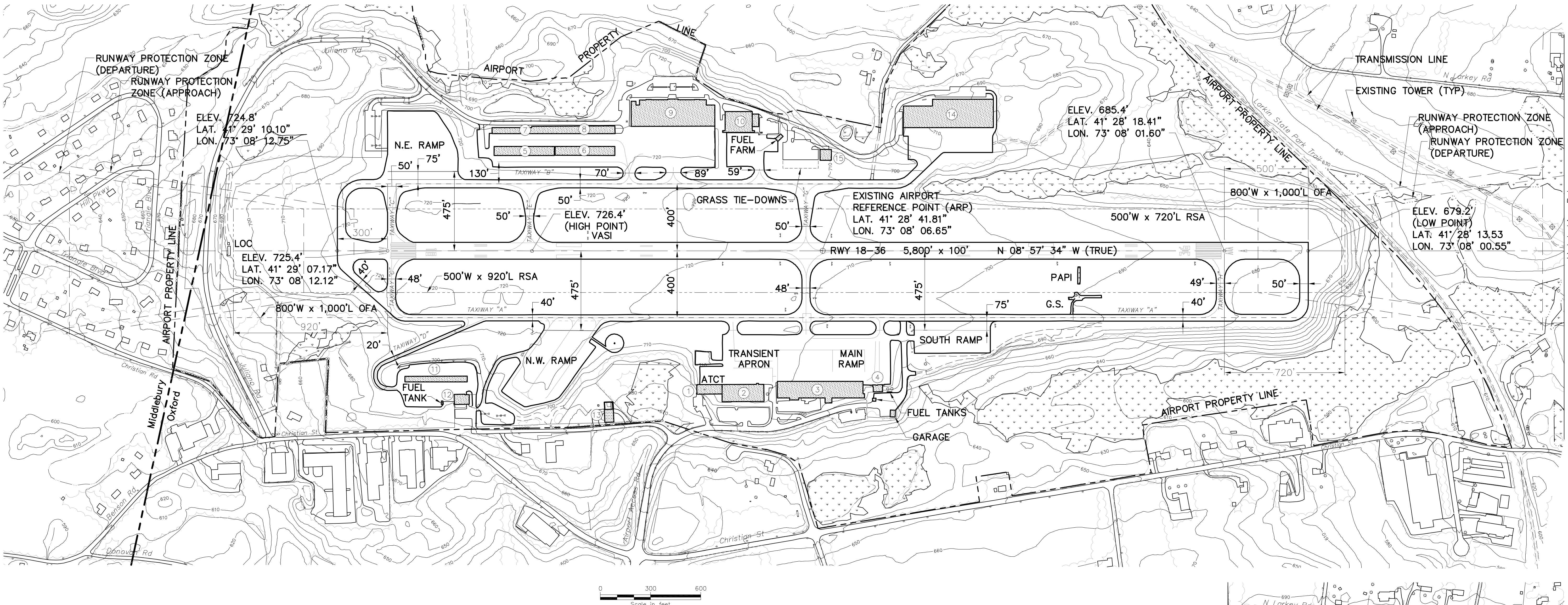

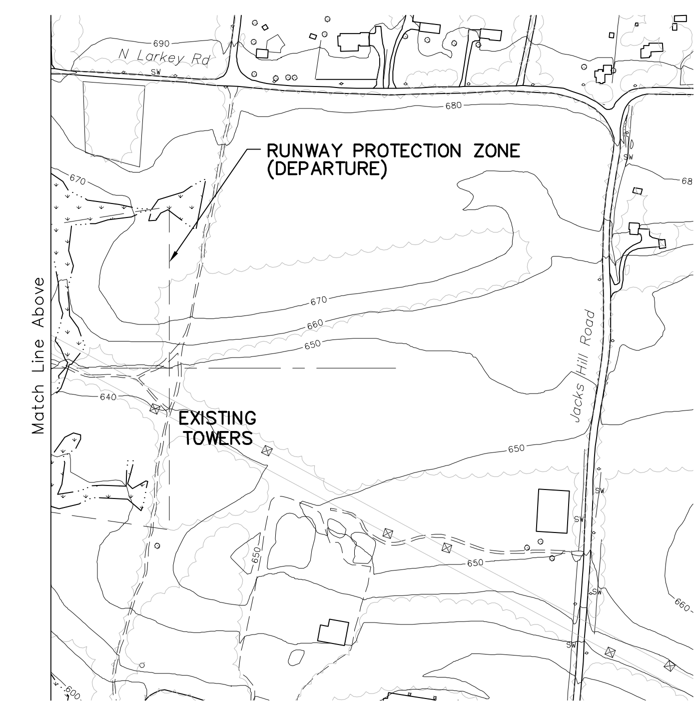

LEGEND

Existing	Description	Existing	Description
	Runway Centerline		Fence
	Runway Safety Area (RSA)		Roads
	Runway Object Free Area (ROFA)		Tree line
	Runway Protection Zone (RPZ)		Wetlands
	Building Restriction Line (BRL)		Stream/River/Body of Water
	Airport Pavement		Ground Elevation Contours
	Airport Reference Point	n/a	Pavement to be Removed
①	Airport Buildings/Building No.	n/a	Proposed Land Acquisition
	Other Buildings	n/a	Proposed Easement Acquisition
	Tiedowns	n/a	Proposed Tree Clearing
	Airport Property Line		

Note: Some Features In The Legend May Not Have Been Used

FACILITIES TABLE

Existing

#	Facility Name	Top Elevation
1	Keystone Hangar A & ATCT	779.9
2	Keystone FBO Hangar B	748.0'
3	Keystone FBO Hangars C, D, E	747.5'
4	Airport Management/ARFF/Maintenance	727.6'
5	T-Hangar	735.7'
6	T-Hangar	735.7'
7	T-Hangar	738.3'
8	T-Hangar	738.3'
9	Key Air Hangar F	756.5'
10	Double Diamond Hangar	749.1'
11	T-Hangar	714.4'
12	Executive Flight	724.4'
13	Fuel Farm	702.3
14	Key Air Hangar G	739.9'
15	Restauraunt	730'

Note: Elevations Are Rooftop Elevations

NOTES:

1. All positional data references North American Datum of 1983 (NAD 83).
2. Ground contour interval: 10 feet.
3. See Data Sheet, drawing ALP-3 for additional tables, and windroses.

Revisions:	Drawn By:	App'd. By:	Date:

14.1 Degrees W Magnetic
Jan. 2005, Rate of Change 0.0'

Designed By:	Date:
MR	9-07
Drawn By:	Date:
PM	9-07
Checked By:	Date:
POM	9-07

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CONNECTICUT DEPARTMENT OF TRANSPORTATION

Waterbury–Oxford Airport Master Plan Update

EXISTING AIRPORT LAYOUT

Drawing No. **ALP-1**

SCALE: AS NOTED | DATE: SEPTEMBER 2007 | SHEET 1 OF 7

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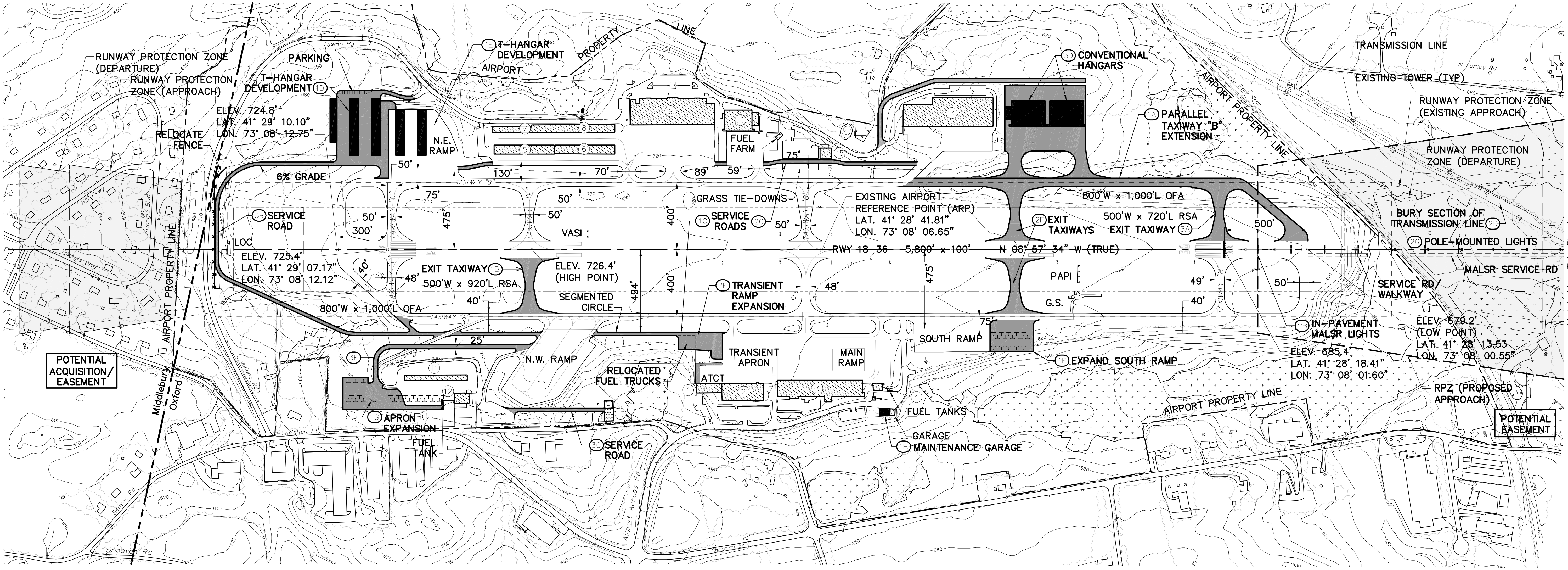


FACILITIES TABLE

Existing			Proposed		
#	**Facility Name**	**Top Elevation**	**#**	**Facility Name**	**Top Elevation**
1	Keystone Hangar A & ATCT	782.0	1A	Extend Parallel Taxiway "B"	–
2	Keystone FBO Hangar B	748.0'	1B	Extend Exit Taxiway "E"	–
3	Keystone FBO Hangars C, D, E	747.5'	1C	Service Road Construction	–
4	Airport Management/ARFF/Maintenance	727.6'	1D	T–Hangar Development	745'
5	T–Hangar	735.7'	1E	T–Hangar Development – NE Ramp	745'
6	T–Hangar	735.7'	1F	Expand South Ramp	–
7	T–Hangar	738.3'	1G	Expand Executive Flight Ramp	–
8	T–Hangar	738.3'	1H	Construct Maintenance Garage	710'
9	Key Air Hangar F	756.5'	2C	Service Road Construction	–
10	Double Diamond Hangar	749.1'	2D	Burial of Transmission Line	–
11	T–Hangar	714.4'	2E	Expand Transient Apron	–
12	Executive Flight	724.4'	2F	Exit Taxiway Construction	–
13	Fuel Farm	702.3	2G	Runway 36 MALSR Installation	685'
14	Key Air Hangar G	739.9'	3A	Extend Exit Taxiway "H"	–
15	Restaurant	730'	3B	Service Road North of Runway	–
			3C	Service Road to Fuel Farm	–
			3D	Hangar Development	732'
			3E	Taxiway "D" Relocation	–

Note: Elevations Are Rooftop Elevations

NONCONFORMING CONDITIONS

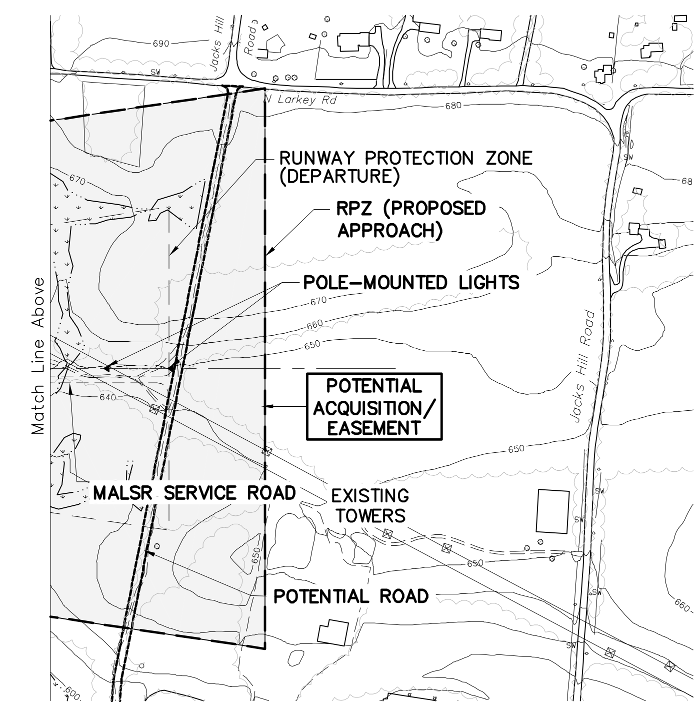
Description	Existing	Standard ARC D–III	Remarks	Date Approved
RSA length Beyond Runway 18	920'	1,000'	Maximum Practical–Declared Distances	2003
RSA length Beyond Runway 36	720'	1,000'	Maximum Practical–Declared Distances	2003
Runway Centerline to Aircraft Parking	475'	500'	**Offset per wingspan of Gulfstream V is 400'**	2007
Taxiway "A" Width	40'	50'	**Width per ~~undercarriage~~ wheel span of Gulfstream V is 14'4"**	2007
Taxiway Centerline to Aircraft Parking	75'	93'	**Offset per wingspan of Gulfstream V is 75'**	2007
Taxiway Centerline to Taxilane Centerline	130'	152'	**Offset per wingspan of Gulfstream V is 122'**	2007

Certification: The Connecticut Department Transportation certifies that all airport elements shown on this ALP are in accordance with criteria contained in the current edition of FAA Circular 150/5300–13, except as noted.

Name   Date

NOTES:

1. The FAA's approval of this Airport Layout Plan (ALP) represents acceptance of the general location of future facilities depicted. During the preliminary design phase, the airport owner is required to resubmit for approval the final locations, heights and exterior finish of structures. The FAA's concern is obstructions, impact on electronic aids or adverse effects on controller view of aircraft approach and ground movement areas, which could adversely affect the safety, efficiency or utility of the airport.
2. All positional data references North American Datum of 1983 (NAD 83).
3. Ground contour interval: 10 feet.
4. See Data Sheet ALP–3 for additional tables, legend and windroses.



Revisions:	Drawn By:	App'd. By:	Date:

14.1 Degrees W Magnetic
Jan. 2005, Rate of Change 0.0°

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DATE 10-17-07

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CONNECTICUT DEPARTMENT OF TRANSPORTATION

WATERBURY OXFORD AIRPORT OXC MASTER PLAN

Waterbury–Oxford Airport Master Plan Update

AIRPORT LAYOUT PLAN

Drawing No. ALP-2

SCALE: AS NOTED   DATE: SEPTEMBER 2007   SHEET 2 OF 7

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RUNWAY DATA TABLE

RUNWAY DATA	Runway 18/36 Existing	Runway 18/36 Proposed
Effective Gradient (%)	0.8%	0.8%
Wind Coverage (%)	97.1%	97.1%
Max. Elevation (MSL)	726.4'	726.4'
Runway Length	5,800'	5,800'
Runway Width	100'	100'
Displaced Threshold	18: 300' 36: 500'	18: 300' 36: 500'
Usable Runway Length	5,000'	5,000'
Surface Type	Grooved Asphalt	Grooved Asphalt
Pavement Strength		
Single Wheel	47,000 lbs	47,000 lbs
Dual Wheel	54.000 lbs	54.000 lbs
Dual Tandem	108,000 lbs	108,000 lbs
Approach Surface Slope	Rwy 18: 34:1 Rwy 36: 50:1	Rwy 18: 34:1 Rwy 36: 50:1
Approach Minimums (36 ILS)	1 mile: 250'	1/2 mile: 200'
Visual Approach Aids	PAPI, VASI	PAPI, VASI, MALSR
Instrument Approach Aids	ILS, NDB, RNAV	ILS, NDB, RNAV
Runway Lighting	MIRL	MIRL
Runway Marking	Precision	Precision
Airport Reference Code (ARC)	D–II	D–III
Aircraft	Gulfstream IV	Gulfstream V
Runway Object Free Area (ROFA)		
Length Beyond Runway	1,000'	1,000'
Width	800'	800'
Runway Safety Area (RSA)		
Length Beyond Runway	18: 920' 36: 720'	18: 920' 36: 720'
Width	500'	500'
FAR Part 77 Category	18: NPI 36: PIR	18: NPI 36: PIR
Runway End Coordinates (NAD 83)		
Rwy 18 Displaced Threshold	Lat: 41° 29' 07.17 Lon: 73° 08' 12.12"	Lat: 41° 29' 07.17 Lon: 73° 08' 12.12"
Rwy 18 End	Lat: 41° 29' 10.10" Lon: 73° 08' 12.75"	Lat: 41° 29' 10.10" Lon: 73° 08' 12.75"
Rwy 36 Displaced Threshold	Lat: 41° 28' 18.41" Lon: 73° 08' 01.60"	Lat: 41° 28' 18.41" Lon: 73° 08' 01.60"
Rwy 36 End	Lat: 41° 29' 13.53" Lon: 73° 08' 00.55"	Lat: 41° 29' 13.53" Lon: 73° 08' 00.55"
Runway End Elevations (MSL)	18: 724.8' 36: 679.2'	18: 724.8' 36: 679.2'
Displaced Threshold Elevation (MSL)	18: 725.4' 36: 685.4'	18: 725.4' 36: 685.4'

AIRPORT DATA TABLE

AIRPORT DATA	EXISTING	PROPOSED
Airport Elevation (MSL)	726'	726'
Airport Reference Point (NAD 83)		
Lattitude	41° 28' 41.81"	41° 28' 41.81"
Longitude	73° 08' 06.65"	73° 08' 06.65"
Mean Max Temperature of Hotest Month	83° F	83° F
Airport Terminal Area NAVAIDS	ILS, NDB	ILS, NDB
Magnetic Variation	14.1° W	14.1° W
Date of Magnetic Variation	2005	2005
Wind Coverage		
All Weather	97.1%	97.1%
IFR	96.6%	96.6%
Airport Reference Code	D–II	D–III
Design Aircraft	Gulfstream IV	Gulfstream V
Taxiway Lighting	MITL	MITL
Taxiway Marking	Yes	Yes

NAVAIDS AND VISUAL AIDS

RUNWAY	EXISTING	ULTIMATE
18	LNAV, NDB, VASI	LPV, LNAV, NDB, VASI
36	ILS, LNAV, NDB, PAPI, REIL	ILS, LPV, LNAV, NDB, PAPI, MALSR

LEGEND

Existing	Description	Proposed
	Runway Centerline	
	Runway Safety Area (RSA)	
	Runway Object Free Area (ROFA)	
	Runway Protection Zone (RPZ)	
	Building Restriction Line (BRL)	
	Airport Pavement	
	Airport Reference Point	
1	Airport Buildings/Building No.	1A
	Other Buildings	
	Tiedowns	
	Airport Property Line	
	Fence	
	Roads	
	Tree line	
	Wetlands	n/a
	Stream/River/Body of Water	
100	Ground Elevation Contours	100
n/a	Potential Easement or Acquisition	
n/a	Selective Tree Clearing	
n/a	Potential Ground Obstruction	

Note: Some Features In The Legend May Not Have Been Used

RUNWAY PROTECTION ZONES

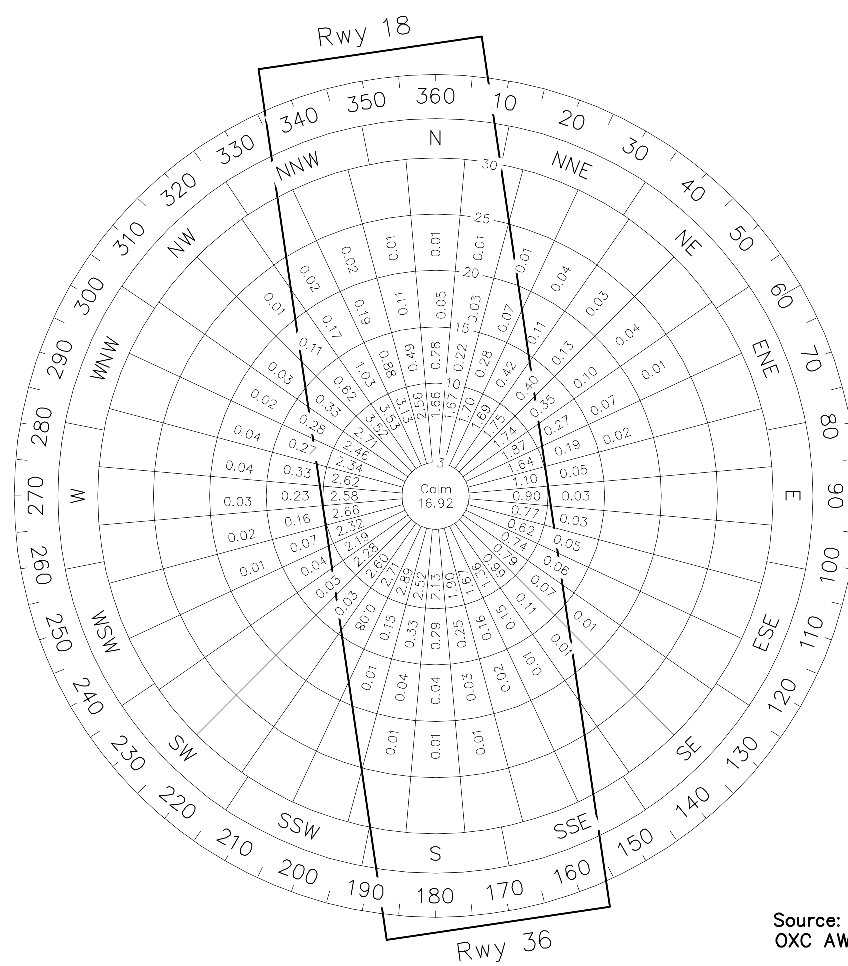
	RWY	APPROACH W1	APPROACH L	APPROACH W2	DEPARTURE W1	DEPARTURE L	DEPARTURE W2
EXISTING	18	500'	1,700'	1,010'	500'	1,700'	1,010'
EXISTING	36	500'	1,700'	1,010'	500'	1,700'	1,010'
PROPOSED	18	500'	1,700'	1,010'	500'	1,700'	1,010'
PROPOSED	36	1,000'	2,500'	1,750'	500'	1,700'	1,010'

NOTE: RPZ BEGINS 200' FROM RUNWAY END OR THRESHOLD

W1 L W2

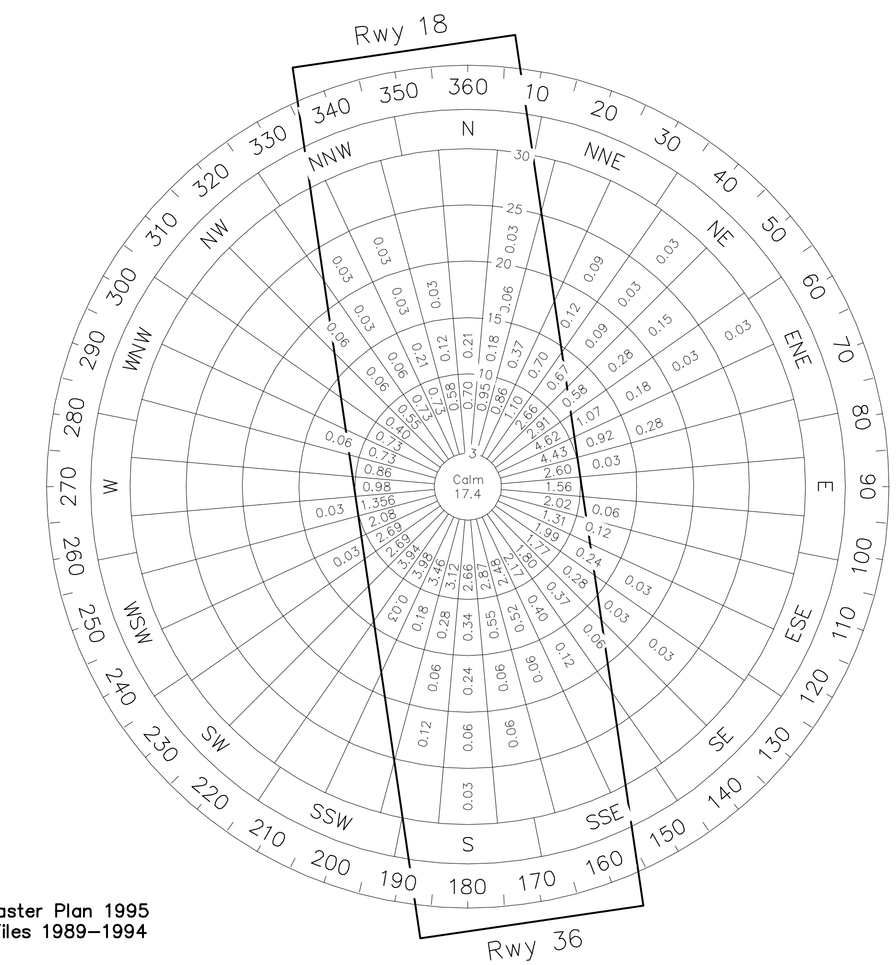
DECLARED DISTANCES

Runway End ID	TORA	TODA	ASDA	LDA	LDA: Approach end RSA length	LDA: Stop end RSA length	ASDA: RSA Length	Date of Approval
18	5,800'	5,800'	5,300'	5,000'	920'	720'	720'	2005
36	5,800'	5,800'	5,500'	5,000'	720'	920'	920'	2005



All Weather Wind Rose
Total Coverage = 97.1%

Source: Airport Master Plan 1995
OXC AWOS Data Files 1989–1994



I.F.R Wind Rose
Total Coverage = 96.6%

Revisions:	Drawn By:	App'd. By:	Date:

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MR	9–07
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CONNECTICUT DEPARTMENT OF TRANSPORTATION

WATERBURY OXFORD AIRPORT OXC MASTER PLAN

Waterbury–Oxford Airport
Master Plan Update

DATA SHEET

Drawing No. ALP-3

SCALE: AS NOTED | DATE: SEPTEMBER 2007 | SHEET 3 OF 7

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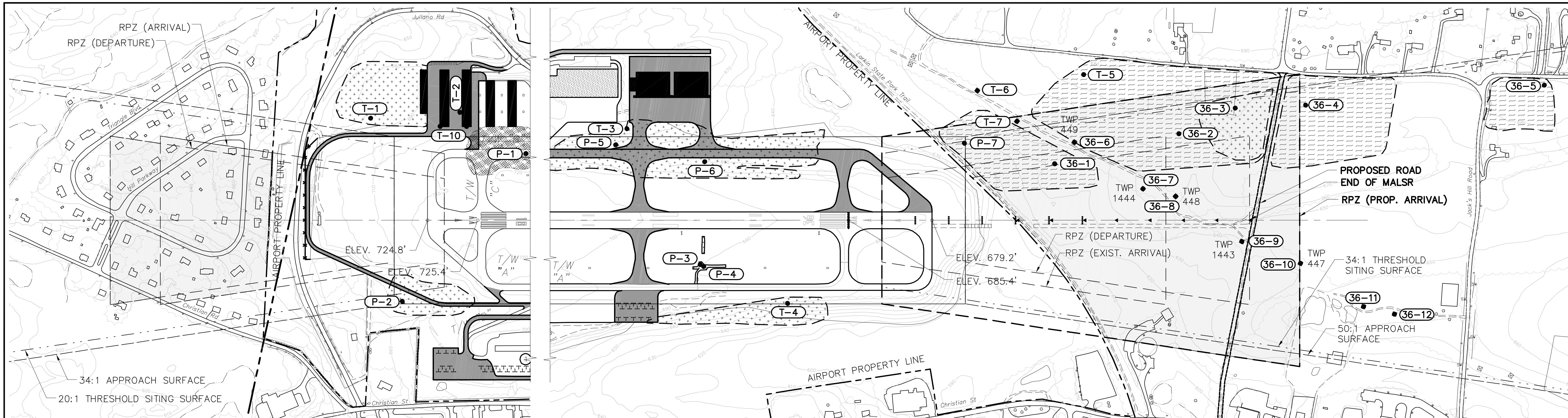
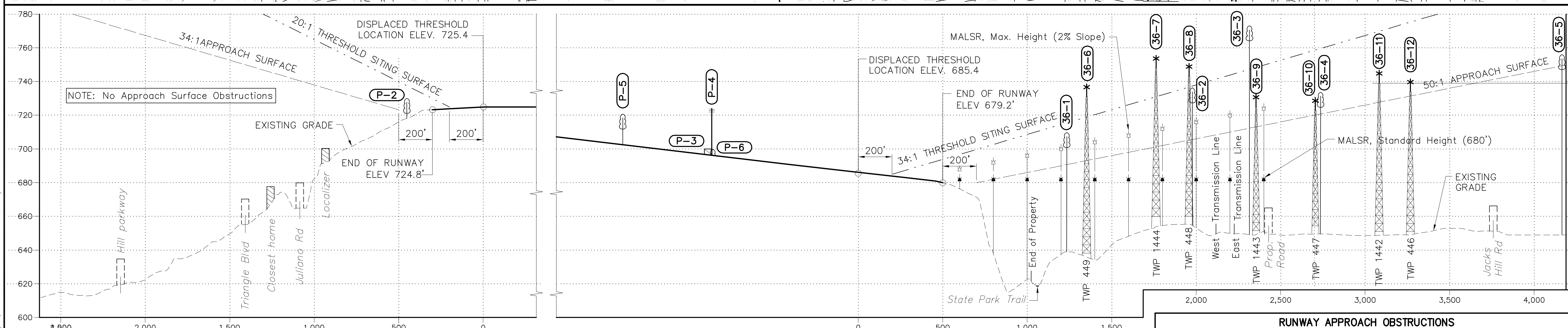




TRANSITIONAL SURFACE OBSTRUCTIONS

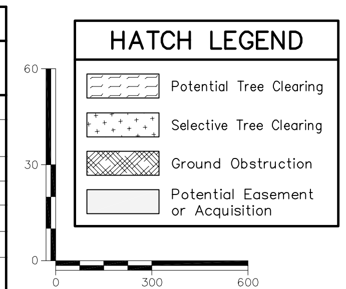
Number	Trees	Top Elevation	Elevation of Surface	Penetration	Ownership	Proposed Action
T-1	Trees	750'	740'	10'	State	Cut/remove
T-2	Light Tower	760'	744'	16'	State	None/lighted
T-3	Trees	728'	718'	10'	State	Cut/remove
T-4	Trees	707'	698'	9'	State	Cut/remove
T-5	Trees	742'	712'	30'	Private	None - Dis. Thresh.
T-6	Trans. Tower	730'	722'	8'	Utility	Light
T-7	Trans. Tower	736'	695'	41'	Utility	Bury Trans. Line
T-8*	ATCT	782'	765'	27'	State	None/Lighted
T-9*	Restaurant	730'	720'	10'	State	Light
T-10	Proposed T-Hangers	745'	735'	10'	State	Light

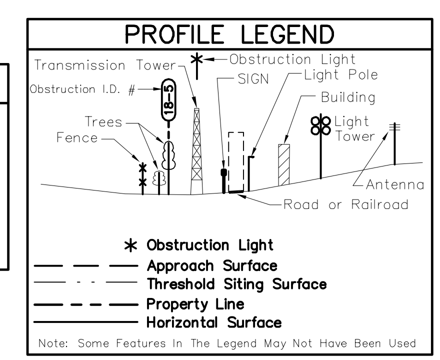
Easement or Acquisition Required *Not Shown, See Alp-2

PRIMARY SURFACE OBSTRUCTIONS

Number	Description	Top Elevation	Elevation of Surface	Penetration	Ownership	Proposed Action
P-1	Ground	728'	725'	3'	State	None
P-2	Trees	730'	725'	5'	State	None-Displaced threshold
P-3	GS Building	700'	695'	5'	State	None-Lighted
P-4	GS Antenna	724'	695'	29'	State	None-Lighted
P-5	Trees	727'	703'	24'	State	Cut/remove
P-6	Trees	700'	695'	5'	State	Cut/remove
P-7	Trees	680'	679'	1'	State	None-Displaced threshold

Easement Or Acquisition Required





RUNWAY APPROACH OBSTRUCTIONS

Number	Description	Top Elevation	Elevation of Surface	Penetration	Ownership	Proposed Action
36-1	Trees	710'	690'	20'	Private	None-Displaced Threshold
36-2	Trees	736'	705'	31'	Private	None-Displaced Threshold
36-3	Trees	773'	712'	61'	Private	Selective Cut#
36-4	Trees	734'	720'	14'	Private	None-Displaced Threshold
36-5	Trees	756'	749'	7'	Private	None-Displaced Threshold
36-6	Transmission Tower 449	731'	692'	39'	Utility	Bury Transmission Line
36-7	Transmission Tower 1444	747'	700'	47'	Utility	Bury Transmission Line
36-8	Transmission Tower 448	742'	705'	37'	Utility	Bury Transmission Line
36-9	Transmission Towe 1443	724'	713'	11'	Utility	Bury Transmission Line
36-10	Transmission Tower 447	722'	720'	2'	Utility	None-Displaced Threshold
36-11	Transmission Tower 1442	739'	727'	12'	Utility	None-Displaced Threshold
36-12	Transmission Tower 446	734'	731'	3'	Utility	None-Displaced Threshold
36-13*	Utility Pole	790	782	8'	Utility	None-Displaced Threshold

Easement or Acquisition Required * See ALP-5

Revisions:	Drawn By:	App'd. By:	Date:

Jan. 2005, Rate of Change 0.0°

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CONNECTICUT DEPARTMENT OF TRANSPORTATION

WATERBURY OXFORD AIRPORT OXC MASTER PLAN

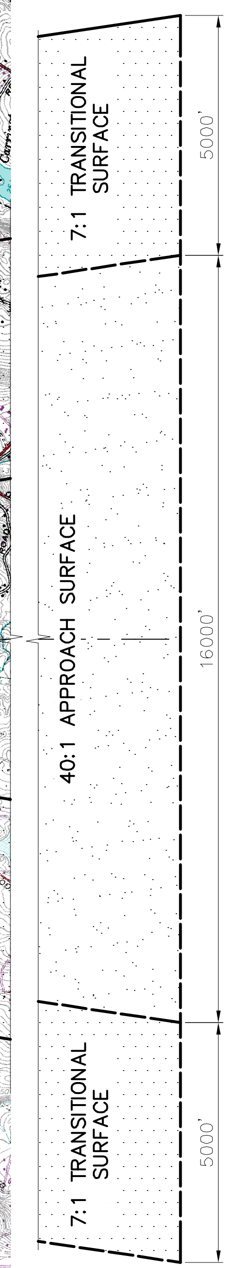
Waterbury-Oxford Airport Master Plan Update

INNER APPROACH SURFACE DRAWING

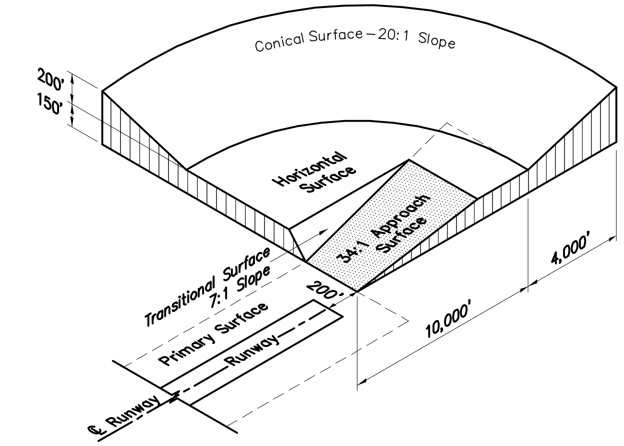
Drawing No. ALP-4

SCALE: AS NOTED | DATE: SEPTEMBER 2007 | SHEET 4 OF 7

File: U:\12489\ACAD\FINAL_SEPT_2007\ALP-4_PLAN-PROFILE_12489_09-24-07.DWG Saved: 9/24/2007 11:24 AM User: Medina, Perry



0 2,000 4,000
Scale in feet



IMAGINARY SURFACES – ISOMETRIC VIEW

NO SCALE

Woodbury	Waterbury, CT
Southbury AIRPORT	Naugatuct

USGS QUADRANGLES

HATCH LEGEND

- Tree Penetration
- ● (H-1) Obstruction & Obstruction I.D. No.

HORIZONTAL & CONICAL SURFACE OBSTRUCTIONS

Number	Description	Top Elevation	Elevation of Surface	Penetration	Ownership	Proposed Action
H-1	Trees	900'	876'	24'	Private	–
H-2	Trees	916'	876'	40'	Private	–
H-3	Trees	964'	876'	88'	Private	–
H-4	Ant. on Tower	962'	876'	86'	Private	None – Lighted
H-5	Trans. Tower	954'	876'	78'	Utility	None
H-6	Ant. on Tower	950'	876'	74'	Private	None – Lighted
H-7	Ant. on Tower	901'	876'	25'	Private	None – Lighted
C-1	Ant. on Tower	939'	913'	26'	Private	None – Lighted

Easement Or Acquisition Required

NOTE: PRIMARY, INNER APPROACH & TRANSITIONAL SURFACE OBSTRUCTIONS ARE ILLUSTRATED ON ALP-4

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CONNECTICUT DEPARTMENT OF TRANSPORTATION

WATERBURY OXFORD AIRPORT OXC MASTER PLAN

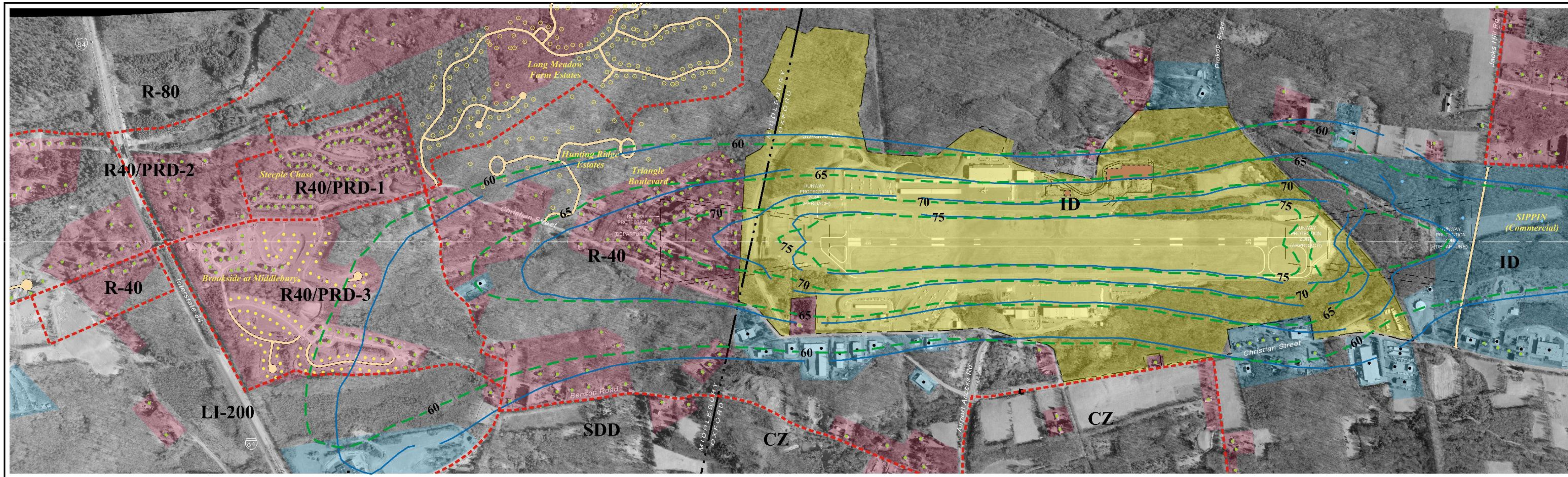
Waterbury–Oxford Airport
Master Plan Update

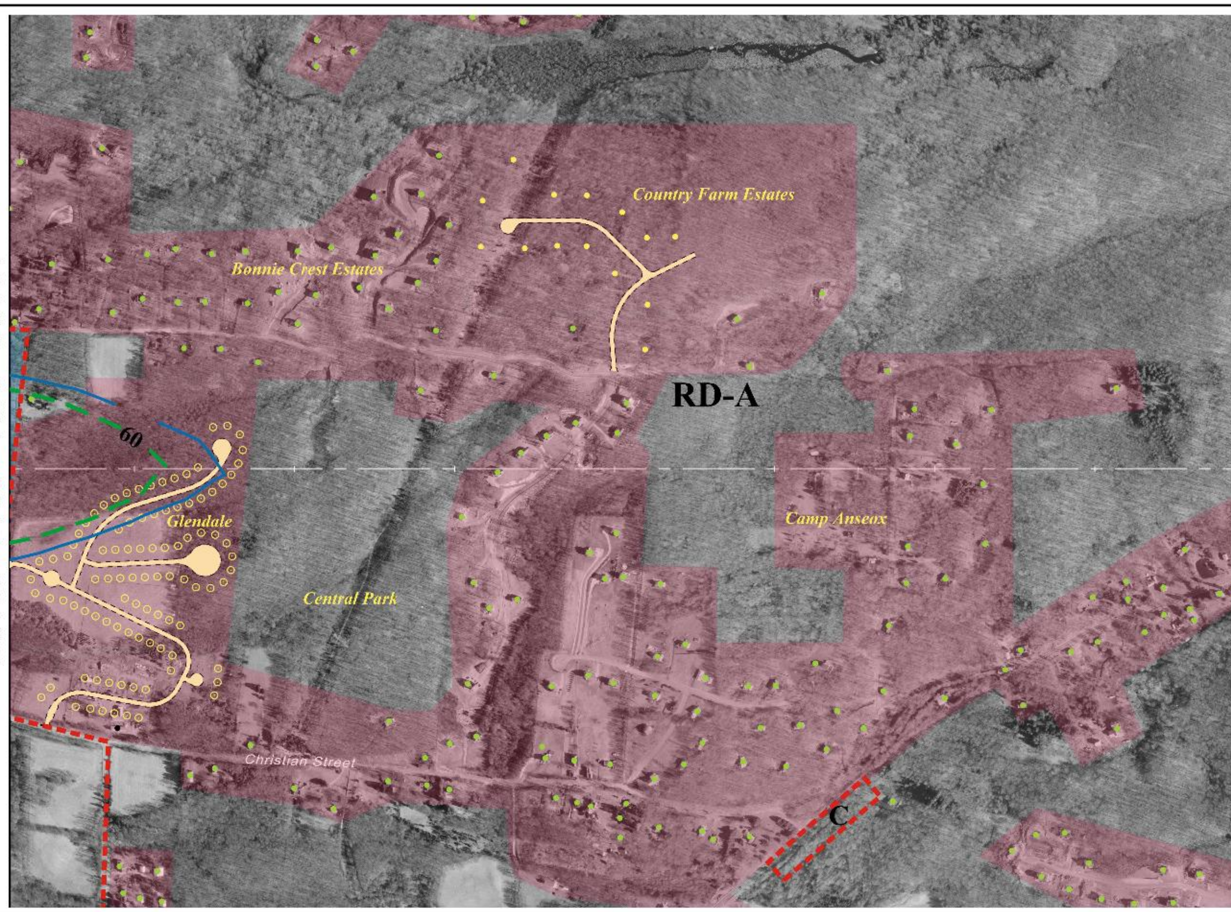
AIRPORT AIRSPACE PLAN

Drawing No. ALP-5

SCALE: AS NOTED | DATE: SEPTEMBER 2007 | SHEET 5 OF 7

File: U:\12489\ACAD\FINAL_SEPT_2007\ALP-5_AIRSPACE_12489_09-24-07.DWG Saved: 9/24/2007 11:25 AM User: Medina, Perry





ZONING

Runway Alignment (Marks every 1,000')	
Town Boundary	
Approx. Airport Property Line	
Zoning Limit	

Town of Oxford

ZONE	Description
C	Commercial
CZ	Corporate Zone
ID	Industrial District
RD-A	Residential District - A

Source:Oxford Zoning Map

Town of Middlebury

ZONE	Description
R-40	Residential
R-80	Residential
R-40/PRD-1	Planned Residential Development
R-40/PRD-2	Planned Residential Development
R-40/PRD-3	Planned Residential Development
LI	Light Industry
SDD	Special Development District

Source:Official Middlebury, CT Zoning Map - May 1, 2003

LAND USE

- Airport Property
- Undeveloped, Open, Wooded
- Residential
- Commercial/Industrial
- State Park Trail
- Single family, Existing
- Single family, Post 2003
- Single family, Future*
- Commercial, Existing
- Commercial, Future*

*Per approved Site Plans provided by the Towns of Oxford and Middlebury

Miscellaneous

- 65 — 2003 Noise Contour with dB Level in DNL
- 65 — 2008 Noise Contour with dB Level in DNL

DNL = Day-Night Average Noise Level

0 600 1,200
Scale in feet

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CONNECTICUT DEPARTMENT OF TRANSPORTATION

WATERBURY OXFORD AIRPORT OXC MASTER PLAN

Waterbury-Oxford Airport
Master Plan Update

LAND USE PLAN

Drawing No. ALP-6

SCALE: AS NOTED | DATE: SEPTEMBER 2007 | SHEET 6 OF 7

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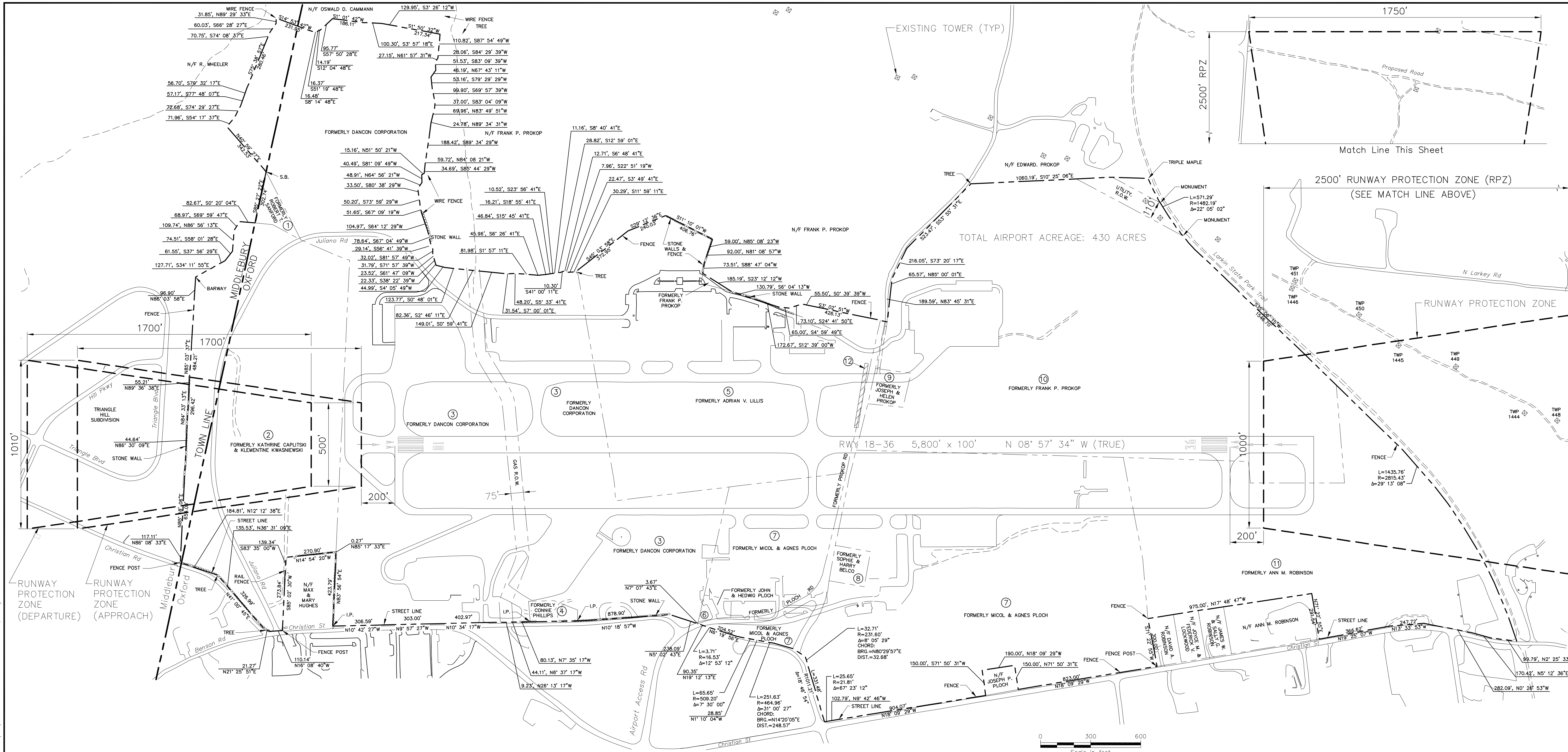

MAP KEY	GRANTOR	GRANTEE	INSTRUMENT	BOOK	PAGE	DATE	TOWN	REMARKS
1	ROBERT T. SANFORD	STATE OF CT.	W.D.	69	40	3-25-68	OXFORD	
2	KATHRINE CAPLITSKI & KLEMENTINE KWASNIEWSKI	"	INTERLOCUTORY JUDGEMENT	67 68	6&7 600	10-3-68 11-3-67	MIDDLEBURY OXFORD	
3	DANCON CORPORATION	"	"	68	599	9-22-67	OXFORD	
3	DANCON CORPORATION	"	Q.C.	67 66	331 700	9-4-68 9-9-68	OXFORD MIDDLEBURY	CORRECTS INACCURATE DESCRIPTION IN CONDEMNATION PROCEEDINGS
4	CONNIE M. PHILLIPS	"	W.D.	68	246	1-9-66	OXFORD	
5	ADRIAN LILLIS	"	"	62	500	8-18-66	"	
6	JOHN M. & HEDWIG F. PLOCH	"	INTERLOCUTORY JUDGEMENT	68	601	5-26-67	"	
7	MICHOL & AGNES PLOCH	"	W.D.	62	511	9-19-66	"	EASEMENT AMERICAN TELEPHONE & TELEGRAPH CO., VOL. 27, PG. 153, OXFORD LAND RECORDS

WATERBURY-OXFORD AIRPORT

MAP KEY	GRANTOR	GRANTEE	INSTRUMENT	BOOK	PAGE	DATE	TOWN	REMARKS
8	SOPHIE & HARRY BELCO	"	INTERLOCUTORY JUDGEMENT	68	600	5-26-67	OXFORD	
9	JOSEPH J. & HELEN A. PROKOP	"	W.D.	69	9	8-30-67	"	EASEMENT AMERICAN TELEPHONE & TELEGRAPH CO., VOL. 27, PG. 347, OXFORD LAND RECORDS
10	FRANK P. PROKOP	"	INTERLOCUTORY JUDGEMENT	68	601	1-5-68	"	
11	ANN M. ROBINSON	"	W.D.	68	247	1-9-66	"	EASEMENT AMERICAN TELEPHONE & TELEGRAPH CO., VOL. 27, PG. 348, OXFORD LAND RECORDS
	AMERICAN TELEPHONE & TELEGRAPH CO.	"	Q.C.	68	315	5-9-67	"	RELEASE EASEMENT RECORDED IN OXFORD LAND RECORDS, VOL. 27, PG. 153
	AMERICAN TELEPHONE & TELEGRAPH CO.	"	"	68	351	6-8-67	"	RELEASE EASEMENT RECORDED IN OXFORD LAND RECORDS, VOL. 27, PG. 149
	AMERICAN TELEPHONE & TELEGRAPH CO.	"	"	68	352	6-8-67	"	RELEASE EASEMENT RECORDED IN OXFORD LAND RECORDS, VOL. 27, PG. 347
12	STATE OF CT.	WOODBURY TELEPHONE COMPANY	EASEMENT	70	551	4-3-69	"	20' TELEPHONE R.O.W.

NOTE: APPROXIMATE PROPERTY LINE INFORMATION BASED ON DRAWINGS 1 AND 2, WATERBURY-OXFORD AIRPORT EXHIBIT "A", DATED 9-14-1971.

LEGEND

ITEM	EXISTING
AIRPORT PROPERTY LINE	
INTERNAL PARCELS	
TOWN BOUNDARY	
RUNWAY PROTECTION ZONE (RPZ)	
UTILITY R.O.W. (LABELED ON DRAWING)	
EASEMENT	

Revisions:	Drawn By:	App'd. By:	Date:

14.1 Degrees W Magnetic
Jan. 2005, Rate of Change 0.0°

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POM	9-07

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CONNECTICUT DEPARTMENT OF TRANSPORTATION

WATERBURY OXFORD AIRPORT OXC MASTER PLAN

Waterbury-Oxford Airport Master Plan Update

PROPERTY MAP

Drawing No. **ALP-7**

SCALE: AS NOTED | DATE: SEPTEMBER 2007 | SHEET 7 OF 7

File: U:\12489\ACAD\FINAL_SEPT_2007\ALP-7_PROPERTY-MAP_12489_09-24-07.DWG Saved: 9/24/2007 11:28 AM User: Medina, Perry

Appendix F

AIRPORT ECONOMIC IMPACT

Introduction

Airports are economic generators in the communities they serve. They offer business opportunities to entities engaged in servicing aircraft and providing flight services to local and visiting pilots and passengers. Airport businesses also serve other users in their community by providing a convenient location to receive and send shipments of goods. In sum, airports serve as gateways for economic activity, providing a stimulus for business enterprises, and generating employment opportunities for area residents.

The economic contribution of an airport should be publicly recognized so that actions to protect its continued operation can gain community support. For some, an airport is viewed as a recreational facility that is used by relatively few persons. However, a broader vision is more appropriate, as airports provide services that affect all citizens. For example, an airport enables such activities as:

1. Access to the national air transportation system.
2. Transshipment of equipment, supplies, and personnel.
3. Emergency ingress and egress transportation, including medical response.
4. Shipment of time-sensitive items.
5. Pilot training.
6. Aircraft maintenance and storage.

The importance of air transportation, particularly in the corporate aviation sector, is growing. The ability to make just-in-time deliveries and to transport sales and customer service staff to quickly forming events is a critical business advantage.

The Waterbury-Oxford Airport (OXC) is actively used for all of the above purposes, and generates positive economic impacts in terms of employment and purchases of goods and services from local businesses. In general, the local communities served by OXC include those within the Central Naugatuck Valley and beyond, as reflected by the geographic distribution of the based aircraft owners.

Airport economic impacts are generally expressed as direct, indirect, and induced. Direct economic impacts are defined as the jobs and sales generated by businesses located at an airport (i.e., those which are dependent on access to the facility). The expenditures by these businesses for local goods, services, and capital improvements are also classified as direct impacts.

Indirect economic impacts are the jobs and revenues generated by businesses located elsewhere in the community, but are due to their use of the airport. This would include any sector of the local economy that serves users of the facility, or that uses an airport to transport goods, supplies, or personnel in order to enhance business opportunities and activities. Like on-airport businesses, these enterprises employ staff, purchase locally produced goods and services, and invest in capital projects. Businesses in this category can include hotels, restaurants, manufacturers, shippers, and retail stores whose existence is tied to the airport or to aviation. When assessing economic impact values, distinction is made between those generated as a result of the airport (direct) and those serving other segments of the local economy (indirect).

Induced economic impacts are those generated in a community caused by the recycling of spending from both the direct and indirect economic impacts. Airport businesses, users, employees, and the airport itself are, in essence, consumers whose expenditures support other businesses and employment in the community. Studies have indicated that a dollar spent in a region will create at least another dollar of income in that region. This reaction is commonly referred to as the "multiplier effect." Thus, the induced economic impact of any activity is at least equal to the sum of the direct and indirect impacts, in terms of dollars.

Finally, the total economic impact is defined as the sum of the direct, indirect and induced impacts. For example, if an airport generates $60 in direct impact, $40 in indirect impact, and has a 2.0 multiplier for the induced impact, then the total economic impact would be $200 (i.e., ($60 + $40) * 2.0 = $200).

As an airport's activity level changes over time, the total economic impact will similarly change. Continued improvement of an airport may serve to attract more activity and result in an increased economic impact value to the communities served.

OXC Airport Tenant Survey

A detailed economic survey of 23 tenants at Waterbury-Oxford Airport (OXC) was conducted. The survey requested information concerning tenant expenditures for salaries, wages, purchases of goods and services, and capital investments to support their operations in calendar year 2004. The survey results are confidential, and only aggregate totals are identified.

Responses were obtained from only 8 of the 23 tenants. Furthermore, not all respondents provided information for each question, and despite significant efforts to increase the response rate, the data obtained was limited. As such, in lieu of a comprehensive evaluation of airport economic activity at OXC, the survey data was subjected to a weighted extrapolation to account for the non-responding tenants. The weighted extrapolation was used to derive generalized estimates of direct, indirect, and induced economic impacts, and employment levels.

Direct Impacts

Direct impacts are the sum of salaries and wages paid to full-time and part-time employees by the Airport tenants, and their expenditures for local goods and services and capital investments. The computed direct economic impacts totaled $26.6 million in 2004. The total estimated direct employment at OXC is 166. Of these, 96 are full-time employees and 70 are part-time positions.

Indirect Impacts

Indirect impacts were estimated from the number of itinerant aircraft arrivals made by visiting (i.e., transient) aircraft. Due to the unique characteristics of OXC, it was assumed that visiting pilots and passengers, and their associated expenditures were limited, and resulted in only $400,000 annual indirect impact in 2004. This conservative estimate was derived from the following assumptions:

- 40% of all itinerant aircraft landings were conducted by visiting aircraft
- Propeller-driven aircraft carried an average of 2 passengers including the pilot
- Business jets carried an average of 3 passengers, plus a crew of two
- Each visitor, including the pilot, spends $25 daily while in the local area

The Airport also generates additional indirect economic impacts from off-airport businesses that use OXC for the shipment of goods and transportation of personnel. However, this portion of the indirect benefit was not quantified.

Induced Impacts

The multiplier effect or the induced economic impact for OXC was assumed to equal the sum of the direct and indirect impacts. Thus, the induced economic impact is $27 million in 2004.

Total Economic Impact

The total estimated economic impact of OXC based on the survey responses was therefore $54 million in 2004, as listed below.

- Direct: $26.6 million
- Indirect: $ 0.4 million
- Induced: $27.0 million
- Total: $54.0 million

Additionally, OXC provided direct employment for 166 persons, or approximately 320 total jobs throughout the local economy. These levels should increase as more activity occurs at the OXC.

Comparison with Other Airports

Due to the limited survey response rate for OXC, a second approach for estimating the economic impact of OXC was developed. The second assessment used a comparative evaluation of general aviation airports with similar characteristic to OXC.

Several states have conducted economic impact analyses for the general aviation airports in their system. Relatively recent studies published by the state aviation agencies of Arizona, Florida, New Jersey, New York, Pennsylvania and Texas were reviewed, and used as a second means to estimate OXC's economic output.

A sample of airports from all six states was selected for comparison. These included airports with a runway length of at least 5,000 feet, based corporate jet aircraft, but no airline, air cargo, or military facilities. The sample airports are listed in Table E-1 (in increasing order of general aviation itinerant operations). An average of 39,200 itinerant aircraft operations was determined for the listed airports, which is similar to the 35,839 itinerant operations at OXC in 2003.

TABLE E-1 – AIRPORT ECONOMIC IMPACT SUMMARY					
Airport Name	**Location**	**Year**	**Aviation Related Jobs**	**Itinerant Operations**	**Annual Economic Impact ($)**
Monmouth Executive	Belmar/Farmingdale, NJ	2004	391	7,653	$7,183,400
Robert J. Miller Airpark	Toms River, NJ	2004	115	11,200	$9,486,700
Mid-Valley	Weslaco, TX	2003	72	16,000	$5,277,000
Sedona	Sedona, AZ	2002	327	20,000	$21,178,718
Fort Worth Spinks	Fort Worth, TX	2003	213	20,000	$18,208,200
Mesquite Metro	Mesquite, TX	2003	116	20,500	$8,334,100
Sullivan County	Monticello,, NY	2002	57	20,535	$4,697,000
Hernando County	Brooksville, FL	2000	121	22,000	$9,373,700
Odessa-Schlemeyer Field	Odessa, TX	2003	105	23,750	$8,398,200
Winter Haven's Gilbert	Winter Haven, FL	2000	50	25,000	$4,548,500
McGregor Executive	Waco, TX	2003	152	26,750	$13,575,200
Show Low Regional	Show Low, AZ	2002	140	28,000	$9,730,978
Bob Sikes	Crestview, FL	2000	499	29,000	$47,235,100
Ocala International	Ocala, FL	2000	157	35,171	$14,475,900
Denton Municipal	Denton, TX	2003	472	45,000	$30,578,700
Allegheny County	Pittsburgh, PA	1999	1,279	47,329	$123,472,300
Dutchess County	Wappingers Falls, NY	2002	847	49,323	$55,379,000
Vandenburg	Tampa, FL	2000	110	44,000	$9,686,800
Ryan Field	Tuxson, AZ	2002	497	50,116	$35,769,729
Republic Airport	Farmingdale, NY	2003	1,374	91,263	$139,649,100
Northeast Philadelphia	Philadelphia, PA	1999	830	99,450	$255,648,600
Morristown Municipal	Morristown, NJ	2004	3,180	130,440	$271,089,500
		Total:	**11,104**	**862,480**	**$1,102,976,425**
		Average:	**505**	**39,204**	**$50,135,292**
				Average Annual Economic Impact per Itinerant Operation:	**$1,279**

The values indicated in Table E-1 vary widely, which is due in part to the individually unique airport-community relationships. The lowest illustrated economic impact value is approximately $5 million, and is for an airport with little business jet activity. The highest, over $271 million, is for an airport with over four times the itinerant traffic as OXC. However, in general the results for each airport are impressive, with output substantially more than the cost of operating, maintaining, and improving each facility on an annual basis.

Using the average value of total economic impact per general aviation itinerant operation of $1,279, it is estimated that OXC generated a total economic return to the community of nearly $46 million in 2003.

Conclusion

The weighted extrapolated survey data developed from tenants at OXC ($54 million) compares favorably with that estimated for similar airports from the statewide studies ($46 million). As such, based on these two methods, it is reasonable to estimate the total annual economic impact value of OXC to be approximately $50 million.

Additionally, OXC provides full-time and part-time employment opportunities for some 166 individuals within the local communities of the Central Naugatuck Valley, and generate over 330 total jobs considering the multiplier effect.

A 1994 study by the American Associates of Airport Executives (AAAE) estimated OXC's total economic impact to be $16 million (in 1993 dollars). Even adjusting for inflation, the substantial facility development at OXC over the past 10 years, and the additional based and visiting aircraft, has generated a substantial increase in the economic contribution of the Airport to the local economy.