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Environmental Impact Analysis Process

Final Environmental Impact Statement
for
Proposed Air Force Reserve Mission Change
(C-130 to C-5A Aircraft)
and
Westover Metropolitan Development Corporation
(Expansion of Civil Aviation Operations Through 1995)
at
Westover Air Force Base, Massachusetts
April 1987

93-17126

DEPARTMENT OF THE AIR FORCE
Headquarters, Air Force Reserve
Robins Air Force Base, Georgia

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COVER SHEET

(a) Responsible Agency: U.S. Air Force

(b) Designation: Final Environmental Impact Statement (2 volumes)

(c) Proposed Actions: Two separate proposed actions are under consideration by the U.S. Air Force for implementation at Westover Air Force Base (AFB), Massachusetts:
(1) Reorganization of the 439th Tactical Airlift Wing (TAW). The 439th TAW currently based at Westover AFB would be reorganized as the 439th Military Airlift Wing and reconfigured to support a worldwide strategic airlift capability. This would be accomplished by relocating the 16 C-130E aircraft currently assigned to the 439th TAW and replacing them with a total of 16 C-5A aircraft to be released from the active forces. Replacement of the C-130 aircraft with 8 C-5A aircraft is considered as an alternative.
(2) Increase in the hours of airfield operation to 24 hr/day. On June 13, 1986, the Westover Metropolitan Development Corporation (WMDC) submitted a request to increase the hours of airfield operation from the current 7 a.m. to 11 p.m. to 24 hr/day. This increase is considered by WMDC to be necessary for the development of civil aviation operations to the potential levels identified in a traffic analysis prepared for the WMDC Master Plan.

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(e) Abstract: This statement assesses the environmental impacts expected to result from implementing either proposed action alone and the cumulative impacts of both actions; the no action alternative is also considered. Implementation of either proposed action would create positive economic impacts through increases in both permanent and temporary increases in direct and indirect employment. The principal adverse impacts expected to result from implementation of either proposed action, alone or in combination, would be related to increases in noise levels in areas surrounding the base. In all cases, the primary human response would be annoyance; no other significant adverse effects on humans, including hearing loss and nonauditory health impacts would be expected to result. Increases in noise levels would result in impacts on current land uses (primarily residential development) and could impose constraints on future development (also primarily residential uses). Some decreases in property values may also occur in affected areas.

Nighttime operations that may occur if civil aviation operations are developed to the levels indicated in the traffic demand analysis would result in sleep disturbance to some residents. WMDC has proposed a mitigation plan that will reduce but not eliminate sleep disturbance and other noise impacts.

(f) Released to the public on April 10, 1987.

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SUMMARY

Two separate proposed actions related to operations at Westover Air Force Base (AFB), Massachusetts, are under consideration by the U.S. Air Force. The first is reorganization of the 439th Tactical Airlift Wing (TAW) to support a strategic airlift mission. The second is a request by the Westover Metropolitan Development Corporation (WMDC) for an increase in the hours of airfield operation to 24 hr/day.

Reorganization of the 439th TAW to provide a strategic airlift mission capability is required to provide a location for beddown of 16 C-5A cargo aircraft to be released from the active forces. To partially fill the airlift capacity shortfall identified by the Congressionally Mandated Mobility Study, the U.S. Department of Defense is purchasing a total of 50 C-5B aircraft. Because of congressional limitations on active force manpower, transfer of C-5A aircraft and flying missions from the active to the reserve forces is necessary. A total of 44 C-5A aircraft will be transferred to the Air Reserve Forces. Twelve aircraft authorized for the Air National Guard will be located at Stewart Air National Guard Base, New York. The remaining 32 aircraft will be assigned to the Air Force Reserve (AFRES). The first AFRES C-5A equipped unit has already been established at Kelly AFB, Texas, and is authorized to receive a total of 16 aircraft. The proposed reorganization of the 439th TAW would provide a location for beddown of the remaining 16 aircraft to be released to AFRES. The reorganization of the 439th TAW would be accomplished by replacement of the 16 C-130E aircraft with 16 C-5A aircraft and reconfiguration of the unit as the 439th Military Airlift Wing (MAW).

The second action under consideration, the request by the WMDC to increase the hours of airfield operation to 24 hr/day, is considered by WMDC to be necessary for expansion of commercial (particularly all-cargo freight carriers) and general aviation aircraft operations to the potential levels identified in the WMDC Master Plan prepared in May 1986. Although a decision by the Air Force to increase the hours of airfield operation would not result in a direct increase in civil aviation activity, it would provide a basis for WMDC to proceed with negotiations with potential air cargo carriers. Thus, a decision by the Air Force to permit 24-hr airfield operations would be likely to result in increases in aircraft operations which would affect persons living in the vicinity of Westover AFB, and the Air Force is required by the National Environmental Policy Act (NEPA) to consider the potential impacts of its decision.

This Environmental Impact Statement (EIS) analyzes the impacts likely to result from implementation of either of the military actions or the WMDC action in comparison with continuing current operations (the "no action" alternative). The cumulative impacts likely to result from implementation of both proposed actions in combination are also considered.

DESCRIPTION OF THE PROPOSED ACTIONS

Reorganization of the 439th Tactical Airlift Wing

The 439th TAW currently based at Westover AFB would be reorganized as the 439th MAW and reconverted to support a worldwide strategic airlift capability. This would be accomplished by relocating the 16 C-130E aircraft currently assigned to the 439th TAW and replacing them with a total of 16 C-5A aircraft to be released from the active forces. Of this total, 14 aircraft would be primary assigned aircraft (PAA) for which aircrews, support personnel, and annual flying program hours would be authorized. The two remaining aircraft would be designated as backup aircraft inventory (BAI) for which no personnel or flying program would be authorized. At some time in the future, the backup aircraft may be converted to active status; therefore, the analyses in this EIS are based on the operation of 16 aircraft.

Implementation of the proposed military action would

1. reorganize the 439th TAW as the 439th MAW,
2. convert the unit equipage from 16 PAA C-130E aircraft to a total of 16 C-5A aircraft (14 PAA and 2 BAI),
3. reconfigure unit mission capabilities to support a worldwide strategic airlift mission operating within the Military Airlift Command operational channel.

The original proposed action, announced in the spring of 1985, was the replacement of the C-130 aircraft with 8 C-5A aircraft and was presented at the public scoping meeting held on September 26, 1985. At that time, the possibility of assigning 16 C-5A aircraft was presented as an alternative. Subsequent to the public scoping meeting, the Air Force determined that the proposed military action should be changed to reflect the basing of 16 aircraft as indicated above. Replacement of the C-130 aircraft with 8 C-5A aircraft is now considered as an alternative.

Military alternatives considered in this EIS include the proposed and alternate mission changes and the no action alternative (continuation of current operations). In addition to Westover AFB, five other installations were considered as alternatives: (1) Orlando International Airport (formerly McCoy AFB), Florida; (2) Patrick AFB, Florida; (3) Cape Canaveral Air Force Station, Florida; (4) Charleston AFB, South Carolina; and (5) Hunter Army Airfield, Georgia. Because Air Force evaluations determined that these locations did not meet the siting criteria, they are not considered further in this EIS.

Implementation of the proposed (16 C-5A aircraft) military action would result in a decrease in the annual flying hour program from the current level of 6,460 hr to approximately 4,960 hr. Local flying activity would decrease from the current level of 30 sorties per week to 4 sorties per week. Sortie duration would increase from 2.5 to 5 hr, resulting in a decrease in local flying hours from 75 to 20 per week. Implementation of the alternate (8 C-5A aircraft) military action would result in a reduction in the annual flying hour program to approximately 2,480 hr, with a reduction in local training activity to approximately 2 sorties per week (10 hr/week).

The proposed military action would result in an increase of approximately 332 full-time positions authorized for the 439th MAW. This would include approximately 13 civil service positions plus 319 air reserve technicians (ART) positions. In addition to the increase in full-time position authorizations, approximately 1,000 additional military reserve positions would be authorized, to be filled by military personnel assigned to the Air Force Reserve. Reservists normally attend unit training assemblies one weekend per month and serve on active duty for approximately 2 weeks/year. Of these additional reserve positions, 319 would be filled by ARTs who hold both reserve and civil service appointments, resulting in a net increase of 681 reserve positions available to be filled. Implementation of the alternate mission change would result in the creation of approximately 5 additional civilian positions, 124 ART positions, and 469 non-ART part-time reserve positions.

Construction of new facilities and the modification and upgrading of existing facilities would be required for either military action. The estimated cost of construction and modification projects required for implementation of the proposed mission change is $46.9 million. Because the alternate military action would require less apron and taxiway area, the estimated cost of projects required for this mission change is $40.9 million. These projects would be in addition to ongoing and planned projects totaling approximately $11 million (after adjustment for projects which would not be required if the proposed or alternate military action were implemented).

Increase in airfield operating hours and expansion of WMDC operations

Westover AFB has been available for civil aviation activity since 1981; however, for a number of reasons (including the lack of 24-hr operational capability, lack of facilities to support commercial air carrier operations, and unsettled economic conditions), development of civil aviation activity has been limited. Commercial air carrier activity now consists mainly of two daily scheduled all-cargo flights operated by Emery Air Freight. Approximately 35 general aviation aircraft are based at Westover. There is no scheduled air passenger service.

An air traffic demand analysis prepared for the WMDC Master Plan addresses three basic categories of aviation demand (scheduled passenger service, air cargo, and general aviation activity) and identifies potential traffic levels that could reasonably be achieved by 1995 if suitable facilities and operating conditions are provided. This analysis concluded that the Westover area has sufficient traffic demand to economically sustain both scheduled air carrier services and scheduled all-cargo services.

Airfield operations at Westover AFB are controlled by the Air Force. At present, the control tower is operated only between 7 a.m. and 11 p.m.; aircraft operations between 11 p.m. and 7 a.m. are not permitted on a regular basis. WMDC considers 24-hr operations as necessary for development of cargo aircraft operations to the level indicated in the WMDC Master Plan. On June 13, 1986, WMDC submitted a request to the Air Force to increase the operating hours of the tower to 20 hr/day on an interim basis pending a permanent increase to 24 hr/day. Because the number and

distribution of operations during a 20-hr operating period would be approximately the same as during a 24-hr period, only the impacts of 24-hr operation are addressed in this EIS.

The traffic analysis prepared for WMDC indicates that a level of approximately 23 all-cargo flights per day could be achieved by 1995 if suitable facilities and operating conditions are provided. Approximately 24 passenger flights per day might also be reached by 1995. Passenger and general aviation operations would occur primarily during the hours between 7 a.m. and 10 p.m. (considered as "daytime" for purposes of noise impact assessment); however, it is anticipated that a significant portion of the daily air cargo operations (a takeoff or landing is considered as a separate operation) would occur during the nighttime hours between 10 p.m. and 7 a.m. Although the actual operations cannot be determined at this time, in typical air cargo terminal operations, incoming aircraft arrive on approximately the same schedule; cargo is unloaded, sorted, and redistributed; and the aircraft then depart on approximately the same schedule. For this analysis, arrivals of air cargo aircraft were assumed to occur between 10 p.m. and midnight and departures between 5 a.m. and 7 a.m.

Subsequent to the release of the Draft Environmental Impact Statement (DEIS), WMDC developed a mitigation plan to reduce the impacts of increased civil aviation operations. This plan includes the following major provisions:

- prohibiting scheduled operations by Stage II large turbojet (e.g., B-727-200 and B-747-100) aircraft between the hours of 10 p.m. and 7 a.m.;
- restricting scheduled operations between the hours of 1 a.m. and 5 a.m.;
- establishing preferential runway utilization to minimize population impacted by aircraft operations. To the maximum extent permitted by weather conditions and military aircraft operations, runway 23 would be used for landings and runway 05 for departures;
- requiring that aircraft initiate takeoffs from the beginning of the runway to increase altitudes and minimize ground-level noise over populated areas; and
- limiting 9-hr (10 p.m. to 7 a.m.) equivalent noise levels (Leq-9) to the level projected to result from the operation of all Stage III aircraft by the time the maximum number of operations is reached.

This mitigation plan is discussed in detail in Sect. 4.1.2.2 and in Appendix J. Analysis of the impacts (see Appendix K) expected to result from operations in accordance with this mitigation plan indicates a significant reduction in impacts relative to the levels identified in the DEIS for operations without mitigation (see Appendix D). Section 4.2 provides a comparison of the mitigated and unmitigated impacts of civil

aviation operations, alone and in combination with the proposed and alternate military operations.

The projected level of air cargo movements would require approximately 475 additional employees (in addition to about 95 persons currently employed to service air cargo operations). Projected passenger airline and terminal building operations would require approximately 120 new employees, and projected growth in general aviation services to corporate aircraft could require up to 85 additional flight-line and fuel-service employees. Thus, development of air cargo, passenger, and general aviation services to the potential levels identified in the WMDC Master Plan could result in the creation of 680 new jobs at Westover. The majority of these jobs would be classified as semi-skilled and could be filled by persons in the local labor force.

To support the development of civil aviation operations, renovation of several existing facilities would be required; and several new buildings, including hangars, office facilities, and a passenger terminal, would have to be constructed. Improvements to airfield pavement and lighting, access roads, and automobile parking facilities would also be required. In addition, a major investment in ground support equipment and vehicles would also be required. WMDC estimates the cost of required facilities and equipment at approximately $32 million, of which approximately 75% would be leveraged private investments.

IMPACTS EXPECTED TO RESULT FROM THE PROPOSED ACTIONS

The only significant adverse impacts expected to result from either the military or WMDC actions under consideration by the Air Force would be related to increases in noise levels in areas surrounding the base. Subsequent to the issuance of the DEIS, WMDC has developed a mitigation plan that provides a significant reduction in the noise impacts expected to result from civil aviation operations, both alone and in combination with either military action. The primary human response would be annoyance. Nighttime civil aviation operations would result in repeated sleep disturbance to some individuals. Little is known about the long-term effect of sleep disturbance on health. No other significant effects to humans, including hearing loss or nonauditory health effects, would be expected on the basis of the projected noise levels. No significant adverse impacts to domestic animals, wildlife, or structures, including historical and archaeological resources, would be expected to occur. Increases in noise levels would impact some current land uses (primarily residential development) and could impose some constraints on future development (also primarily residential uses). Decreases in property values may also occur in areas exposed to increased noise levels. Implementation of either the military or WMDC actions would create positive economic impacts through both permanent and temporary increases in direct and indirect employment. Impacts on flight safety, generation of air and water pollutants, hazardous and solid wastes, and socioeconomic impacts not related to noise were also analyzed and determined not to be significant.

Impacts of Reorganization of the 439th Tactical Airlift Wing

Increased noise levels are the predominant issue related to reorganization of the 439th TAW. Because most members of reserve flight crews have full-time civilian jobs, most local flying activity is scheduled for weekend training assemblies or after normal working hours during the week. Either mission change (the proposed 16 C-5A aircraft or the alternate 8 C-5A aircraft) would result in a continuation of this schedule of activities; however, the number of training sorties would be reduced from the current level of approximately 30 per week to 4 per week for the proposed (16 C-5A) action and 2 per week for the alternate (8 C-5A) action. No military activity would be routinely scheduled between the hours of 10 p.m. and 7 a.m.; therefore, sleep interference would be minimal.

Measures to reduce noise exposures have been incorporated into planned flight patterns, and limited additional mitigation measures may be feasible to reduce specific impacts identified as operations are developed. Implementation of the proposed (16-aircraft) military action would result in an increase in the area exposed to DNL levels >65 dB (the maximum level considered acceptable for residential use without incorporation of noise attenuation measures in residential construction) from the current level of approximately 3.3 sq. mi. to approximately 9.2 sq. mi. The number of persons exposed to DNL levels >65 dB would increase from the current level of fewer than 100 to approximately 3,550. Approximately 30 persons would be exposed to DNL levels >75 dB (the maximum level considered discretionarily acceptable for residential use). Of the 3,550 persons exposed to DNL levels >65 dB, approximately 700 would be expected to be highly annoyed. A few additional persons residing in areas exposed to DNL levels <65 dB may also be highly annoyed by aircraft noise. Implementation of the alternate military action (8 aircraft) would result in an increase in the area exposed to DNL levels >65 dB to approximately 5.7 sq. mi. and the exposure of approximately 1,600 residents to DNL levels >65 dB; none would be exposed to levels >75 dB. Of these individuals, approximately 350 would be expected to be highly annoyed by aircraft noise.

Because the majority of military flight operations would take place during 5-hr local training sorties, 5-hr equivalent noise levels (Leq-5) were also considered. Approximately 16,200 people could be exposed to Leq-5 levels >65 dB during operations on runway 23, and approximately 47,500 could be exposed during operations on runway 05. Noise levels during local training sorties could interfere with activities in which verbal communication is important (such as classroom instruction, business conferences, and religious activities) and with listening to television and radio programs or recorded music. Local training sorties would be scheduled about four times per week for the proposed (16 C-5A) military action and about twice per week for the alternate (8 C-5A) action. Operations on runway 05, which would affect the largest number of people, would be expected to occur less than 20% of the time. As noted previously, most local flying activity would be scheduled for training weekends and after normal working hours during the week. Thus, residential and recreational uses would likely be affected more frequently than educational or business activities.

Either military action would be expected to have a small positive impact on airspace management and air traffic safety. The probability of a serious aircraft accident would also be reduced as a result of the lower mishap probability rate for the C-5A as compared with the C-130 and the reduction in the number of local flying hours. The potential consequences of an accident involving a C-5A are greater because of the greater size, weight, speed, and fuel capacity of the C-5A as compared to the C-130E.

The bathing beach and portions of the picnic areas at the Chicopee Memorial State Park are heavily used by area residents during the summer months and lie just within the boundaries of the clear zone for the approach to runway 05 recommended by the Air Force's Air Installation Compatible Use Zone (AICUZ) program for the operation of heavy cargo aircraft. Because the existing land use is incompatible with recommendations of the AICUZ program, implementation details are currently being worked out for a permanent displacement of the landing threshold of runway 05. The entire threshold relocation project is scheduled to be completed by late 1988. This action will reduce, but not eliminate, the conflict between the existing land uses within the park and land-use recommendations of the AICUZ program. The Air Force has determined that displacement of the landing threshold for runway 05 will be implemented even if a decision is made to base the C-5A aircraft at an alternate location and is proceeding with negotiations with the City of Chicopee to obtain easements for areas within the clear zones for the approaches to both runways 05 and 33 which would provide assurances that incompatible land uses will not be developed within these areas.

Either military action would have a positive effect on employment in the region around Westover AFB. Implementation of the proposed military action (16 C-5A aircraft) would add 332 permanent full-time positions and 681 part-time positions to the numbers authorized for AFRES operations at WAFB. Implementation of the alternate military action (8 C-5A aircraft) would result in increases of 129 full-time and 469 part-time positions, respectively. The increases in personnel authorizations for the proposed and alternate military actions would result in payroll increases of $13.4 and $6.0 million respectively. These increases would be expected to support additional full-time indirect employment totaling approximately 225 to 250 jobs for the proposed military action and 100 to 125 jobs for the alternate military action. In addition to the permanent long-term employment resulting from the increase in personnel authorizations, construction expenditures for the proposed military action would provide a total of approximately 800 person-years of direct employment and 700 to 800 person-years of indirect employment during the construction period. Construction expenditures for the alternate military action would provide a total of approximately 670 and 580 person-years of direct and indirect employment respectively.

Either military action would result in a small net decrease in the emission of air pollutants resulting from aircraft operations relative to current operations. The reductions would be small in relation to regional emissions, and effects on regional air quality would likely be undetectable. Small increases in the rates of generation of hazardous chemical wastes, solid wastes, and industrial and sanitary wastewater would also result; however, no significant adverse impacts are considered likely to occur. Construction activities would be confined to areas that

have already been disturbed, and although the potential would exist for disturbance of two bird species of special interest (the upland sandpiper and the grasshopper sparrow), significant adverse impacts to these species or to other wildlife are considered unlikely. Because construction activities would be confined to areas that have already been developed, no impacts to floodplains or wetlands would be expected to result.

No significant changes in demographics or demand for housing or public services would be expected to result from increases in employment and the resulting inmigration of new residents associated with either military action; thus, no adverse socioeconomic impacts are considered likely. No impacts to historical, archaeological, or cultural resources would be expected to result from either military action.

Impacts of Increases in Civil Aviation Operations (No Change in Military Operations)

Subsequent to the issuance of the DEIS and in response to comments received on the DEIS regarding the significance of projected impacts and the need for mitigation measures, WMDC submitted a mitigation plan that would significantly reduce the noise impacts resulting from increases in civil aviation operations. If WMDC's request for increase in the hours of airfield operations is approved, WMDC is committed to implementation of the measures included in this mitigation plan. Therefore, the analysis of noise impacts expected to result from increases in civil aviation operations has been revised on the basis of these mitigation measures. To provide a basis for evaluation of the effectiveness of these mitigation measures, the impacts based on operations presented in the DEIS, which did not include mitigation measures, are provided for reference.

If the development of civil aviation operations with mitigation takes place in the absence of a change in military aircraft operations (i.e., no change in the mission of the 439th TAW), the area exposed to DNL levels >65 dB would increase from approximately 3.3 sq. mi. to approximately 6.8 sq. mi. The number of persons exposed to DNL levels >65 dB would increase from fewer than 100 to approximately 1,500. Without the WMDC noise mitigation procedures, the area exposed to DNL levels >65 dB would increase to approximately 8.3 sq. mi. and about 6,500 persons would be exposed to DNL levels >65 dB. Thus, the proposed mitigation measures would reduce the area exposed to DNL levels >65 dB by about 18% and the population exposed by about 77% in comparison with the exposures indicated in the DEIS. The reductions result from a combination of elimination of nighttime operations by Stage II aircraft and from the change in runway utilization to reduce overflights of the most heavily populated areas.

Because approximately 28 of the operations would take place between 10 p.m. and 7 a.m. (with most of the landings between 10 p.m. and midnight and most of the takeoffs between 5 a.m. and 7 a.m.), the equivalent noise level for this period was also evaluated for both mitigated and unmitigated operations. As indicated in the DEIS, operations without mitigation measures would expose an area of about 9.2 sq. mi. to weighted nine-hour equivalent (Leq-9) noise levels >65 dB and about 10,800 persons would be exposed to such levels. Operations in accordance with the mitigation plan to which WMDC has committed would reduce the area exposed to Leq-9 levels >65 dB by approximately 32% (from 9.2 to 6.3 sq. mi.). The reduction in

area results primarily from the elimination of operations by Stage II aircraft during the nighttime hours. Because the population density in Chicopee to the southeast of the base is significantly higher than in the area to the northeast of the base, runway utilization has a greater effect on population exposure. The largest numbers of people are affected by landings on runway 05 and takeoffs on runway 23 which result in operations over Chicopee. In the analysis presented in the DEIS, runway 23 was assumed to be used 80% of the time. As discussed in Sect. 4.1.2, an analysis of wind speeds and directions in the Westover area indicates that between 10 p.m. and 7 a.m., runway 05 could be used for takeoffs more than 90% of the time.

Sleep disturbance would be a factor in the level of annoyance resulting from the development of civil aviation operations to the levels indicated in the WMDC Master Plan. Depending on the type of aircraft, the type of operations (landings or takeoffs), the time of year (winter or summer), and the runway in use, from 300 to 19,200 persons could be awakened by one or more aircraft operations during the period between 10 p.m. and 7 a.m. The largest number of residents could be awakened by takeoffs on runway 23 and by landings on runway 05. Subsequent to the issuance of the DEIS, WMDC proposed a mitigation plan that would minimize takeoffs on runway 23 and landings on runway 05. Takeoffs on runway 23 and landings on runway 05 are projected to occur less than 10% of the time during nighttime hours and less than 20% of the time during daytime hours. Under the mitigation plan proposed by WMDC, only about 500 persons would be expected to be awakened by a single operation on 90% of the nights on which flights occur. Because there would be up to 28 operations during the period from 10 p.m. to 7 a.m., some individuals would be expected to be awakened more than once and some individuals may be awakened by some operations and not by others. Therefore, the total number of individuals awakened and the total number of awakenings cannot be estimated.

These estimates are based on data obtained using subjects in a laboratory environment; limited data from a study conducted in the vicinity of the Roissy Paris Airport suggest that the actual number of awakenings resulting from a single operation would be lower than predicted on the basis of laboratory data (Vallet 1980). Because individual residents would be affected by 2 to 14 aircraft operations in a 2-hr period, some individuals would likely be awakened more than once and the total number of individuals awakened would likely be greater than the number awakened by a single event.

Increases in civil aviation activity would probably have a small negative impact on airspace management and air traffic safety. The probability of a serious aircraft accident in the vicinity of Westover AFB would increase slightly as a result of the increase in operations. The consequences of an accident involving a heavily loaded cargo aircraft would be somewhat greater than those resulting from an accident involving a C-130 aircraft on a typical training mission. The level of risk resulting from increases in civil aviation aircraft activity in combination with the current level of military aircraft operations would be similar to that at other military and civilian airports with similar traffic levels and would not be considered to be significant.

An increase in civil aviation operations to the levels projected by WMDC would have a positive impact on regional employment. In addition to the approximately 680 new direct jobs created, the increase in payroll would be expected to result in the creation of approximately 150 to 180 new indirect jobs in the region. Expenditures for materials and labor and locally purchased equipment would result in additional direct and indirect employment benefits in the area.

Increases in civil aviation operations would increase emissions of air pollutants associated with aircraft operations and the generation of hazardous wastes, solid wastes, and sanitary and industrial wastewaters associated with maintenance and support activities. No significant adverse impacts would be likely to result from the projected increases. Construction activities would be confined to areas already disturbed by previous construction, and significant adverse impacts are considered unlikely. Although the number of vehicles entering the industrial park area would increase, traffic volumes would be well within the capacity of area secondary roads, and no significant impacts would be expected.

It is expected that the majority of additional jobs created by development of civil aviation operations at Westover would be filled by persons already in the local labor force, and only a few persons would be likely to move into the area. Increases in demand for housing and public services would be small in relation to the current availability of housing units and services in the area, and adverse impacts would be unlikely.

Cumulative Impacts Resulting from Reorganization of the 439th TAW and Development of WMDC Operations

As in the case of the individual actions, the only significant adverse cumulative impacts expected to result from implementation of the reorganization of the 439th TAW in combination with the development of civil aviation operations at Westover AFB would be related to increases in noise levels in areas surrounding the base. The predicted noise levels would result in increased levels of annoyance. Nighttime civil aviation operations would result in repeated sleep disturbance to some individuals, but little is known about the long-term health effect of sleep disturbance. No other significant effects on humans would be likely to occur. The predicted noise levels would impact existing land uses, particularly residential development, and could impose constraints on future land uses. Reductions in property value might also occur. No significant adverse impacts to domestic animals, wildlife, or structures would be expected to occur as a result of the increases in noise levels.

If development of civil aviation aircraft activity in accordance with the mitigation plan proposed by WMDC occurred in combination with the proposed (16-aircraft) reorganization of the 439th TAW, the area exposed to DNL levels >65 dB would increase to approximately 11.8 sq. mi. (or 2.4 sq. mi. less than the area affected without the WMDC mitigation plan). This area represents an increase of approximately 28% relative to the area exposed by the proposed Air Force operations alone and an increase of approximately 73% relative to the area exposed to equivalent levels by increased civil aircraft operations in combination with current military operations. Because the population is not evenly distributed in the areas surrounding the base, increases in population exposure to DNL levels

>65 dB would not be proportional to the increases in area. Approximately 5,900 persons would be exposed to DNL levels >65 dB by combined military (16 C-5A) and civil aviation operations. This represents an increase of 66% relative to the exposures resulting from proposed military operations and an increase of approximately 290% relative to the exposure resulting from the development of civil aviation operations with no change in military operations. Approximately 1,330 persons would be expected to be highly annoyed by cumulative aircraft noise.

If development of civil aviation operations (with mitigation) occurred in combination with the alternate (8 aircraft) reorganization of the 439th TAW, the area exposed to DNL levels >65 dB would increase to approximately 11.1 sq. mi., and approximately 3,370 persons would be exposed to DNL levels >65 dB. This represents increases of 54% and 29% in area and 114% and 123% in population exposure relative to the exposures resulting from the alternate military and civil aviation operations respectively. Approximately 760 persons would be expected to be highly annoyed.

During local training sorties, the daytime noise environment would be dominated by the military aircraft operations. Military training operations would normally occur during a 5-hr period, and noise contributions of civil aviation operations during this time period would be insignificant. Because military training operations would not be scheduled for nighttime hours and other military operations would take place at night infrequently, nighttime noise levels and resulting impacts would be the same as for civil aviation operations alone.

Cumulative impacts on airspace management and air traffic safety would result in little change relative to current operations. The increase in civil aviation operations would be offset by the decrease in military operations. The potential consequences of an aircraft accident, should one occur, would be somewhat greater than for current operations because of the large size of the C-5A and the loading of commercial cargo aircraft.

Development of civil aviation operations in combination with either reorganization of the 439th TAW would result in increases in the emission of air pollutants associated with aircraft operations. With the exception of emissions of nitrogen oxides (which would increase in both cases), increases in emissions resulting from additional civil aviation operations would be partially offset by reductions in emissions from military operations; however, total emissions would increase relative to current levels.

Increases in the generation of hazardous wastes, solid wastes, and sanitary and industrial wastewater would result from either the military or WMDC actions, and the cumulative impacts would be additive. These materials will be discharged or disposed of in accordance with applicable standards and regulations. No significant adverse impacts would be expected to result from the combined increases.

Cumulative impacts on employment in the region surrounding Westover would also be positive. If development occurred in combination with the proposed military action, approximately 1000 direct and 375 to 430

indirect full-time jobs would be created. If development occurred in combination with the alternate military action, approximately 800 direct and 250 to 305 indirect full-time jobs would be created. Additional temporary direct and indirect employment would occur as a result of expenditures for construction of required facilities and local purchases of materials and equipment.

Because it is expected that the majority of additional jobs related to the WMDC action would be filled by persons already in the local labor force, cumulative migration into the area surrounding Westover and resulting increases in demands for housing and public services would be essentially the same as for the proposed or alternate military action change alone and no adverse impacts would be expected. Increases in employment and cargo operations would result in cumulative increases in traffic volumes in the vicinity of the base but would not be expected to result in significant increases in either traffic congestion or air pollutant emissions.

No cumulative adverse impacts to historical, archaeological, or cultural resources would be expected to occur.

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ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
AFESC	Air Force Engineering Services Center
AFFF	aqueous-film-forming foam
AFR	Air Force Regulation
AFRES	Air Force Reserve
AFS	Air Force station
AGE	aerospace ground equipment
AGL	above ground level
AICUZ	Air Installation Compatible Use Zone
AL	sound level on the A-weighted scale expressed in decibels
ALm	maximum A-weighted sound level
ANG	Air National Guard
APZ	accident potential zone
ARF	Air Reserve Forces (AFRES and ANG)
ART	air reserve technician
ATA	airport traffic area
ATC	air traffic control (center)
BAI	backup aircraft inventory
BASH	bird-aircraft strike hazard
BCE	base civil engineer
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CHABA	Committee on Hearing, Bioacoustics and Biomechanics
CO	carbon monoxide
COD	chemical oxygen demand
CSG	combat support group
dB	decibel
dB(A)	decibels on the A-weighted scale
DCM	Deputy Commander for Maintenance
DEIS	Draft Environmental Impact Statement
DEQE	Department of Environmental Quality Engineering
DOD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
DNL	day/night weighted average noise level
DPDMO	Defense Property Disposal Management Office
DRMO	Defense Reutilization and Marketing Office
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
EPNL	effective perceived noise levels
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
FEIS	Final Environmental Impact Statement
ft	foot
gal/min	gallons per minute
HC	hydrocarbons
hr	hour
HUD	Dept. of Housing and Urban Development
I&R	inspection and repair
IWTP	industrial waste treatment plant
JUA	Joint Use Agreement
Leq	equivalent sound level
LS	lump sum

LTO	landing-takeoff
MAW	Military Airlift Wing
MEOEA	Massachusetts Executive Office of Environmental Affairs
MEPA	Massachusetts Environmental Policy Act
mg/L	milligrams per liter
MNHP	Massachusetts Natural Heritage Program
MTM	million-ton-miles
NAAQS	National Ambient Air Quality Standards
NDI	nondestructive inspection
NEPA	National Environmental Policy Act
NM	nautical mile
NOV	Notice of Violation
NOX	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
OMS	organizational maintenance squadron
PAA	primary assigned aircraft
PM	particulate matter
PNLM	maximum perceived noise level
ppb	parts per billion
ppm	parts per million
PVPC	Pioneer Valley Planning Commission
RCRA	Resource Conservation and Recovery Act
ROI	region of influence
SAC	Strategic Air Command
sec	second
SEL	sound equivalent level
SELT	sound exposure level (tone corrected)
SIP	State Implementation Plan
SOX	Oxides of sulfur
SPCC	Spill Prevention Control and Countermeasures
sq. mi.	square mile
TACAN	tactical air navigation
TAW	Tactical Airlift Wing
TBD	to be determined
TOC	total organic carbon
TSD	transportation, storage, and disposal
ug/L	micrograms per liter
USAF	U.S. Air Force
VCSE	Valley Citizens For Safe Environment
VFR	visual flight rules
WAFB	Westover Air Force Base
WMDC	Westover Metropolitan Development Corporation
y-avg	yearly average

1. PURPOSE OF AND NEED FOR THE PROPOSED ACTION

1.1 PURPOSE

Two separate proposed actions related to operations at Westover Air Force Base (AFB), Massachusetts, are under consideration by the U.S. Air Force (USAF). The first is reorganization of the 439th Tactical Airlift Wing (TAW) to support a strategic airlift mission. The second is a request by the Westover Metropolitan Development Corporation (WMDC) for an increase in the hours of airfield operation to 24 hr/day to accommodate an increase in civil aviation operations, including commercial air cargo and passenger services plus general aviation activities.

Reorganization of the 439th TAW to provide a strategic airlift mission capability is required to provide a location for beddown of 16 C-5A cargo aircraft to be released from the active forces. To partially fill the airlift capacity shortfall identified by the Congressionally Mandated Mobility Study, the Department of Defense is purchasing a total of 50 C-5B aircraft. Because of congressional limitations on active force manpower, transfer of C-5A aircraft and flying missions from the active to the reserve forces is necessary to accommodate acquisition of the new C-5B aircraft. A total of 44 C-5A aircraft will be transferred to the Air Reserve Forces.

The second action under consideration, the request by the WMDC to increase the hours of airfield operation to 24 hr/day, is considered by WMDC to be necessary for expansion of commercial (particularly all-cargo freight carriers) and general aviation operations to the potential levels identified in the WMDC Master Plan prepared in May 1986.

1.2 NEED

1.2.1 Need for the Proposed Military Action

In January 1982, the Office of the Secretary of Defense decided to purchase 50 C-5B aircraft to partially fill the airlift shortfall identified in the Congressionally Mandated Mobility Study published in April 1982. Because of congressional limitations on manpower ceilings, the USAF tasked the Military Airlift Command to transfer flying missions to the Air Reserve Forces [Air Force Reserve (AFRES) and Air National Guard (ANG)]. The Military Airlift Command conducted an Operations and Resources Study, which concluded that the best alternative to meet operations, manpower, and budget considerations is to transfer C-5As to the Air Reserve Forces as C-5Bs are delivered to the active forces. As a result, the USAF decided to transfer C-5As to both AFRES and ANG. This assignment of aircraft would allow the Air Force to meet several objectives:

1. modernize the Air Reserve Forces airlift inventory,
2. provide facilities that would accept the C-5 aircraft at a greatly reduced capital investment,

3. provide annual operational cost savings by reducing the required flying hour program because of the Air Reserve Forces' flying experience,
4. meet the congressionally mandated manpower ceiling, and
5. achieve the congressionally supported 66 million ton-miles/day capability.

Twelve aircraft authorized for the ANG will be located at Stewart Air National Guard Base, New York. The remaining 32 aircraft will be assigned to AFRES.

Next AFRES was tasked to identify locations where C-5As could be based. The criteria were:

1. adequacy of runways, ramp, and support facilities;
2. potential for recruiting reservists in the base region;
3. type and cost of required military facility construction;
4. current base use and occupancy and other organizational considerations; and
5. adequacy of fuel storage and hydrant facilities.

Using these criteria, AFRES identified Kelly AFB, Texas; Westover AFB, Massachusetts; Orlando International Airport (formerly McCoy AFB), Florida; Patrick AFB, Florida; Cape Canaveral Air Force Station, Florida; Charleston AFB, South Carolina; and Hunter Army Airfield, Georgia, as possible locations. These locations were identified because they have an adequate runway of at least 10,000 x 200 ft and they have been assigned large aircraft in the past. Also, some of these installations still retain facilities that might be modified to support this new mission.

The first AFRES C-5A equipped unit has already been established at Kelly AFB, Texas, and is authorized a total of 16 aircraft. The proposed reorganization of the 439th TAW would provide a location for beddown of the remaining 16 aircraft to be released to AFRES.

1.2.2 Need for the Action Proposed by WMDC

Westover AFB has been available for civil aviation activity since 1981; however, for a number of reasons (including the lack of 24-hr operational capability, lack of facilities to support commercial air carrier operations, and unsettled economic conditions), development of civil aviation activity has been limited. Commercial air carrier activity now consists mainly of two daily scheduled all-cargo flights operated by Emery Air Freight. Approximately 35 general aviation aircraft are based at Westover. There is no scheduled air passenger service.

An air traffic demand analysis prepared for the WMDC Master Plan addresses three basic categories of aviation demand (scheduled passenger service, air cargo, and general aviation activity) and identifies potential traffic levels that could reasonably be achieved by 1995 if suitable facilities and operating conditions are provided. This analysis concluded that the Westover area has sufficient traffic demand to economically

sustain both scheduled air carrier services and scheduled all-cargo services.

Airfield operations at Westover AFB are controlled by the Air Force. At present, the control tower is operated only between 7 a.m. and 11 p.m.; aircraft operations between 11 p.m. and 7 a.m. are not permitted on a regular basis. WMDC considers it necessary for Westover to operate on a 24-hr basis in order to develop civil aviation operations to the level indicated in the WMDC Master Plan. On June 13, 1986, WMDC submitted a request to the Air Force to increase the operating hours of the tower to 20 hr/day on an interim basis pending a permanent increase to 24 hr/day. Because the number and distribution of operations during a 20-hr operating period would be approximately the same as during a 24-hr period, only the impacts of 24-hr operation are addressed in this Environmental Impact Statement (EIS). As noted above, WMDC considers the capability to support 24-hr/day operations essential to the development of civil aviation operations to the levels identified in the WMDC Master Plan.

1.3 SCOPE OF THE ENVIRONMENTAL REVIEW

This EIS is prepared pursuant to Sect. 102 of the National Environmental Policy Act (NEPA) of 1969 (Public Law 91-190), as implemented by the President's Council on Environmental Quality (CEQ) regulations (CEQ 1978) and Air Force Regulation (AFR) 19-2. The principal objectives of NEPA are to build into the decision-making process an appropriate and careful consideration of the environmental aspects of proposed actions and to make environmental information available to public officials and citizens before decisions are made and actions are taken. This EIS analyzes the impacts likely to result from implementation of either of the proposed actions in comparison with continuation of current operations (the "no action" alternative). The cumulative impacts which would likely result from implementation of both proposed actions in combination are also considered.

Consistent with AFR 19-2 and CEQ regulations, a public scoping meeting was held on September 26, 1985, at the Bellamy School in Chicopee, Massachusetts, to determine the scope of the issues to be addressed in the Draft EIS and to identify the significant issues related to the proposed action. The Draft Environmental Impact Statement (DEIS) was issued on December 5, 1986, with publication of the Notice of Availability in the Federal Register. The public comment period ended on February 11, 1987. During this period, a public hearing on the DEIS was held on January 8, 1987, at Bellamy School at 7:30 p.m. The predominant concern expressed during the public comment period related to increased noise levels that would result from the proposed mission change and the WMDC proposal to operate the airfield on a 24-hr basis.

The Air Force has responded to each substantive comment received on the DEIS and, in some instances, has revised the text of the DEIS, including Appendices A through E, in response to the comments. The revisions are denoted by a vertical line in the left margin of the page where the revision was made. Pages without these vertical lines were not

revised. Photocopies of all written comments received are included in Appendix H. A verbatim transcript of the public hearing is included in Appendix I. Responses to principal concerns expressed in many of the comments are included in Appendix F, and responses to specific questions are included in Appendix G.

Copies of this FEIS have been provided to all persons and organizations requesting copies and to those who received copies of, or submitted comments on, the DEIS. Distribution of the FEIS is indicated in Appendix E.

1.4 REGULATORY REVIEW AND APPROVALS

There is no further regulatory review or approval required for implementation of either the proposed or alternate military action. Implementation of either military action would require submission of applications to the City of Chicopee for permits for new or modified discharges of industrial wastewater to the municipal sewer system.

No further regulatory approval is required for an extension of the airfield operating hours. Since the original Economic Development Plan (EDP) for the civil airport was approved in 1981, WMDC has acquired control of additional aviation acreage, bringing the total airport project area to 178 acres. This change in project area will require revision of the EDP by WMDC, subsequent approval of that revision by a two-thirds vote of the Chicopee Board of Aldermen, and approval by the Mayor. In addition, leases between WMDC and air carriers are subject to approval by the Massachusetts Aeronautics Commission. The mitigation plan proposed by WMDC (Appendix J) provides for limiting nighttime noise levels to the levels resulting from the projected number of operations by Stage III aircraft in 1995. WMDC may permit a mix of Stage II and Stage III aircraft in the interim if the Leq-9 is not larger than the maximum permitted contour. WMDC will file the maximum nighttime noise contour with the Massachusetts Executive Office of Environmental Affairs, MEPA Unit. This will become the basis for evaluating the impacts of periodic changes in civil aviation activity. WMDC is committed to filing an Environmental Notification Form with the MEPA Unit for review under the Massachusetts Environmental Policy Act before WMDC approves any substantial increase in scheduled commercial flights. The filing with MEPA will be accompanied by an updated Leq-9 contour to show the cumulative effect of the proposed change. Each filing is publicly noticed and given a 30 day comment period.

The operations of WMDC are also subject to oversight by the Airport Advisory Committee, a citizen review committee appointed by the Board of Aldermen of the City of Chicopee. The committee has legal powers to veto actions of the WMDC which it deems detrimental to the community environment. WMDC is recommending to the Board of Aldermen that the ordinance establishing the Advisory Committee be amended to expand the Committee to include citizen representatives of surrounding communities directly impacted by civil aircraft operations at Westover (Appendix J).

If the request for extension of the airfield operating hours is approved, appropriate procedural measures and operational restrictions will be incorporated into the Joint Use Agreement between the Air Force and WMDC to execute WMDC's mitigation plan. The agreement stipulates that violations of the terms and conditions for use of Westover AFB can be cause for termination unless corrective action is taken within 10 days of written notification.

2. ALTERNATIVES INCLUDING THE PROPOSED ACTION

This section includes a detailed description of the proposed actions and a comparison of the separate and cumulative impacts expected to result from implementation of the action. The environmental impacts of the proposed and alternative actions are addressed in Sect. 4.

2.1 THE PROPOSED ACTIONS

Two separate proposed actions related to operations at Westover Air Force Base (AFB), Massachusetts, are under consideration by the U.S. Air Force. The first is reorganization of the 439th Tactical Airlift Wing (TAW) to support a strategic airlift mission (military action). The second is a request by the Westover Metropolitan Development Corporation (WMDC) for an increase in the hours of airfield operation to 24 hr/day (WMDC action) to support increased activity. The possible individual and combined actions of the military and WMDC are considered in this Environmental Impact Statement (EIS).

2.1.1 Reorganization of the 439th Tactical Airlift Wing

This proposed military action would result in the conversion of the 439th TAW, currently located at Westover AFB, Massachusetts, from a tactical to a strategic airlift mission and the replacement of the 16 currently assigned C-130E aircraft with a total of 16 C-5A aircraft. The Westover C-130Es would be relocated to other compatible reserve units to replace older aircraft.

Of the total of 16 C-5A aircraft, 14 would be primary assigned aircraft (PAA) for which aircrews, maintenance and support personnel, and flying program hours would be authorized. The remaining aircraft would be designated as backup aircraft inventory (BAI), and no personnel or flying hours would be authorized for these aircraft. It is possible that the backup aircraft would be converted to "active" (PAA) status at some time in the future; therefore, the analyses in this EIS are based on the operation of 16 PAA C-5A aircraft.

As originally announced in the spring of 1985, the proposed action was the replacement of the 16 C-130 aircraft with 8 C-5A aircraft. This proposed action was presented at the public scoping meeting held on September 26, 1985. At that time, the possibility of the assignment of a total of 16 C-5A aircraft was presented as an alternative. Subsequent to the public scoping meeting, the Air Force determined that the proposed military action should be changed to reflect the basing of a total of 16 C-5A aircraft as indicated previously. Replacement of the C-130 aircraft with 8 C-5A aircraft is considered as an alternative military action (see Sect. 2.1.1.5.2).

2.1.1.1 Changes in unit organization, equipment, and mission

Implementation of the proposed military action would

1. reorganize the 439th TAW as the 439th Military Airlift Wing,

2. convert unit equipage from 16 PAA C-130E aircraft to 14 PAA and 2 BAI C-5A aircraft, and

3. reconfigure unit mission capabilities to support the worldwide strategic airlift mission of the Military Airlift Command.

The conversion would begin in the first quarter of Fiscal Year 1988 with the receipt of the first aircraft.

2.1.1.2 Changes in flight operations

If the proposed mission change were implemented, the annual flying hour program would decrease from the current level of 6,460 hr to 4,400 hr. It should be noted that this represents a further reduction from the level of 4,960 hr indicated in the Draft EIS (DEIS). Implementation of the proposed action would result in a decrease in the number of hours flown in the local area and an increase in the number of hours flown away from the base. Changes in aircraft operations resulting from implementation of the proposed military action (16 C-5As) are summarized in Table 2.1.

Local training sorties would decrease from the current level of about 30 per week to an average of 4 per week. The average sortie duration would increase from the current 2.5 hr to 5 hr, resulting in a net decrease in total weekly flying hours from 75 to 20. Local training sorties would consist of two takeoffs and landings plus an average of 18 touch-and-go landings or low approaches during the 5-hr flight. Aircraft operations during a typical local training sortie are described in detail in Sect. 4.1.2.1.

Off-station flying activity would increase from the current level of approximately 2,710 hr/year to approximately 3,400 hr/year. Off-station sorties, primarily in support of the Military Airlift Command, would result in a single takeoff and landing in the Westover area. Off-station sorties would average about five per week, and each aircraft would be away from the base for several days. For purposes of impact analysis, it is assumed that one aircraft would depart and one would return on an average day.

2.1.1.3 Changes in personnel authorizations

Implementation of the proposed military action (16 C-5As) would require an increase in personnel authorizations. This increase would be necessary to (1) reconfigure the aircraft maintenance support personnel into a three-squadron structure and (2) establish a security squadron to provide aircraft security. Personnel authorizations for the existing and proposed military actions are summarized in Table 2.2.

Implementation of the proposed military action would result in an increase of 52% in full-time employment. This figure includes an increase of 319 air reserve technician (ART) positions and 13 civilian positions. In addition to the full-time employment, 1,000 additional part-time reserve positions would also be authorized. Of these, 319 would be filled

Table 2.1. Summary of changes in flight operations resulting from implementation of the proposed mission change (16 C-5A aircraft) at Westover AFB

Activity	Activity level		
	Current	Projected	Net change
Local flying activity			
Local sorties, per week	30	4	-26
Sortie duration, hr	2.5	5	+2.5
Local flying hours/week	75	20	-55
Local hours/year	3,750	1,000	-2,750
Off-station flying activity, hr/year	2,710	3,400	+690
Total annual hours	6,460	4,400	-2,060

Table 2.2. Personnel authorizations for current (16 C-130 aircraft) and proposed (14 PAA C-5A aircraft) missions at Westover AFB

Category	Personnel authorizations		
	Current	Proposed	Change
Full-time positions			
Civilian	424	437	+ 13
Air reserve technicians	213	532	+ 319
Active duty military	6	6	0
Total full-time	643	975	+ 332
Part-time (reserve) positions			
Air reserve technicians	213	532	+ 319
Other reservists (non-ART)	1,619	2,300	+ 681
Total part-time	1,832	2,832	+1,000

by the additional ARTs who hold both civil service and reserve appointments, resulting in a net increase of 681 part-time positions.

2.1.1.4 Facility construction or modification

Construction of new facilities and the modification and upgrading of existing facilities would be required to provide adequate support facilities to permit implementation of the proposed military action. Table 2.3 lists proposed projects required to accommodate the military action. The estimated cost of Air Force Reserve (AFRES) facility construction/modification projects required for implementation of the proposed military action is approximately $46.9 million. This does not include costs for permanent displacement of the landing threshold for runway 05 (see Sect. 4.3.3.2.3) since the details of this project have not yet been finalized. These projects are in addition to the existing AFRES projects summarized in Table 2.4.

2.1.1.5 Alternatives to the proposed reorganization of the 439th TAW

Alternatives to the proposed military action (16 C-5As) considered in this EIS include an alternate military action (8 C-5As) and the no-action alternative. In addition to these alternatives, basing of the additional AFRES C-5A aircraft at alternate locations was evaluated and determined not to be feasible for reasons other than potential environmental impacts.

2.1.1.5.1 No action

Adoption of the no-action alternative would result in continuation of the current mission and aircraft operations at Westover AFB. If reassignment of the C-5A aircraft to Westover AFB is determined to be unacceptable, another beddown location using different selection criteria would have to be identified.

2.1.1.5.2 Alternative military action (8 C-5As)

The possibility exists that the 439th TAW could be reorganized as an 8-PAA C-5A unit. Changes in the annual flying program for this alternate military action are summarized in Table 2.5. The annual flying hour program would decrease from the current level of 6,460 hr to approximately 2,480 hr. Local sorties would average about 2 per week; and activities and durations would be the same as for the proposed mission change. Off-station flying activity would be reduced to approximately 1,880 hr/year.

Implementation of this alternative action would also increase manpower authorizations above those for the current mission. Increases would involve approximately 124 ARTs, 5 civilians, and 469 non-ART reserve positions (see Table 2.6).

Implementation of this alternate military action would require the same construction projects as the proposed military action (Table 2.3). Because the reduced number of aircraft would require less apron and taxiway surface, the cost for this project would be reduced by approximately $6 million, resulting in a total estimated cost of $40.9 million (not including costs for displacement of the landing threshold for runway 05).

Table 2.3. Construction projects required for proposed mission change at Westover AFB[a]

Fiscal year	Project	Scope (sq. ft)	Estimated cost ($1000)
1987	Relocate AGE shop to B/7075	16,000	356
1987	Alter/upgrade OMS shops, B/7075	16,000	360
1987	Alter/upgrade Squadron Operations, B/7087	22,000	1,250
1987	Security Police central control, B/7075	3,000	75
1987	Alter/upgrade hangar B/7000 for fuel system repair and maintenance dock	LS	6,505
1987	Fire station	16,000	1,800
1987	Alter/upgrade Avionics Shop, B/2426	16,000	360
1987	Alter DCM offices, B/7072	14,000	350
1987	Add to liquid oxygen/nitrogen storage	LS	70
1987	Alter Armory, B/1520	LS	45
1988	Construct pull-through hangar	94,000	14,600
1987	Construct aprons and taxiways	170,000 sq. yd.	13,730
1987	Upgrade hydrant refueling system	1,800 gal/min	1,000
1988	Alter Aerial Port Training, B/7087	7,000	95
1988	Alter/upgrade Engine I&R Shop	20,000	350
1989	Alter Acft. Maintenance Shops	LS	2,500
	Total construction funds		43,446
	Design funds (8% of construction cost)		3,476
	Total estimated cost		46,922

[a]Acronyms used in this table are

AGE aerospace ground equipment
DCM deputy commander for maintenance
I&R inspection and replacement
LS lump sum
OMS organization maintenance squadron
NDI nondestructive inspection

Table 2.4. Planned construction projects at Westover AFB (no change in Air Force mission)

Fiscal year	Project	Scope	Cost ($1000)
1989	Additions and alterations to Operations & Training Bldg.	26,000 LS	2,319
1993	Replace Heat Plant	LS	4,800
1987	AFFF[a] system (fuel cell)[b]	1 each	500
1991	Alter Aircraft Maint. Hangar[b]	LS	1,000
1991	Relocate Electrical Switching Station	LS	700
1989	Alter airmen dorms	5 each	1,600
1990	AFFF fire protection system[b] (Hangars 1 & 3)	2 each	1,000
TBD	Fire Station	11,334 sq. ft	1,500
	Existing equipage program total		13,419[c]

[a]Acronyms used in this table are

AFFF aqueous-film-forming foam
BCE base civil engineer
LS lump sum
TBD to be determined

[b]Not required if proposed mission change is implemented.

[c]This does not include costs for permanent displacement of the landing threshold for runway 05 (see Sect. 4.3.3.2.3) since the exact details of this project have not yet been determined.

Table 2.5. Summary of changes in flight operations resulting from implementation of the alternate mission change (8 C-5A aircraft) at Westover AFB

Activity	Activity level		
	Current	Projected	Net change
Local flying activity			
Local sorties per week	30	2	-28
Sortie duration, hr	2.5	5.0	+2.5
Local flying hours per week	75	10	-65
Local hours per year	3,750	600	-3,150
Off-station flying activity, hr/year	2,710	1,880	-830
Total annual hours	6,460	2,480	-3,980

Table 2.6. Personnel authorizations for current (16 C-130 aircraft) and alternate (8 C-5A aircraft) missions at Westover AFB

Category	Personnel authorizations		
	Current	Proposed	Change
Full-time positions			
Civilian	424	429	+ 5
Air reserve technicians	213	337	+ 124
Active duty military	6	6	0
Total full-time	643	772	+ 129
Part-time (reserve) positions			
Air reserve technicians	213	337	+ 124
Other reservists (non-ART)	1,619	2,088	+ 469
Total part-time	1,832	2,425	+ 593

2.1.1.5.3 Alternative locations evaluated and determined not to be feasible

Five alternative locations were considered for basing the remaining C-5A aircraft to be assigned to AFRES. These locations were (1) Orlando International Airport (formerly McCoy AFB), Florida; (2) Patrick AFB, Florida; (3) Cape Canaveral Air Force Station, Florida; (4) Charleston AFB, South Carolina; and (5) Hunter Army Airfield, Georgia. These were evaluated with respect to the following economic, operational, technical, and other criteria:

- adequacy of runways, ramps, and support facilities;
- recruiting potential for reservists in the base region;
- type and cost of required military facility construction;
- current base use and occupancy and other organizational considerations; and
- adequacy of fuel storage and hydrant refueling systems.

The results of this evaluation are summarized below. Based on this evaluation, basing of the C-5A aircraft at the alternate locations was determined not to be feasible because the alternate sites did not meet the primary criteria. Therefore, the environmental impacts of basing at an alternate location were not evaluated.

Orlando International Airport (formerly McCoy AFB), Florida. McCoy AFB was once a Strategic Air Command Base. The Air Force deactivated the unit at McCoy AFB in the mid-1970s. The city of Orlando took over most of the airport, and the U.S. Department of Defense currently utilizes only a small portion of the airport. The existing runways are adequate for C-5A operations, but ramp and support facilities are insufficient to operate either an 8- or 16-PAA C-5A unit. The costs to construct a parking ramp, hydrant system, and other required support facilities are $56.6 million for an 8-PAA C-5A unit and $83.4 million for a 16-PAA C-5A unit. These costs do not include purchasing additional land required for C-5A operations. Orlando International is using most of the available ramp, and the Air Force would need to purchase land to operate C-5As. From 70 to 150 acres would be required depending on whether an 8- or 16-PAA unit was activated. However, because of civilian encroachment around the airport, land is not available for purchase for C-5A operations. Although the recruiting base around Orlando International was determined sufficient to support an AFRES C-5A operational unit, Orlando was eliminated because of insufficient space to expand and the high cost of support facilities.

Patrick AFB, Florida. Patrick AFB is an Air Force Systems Command Base located on the east coast of Florida near the town of Melbourne. The existing runway is sufficient for C-5A operations, but no ramp or support facilities exist to operate C-5A aircraft. The cost to build ramp and support facilities would be the same as for Orlando: $56.6 million for an 8-PAA C-5A unit and $83.4 million for a 16-PAA C-5A unit. However, land is not available for construction of ramp and support facilities. Location of C-5As at Patrick would require filling in 70 to 150 acres of the Banana River west of the base. These costs are not included in the above figures. The recruiting potential around Patrick was determined to

be sufficient to operate C-5A aircraft, but the costs and lack of available land for expansion eliminated Patrick as a reasonable alternative.

Cape Canaveral Air Force Station (AFS), Florida. Cape Canaveral AFS is an Air Force Systems Command Base located between Titusville and Cocoa Beach, Florida. The airfield is currently restricted to daylight operations under visual flight rules only. There are no facilities capable of handling C-5A aircraft. New facilities, a parking ramp, and navigational aids would be required for operations. The cost of adding these facilities plus improving the existing runway is estimated to be $111.8 million for an 8-PAA C-5A unit and $138.6 million for a 16-PAA unit. Additionally, the close proximity of Cape Canaveral AFS to the missile launch area could result in operational constraints which could jeopardize mission capability and readiness. The demographics of the surrounding area were considered suitable to provide the necessary manpower for a reserve 16-PAA C-5A unit, but the high costs for ramp and support facilities eliminated Cape Canaveral as an alternative.

Charleston AFB, South Carolina. Charleston is a Military Airlift Command base located approximately 10 miles north of Charleston, South Carolina. The base currently has 54 PAA C-141Bs assigned. The runway and most facilities are adequate for C-5A operations since C-5As were originally based at Charleston in the early 1970s. The costs estimated to build the necessary facilities are $16.3 million for an 8-PAA unit and $23.6 million for a 16-PAA unit. However, both of these options would require the MAC to relocate the C-141s. A total of 13 C-141s would have to be moved to park 8 C-5As, and 29 C-141s would have to be moved to park 16 C-5As. Based on preliminary estimates, the cost of moving these aircraft could be at least double the construction estimates. The demographics of the Charleston area are considered good, but because of the existing Reserve Associate Wing currently located at Charleston, the ability to recruit the additional personnel necessary to operate a C-5A unit is doubtful.

Hunter Airfield, Savannah, Georgia. Hunter is an Army Airfield located just west of Savannah, Georgia. The runway is adequate for C-5A operations but new vertical facilities, a fuel hydrant system, and additional ramp would be required for permanent C-5A operations. The estimated cost for construction of these facilities is $52.3 million for an 8-PAA C-5A unit and $79.1 million for a 16-PAA C-5A unit. A serious drawback is that the demographics of the Savannah area are not considered adequate to recruit personnel with the skills necessary for a C-5A operation.

2.1.2 Increase in Airfield Operating Hours

Westover AFB has been available for civil aviation activity since 1981; however, for a number of reasons, including the lack of 24-hr operational capability, lack of facilities to support commercial air carrier operations, and unsettled economic conditions, development of civil aviation activity has been limited. Commercial air carrier activity now consists primarily of two daily scheduled all-cargo flights operated by Emery Air Freight. Approximately 35 general aviation aircraft are based at Westover. There is no scheduled air passenger service.

An air traffic demand analysis prepared for the WMDC Master Plan addresses three basic categories of aviation demand (scheduled passenger

service, air cargo, and general aviation activity) and identifies potential traffic levels that could reasonably be achieved by 1995 if suitable facilities and operating conditions are provided. This analysis concluded that the Westover area has sufficient traffic demand to economically sustain both scheduled air carrier services and scheduled all-cargo services.

Airfield operations at Westover AFB are controlled by the Air Force. At present, the control tower is operated only between 7 a.m. and 11 p.m.; aircraft operations between 11 p.m. and 7 a.m. are not permitted on a regular basis. WMDC considers the capability to accommodate 24-hr operations as necessary for development of cargo aircraft operations to the level indicated in the WMDC Master Plan. Since 1981, WMDC has contacted nearly every air carrier, both passenger and cargo, serving the Northeast in an effort to interest them in using this facility. All of the carriers contacted responded that without the flexibility to provide 24-hr airfield operations, the investment required to use this facility could not be justified.

On June 13, 1986, WMDC submitted a request to the Air Force to increase the operating hours of the tower to 20 hr/day on an interim basis pending a permanent increase to 24 hr/day. Because the number and distribution of operations during a 20-hr operating period would be approximately the same as during a 24-hr period, only the impacts of 24-hr operation are addressed in this EIS.

2.1.2.1 Expansion of civil aviation operations that may occur if the proposed action is approved

The traffic analysis prepared for WMDC indicates that a level of approximately 23 all-cargo flights per day could be achieved by 1995 if suitable facilities and operating conditions are provided. Approximately 24 passenger flights per day might also be reached by 1995. Passenger and general aviation operations would occur primarily between 7 a.m. and 10 p.m. (considered as "daytime" for purposes of noise impact assessment); however, it is anticipated that about 17 of the 46 projected daily air cargo operations (a takeoff or landing is considered as a separate operation) would occur between 10 p.m. and 7 a.m. (considered as "nighttime" for purposes of noise impact assessment). Although the actual schedule of operations cannot be determined at this time, in typical air cargo terminal operations, incoming aircraft depart from the originating locations late in the evening to allow collection of shipments at the end of the business day. These aircraft would arrive at the terminal location on approximately the same schedule; cargo would be unloaded, sorted, and redistributed; and the aircraft would then depart on approximately the same schedule to allow arrival at the destination early in the business day. For this analysis, the majority of nighttime arrivals of air cargo aircraft were assumed to occur between 10 p.m. and midnight and the majority of the nighttime departures were assumed to take place between 5 a.m. and 7 a.m.

Based on the noise impacts identified in the DEIS and on the comments on the DEIS pertaining to the significance of those impacts, particularly the impacts of nighttime operations, WMDC developed a mitigation plan to

reduce the impacts of increases in civil aviation operations. This plan includes the following major provisions:

- prohibiting scheduled operations by Stage II large turbojet (e.g., B-727-200 and B-747-100) aircraft between the hours of 10 p.m. and 7 a.m.;
- restricting scheduled operations between the hours of 1 a.m. and 5 a.m.
- establishing preferential runway utilization to minimize population impacted by aircraft operations. To the maximum extent permitted by weather conditions and military aircraft operations, runway 23 would be used for landings and runway 05 for departures;
- requiring that aircraft initiate takeoffs from the beginning of the runway to increase altitudes and minimize ground-level noise over populated areas; and
- limiting 9-hr (10 p.m. to 7 a.m.) equivalent noise levels (Leq-9) to the level projected to result from the operation of all Stage III aircraft by the time the maximum number of operations is reached.

This mitigation plan is discussed in detail in Sect. 4.1.2.2 and in Appendix J. Analysis of the impacts expected to result from operations in accordance with this mitigation plan (See Appendix K) indicates a significant reduction in impacts relative to the levels identified in the DEIS for operations without mitigation (See Appendix D). Section 4.2 provides a comparison of the mitigated and unmitigated impacts of civil aviation operations, alone and in combination with the proposed and alternate military operations.

2.1.2.2 Increases in employment that may result if the proposed action is approved

Increasing the hours of airfield operation would require hiring of two additional air traffic control personnel to provide the level of staffing required for 24-hr tower operation. These personnel would be civil service (government) employees and would be hired by the Air Force. WMDC would reimburse the Air Force for the additional personnel costs associated with extended tower operating hours.

The projected level of air cargo movements would require approximately 475 additional employees (in addition to the approximately 95 persons currently employed to service air cargo operations). Projected passenger airline and terminal building operations would require approximately 120 new employees, and projected growth in general aviation services to corporate aircraft could require up to 85 additional flight line and fuel service employees. Thus, development of air cargo, passenger, and general aviation services to the potential levels identified in the WMDC Master Plan could result in the creation of 680 new jobs at Westover. The majority of these jobs would be classified as semi-skilled and could be filled by persons in the local labor force.

2.1.2.3 Facility construction and modification that may result if the proposed action is approved

Although WMDC believes that 24-hr operations are required to permit development of civil aviation operations to the levels identified in the WMDC Master Plan, limited passenger service could be developed within the current operating limitations. To support development of passenger service, WMDC has obtained a grant of $500,000 from the Massachusetts Aeronautics Commission for renovation of an existing building to provide a passenger terminal. WMDC is currently evaluating bids for this project, and construction is expected to begin in the second or third quarter of calendar year 1987. This project is not affected by the Air Force decision with respect to extension of airfield operating hours.

To support the further development of WMDC operations, renovation of several existing facilities would be required and several new buildings, including hangars and office facilities, would have to be constructed. Improvements to airfield pavement and lighting, access roads, and automobile parking facilities would also be required. In addition, a major investment in ground support equipment and vehicles would also be required. WMDC estimates the cost of required facilities and equipment at approximately $32 million, of which approximately 75% would be leveraged private investments.

2.1.2.4 Alternatives to the proposed increase in airfield operating hours and development of civil aviation operations

2.1.2.4.1 No action

A decision by the Air Force to deny WMDC's request would result in a continuation of operations under the existing Joint Use Agreement and is considered to be the "no action" alternative. Although some increase in civil aviation operations could occur under the terms of the existing agreement, it is considered unlikely, based on the limited success of WMDC in developing civil aviation operations to date, that significant changes in civil aviation operations would occur; and the level of impact would continue to be determined by military aircraft operations.

2.1.2.4.2 Limit increase in airfield operating hours

As noted in Sect. 2.1.2, WMDC initially requested an interim increase in the hours of airfield operation to 20-hr/day pending a permanent increase to 24-hr/day. Although WMDC anticipates that operations would normally be limited to approximately 20-hr/day, the ability to provide 24-hr operations to allow landing of inbound aircraft delayed by weather or mechanical problems is considered to be necessary for the development of air cargo services. Thus, limiting the hours of airfield operation to less than 24-hr/day is not considered to be a feasible alternative.

2.1.2.4.3 Restrict types of aircraft permitted to operate at night

The projected aircraft operations analyzed in the DEIS were based on current air carrier fleet mixes and included nighttime operations by aircraft such as the Boeing 727-200 and 747-100 which do not meet the more

restrictive noise standards applicable to Stage III aircraft. The mitigation plan proposed by WMDC would prohibit nighttime operations by Stage II large turbojet aircraft and would limit the 9-hr nighttime equivalent noise level to the level projected for operations in 1995 by Stage III aircraft.

2.1.2.4.4 Develop civil aviation operations at another location

The Westover Metropolitan Development Corporation was established for the purpose of developing economic uses of excess government property that was formerly a part of Westover Air Force Base. Development of civil aviation operations at a location other than Westover is not consistent with the mission of WMDC and is not within its power to accomplish. In developing civil aviation operations at Westover, and particularly in developing air cargo operations, WMDC must compete with other aviation facilities in the region to attract air carriers on the basis of both service demand and economic considerations. If either demand or economic considerations favor development at another location, the projected level of operations would not be achieved and the associated impacts would not occur. Thus, development of operations at an alternate location is not considered a feasible alternative.

2.2 IMPACTS EXPECTED TO RESULT FROM THE PROPOSED ACTIONS

The only significant adverse impacts expected to result from either the military or WMDC actions under consideration by the Air Force would be related to increases in noise levels in areas surrounding the base (Sect. 4.2). As noted in Sect. 2.1.2.1 subsequent to the issuance of the DEIS, WMDC has developed a mitigation plan that provides a significant reduction in the noise impacts expected to result from civil aviation operations, both alone and in combination with either military action. Areas and populations exposed to day-night average noise levels (DNL) (see Appendix A) greater than 65 decibels (dB) by current and proposed aircraft operations are summarized in Table 2.7. This table also provides a comparison of the impacts expected to result from civil aviation operations with and without the mitigation measures proposed by WMDC. The primary human response would be annoyance. Nighttime civil aviation operations would result in repeated sleep disturbance to some individuals. Little is known about the long-term effects of sleep disturbance on health. No other significant effects to humans, including hearing loss or nonauditory health effects, would be expected on the basis of the projected noise levels. No significant adverse impacts to domestic animals, wildlife, or structures, including historical and archaeological resources, would be expected to occur. Increases in noise levels would impact some current land uses (primarily residential development) and could impose some constraints on future development (also primarily residential uses). Decreases in property values may also occur in areas exposed to increased noise levels. Implementation of either the military or WMDC actions would create positive economic impacts through both permanent and temporary increases in direct and indirect employment. Employment impacts of the proposed actions are summarized in Table 2.8. Impacts on flight safety, generation of air and water pollutants, hazardous and solid wastes, and socioeconomic impacts not related to noise were also analyzed and determined not to be significant.

Table 2.7. Comparison of noise impacts of proposed actions at Westover AFB

Action	DNL contour interval (dB) 65-70	70-75	75-80	80-85	>85	Total >65 dB	% Change
	Areas within DNL contour intervals (sq. mi.)						
No action	1.79	0.73	0.58	0.20	0.05	3.34	
Individual actions							
Proposed military (16 C-5A) action	4.49	2.52	1.46	0.72	0.03	9.22	+176
Alternate military (8 C-5A) action	2.98	1.49	0.65	0.59	0.02	5.73	+ 71
WMDC civil aviation operations plus current military operations							
with mitigation	3.46	1.67	0.85	0.67	0.17	6.83	+105
without mitigation	4.21	2.18	0.89	0.72	0.30	8.31	+184
Cumulative actions							
Proposed military action plus WMDC civil aviation operations							
with mitigation	6.48	2.65	1.37	0.71	0.59	11.79	+253
without mitigation	8.03	3.14	1.57	0.76	0.71	14.21	+325
Alternate Military action plus WMDC civil aviation operations							
with mitigation	4.56	2.08	1.09	0.77	0.33	8.84	+165
without mitigation	5.65	2.73	1.39	0.79	0.52	11.08	+231

Table 2.7. (Continued)

Action	DNL contour interval (dB) 65-70	70-75	75-80	80-85	>85	Total >65 dB
	Population within DNL contours (persons)					
No action	100	0	0	0	0	100
Individual actions						
Proposed military (16 C-5A)	3,384	137	27	0	0	3,548
Alternate military (8 C-5A)	1,469	102	0	0	0	1,571
WMDC civil aviation operations plus current military operations						
with mitigation	1,215	294	0	0	0	1,509
without mitigation	5,981	534	0	0	0	6,515
Cumulative actions						
Proposed military action plus WMDC civil aviation operations						
with mitigation	5,197	519	165	0	0	5,881
without mitigation	8,576	2,664	200	0	0	11,440
Alternate military action plus WMDC civil aviation operations						
with mitigation	3,028	216	124	0	0	3,368
without mitigation	7,207	1,524	150	0	0	8,881

Table 2.8. Comparison of employment impacts of proposed actions at Westover AFB

	Air Force Actions	
	Proposed	*Alternate*
Direct employment		
Full-time jobs	332	129
Part-time positions	681	469
Payroll increase	$13.4 million/year	$6.0 million/year
Indirect employment		
Full-time jobs (estimated)	225-250	100-125
Construction employment		
Direct (person years)	800	670
Indirect (person years)	700-800	550-600
	Potential WMDC Civil Aviation Operations	
Direct employment		
Full-time jobs	680	
Payroll increase	$9.2 million	
Indirect employment		
Full-time jobs (estimated)	150-180	
Construction employment		
Direct (person years)	600-650	
Indirect (person years)	400-600	
	Cumulative Impacts	
	Potential WMDC Civil Aviation Operations plus Air Force action	
	Proposed	Alternate
Direct employment		
Full-time jobs	1,012	809
Part-time positions	681	469
Payroll increase	$22.6 million/year	$13.2 million/year
Indirect employment		
Full-time jobs (estimated)	375-430	250-305
Construction employment		
Direct (person years)	1,400-1,450	1,220-1,270
Indirect (person years)	1,100-1,400	950-1,200

2.2.1 Impacts of Reorganization of the 439th Tactical Airlift Wing

Increased noise levels are the predominant issue related to reorganization of the 439th TAW. Because most members of reserve flight crews have full-time civilian jobs, most local flying activity is scheduled for weekend training assemblies or after normal working hours during the week. Neither mission change (the proposed 16 C-5A aircraft or the alternate 8 C-5A aircraft) would result in a change to this pattern; however, the number of training sorties would be reduced from the current level of approximately 30 per week to 4 per week for the proposed (16 C-5A) action and 2 per week for the alternate (8 C-5A) action. No military activity would be routinely scheduled between the hours of 10 p.m. and 7 a.m.; therefore, sleep interference would be minimal.

Measures to reduce noise exposures have been incorporated into planned flight patterns, and limited additional mitigation measures may be feasible to reduce specific impacts identified as operations are developed. Implementation of the proposed (16-aircraft) military action would result in an increase in the area exposed to DNL levels >65 dB (the maximum level considered acceptable for residential use without incorporation of noise attenuation measures in residential construction) from the current level of approximately 3.3 sq. mi. to approximately 9.2 sq. mi. The number of persons exposed to DNL levels >65 dB would increase from the current level of fewer than 100 to approximately 3,550. Approximately 30 persons would be exposed to DNL levels >75 dB (the maximum level considered acceptable for residential use with the incorporation of noise reduction [attenuation] measures in residential construction). Of the 3,550 persons exposed to DNL levels >65 dB, approximately 700 would be expected to be highly annoyed. A few additional persons residing in areas exposed to DNL levels <65 dB may also be highly annoyed by aircraft noise. Implementation of the alternate military action (8 aircraft) would result in an increase in the area exposed to DNL levels >65 dB to approximately 5.7 sq. mi. and the exposure of approximately 1,600 residents to DNL levels >65 dB; none would be exposed to levels >75 dB. Of these individuals, approximately 350 would be expected to be highly annoyed by aircraft noise.

Because the majority of military flight operations would take place during 5-hr local training sorties, 5-hr equivalent noise levels (Leq-5) were also considered. Approximately 16,200 people could be exposed to Leq-5 levels >65 dB during operations on runway 23, and approximately 47,500 could be exposed during operations on runway 05. Noise levels during local training sorties could interfere with activities in which verbal communication is important (such as classroom instruction, business conferences, and religious activities) and with listening to television and radio programs or recorded music. Local training sorties would be scheduled about four times per week for the proposed (16 C-5A) military action and about twice per week for the alternate (8 C-5A) action. Operations on runway 05, which would affect the largest number of people, would be expected to occur less than 20% of the time. As noted previously, most local flying activity would be scheduled for training weekends and after normal working hours during the week. Thus, residential and recreational uses would likely be affected more frequently than educational or business activities.

Either military action would be expected to have a small positive impact on airspace management and air traffic safety. The probability of a serious aircraft accident would also be reduced as a result of the lower mishap probability rate for the C-5A as compared with the C-130 and the reduction in the number of local flying hours. The potential consequences of an accident involving a C-5A are greater because of the greater size, weight, speed, and fuel capacity of the C-5A as compared to the C-130E.

The bathing beach and portions of the picnic areas at the Chicopee Memorial State Park are heavily used by area residents during the summer months and lie just within the boundaries of the clear zone for the approach to runway 05 recommended by the Air Force's Air Installation Compatible Use Zone (AICUZ) program for the operation of heavy cargo aircraft. Because the existing land use is incompatible with recommendations of the AICUZ program, implementation details are currently being worked out for a permanent displacement of the landing threshold for runway 05. The entire threshold relocation project is scheduled to be completed by late 1988. This action will reduce, but not eliminate, the conflict between the existing land uses within the park and land-use recommendations of the AICUZ program. The Air Force has determined that displacement of the landing threshold for runway 05 will be implemented even if a decision is made to base the C-5A aircraft at an alternate location and is proceeding with negotiations with the City of Chicopee to obtain easements for areas within the clear zones for the approaches to both runways 05 and 33 which would provide assurances that incompatible land uses will not be developed within these areas.

Either military action would have a positive effect on employment in the region around Westover AFB. As noted in Table 2.8, implementation of the proposed military action (16 C-5A aircraft) would add 332 permanent full-time positions and 681 part-time positions to the numbers authorized for AFRES operations at WAFB. Implementation of the alternate military action (8 C-5A aircraft) would result in increases of 129 full-time and 469 part-time positions, respectively. The increases in personnel authorizations for the proposed and alternate military actions would result in payroll increases of $13.4 and $6.0 million respectively. These increases would be expected to support additional full-time indirect employment totaling approximately 225 to 250 jobs for the proposed military action and 100 to 125 jobs for the alternate military action. In addition to the permanent long-term employment resulting from the increase in personnel authorizations, construction expenditures for the proposed military action would provide a total of approximately 800 person-years of direct employment and 700 to 800 person-years of indirect employment during the construction period. Construction expenditures for the alternate military action would provide a total of approximately 670 and 580 person-years of direct and indirect employment respectively.

Either military action would result in a small net decrease in the emission of air pollutants resulting from aircraft operations relative to current operations. The reductions would be small in relation to regional emissions, and effects on regional air quality would likely be undetectable. Small increases in the rates of generation of hazardous chemical wastes, solid wastes, and industrial and sanitary wastewater would also result; however, no significant adverse impacts are considered

likely to occur. Construction activities would be confined to areas that have already been disturbed, and although the potential would exist for disturbance of two bird species of special interest (the upland sandpiper and the grasshopper sparrow), significant adverse impacts to these species or to other wildlife are considered unlikely. Because construction activities would be confined to areas that have already been developed, no impacts to floodplains or wetlands would be expected to result.

No significant changes in demographics or demand for housing or public services would be expected to result from increases in employment and the resulting inmigration of new residents associated with either military action; thus, no adverse socioeconomic impacts are considered likely. No impacts to historical, archaeological, or cultural resources would be expected to result from either military action.

2.2.2 Impacts of Increases in Civil Aviation Operations (No Change in Military Operations)

As noted in Sect. 2.1.2, subsequent to the issuance of the DEIS and in response to comments received on the DEIS regarding the significance of projected impacts and the need for mitigation measures, WMDC submitted a mitigation plan that would significantly reduce the noise impacts resulting from increases in civil aviation operations. If WMDC's request for increase in the hours of airfield operations is approved, WMDC is committed to implementation of the measures included in this mitigation plan. Therefore, the analysis of noise impacts expected to result from increases in civil aviation operations has been revised on the basis of these mitigation measures. To provide a basis for evaluation of the effectiveness of these mitigation measures, the impacts based on operations presented in the DEIS, which did not include mitigation measures, are provided for reference.

If the development of civil aviation operations takes place in the absence of a change in military aircraft operations (i.e., no change in the mission of the 439th TAW), the area exposed to DNL levels >65 dB would increase from approximately 3.3 sq. mi. to approximately 6.8 sq. mi. The number of persons exposed to DNL levels >65 dB would increase from fewer than 100 to approximately 1,500. As indicated in the DEIS, in the absence of mitigation measures, the area exposed to DNL levels >65 dB would increase to approximately 8.3 sq. mi. and about 6,500 persons would be exposed to DNL levels >65 dB. Thus, the proposed mitigation measures would reduce the area exposed to DNL levels >65 dB by about 18% and the population exposed by about 77% in comparison with the exposures indicated in the DEIS. The reductions result from a combination of elimination of nighttime operations by B-727 and B-747 aircraft and from the change in runway utilization to reduce overflights of the most heavily populated areas.

Because approximately 28 operations would take place between 10 p.m. and 7 a.m. (with most of the landings between 10 p.m. and midnight and most of the takeoffs between 5 a.m. and 7 a.m.), the equivalent noise level for this period was also evaluated for both mitigated and unmitigated operations. As indicated in the DEIS, operations without mitigation measures would expose an area of about 9.2 sq. mi. to weighted 9-hr equivalent (Leq-9) noise levels >65 dB and about 10,800 persons would be

exposed to such levels. Operations in accordance with the mitigation plan to which WMDC has committed would reduce the area exposed to Leq-9 levels >65 dB by approximately 32% (from 9.2 to 6.3 sq. mi.). The reduction in area results primarily from the ultimate elimination of operations by Stage II aircraft during the nighttime hours. Because the population density in Chicopee to the southeast of the base is significantly higher than in the area to the northeast of the base, runway utilization has a greater effect on population exposure. The largest numbers of people are affected by landings on runway 05 and takeoffs on runway 23 which result in operations over Chicopee. In the analysis presented in the DEIS, runway 23 was assumed to be used 80% of the time. As discussed in Sect. 4.1.2, an analysis of wind speeds and directions in the Westover area indicates that between 10 p.m. and 7 a.m., runway 05 could be used for takeoffs more than 90% of the time.

Sleep disturbance would be a significant factor in the level of annoyance resulting from the development of civil aviation operations to the levels indicated in the WMDC Master Plan. Depending on the type of aircraft, the type of operations (landings or takeoffs), the time of year (winter or summer), and the runway in use, from 300 to 19,200 persons could be awakened by one or more aircraft operations during the period between 10 p.m. and 7 a.m. The largest number of residents could be awakened by takeoffs on runway 23 and by landings on runway 05. Subsequent to the issuance of the DEIS, WMDC has proposed a mitigation plan that would minimize takeoffs on runway 23 and landings on runway 05. Takeoffs on runway 23 and landings on runway 05 are projected to occur less than 10% of the time during nighttime hours and less than 20% of the time during daytime hours. Under the mitigation plan proposed by WMDC, only about 500 persons would be expected to be awakened by a single operation on 90% of the nights on which flights occur. Because there would be up to 28 operations during the period from 10 p.m. to 7 a.m., some individuals would be expected to be awakened more than once and some individuals may be awakened by some operations and not by others. Therefore, the total number of individuals awakened and the total number of awakenings cannot be estimated.

These estimates are based on data obtained using subjects in a laboratory environment; limited data from a study conducted in the vicinity of the Roissy Paris Airport suggest that the actual number of awakenings resulting from a single operation would be lower than predicted on the basis of laboratory data (Vallet 1980). Because individual residents would be affected by 2 to 14 aircraft operations in a 2-hr period, some individuals would likely be awakened more than once and the total number of individuals awakened would likely be greater than the number awakened by a single event.

Increases in civil aviation activity would probably have a small negative impact on airspace management and air traffic safety. The probability of a serious aircraft accident in the vicinity of Westover AFB would increase slightly as a result of the increase in operations. The consequences of an accident involving a heavily loaded cargo aircraft would be somewhat greater than those resulting from an accident involving a C-130 aircraft on a typical training mission. The level of risk resulting from increases in civil aviation aircraft activity in combination with the current level of military aircraft operations would

be similar to that at other military and civilian airports with similar traffic levels and would not be considered to be significant.

An increase in civil aviation operations to the levels projected by WMDC would have a positive impact on regional employment. In addition to the approximately 680 new direct jobs created, the increase in payroll would be expected to result in the creation of approximately 150 to 180 new indirect jobs in the region. Expenditures for materials and labor and locally purchased equipment would result in additional direct and indirect employment benefits in the area.

Increases in civil aviation operations would increase emissions of air pollutants associated with aircraft operations and the generation of hazardous wastes, solid wastes, and sanitary and industrial wastewaters associated with maintenance and support activities. No significant adverse impacts would be likely to result from the projected increases. Construction activities would be confined to areas already disturbed by previous construction, and significant adverse impacts are considered unlikely. Although the number of vehicles entering the industrial park area would increase, traffic volumes would be well within the capacity of area secondary roads, and no significant impacts would be expected.

It is expected that the majority of additional jobs created by development of civil aviation operations at Westover would be filled by persons already in the local labor force, and only a few persons would be likely to move into the area. Increases in demand for housing and public services would be small in relation to the current availability of housing units and services in the area, and adverse impacts would be unlikely.

2.2.3 Cumulative Impacts Resulting from Reorganization of the 439th TAW and Development of WMDC Operations

As in the case of the individual actions, the only significant adverse cumulative impacts expected to result from implementation of the reorganization of the 439th TAW in combination with the development of civil aviation operations at Westover AFB would be related to increases in noise levels in areas surrounding the base. The predicted noise levels would result in increased levels of annoyance. Nighttime civil aviation operations would result in repeated sleep disturbance to some individuals, but little is known about the long-term health effects of sleep disturbance. No other significant effects on humans would be likely to occur. The predicted noise levels would impact existing land uses, particularly residential development, and could impose constraints on future land uses. Reductions in property value might also occur. No significant adverse impacts to domestic animals, wildlife, or structures would be expected to occur as a result of the increases in noise levels.

If development of civil aviation aircraft activity in accordance with the mitigation plan proposed by WMDC occurred in combination with the proposed (16-aircraft) reorganization of the 439th TAW, the area exposed to DNL levels >65 dB would increase to approximately 11.8 sq. mi. (or 2.4 sq. mi. less than the area affected without the WMDC mitigation plan). This area represents an increase of approximately 28% relative to the area exposed by the proposed Air Force operations alone and an increase of approximately 73% relative to the area exposed to equivalent levels by

increased civil aircraft operations in combination with current military operations. Because the population is not evenly distributed in the areas surrounding the base, increases in population exposure to DNL levels >65 dB would not be proportional to the increases in area. Approximately 5,900 persons would be exposed to DNL levels >65 dB by combined military (16 C-5A) and civil aviation operations. This represents an increase of 66% relative to the exposures resulting from proposed military operations and an increase of approximately 290% relative to the exposure resulting from the development of civil aviation operations with no change in military operations. Approximately 1,330 persons would be expected to be highly annoyed by cumulative aircraft noise.

If development of civil aviation operations (with mitigation) occurred in combination with the alternate (8 aircraft) reorganization of the 439th TAW, the area exposed to DNL levels >65 dB would increase to approximately 11.1 sq. mi., and approximately 3,370 persons would be exposed to DNL levels >65 dB. This represents increases of 54% and 29% in area and 114% and 123% in population exposure relative to the exposures resulting from the alternate military and civil aviation operations respectively. Of the approximately 3,370 persons exposed to DNL levels >65 dB, about 760 persons would be expected to be highly annoyed. A few additional persons in areas with DNL levels <65 dB would also be highly annoyed.

During local training sorties, the daytime noise environment would be dominated by the military aircraft operations. Military training operations would normally occur during a 5-hr period, and noise contributions of civil aviation operations during this time period would be insignificant. Because military training operations would not be scheduled for nighttime hours and other military operations would take place at night infrequently, nighttime noise levels and resulting impacts would be the same as for civil aviation operations alone.

Cumulative impacts on airspace management and air traffic safety would result in little change relative to current operations. The increase in civil aviation operations would be offset by the decrease in military operations. The potential consequences of an aircraft accident, should one occur, would be somewhat greater than for current operations because of the large size of the C-5A and the loading of commercial cargo aircraft.

Development of civil aviation operations in combination with either reorganization of the 439th TAW would result in increases in the emission of air pollutants associated with aircraft operations. With the exception of emissions of nitrogen oxides (which would increase in both cases), increases in emissions resulting from additional civil aviation operations would be partially offset by reductions in emissions from military operations; however, total emissions would increase relative to current levels.

Increases in the generation of hazardous wastes, solid wastes, and sanitary and industrial wastewater would result from either the military or WMDC actions, and the cumulative impacts would be additive. These materials will be discharged or disposed of in accordance with applicable

standards and regulations. No significant adverse impacts would be expected to result from the combined increases.

Cumulative impacts on employment in the region surrounding Westover would also be positive. If development occurred in combination with the proposed military action, approximately 1000 direct and 375 to 430 indirect full-time jobs would be created. If development occurred in combination with the alternate military action, approximately 800 direct and 250 to 305 indirect full-time jobs would be created. Additional temporary direct and indirect employment would occur as a result of expenditures for construction of required facilities and local purchases of materials and equipment.

Because it is expected that the majority of additional jobs related to the WMDC action would be filled by persons already in the local labor force, cumulative migration into the area surrounding Westover and resulting increases in demands for housing and public services would be essentially the same as for the proposed or alternate military action change alone and no adverse impacts would be expected. Increases in employment and cargo operations would result in cumulative increases in traffic volumes in the vicinity of the base but would not be expected to result in significant increases in either traffic congestion or air pollutant emissions.

No cumulative adverse impacts to historical, archaeological, or cultural resources would be expected to occur.

REFERENCES FOR SECTION 2

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3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1 LOCATION, HISTORY, AND MISSION OF WESTOVER AIR FORCE BASE

3.1.1 Location of Westover Air Force Base

Westover Air Force Base (AFB) is located in Chicopee in the northern portion of Hampden County, Massachusetts. The towns of Holyoke, Ludlow, Springfield, and West Springfield in Hampden County, and Granby and South Hadley in Hampshire County adjoin or are near the base (Fig. 3.1).

3.1.2 History of Westover Air Force Base

Construction and activation of Westover AFB began in April 1940. During World War II, Westover served as a bomber training base and as a port of embarkation/debarkation. Following World War II, the headquarters of the Military Airlift Command (MAC) were located at Westover. In 1955, the Strategic Air Command (SAC) assumed control of the installation and Westover became the largest SAC facility in the eastern United States. On April 1, 1974, the SAC 99th Bombardment Wing was deactivated and the installation was transferred to the Air Force Reserve (AFRES) on May 1, 1974.

Since transfer to the AFRES, the 439th Tactical Airlift Wing (TAW) has been the major unit on base and is the current host unit. The 439th TAW has maintained an active flying mission at WAFB since its organization in 1974. The base is operated and maintained by the 439th Combat Support Group (CSG) attached to the 439th TAW.

Following the transfer of the installation to AFRES, the 439th CSG was assigned responsibility for identifying property considered to be excess to mission requirements. The original installation encompassed an area of approximately 4700 acres. About 2300 acres have been deeded to the surrounding townships for commercial and industrial development and for recreational use, and the base currently consists of approximately 2360 acres. Of the 2300 acres transferred to civilian ownership, approximately 1200 acres were transferred to the Westover Metropolitan Development Corporation for commercial and industrial development uses. Approximately 178 acres of the land designated for commercial development is designated as an airpark. The area designated for recreational uses includes the former base golf course and a wildlife management area at the northeast corner of the base. The current boundaries and layout of the base are shown in Fig. 3.2.

3.1.3 Current Mission of Westover Air Force Base

The mission of the 439th TAW is to organize, recruit, and train Air Force reservists while maintaining operationally ready aircraft, crews, and support personnel. Sixteen C-130E aircraft are currently assigned to the 439th TAW. The work force consists of approximately 1000 full-time employees (active duty military, civilians, technicians, and non-appropriated-fund employees) plus approximately 2700 reservists who attend unit training assemblies one weekend per month. (It should be noted that these figures include personnel assigned to units not affected

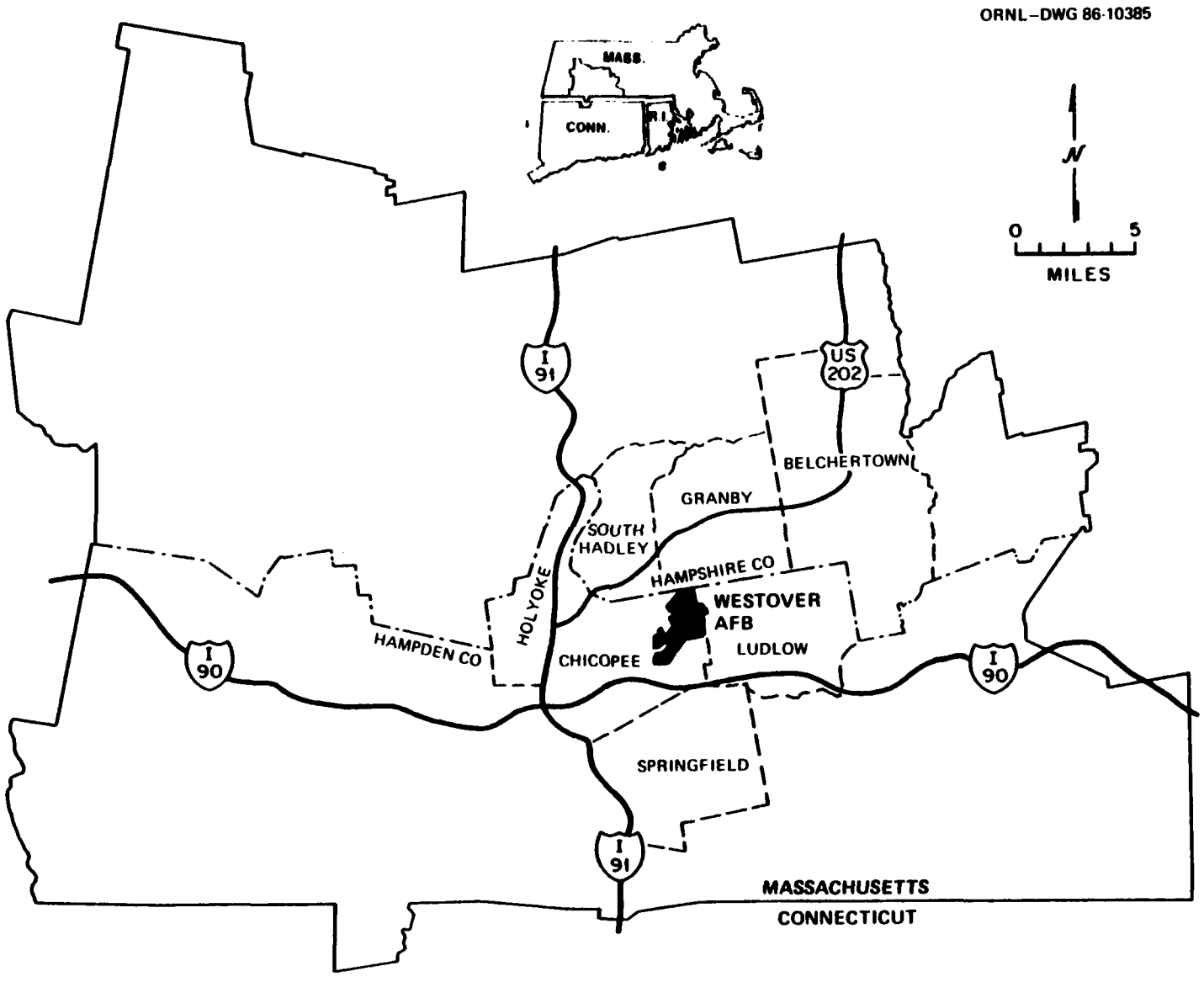

Fig. 3.1 Area location of Westover AFB.

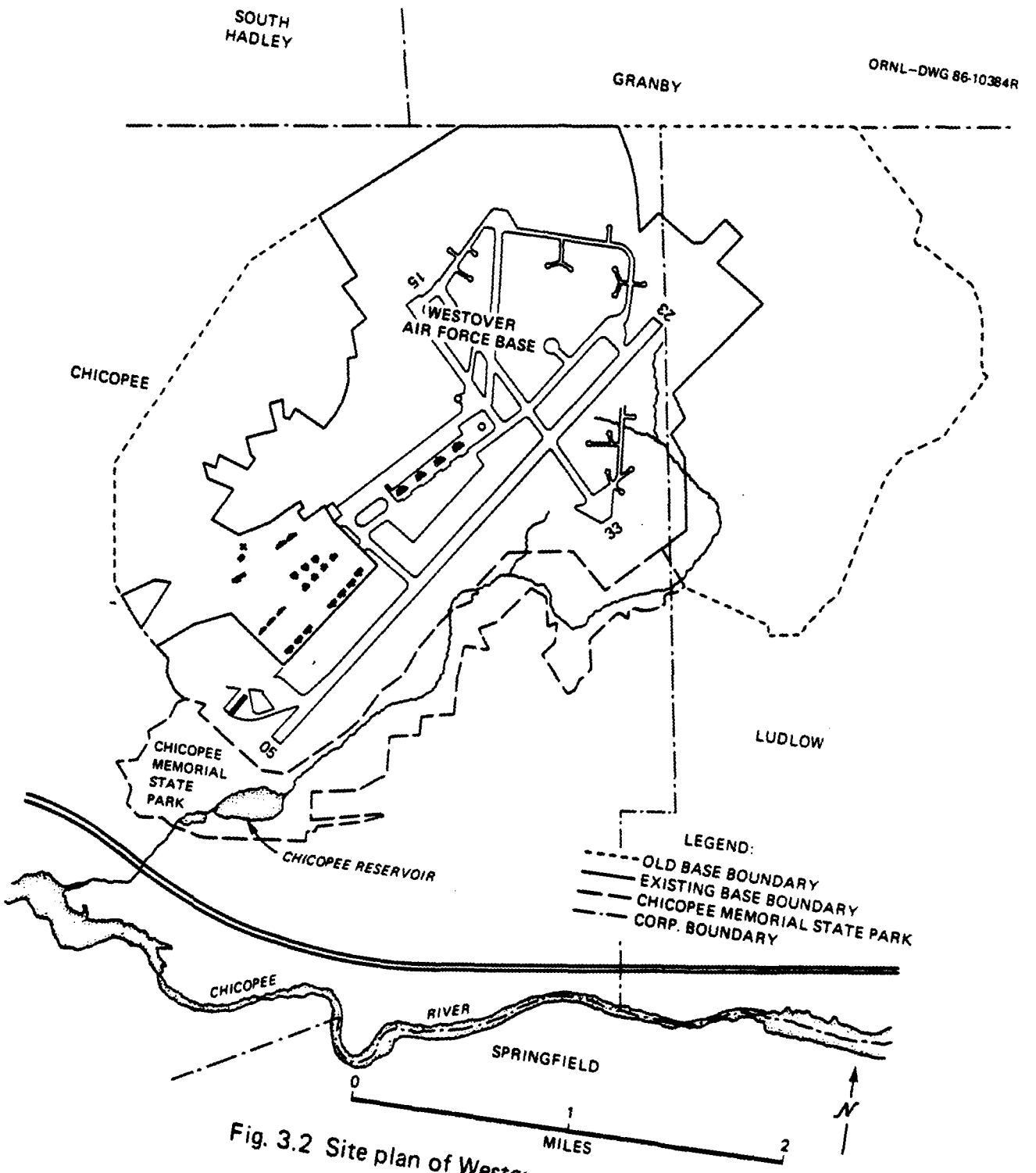

Fig. 3.2 Site plan of Westover AFB.

by the proposed mission change and are therefore not included in Tables 2.2 and 2.6.) Major AFRES organizations and active component tenant units at Westover AFB are listed in Table 3.1.

Other tenant military organizations include a helicopter unit of the Massachusetts Army National Guard and reserve organizations of the Army, Navy, and Marine Corps. The mission of these units is primarily to train reservists for defense purposes. In addition to these military units, a number of other federal agencies are represented on the base and are staffed with civilian personnel.

The mission of the 439th TAW is to provide command and staff supervision for all assigned or attached subordinate units. The 337th Tactical Airlift Squadron provides tactical airlift support for strategic airborne forces and Air Force special operations support within currently authorized resources. The wing also provides individuals and equipment on a voluntary basis to perform directed active force missions. Through the 439th CSG, the 439th TAW operates and maintains Westover AFB as an AFRES facility and supports assigned tenant units.

Upon mobilization, the 439th TAW would be assigned to the Military Airlift Command and would perform airlift and support missions as assigned by the Military Airlift Command. The 439th CSG would continue to maintain host responsibility for Westover AFB, and any remaining wing units would then be assigned in tenant status.

The 439th TAW operates worldwide air-land and air-drop training missions. These missions provide training support for both active-duty and reserve-component air-drop units and logistical support for Army, Air Force, and Navy major commands.

3.1.4 Existing Aircraft Operations

Air traffic in the vicinity of Westover is dominated by the C-130 aircraft assigned to the base. In addition to the assigned Air Force Reserve and Army National Guard aircraft, transient military aircraft, commercial cargo carriers, and general aviation aircraft also utilize the facilities at Westover. The Westover Metropolitan Development Corporation is currently working to increase the joint use of Westover by cargo and scheduled commuter aircraft. The potential impacts of this proposal are addressed throughout this Environmental Impact Statement (EIS).

3.1.4.1 Air traffic

As indicated in Table 2.1, local training sorties currently average 30 per week. Although the airfield is in operation 7 days/week, the majority of the 439th TAW flying activity takes place on 5 days. An average busy day is considered to include approximately 0.5 off-station sorties (i.e., one every other day) plus six local training sorties. The mission sortie results in a single takeoff and landing in the Westover area, while each training sortie consists of one takeoff and landing plus an average of eight touch-and-go operations, which consist of a takeoff and landing connected by a pattern in the local area. An average of approximately six cargo drop operations are also conducted each day by C-130 aircraft. In addition to the C-130E operations, transient military

Table 3.1. Major organizations and tenants at Westover AFB

Organization	Designation
AFRES Units	
Tactical Airlift Squadron	337th
Civil Engineering Squadron	439th
Consolidated Aircraft Maintenance Squadron	439th
Mobile Aerial Port Squadron	42nd
Aerial Port Squadrons	58th, 59th
Tactical Hospital	439th
Aeromedical Evacuation Squadron	74th
Information Systems Squadron	439th
Weapons System Security Flight	439th
Tenant Units	
3512th USAF Recruiting Squadron (ATC)	
Operating Location B, Detachment 6, 26th Weather Squadron, 3rd Weather Wing (Active)	
Operating Location C, Information Systems Groups (AFCC)	
Massachusetts Army National Guard	
1059th Medical Detachment	
Army Aviation Flight Activity	
Brigade Support Section, Company A, 26th Aviation Battalion	

and civilian aircraft operations are also considered. As noted in Sect. 2.1.2, commercial aircraft activity now consists primarily of two daily scheduled all-cargo flights operated by Emery Air Freight (4 operations per day). No air passenger service is currently scheduled at Westover. Approximately 35 general aviation aircraft are based at Westover, and these aircraft conduct an average of about 16 operations per day (8 takeoffs and 8 landings). Training operations for civil aviation aircraft are not permitted at Westover, and aircraft normally arrive and depart without operations in the airport traffic pattern. Table 3.2 provides a summary of current aircraft activity on an average busy day.

3.1.4.2 Air traffic control

The major airspace feature in the vicinity of Westover is the airport traffic area (ATA) for the base, a controlled airspace that extends from ground level to an altitude of 3000 ft above ground level within a 5-mile radius of the Westover control tower. Aircraft entering the ATA must be in contact with the Westover control tower which coordinates traffic on the runways and within the ATA. Approach and departure control is provided by a regional air traffic control facility at Bradley International Airport at Windsor Locks, Connecticut.

Operations and flight paths are coordinated with the Federal Aviation Administration (FAA) and are integrated to minimize conflict with civilian aircraft operations at Bradley and Barnes Airports and with other private flying activities. Runway utilization is selected to allow takeoffs and landings into the wind and to minimize crosswinds. Seasonal changes result in changes in predominant wind direction and determine the percentage utilization of each runway. Annual average runway utilization is summarized in Table 3.3.

Table 3.3. Annual average runway utilization for current aircraft operations at Westover AFB

Runway	Takeoff toward	Utilization (% of operations)
05	Granby	13.8
23	Chicopee	57.6
15	Ludlow	0.3
33	South Hadley	28.3

The normal operating hours for the Westover tower are from 7 a.m. to 11 p.m., 7 days/week. Because the airfield is normally closed at night, very few operations occur between the hours of 10 p.m. and 7 a.m., the period during which noise intrusions from aircraft and other sources are considered to be most annoying. Because most members of reserve flight crews have full-time civilian jobs, most local flying activity is scheduled for weekend training assemblies or after normal working hours

Table 3.2. Current aircraft operations at Westover AFB

Aircraft	Annual average operations (number per day)						
	Departures (Takeoffs)	Arrivals (Landings)	Closed patterns (Takeoffs)	Closed patterns (Landings)	Drop[a] zone	Total operations per day	Total operations annual
Assigned aircraft							
C-130E	8.5	8.5	48.0	48.0	6.0[a]	125[a]	18,460[a,b]
Transient military aircraft							
Heavy cargo (C-5A)	0.03	0.03	0.01	0.01	0	0.08	29[c]
Medium cargo (C-135, C-141)	3.4	3.4	0	0	0	6.8	2,482[c]
Light cargo (C-130)	3.4	3.4	0	0	1.7[a]	10.2	3,723[a,b]
Fighter/Trainer (F-4, F-15, FB-111, A-4, A-10, T-37, etc.)	7.3	7.3	0.70	0.70	0	16	5,840[c]
Commercial and general aviation							
DC-8	2.0	2.0	0	0	0	4.0	1,144[d]
3-engine jet	0.03	0.03	0	0	0	0.06	17[d]
Business jet	1.0	1.0	0	0	0	2.0	572[d]
2-engine turbo prop	3.0	3.0	0	0	0	6.0	1,716[d]
Single prop	4.0	4.0	0	0	0	8.0	2,288[d]
TOTAL OPERATIONS	32.66	32.66	48.71	48.71	7.7[a]	178.14	36,271

[a]Drop zone operations include an approach and a departure and are counted as two operations.

[b]$\frac{11\ \text{opns}}{\text{sortie}} \times \frac{30\ \text{sorties}}{\text{wk}} \times \frac{52\ \text{wks}}{\text{yr}} + \frac{2\ \text{opns}}{\text{mission}} \times \frac{12.5\ \text{mission}}{\text{wk}} \times \frac{52\ \text{wks}}{\text{yr}} = \frac{18{,}460\ \text{opn}}{\text{yr}}$

[c]365 days/yr

[d]$\frac{5.5\ \text{days}}{\text{wk}} \times \frac{52\ \text{wks}}{\text{yr}}$

(approximately 4:30 p.m.) during the week. Local flying activity is normally completed before 10 p.m.

3.2 NOISE

Noise associated with activities at Westover AFB is characteristic of that associated with most Air Force base flying operations. During periods of no aircraft activity, noise associated with base operations results primarily from maintenance and shop activities, ground traffic movement, occasional construction, and similar sources. The resultant noise is almost entirely restricted to the base itself and is comparable to that which might occur in adjacent community areas. It is only during periods of aircraft ground or flight activity that this situation changes.

Environmental noise levels resulting from current aircraft operations at Westover AFB are described in terms of yearly average day/night sound level (DNL y-avg) values. The DNL value is used by the U.S. Environmental Protection Agency (EPA), the U.S. Department of Housing and Urban Development, the FAA, and the Department of Defense to describe noise exposure and to predict the effect on a population of the average long-term exposure to environmental noise. The DNL is the noise level averaged on an energy basis over a period of 24 hr, with a 10-dB penalty applied to nighttime (10 p.m. to 7 a.m.) sound levels to account for increased annoyance by noise during the night hours (Newman and Beattie 1985). The annual average DNL (DNL y-avg) provides the basis for the land-use-compatibility guidelines in the Air Force Air Installation Compatible Use Zone (AICUZ) program (USAF 1984). In the remainder of this document, the term DNL will be used in lieu of DNL y-avg, yearly average being implied.

DNL values are expressed on an A-weighted decibel scale. The A-scale de-emphasizes the low- and high-frequency portions of the sound spectrum and provides a good approximation of the response of the average human ear. The A-scale correlates well with the average person's judgment of the relative loudness of a noise event (EPA 1974). The decibel is a logarithmic scale on which an increase of 3 dB represents a doubling of sound energy. In reality, a 3-dB difference in noise levels is only moderately detectable by the human ear. A difference on the order of 10 dB represents a subjective doubling of loudness. Thus, 3 dB corresponds to a factor of two in sound <u>energy</u>, while 10 dB corresponds to approximately a factor of two in subjective <u>loudness</u> (AFM 19-10).

Data describing flight tracks, altitude profiles, power settings, flight path and profile utilization, and ground runup information by type of aircraft are input into a central computer at the Air Force Engineering Services Center at Tyndall AFB, Florida. DNL contours are generated using NOISEMAP, a program that combines the operational data and standard aircraft source noise data corrected to local conditions (Beckmann and Seidman 1978).

3.2.1 Noise Resulting from Current Operations

As noted in Sect. 3.1.4.1 (and Table 3.2) in addition to the 16 C-130E aircraft currently assigned to the 439th TAW, flight operations

at Westover AFB involve transient military aircraft and joint use by civilian aircraft. The effects on area noise resulting from current aircraft operations are illustrated in Fig. 3.3, which shows the estimated locations of contours of constant DNL values in decibels at ground elevation.

As indicated in Fig. 3.3, with the exception of a small area in the Westover Industrial Park adjacent to the base, the 70-dB DNL contour lies entirely within the Westover AFB installation boundary. The 65-dB DNL contour extends into residential areas located at the northwest end of runway 15-33 and the southeast end of runway 05-23. Recreational areas in Chicopee State Park, located at the southwest end of runway 05-23, are also within the 65- to 70-dB DNL contours. Table 3.4 provides a summary of the estimated areas exposed to noise levels in excess of 65 dB DNL in 5-dB increments. As indicated in this table, the 65-dB DNL contour encompasses an area of approximately 3.5 sq. mi. Because the majority of this area lies within the base, it is estimated that fewer than 100 area residents are exposed to noise levels in excess of 65 dB DNL and that no residents are exposed to levels in excess of 70 dB DNL as a result of current aircraft activity.

It should be noted that Fig. 3.3 and Table 3.2 reflect only the contribution of aircraft noise to ambient noise levels. In addition to aircraft noise, traffic noise and other sources may make a significant contribution to, or even dominate, the noise levels at any specific location.

The effects of noise exposure are discussed in Sect. 4.2.

3.3 SAFETY

The following discussion of hazards is included in response to questions raised at the public scoping meeting (Sect. 1.3).

3.3.1 Aircraft Accident Occurrence Rates

Data provided by the Air Force Inspection and Safety Center at Norton AFB indicate that, during the 10-year period from 1975 through 1984, 16 C-130 aircraft were involved in accidents which resulted in destruction of the aircraft. Based on an average of approximately 375,000 flying hours/year for all Air Force C-130 aircraft, this is equivalent to an occurrence rate of 0.4/100,000 flying hours. Based on an annual flying program of approximately 6460 hr, an aircraft from Westover AFB would be expected to be involved in such an accident approximately once in 38 years.

3.3.2 Dropped Objects

The Military Airlift Command maintains data on objects which fall from or are dropped from C-130 aircraft. Any component noted as missing during postflight inspection or maintenance and which cannot be determined to have been missing before the flight is reported as a dropped object. It should be noted that the data for this program are obtained from maintenance inspections and are not correlated with reports of damage

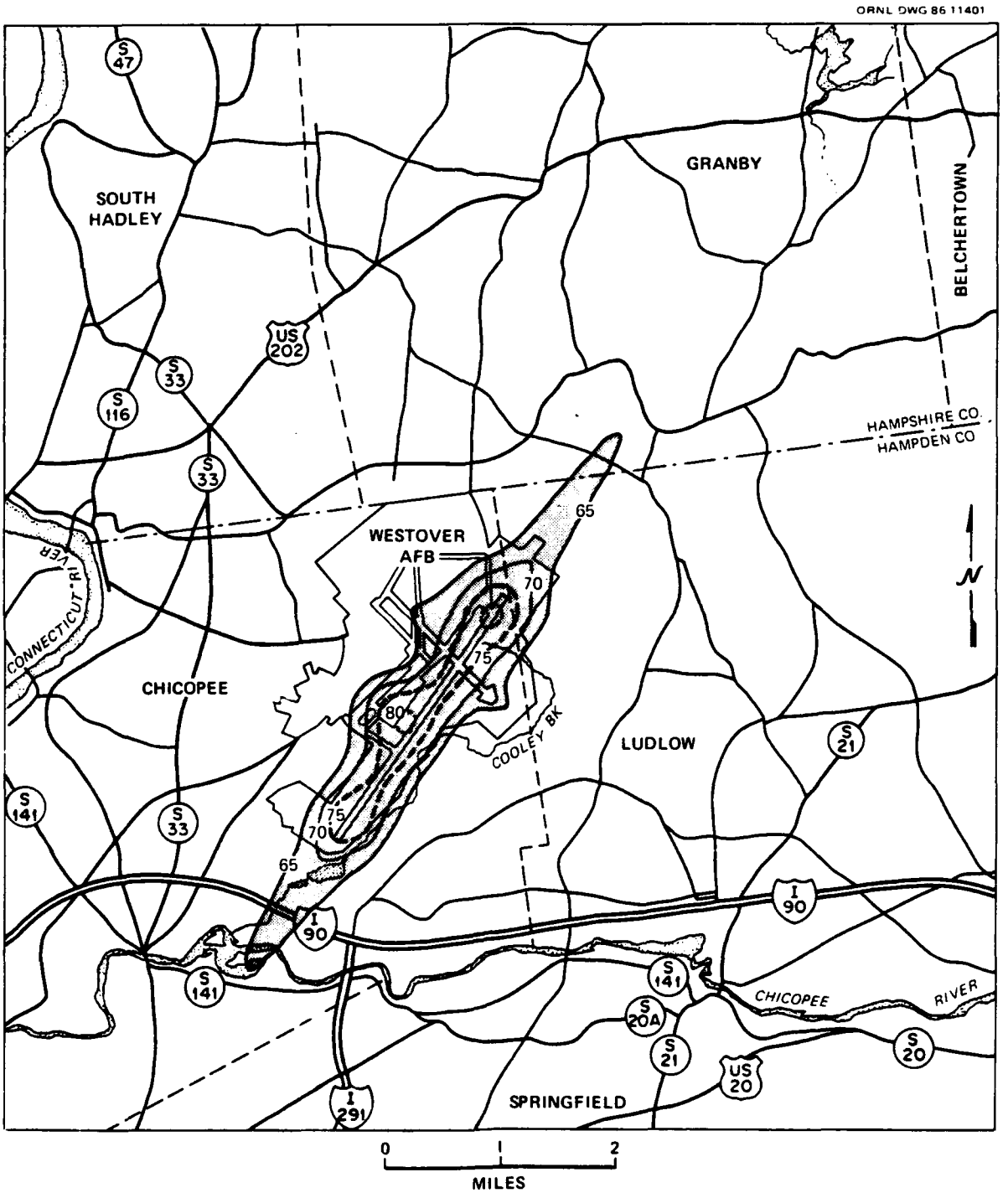

Fig. 3.3 DNL contours resulting from current aircraft operations at Westover AFB.

Table 3.4. Areas exposed to day/night average noise levels (DNL) >65 dB by current aircraft activity at Westover AFB (Current mission: 16 PAA C-130E)

DNL interval	Area within contour (acres)	Area within contour (sq. mi.)	Cumulative area (acres)	Cumulative area (sq. mi.)
>85	29	0.045	29	0.045
80-85	131	0.204	160	0.249
75-80	369	0.576	529	0.825
70-75	468	0.732	997	1.557
65-70	1143	1.786	2140	3.343
Total	2140	3.343		

resulting from objects falling from aircraft. Data for the period 1980 through 1985 indicate an average C-130 dropped-object rate of 1.43/1000 departures. The objects most frequently reported as dropped are landing lights and small inspection panels.

3.3.3 Aircraft Accident Potential Zones and Compatible Land Uses

3.3.3.1 Accident potential zones

In mid-1973, the Air Force performed an Air Force-wide accident hazard study to identify land areas near airports with significant aircraft accident potential. The study reviewed reports on 369 major accidents that occurred from 1968 through 1972 within a 10-nautical-mile radius of airfields and that were directly related to airfield-associated, in-flight mishaps. The location of each accident with respect to the runway was determined for four classes of aircraft: (1) fighter, (2) trainer/ miscellaneous, (3) tanker/transport, and (4) bomber. These classes were selected because of aircraft size, speed, operational characteristics, and procedures. The distribution of Air Force aircraft accidents is illustrated in Fig. 3.4.

Analysis of these data revealed the following:

1. Accident potential increases significantly near the extended runway centerline. Seventy-five percent of the accidents plotted were near the extended runway centerline.
2. Fighter and training-type aircraft account for over 80% of all major Air Force accidents.
3. Nearly 61% of the accidents occurred during the landing phase, as compared to 39% for the takeoff phase.

Hazard zones were selected to minimize the area necessary to include significant percentages of accidents. A zone width of 3000 ft was selected as the optimum. Zone boundaries were established at distances of 3000, 8000, and 15,000 ft to correspond to the break points of the curves in Fig. 3.4. The zone closest to the end of the runway is designated as the clear zone, and the remaining zones are designated as accident potential zones (APZ) I and II. The designation of these zones and the percentage of accidents included in each zone are illustrated in Fig. 3.5.

Figure 3.6 illustrates the clear zones and APZs for each of the runways at Westover AFB as defined in the AICUZ report issued in October 1978. The clear zones identified in that report were 2000 ft rather than the 3000-ft width at most Air Force installations. This reduced width was established based on the type of aircraft using the base and the limited aircraft activity taking place at that time. As indicated in this figure, the clear zones for the approaches to runways 15 and 23 lie almost completely within the current base boundary. With the exception of a small, privately owned tract in the approach to runway 33, those portions of the clear zones for the approaches to runways 05 and 33 which lie outside the installation boundary are owned by Chicopee (Chicopee Country Club) and the state of Massachusetts (Chicopee Memorial State Park). APZs extend into developed areas in Chicopee, Granby, Ludlow, South Hadley, and Springfield.

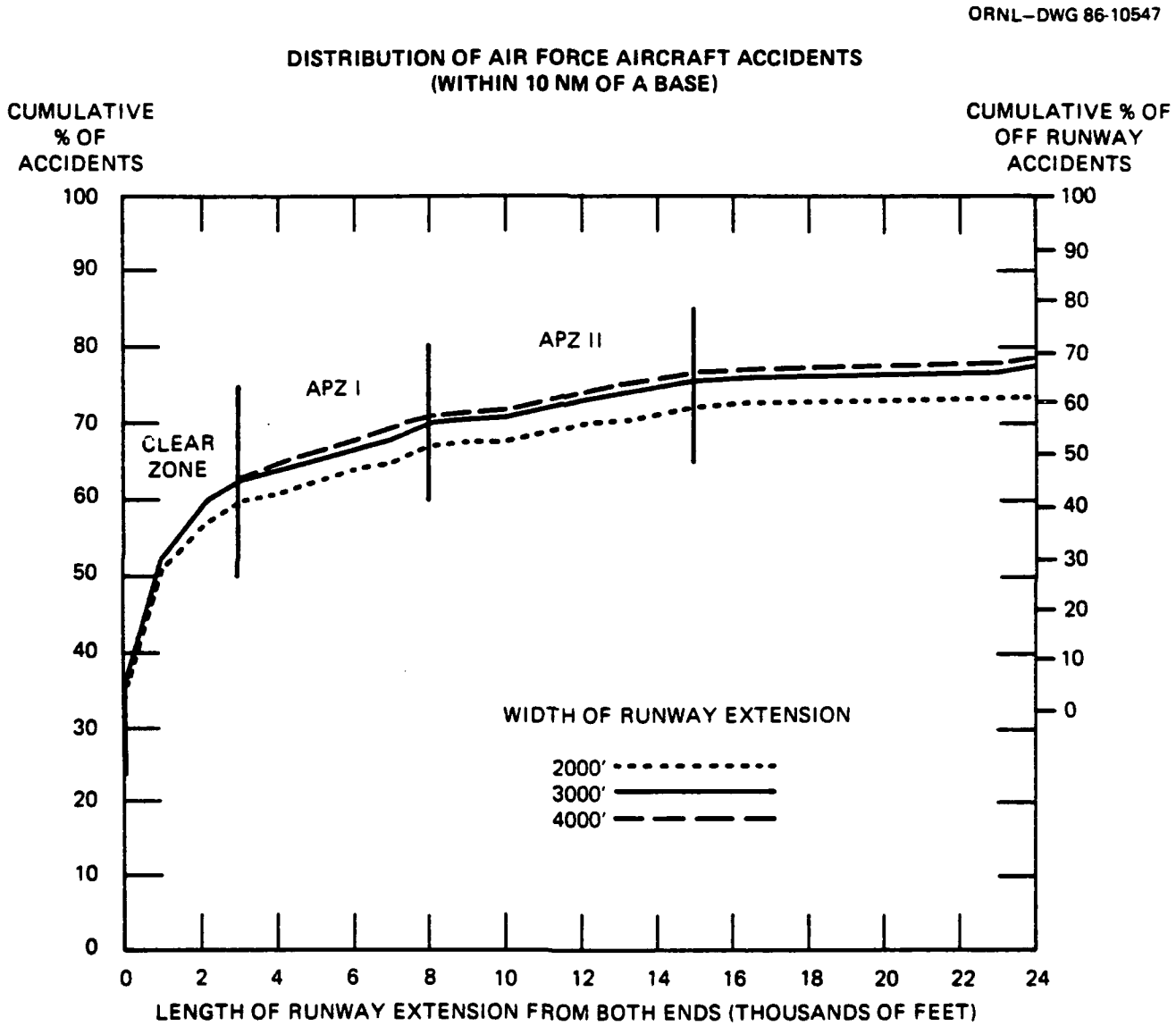

Fig. 3.4 Distribution of Air Force aircraft accidents.

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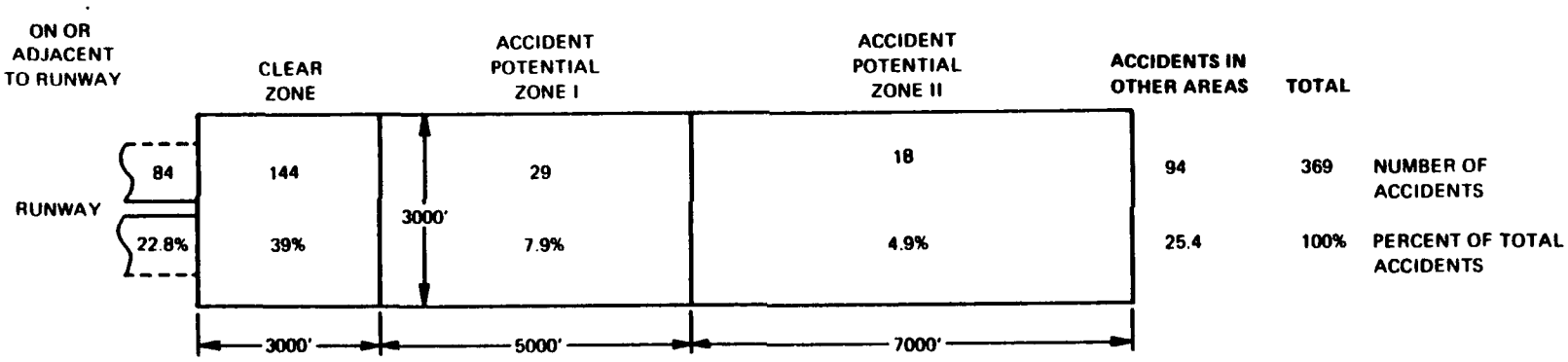

Fig. 3.5 Air Force aircraft accident hazard zones.

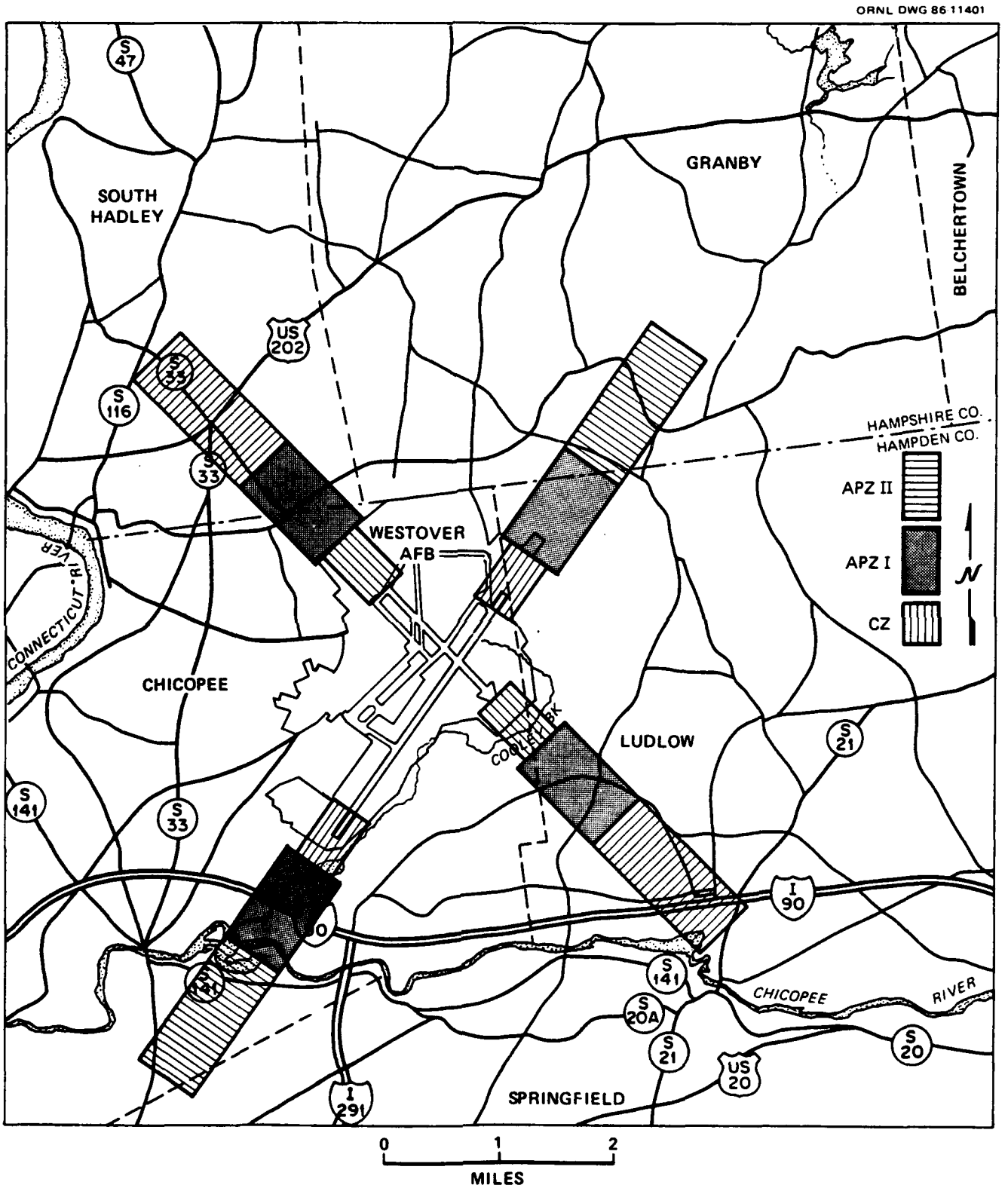

Fig. 3.6. Aircraft accident potential zones for current operations at Westover AFB.

3.3.3.2 Clear zones

Most uses of the land in the clear zones would be incompatible with military aircraft operations. For this reason, it is the policy of the Air Force to acquire real property interest in land within the clear zones to ensure that incompatible development does not take place. This interest may be acquired through purchase, lease, or easement. Authority and funding for acquisition of control over those portions of the clear zones which are outside the base boundaries were included in the FY 1983 Military Construction Program budget. Funding was provided for acquisition of 2000 x 3000 ft clear zones for runway 15/33 and runway 05/23. The clear zone for the approach to runway 23 is within the current base boundary. The Air Force has acquired a small, privately owned area in the clear zone (in Chicopee) for the approach to runway 15. Preliminary contacts regarding the approach to runway 33 have been made with Chicopee and the Massachusetts Department of Environmental Management; however, no agreement has been reached. Chicopee recently voted to defer action on a proposed easement until after the public hearing on this EIS.

3.3.3.3 Recommended land uses in accident potential zones

Accident potential "on or adjacent to the runway" or within the clear zone is so high that few uses are acceptable, while the risk outside APZ I and APZ II (but within the 10-nautical-mile radius area) is not significant enough to warrant special attention.

Land-use guidelines for APZs I and II have been developed. The primary objective has been to restrict all people-intensive uses because there is greater risk in these areas. The basic criterion for APZ I and APZ II land-use guidelines is the prevention of uses that

1. have high residential density characteristics;
2. have high labor intensity;
3. involve explosive, fire, toxic, corrosion, or other hazardous characteristics;
4. promote population concentration;
5. involve utilities and services required for area-wide population where disruption would have an adverse impact (telephone, gas, etc.);
6. concentrate people who are unable to respond to emergency situations such as children, elderly, handicapped, etc.;
7. promote extended duration of population concentration; or
8. pose hazards to aircraft operations.

APZ I is compatible with a wide variety of industrial/manufacturing, transportation, communication/utilities, wholesale trade, open space, recreation, and agricultural uses. However, uses that concentrate people in small areas are not recommended. Structures should be located toward the edge of this zone wherever possible.

APZ II possesses lower accident potential, although risk is still present. Acceptable uses include those of APZ I, as well as low-density single-family residential, and those personal and business services and commercial/retail trade uses of low intensity or scale of operation. High-density functions, such as multistory buildings, places

of assembly (theaters, churches, schools, restaurants, etc.), and high-density office uses, are not considered appropriate.

Population densities should be limited as much as possible. The optimum density recommended for residential usage (where it does not conflict with noise criteria) in APZ II is one dwelling per acre. For most nonresidential uses, buildings should be limited to one story and the lot coverage should not exceed 20%.

3.3.3.4 Compatibility of current land use in accident potential zones

Incompatible land uses exist in APZs I and II for all runways. Minimum incompatible land use exists in APZ I in Chicopee and in APZs I and II in Granby. The primary incompatible land uses (primarily residential development) are in APZ II in Chicopee and in APZs I and II in Ludlow. Prevailing wind directions (which determine runway utilization) and aircraft operational capabilities have minimized problems since AFRES assumed responsibility for the base. The majority of aircraft activity is on runway 05/23, resulting in low levels of activity over Ludlow and South Hadley. The majority of the activity on runway 05/23 results in departures toward Chicopee. The operational characteristics of the C-130E permit the aircraft to climb rapidly and to initiate a left turn before reaching the more densely populated areas in APZ II in Chicopee.

3.3.4 Bird-Aircraft Strike Hazard

Collisions with birds present a significant hazard to aircraft operations. The most serious hazard is the possibility of severe damage to jet engines as the result of intake of a bird into the turbine; however, collisions with birds can also result in damage to the aircraft. Large birds (such as waterfowl, gulls, and raptors) present the greatest hazard because of their size. Any feature or activity in the vicinity of an air installation which attracts birds to the area creates a potential hazard to aircraft operation. Sanitary landfill operations tend to attract large numbers of birds and are of particular concern.

In addition to a large marsh area east-northeast of the end of runway 05, there are seven sanitary landfills within 2 miles of the runways at Westover AFB. Large numbers of gulls tend to congregate on the runways during periods of bad weather and are frequently killed by aircraft. The base has an active program to control bird-aircraft strike hazards, as required by AFR 127-15, and has periodically employed several techniques to drive the birds away. However, the hazard to the propeller-driven C-130E aircraft from birds on the runway is relatively small, and there is no routine program to discourage the gulls from congregating on the runways and aprons.

3.4 AIR QUALITY

Westover AFB is located in Hampden County, which, together with Hampshire County, comprises the Pioneer Valley Air Pollution Control District. The entire state of Massachusetts is currently classified as nonattainment for ozone and as attainment for nitrogen dioxide and sulfur dioxide. Portions of the city of Springfield are classified as

nonattainment for total suspended particulates and carbon monoxide; the remainder of the region is classified as attainment for these pollutants.

Estimated pollutant emissions resulting from current flight operations at Westover AFB are summarized in Table 3.5 and compared to estimated total emissions in the Pioneer Valley Air Pollution Control District. Total annual pollutant emissions from Westover AFB flight operations are estimated to be about 0.11% of the total regional emissions. Although pollutants resulting from Westover flight operations contribute to regional pollution levels, these emissions have only a minor impact because of the relatively small amounts and the altitudes at which the emissions occur.

With the exception of firefighter training, no open burning is conducted at Westover AFB. Firefighter training is normally conducted on one training assembly weekend each month, with one session each day (24/yr). Training is conducted at a specially constructed facility that includes a water spray system for smoke suppression. All water used in smoke suppression and in fire training is collected and discharged through an oil/water separator into the municipal treatment system. A maximum of 200 gal of clean jet fuel (JP-4) is used in each training session. All training sessions are coordinated with the regional office of the Department of Environmental Quality Engineering. Emissions from fire training activities are not included in the emission estimates in Table 3.5. Emissions from fire training activities are estimated to be approximately 1 ton/yr.

3.5 MANAGEMENT OF HAZARDOUS MATERIALS, WASTES, AND WASTEWATER

3.5.1 Fuels Management

Jet fuel is purchased from a contractor who provides off-site bulk storage and pipeline delivery to eight 50,000-gal storage tanks located on the installation. Fuel is delivered to the aircraft from these tanks either through an underground piping (hydrant refueling) system or by tank trucks. Fuel consumption (JP-4) in FY 1984 was approximately 5.1 million gal. Flight line spill control facilities and operating procedures are designed to prevent the accidental release of fuel or oil into the environment. The base has developed a Spill Prevention, Control and Countermeasures (SPCC) Plan that specifies procedures and responsibilities for regular inspection of fuel storage and handling equipment and of spill containment facilities to ensure that the probability of an accidental release is minimized. Should a spill occur, the base has developed a Spill Contingency Plan that specifies procedures for containment and cleanup of spilled materials and requirements for notification of appropriate state and federal agencies. Actions taken in the event of a spill would be determined by the size of the spill and the relative hazards to personnel, aircraft, and facilities and the environment. Small spills and those larger spills that do not constitute a significant hazard to personnel or property would normally be contained and cleaned up by pumping of bulk fuel and absorption of residual quantities using sorbents specifically designed for such applications. In the event of a spill that presented a significant hazard to personnel or property, the fire department would wash down the area in the vicinity of the aircraft or other

Table 3.5. Estimated annual air pollutant emissions from current flight operations at Westover and comparison to regional emissions

Pollutant	Estimated annual pollutant emissions (tons)		
	Regional emissions	Westover AFB	
		Emissions	% of regional
Carbon monoxide	255,565	211	0.08
Hydrocarbons	24,790	146	0.59
Nitrogen oxides	34,221	44	0.10
Sulfur dioxide	34,753	6	0.02
Particulates	17,145	5	0.03
Total	366,474	412	0.11

facility to reduce the fire hazard. The fuel and water would flow into the storm drainage system. Portable absorbent booms would be used to contain as much of the fuel as possible within the storm drainage ditches, and the collected fuel would be removed by pumping and by sorbent materials. The water and residual amounts of fuel not contained by these measures would flow through the storm drainage system to one of three oil/water separators located in the drainage system upstream from the point of discharge into Cooley Brook. These separators have adequate capacities to retain large quantities of fuel in the event of a major spill. The separator in the drainage system receiving runoff from the fuel cell dock, the hangars and nose docks, and approximately half of the hydrant fueling system has the capacity to retain 48,440 gal of fuel. The separator in the drainage system receiving runoff from the hydrant fueling system pumphouse and fuel storage tanks, the large double cantilever hangar (currently not in use), and the other half of the hydrant fueling system has a capacity of 35,536 gal. The separator in the drainage system serving the Westover Metropolitan Airport has a capacity of 70,500 gal. Each of these separators has two compartments which can be operated either alone or in parallel; the capacity of each compartment is half of the total indicated above.

Discharges from the oil/water separators are permitted by the State of Massachusetts in accordance with the requirements of the National Pollutant Discharge Elimination System (NPDES). Permits for the discharges from the separators serving the Air Force operations limit oil and grease concentrations to a maximum of 15 mg/L and require monthly monitoring of oil and grease, pH, and temperature. A review of monitoring records for the last five years indicates that discharges from the separators are in compliance with the limitation on oil and grease. The discharge from the separator serving the Westover Metropolitan Airport is permitted under an NPDES permit issued to the City of Chicopee.

Although not all of the storm drainage from the base or the airport flows through oil/water separators, all areas in which fueling operations are conducted or in which aircraft are parked are served by separators. The probability of an accidental release in an area not served by separators is not considered high enough to warrant the construction of additional separators. In the unlikely event of a spill in an area not served by separators, the use of portable sorbent booms and other containment measures would reduce the probability of significant adverse impacts.

3.5.2 Previous Waste Disposal Practices

Prior to 1974, Westover was an active-duty Air Force base and a significant number of the military personnel and their dependents lived on the base in government housing. As was typical of most active-duty installations at that time, the Air Force provided services for its residents and tenant organizations much like those provided by municipalities, including garbage pickup and disposal, water and wastewater treatment, as well as housing, educational, recreational, and transportation facilities. In recent years, the Air Force, like the other military services, has adopted a policy of purchasing services such as water and wastewater treatment and disposal of nonhazardous solid wastes (garbage) from local municipalities if they are available. Currently, Westover

purchases water and wastewater treatment and solid waste disposal services from the City of Chicopee, and no wastes are disposed of on the base.

Prior to the transfer of the installation to the Air Force Reserve in 1974, wastes were disposed of on the installation by a variety of methods, many of which would not be acceptable under current environmental regulations but which were in compliance with the standards in effect at the time. Many of the materials that were formerly disposed of on Air Force installations, including Westover AFB, are today considered to be "hazardous wastes" under federal regulations (40 CFR Sect 261.3) promulgated pursuant to the Resource Conservation and Recovery Act (RCRA), Public Law 94-580, which was enacted in 1976 as an amendment to the Solid Waste Disposal Act. RCRA defines hazardous waste as a solid waste (including liquids and gases) or a combination of solid wastes that, because of its quantity, concentration, or physical or chemical characteristics, may

- cause or significantly contribute to an increase in mortality or in serious irreversible, or incapacitating reversible, illness; or

- pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

The definition of hazardous wastes can be found in Title 40 of the U.S. Code of Federal Regulations (CFR) Section 261.3. By definition, hazardous wastes are "listed" (specifically named) or may exhibit any of four characteristics: ignitability, corrosivity, reactivity, or extraction procedure toxicity.

Because many of the materials that were formerly disposed of on Air Force installations are now considered as "hazardous," the Air Force initiated the Installation Restoration Program (IRP) to identify sites on its bases with the potential for contaminating surface or groundwater and to provide appropriate remedial actions where significant potential for contamination is determined to exist. The IRP program is divided into four phases, all of which are carried out by independent contractors and reviewed by the Air Force. The activities in each of the phases are as follows:

Phase I - Problem Identification/Records Search. In phase I, the contractor visits the installation to identify waste disposal sites and to evaluate the potential for contamination. Community, state, and regional records are reviewed to determine geological and hydrological conditions in the area and to identify other potential sources of contamination in the area. Records, maps, plans, and other information from the base are reviewed to identify waste disposal sites; and interviews are conducted with current and former employees to determine past waste disposal practices. Each identified disposal site is then evaluated and rated with respect to potential hazard using the Air Force Hazard Assessment Rating Methodology. This methodology considers the characteristics of the materials disposed of at each site, the potential routes of contamination, the population or other resource potentially affected, and the effectiveness of the waste management practices employed at the

time of disposal. Each site receives a score between 0 and 100, with higher scores indicating more significant potential for migration of contaminants. (It should be noted that in the management of the "Superfund" program, EPA uses a different rating methodology.) The results of this study, including the rating of each site and recommendations for further action, are compiled in a report provided to federal, state, and local environmental protection agencies.

Phase II - Problem Confirmation and Quantification. In phase II, sites identified in phase I as requiring further evaluation are examined in more detail. Phase II efforts begin with a preliminary survey performed by the contractor and Air Force representatives to determine the scope of the work required. Based on this survey, a statement of work is prepared and is reviewed by both the Air Force and appropriate regulatory agencies before initiation of the work. Following completion of the investigations identified in the statement of work, a draft report summarizing the results of the investigation and recommending remedial action where appropriate is prepared and reviewed by the Air Force and regulatory agencies. Following their review, a final report is prepared and copies are provided to the regulatory agencies as well as to the local news media.

Phase III - Technology Base Development. Phase III provides for research and development activities where existing technology is not adequate to reduce hazards to acceptable levels. Not many sites require such activity.

Phase IV - Corrective Action. Phase IV is the actual cleanup or corrective action phase. In some cases, cleanup may not be required but the Air Force continues to monitor groundwater and migration of contaminants to assure that problems do not develop.

It should be noted that if, at any point in the IRP process, a potential health problem is identified by the Air Force, its contractor, or the regulatory agencies, the program would advance immediately to the corrective action phase for that site.

The U.S. Army Corps of Engineers conducts a similar program for property formerly owned by the federal government.

The phase I report for Westover AFB (the portion of the original property still owned by the Air Force Reserve) was prepared by CH2M Hill, Inc., and was issued in April 1982 (CH2M Hill 1982). This report identified 15 disposal or spill sites on Westover AFB and the approximate dates that these sites were used or that spills occurred. The locations of these sites are shown in Fig. 3.7, and the ratings assigned to each site are indicated in Table 3.6. Copies of the phase I report were provided to the EPA, the Massachusetts Department of Environmental Quality Engineering (DEQE) and to local news media. This report recommended more detailed evaluation of three sites: two landfills (sites 1 & 2) and the Industrial Waste Treatment Plant (site 15).

The additional evaluations of sites 1, 2, and 15 recommended by the phase I report were carried out by Roy F. Weston, Inc., and the final

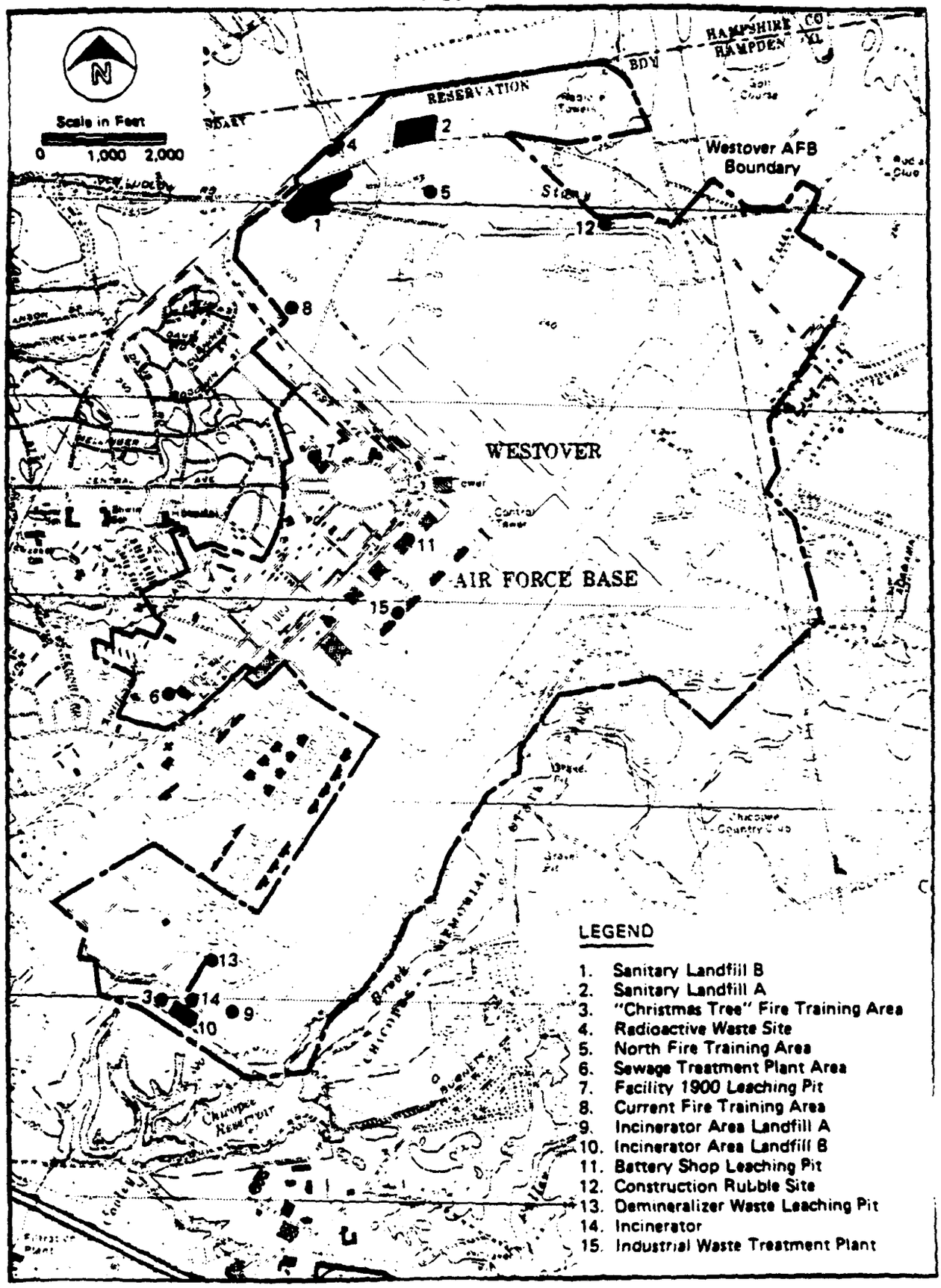

Fig. 3.7. Location of identified disposal and spill sites at Westover AFB. Source: CH2M Hill 1982

Table 3.6. Summary of results of disposal and spill site assessments

Site No.	Site description	Receptors[a]	Pathways[a]	Waste characteristics[a]	Waste management practices factor	Overall score[b]
1	Sanitary landfill B	56	53	80	1.0	68[c]
2	Sanitary landfill A	66	76	40	1.0	61
3	"Christmas tree" fire training area	54	67	48	1.0	56
4	Radioactive waste site	66	58	15	0.95	44
5	North fire training area	63	67	32	1.0	54
6	Sewage treatment plant area	52	49	30	1.0	44
7	Facility 1900 leaching pit	57	49	16	1.0	41
8	Current fire training area	55	67	48	1.0	57
11	Battery shop leaching pit	54	49	24	1.0	42
15	Industrial waste treatment plant	54	49	32	1.0	45

[a]Subscores are a percent of maximum score in each category.

[b]Overall Score is the average of the three subscores for receptors, pathways, and waste characteristics multiplied by the waste management practices factor.

[c]Indicated in source as 68 but appears to be a typographical error; should be 63.

Source: CH2M Hill 1982.

report was issued in May 1984 (Weston 1984). The major findings of this study included the following:

> Landfill B [site 1] was found to be contributing contaminants to groundwater as shown by water quality data for monitoring Well 2 (the central downgradient well). These contaminants are manifested in elevated concentrations not only of typical landfill leachate constituents such as total organic carbon (TOC) (215 mg/L), chemical oxygen demand (COD) (978 mg/L), iron (483 mg/L), and chloride ion (52.5 mg/L), but also of several volatile organic compounds (methylene chloride, 16.0 ug/L; 1,2-dichloroethane, 34.6 ug/L; trichloroethylene, 26.1 ug/L; o-dichlorobenzene, 7.5 ug/L; and others). Mass flux computations of water flow-through beneath Landfill B indicate that as much as 30,000 gal/d of potentially contaminated groundwater may be flowing in an easterly direction toward Stony Brook.
>
> Water quality testing of the surface water from Stony Brook indicated that the staff gage at the base boundary contains slightly elevated levels of TOC (11.5 mg/L) and sulfate (32.4 mg/L), as well as low levels of two volatile organic compounds [1,2-dichloroethane, 2.1 ug/L (indicated as mg/L in error); 1,1-dichloroethylene, 2.1 ug/L (indicated as mg/L in error)]. These constituents are in transport in an off-post direction. The two upstream staff gage samples, obtained upstream of any probable influence of the two landfills, also contained elevated volatile organic compounds. The source or sources for these elevated solvent concentrations are as yet undetermined, but the solvents appear to be from a source or sources other than the landfills.

The key conclusions resulting from the phase II Confirmation Study included the following:

> No state or federally adopted drinking water standards apply for the compounds detected, although an unpublished federal policy "action level" for trichloroethylene of 4.5 ppb [parts per billion, approximately equal to ug/L], based on a National Academy of Sciences cancer risk study, was exceeded in Well B-2. The Well B-2 sample results indicate moderately elevated levels of several organic compounds exceeding the 1×10^{-6} lifetime ingestion cancer risk criteria listed in Water Quality Criteria Documents (28 November 1980).
>
> The organic analytes detected in the stream samples demonstrate that contamination from Westover AFB crosses installation boundaries through surface water pathways. The 1,1-dichloroethylene level of 2.1 ug/L at surface water staff gage SG-1 exceeds the 0.033 ug/L incremental cancer risk of 1×10^{-6} for lifetime ingestion of water and aquatic organisms contaminated with dichloroethylene. The source or sources of organic contamination in Stony Brook cannot be verified by the sampling conducted to date. Besides discharge from Landfills B and A, both the old North Fire Training Area and the Current Fire Training Area [a new facility was constructed subsequent to release of the report and is now in use] are potential sources for solvents crossing the base boundary to the north in Stony Brook.

Based on the results of this study, the report recommended that the phase II IRP study at Westover AFB be continued with a quantification stage effort focused on the northern portion of the base. The Air Force concurred with this recommendation, and studies are currently under way. Upon completion of these studies, a draft report will be submitted to federal and state agencies for review and comment, and the final report will be provided to these agencies and to the news media. Copies of the final report will be available for public inspection at the base.

Based on the studies conducted to date, the Air Force has concluded that groundwater contamination resulting from previous waste disposal practices at Westover AFB does not constitute a hazard to public health that warrants immediate remedial action.

3.5.3 Hazardous Wastes

The report of the Phase I Installation Restoration Program (CH2M Hill 1982) also provided an identification and description of current activities that generate chemical wastes. A summary of the reported current waste generation sources and quantities is presented in Table 3.7. Alkaline cleaning solution, B&B Chemical 3100 (Federal Specification Number 685 000 181 7597, a petroleum-based solvent used as a cleaning compound), and the other materials used in the corrosion control facility are used in cleaning aircraft before repainting. These materials are applied to the aircraft (or to aircraft parts) and are washed off with water. The wastewater is ultimately discharged to the City of Chicopee interceptor for treatment in the municipal treatment facility (See Sect. 3.5.2). The majority of the other chemical wastes are petroleum-based materials and are classified as "hazardous" on the basis of ignitability. Others, such as battery acid and glacial acetic acid (used in nondestructive testing), are classified as hazardous on the basis of corrosivity. As can be seen from Table 3.7, these wastes are similar to those generated by many service industries in the civilian community. PD 680 is a low-volatility petroleum-based solvent that is commonly used as a degreaser and dry cleaning fluid. Hydraulic and engine oils are similar to those used in automotive equipment and heavy machinery and in many other industrial applications. The penetrant used in nondestructive testing is used in the "magnaflux" process, which is also employed in automotive repair and other industrial applications. Very few of the hazardous wastes generated at Westover AFB are unique to the Air Force. Some of these wastes are defined as hazardous under Massachusetts regulations but are not included in the federal listing.

Under the Resource Conservation and Recovery Act (RCRA), hazardous wastes are regulated and tracked from the point of generation through transportation and treatment to storage and disposal or destruction. Although custody of the wastes may be transferred during this process, the generator retains liability for the wastes. RCRA establishes standards and requirements applicable to three general classes of facilities or activities involved in hazardous waste management: generators; transporters; and treatment, storage, and disposal (TSD) facilities. The requirements applicable to activities at Westover AFB are summarized in the following paragraphs.

Table 3.7. Generation of chemical wastes by current operations at Westover AFB

Shop name	Bldg. no.	Waste material	Waste quantity (gal/month)
Aircraft maintenance	7072	PD 680 type II	100
		Hydraulic oil	24
		Engine oil	50
Corrosion control	7051	Alkaline cleaning solution	450
		PD 680 type II	200
		Cold tank stripper	50
		Polyurethane paint thinner	2
		Methyl ethyl ketone	4
		B&B chemical 3100	10
Propulsion	7071	Synthetic turbine oil	50
		Hydraulic oil	100
		Engine oil	300
		Slop waste (PD 680 type II gasoline, paint remover)	50
Battery shop	7072	Battery acid	50
Fuel systems	7051	JP-4	5
Pneudraulics	7072	Hydraulic oil	25
		Preservative oil	5
		PD 680 type II	10
Wheel and tire shop	7072	PD 680 type II	10
Aerospace ground equip.	7057	Engine oil	40
Nondestructive inspection	2426	Glacial acetic acid	1
		Kerosene	4
		Penetrant	8
		Emulsifier	8
		Total	1556

Source: CH2M Hill 1982.

Generators. Generators of hazardous wastes must obtain an EPA identification number and, if applicable, a state identification number. Wastes cannot be shipped off-site without this number on a manifest, which must accompany each shipment of hazardous wastes. The manifest must designate the destination to which the waste is being shipped, an alternate site, the transporter carrying the shipment, and all required identification numbers. The manifest must also indicate the Department of Transportation's (DOT) description of the waste; the hazard number (flammable, corrosive, etc., as specified by DOT); the number and type of containers in the shipment; the total quantities; and the RCRA hazardous waste number. The manifest must be signed by all responsible individuals as the waste is transferred from generator to transporters and from the transporters to the receiving facility. Each time custody of the waste is transferred, a copy of the manifest form is kept by the responsible party and is ultimately returned to the generator. Each container must be labeled in accordance with the requirements of 49 CFR 100-199 and must indicate the name and address of the generator and the manifest document number.

Generators are permitted to accumulate wastes for up to 90 days and to store them on-site without a permit or an interim status as a TSD facility. Storage must comply with the applicable technical and administrative requirements specified in 40 CFR 265 or the approved state equivalent. Each container must be marked with the date that waste accumulation began and the words "Hazardous Waste." In addition, generators must provide a formal program of classroom or on-the-job training for employees to assure that hazardous wastes are handled safely and in compliance with the requirements of the RCRA.

Failure to remove hazardous wastes within 90 days constitutes a violation of RCRA and is subject to enforcement action and penalties. Storage of hazardous wastes for periods of more than 90 days requires interim status or a permit as a TSD facility.

Transportation, Storage, and Disposal Facilities. EPA has established minimum national standards that define acceptable procedures for the management of hazardous wastes and which must be met in the design, construction, operation, and maintenance of all new and existing TSD facilities. These requirements include preparation of comprehensive facility management plans (including procedures for waste analysis, security, comprehensive inspections, and personnel training, and special requirements for handling of ignitable, reactive, or incompatible wastes); preparedness for and prevention of emergencies and releases of hazardous wastes; preparation of written contingency plans and emergency procedures; and maintenance of written operating records, manifest records, and biennial reports of facility activities.

TSD facilities are required to obtain a permit to operate. To obtain a permit, a two-part application must be submitted. To satisfy the requirements for Part A, an applicant must complete and submit the appropriate federal and/or state Consolidated Permit Application Forms. TSD facilities that began operation or construction on or before November 19, 1980, are classified under RCRA regulations as "existing facilities." The Part A submittal deadline for existing facilities was November 19, 1980. Part B of the permit application is submitted in

narrative form and must provide detailed information concerning facilities, procedures, and activities to assure protection of human health and the environment. For existing facilities, the Hazardous Solid Waste Amendments of 1984 define the deadlines for submitting Part B, which will be required at the discretion of regulatory authorities. Pending final action on their permit applications, existing facilities are permitted to operate under "interim status," a period during which the owner/operator of an existing facility is treated as having been issued an RCRA permit even though a final determination has not been made. An existing facility may automatically qualify for interim status if both a timely "notification" form (a form which notifies regulators of hazardous waste management activities) and the first part (Part A) of the RCRA permit application are filed by the specified deadlines. Interim status continues until the permit is issued.

Wastes generated at Westover AFB are disposed of through the Defense Reutilization and Marketing Office (DRMO), [formerly the Defense Property Disposal Management Office (DPDMO)], a tenant activity located on Westover AFB. The function of this organization and its predecessor (DPDMO) is to collect and dispose of surplus, excess, used, and waste materials generated by Department of Defense agencies and activities (including Westover AFB) in the Westover area. This organization operates an Air Force-owned facility on Westover AFB that was in operation before November 19, 1980, and qualified for interim status as a TSD facility.

On April 23, 1985, the U.S. EPA and the Massachusetts DEQE conducted an interim status compliance inspection of the hazardous waste disposal practices at Westover AFB. In August 1985, EPA notified Westover that, based on the results of that inspection, the installation had been determined to be in violation of Massachusetts hazardous waste management regulations and issued a Notice of Violation (NOV) citing specific deficiencies in hazardous waste management procedures. The focus of the violation was Westover's failure to develop and implement a comprehensive base plan to ensure that hazardous wastes and other controlled materials are handled and disposed of in compliance with applicable federal, state, and local regulations. Specific deficiencies cited in the NOV included failure to prepare an adequate emergency plan, failure to identify emergency coordinators and to list locations and office and home telephone numbers of emergency coordinators, and failure to prepare an emergency evacuation plan. Also cited were deficiencies in the labeling and segregation of solvents, battery acid, degreasing agents, used oil, and used hydraulic fluids generated in the maintenance of aircraft and motor vehicles. Westover AFB was not cited for improper disposal of any hazardous waste.

Following receipt of the NOV, the base management reviewed the requirements for TSD facilities and determined that the existing facility operated by the DRMO does not meet the requirements for permitting as a TSD facility. Based on this review, the Air Force decided to relinquish the interim status as a TSD facility and to operate it as a generator only. The primary result of this decision is the requirement that hazardous wastes be transported to a permitted TSD facility within 90 days of generation. This function is still accomplished by the DRMO through qualified transporters who convey the waste to the TSD facility.

On September 27, 1985, Westover published its Hazardous Waste Management Plan. This plan was reviewed by both EPA and DEQE personnel who recommended minor changes which were incorporated in the plan. Implementation of the plan was begun immediately. This plan was revised again (January 1986) to incorporate wastes that would be generated as a result of either C-5A proposal. A follow-up inspection conducted by EPA and DEQE on January 22, 1986, confirmed that the deficiencies noted in the previous inspection had been corrected and that the Westover Hazardous Waste Management Program complies with applicable regulations. Waste fuel, oils, hydraulic fluids, solvents, and other chemicals are now being disposed of in accordance with the management plan and in compliance with applicable regulations.

The requirement still exists for DRMO to receive, store, and arrange for ultimate treatment or disposal of hazardous wastes generated by other DOD agencies and activities in the Westover area. This requirement will exist regardless of the decision with respect to the proposed actions considered in this EIS. DRMO has prepared a preliminary design for a new storage facility and has submitted a request for funding through the DOD budget process. This facility will be permitted as a new TSD facility and will be required to meet all standards applicable to new facilities. Before issuance of the permit, there will be an opportunity for a public hearing in the local area to be held by the Massachusetts DEQE.

The new facility will be used for collection and temporary storage of wastes pending shipment to off-site treatment or disposal facilities; no wastes will be disposed of on the base. It is anticipated that only those wastes generated in the Westover area which are similar to those generated on the installation will be handled at this facility; no storage of acutely toxic wastes is planned. Wastes will likely be delivered to the storage facility by truck; there are no plans to transport wastes by aircraft.

3.5.4 Sanitary and Industrial Wastewater

In 1970, the base negotiated a contract with Chicopee for treatment of sanitary and pretreated industrial wastewater and closed the primary treatment plant that had served the installation since 1941. The contract provides for a maximum discharge of 1.2 million gal/day. Wastes are discharged into the Chicopee interceptor for treatment at the Chicopee Municipal Treatment Plant, which discharges into the Connecticut River.

Industrial wastewaters generated by maintenance activities and corrosion control are discharged into the sanitary sewer for treatment in the municipal system. Following the connection to the municipal treatment system, operation of the Industrial Waste Treatment Plant (IWTP) (Building 7052) was discontinued, and the facility was operated as a lift station for pumping industrial wastewater into the municipal system. This facility was constructed in 1952 and has a design capacity of 30,000 gal/day. Only relatively minor maintenance and repair would be required to return it to service. Although Chicopee has not developed pretreatment standards applicable to any specific activity at Westover, it has enacted a sewer ordinance that (1) establishes limits on pH (5.0 to 9.5 pH units) and oil and grease (100 mg/L); and (2) contains a general prohibition of the introduction of phenols, certain aromatic hydrocarbons (such as

benzene, xylene, and toluene), flammable, toxic, and radioactive materials and other substances that would adversely affect the operation of the municipal treatment facility. The base has recently been advised by EPA that it may be in violation of the pretreatment standard for oil and grease. The Oak Ridge National Laboratory is currently assisting the installation in evaluating alternatives, including reactivation of the IWTP, for ensuring compliance with applicable pretreatment standards.

Although the requirement for establishment of standards for discharges to publicly owned treatment works has been in effect since 1979, the City of Chicopee did not provide funding for a program to develop standards and permits until July 1986; before that time, industrial discharges to the municipal system were dealt with on an "ad hoc" basis as problems were identified. The Air Force has contacted the City several times regarding requirements for permitting of its discharges to the municipal system but has only recently received a response from the City. On March 4, 1987, the base received a letter from the City of Chicopee indicating that discharges to the municipal system will be permitted on an individual facility (building) basis rather than for the base as a whole, and that specific limitations will be established for each discharge. This letter outlined the information regarding facility and piping layout, industrial activities, materials employed, and waste characteristics required for permit applications for each activity. The base is proceeding with preparation of the required permit applications and supporting information, including baseline monitoring data. After review of this information, the City will establish discharge limitations and monitoring requirements for each permitted discharge. If it is determined that the discharge limitations cannot be met without additional treatment, the Air Force will initiate projects to provide the required treatment facilities and will negotiate with the City to establish an acceptable schedule for achieving compliance with the discharge limitations.

3.5.5 Storm Drainage

The storm drainage system for Westover AFB consists of a storm sewer system, culverts, and ditches. The northeast portion of the base discharges stormwater into Stony Brook, the southern section discharges into Cooley Brook, and the western section discharges into Willimansett Brook. The majority of industrial operations, flightline hangars, and the majority of the runways are located in the portion of the base discharging into Cooley Brook, which flows into the Chicopee Reservoir. In 1971, three oil/water separators were constructed to receive storm runoff before discharge. Discharges from these separators are authorized by permits issued under the National Pollutant Discharge Elimination System and are monitored on a monthly basis to demonstrate compliance with the discharge limitation of 15 mg/L established for oil and grease. Monitoring data indicates that the discharges from the separators is in compliance with the oil and grease limitation. Both the reservoir and Cooley Brook support trout and their presence in the receiving waters is indicative of good water quality.

3.5.6 Nonhazardous Solid Wastes

Before 1974, base refuse was disposed of by incineration, open burning, and on-site landfill. In 1974, a contract was initiated for

off-site disposal, and the majority of base refuse is currently disposed of in off-site landfills.

3.6 TERRESTRIAL, AQUATIC, AND WETLAND RESOURCES

3.6.1 Vegetation

Westover AFB lies on a sandy plain with elevations ranging from 230 to 245 ft above mean sea level. About 90% of the base is composed of either buildings, runways, taxiways, or lawns and grass fields that are mowed regularly. The remainder of the base consists primarily of pine plantations, groves of immature pole-stage woodland, and wet meadows and wet immature woodland lying in several small shallow depressions near the northern boundary of the base. A small amount of more mature woodland lies along Stony Brook where it flows through the northern end of the base.

The topography and vegetation adjacent to the base are more varied, and more forest is present. Upland forests occur on level and hilly uplands and on the slopes along Cooley Brook. Swamps (i.e., wet forests) occur in the creek bottom along Cooley Brook, in a depression consisting of about 125 acres and bisected by Cooley Brook in the Chicopee Memorial State Park, and in an area of about 85 acres between Old Ludlow Road and New Ludlow Road northwest of runway 33. A wetland area immediately to the south of Old Ludlow Road was formerly forested but is now an open field cleared of trees and brush. The swamp in the state park consists of mature forest of about 85 acres containing diverse species of hardwood trees as well as white pine and hemlock. The swamp between Old and New Ludlow roads appears to lack conifers and to consist mostly of red maple.

A marsh of about 125 acres associated with Stony Brook lies approximately 1/2-mile east-northeast of the northeast end of runway 05/23. About half of this marsh was previously wooded, as indicated by numerous standing dead snags. The cause of the tree dieoff is unknown. A possible cause is an increased water level, which could have resulted from inadequate drainage under an abandoned road that crosses Stony Brook downstream from the marsh or from previous management of water levels by a formerly active rod and gun club. The marsh currently consists of a peripheral zone of tall grasses (6 to 9 ft high), a wetter, middle zone of shorter vegetation of cattails and sedges (3 to 6 ft high), and a relatively small central zone of open water. A stand of mature pine borders the marsh to the south.

3.6.2 Fauna

The various taxonomic groups of terrestrial and semi-aquatic fauna occurring in the Springfield region of Massachusetts include 6 turtle species, 1 lizard species, 14 snake species, 9 salamander species, 9 species of toads and frogs (determined from species distribution maps in Conant 1958), about 170 species of breeding birds (Cook 1969), and about 60 mammal species (Simpson 1964). However, only a small fraction of these species would be expected to occur on and near Westover AFB, for two primary reasons. First, any given area similar in size to Westover AFB and its immediate environs is too small to possess all the different

habitats required by all of these species. Second, the ecology of the Westover area has been greatly disturbed; forested habitats have been largely eliminated by urban development, and the remaining natural areas occur in small, relatively isolated pockets. The loss of forest habitat has greatly reduced the size of the wildlife populations and the number of species, not only in proportion to the amount of habitat lost (Kroodsma 1985) but also because the forest habitats were fragmented into relatively small, isolated parcels that support only limited types and numbers of fauna (Whitcomb et al. 1981). Thus, forested habitats in the Westover area probably support fewer species and smaller wildlife populations than forested habitats in areas with more extensive forests.

The habitats that support the greatest number of species and individuals of birds (James and Rathbun 1981), as well as other terrestrial vertebrates in the Westover area, are the upland and bottomland forests of hardwood tree species or of a mixture of hardwood and coniferous species (MMWEC 1978). Pine plantations and the cut grassy fields around the runways are less important, as they support significantly fewer species and individuals, although two species of special interest, the upland sandpiper and the grasshopper sparrow, nest in the grassy fields on the base (See Sect. 3.6.3). In addition to hardwood forests, wetlands are an important habitat for many species of birds, mammals, amphibians, and reptiles. Areas of open water, such as Chicopee Lake and the marsh at the former rod and gun club, probably support waterfowl most of the year, although none were observed during a brief reconnaissance survey in November 1984. Adult Canada geese and adults and broods of mallards and wood ducks were observed during surveys on wetlands near the base (MMWEC 1978).

Although a number of important game species occur on and near the base, their populations are not great enough in this urban area to provide significant recreational opportunity. Big game species that may occur in the area include white-tailed deer (which have been observed on Westover AFB) and wild turkey. Small game include eastern cottontail, gray squirrel, raccoon, ruffed grouse, woodcock, mourning dove, black duck, hooded merganser, and others. Small game hunting is permitted in portions of Chicopee Memorial State Park.

3.6.3 Endangered and Special Interest Species

The United States list of endangered species (50 CFR Part 17, July 1984) does not include any plant species currently known to exist in Massachusetts. One endangered plant species, the small whorled pogonia, once occurred in Hampshire County. Of the two known locations of this species in Massachusetts, neither is in the vicinity of Westover AFB.

Several endangered animal species potentially occur in the state but are not known to occur at Westover (Melvin 1985). The Indiana bat occurred historically in the town of Chester in Hampden County but has not been observed since 1939 (Melvin 1985); therefore, its occurrence at the base is highly unlikely. The nearest habitat that has been designated as critical habitat for the Indiana bat is located in West Virginia (50 CFR Part 17, Sec. 17.95, Revised October 1983). Bald eagles have been introduced at Quabbin Reservoir, located 13 miles northeast of the base. They now occur throughout the year at the Reservoir, and it is hoped that

they will nest there in the future (Melvin 1985). However, no suitable habitat for nesting or for regular feeding or roosting is located near the base. Peregrine falcons may occur as very rare transients in the region and were introduced unsuccessfully for 3 years (1978-1980, approximately) at Mt. Tom, located about 5.5 miles northwest of Westover AFB. No habitat near the base is particularly suitable for nesting, feeding, or roosting peregrines. No critical habitat for the peregrine falcon or bald eagle has been designated in the eastern United States.

Two bird species of special interest nest in grasslands on Westover AFB: the upland sandpiper (Bartramia longicauda) and the grasshopper sparrow (Ammodramus savannarum). The upland sandpiper is listed as "State Endangered" in Massachusetts because of its rarity and the decline of its grassland habitats in the state. Of seven nesting sites currently known to exist within the state, the Westover site supports the state's second largest population. An inventory conducted on July 17, 1984, found a total of 36 individuals; 35 of these were observed in the grass strips between the taxiway and runway 15/33 (Melvin 1985). Additional individuals are believed to nest in the northeastern part of the base. The grasshopper sparrow is listed as a "Species of Special Concern" in Massachusetts. A total of 15 singing males were observed on territories on July 17, 1984, mostly in the northern half of the base.

The Massachusetts Division of Fisheries and Wildlife, Natural Heritage Program, is not aware of important habitats for rare, threatened, or endangered wildlife other than the upland sandpiper and the grasshopper sparrow on or adjacent to Westover (Melvin 1985). Although there are several relatively natural areas in the vicinity of the base, such as Chicopee Memorial Park and several marshes, these do not appear to be suitable habitats for reintroduction of the threatened and endangered species that occur or have occurred elsewhere in the region.

3.7 SOCIOECONOMICS

3.7.1 Region of Influence

For purposes of this analysis, the two-county area consisting of Hampden and Hampshire Counties, Massachusetts, is considered as the region of influence (ROI), which is the area projected to experience the great majority of impacts to the human environment (e.g., housing, public services, retail services).

3.7.2 Demographics

The ROI had a 1980 population of 581,831 and a density of 493 people/square mile. Hampden County, site of Westover AFB, contained 443,018 people (76% of the total population), with a density of 698 people/square mile. Hampshire County contained 138,813 people (24% of the total) and had a density of 255 people/square mile. Population density varies greatly between Springfield's 4610 people/square mile and Tolland's 7 people/square mile, reflecting the great variance between urban and rural development in the ROI (PVPC 1984).

Unlike the U.S. as a whole, the region's population declined slightly from 1970 to 1980, with 55,000 people, or almost one-tenth of the population, migrating out of the ROI. Using the 1980 census results, the region's planning agency, the Pioneer Valley Planning Commission, estimates the 1985 population of the ROI at 603,218 persons and projects growth to approximately 624,000 by 1990 and 654,000 by the year 2000 (PVPC 1984).

The population of Hampden and Hampshire Counties is concentrated along the Connecticut River. Westover AFB is located in this area (Chicopee), and the residential distribution of current Westover AFB employees is also concentrated in this area. Table 3.8 summarizes the residential distribution of current employees and illustrates the important differences between the demographic distribution of full-time employees [air reserve technicians (ARTs) and civilians] and part-time reservists. Civilian employees are concentrated close to the base: 92.6% live in the ROI (74.6% in Hampden County and 17.9% in Hampshire County) and 96.1% live in Massachusetts. Residential distribution of the ARTs is almost as close to Westover, with 77.8% living in the ROI and 89.7% living in Massachusetts. Only 34.4% of the non-ART reservists live in the ROI, and only 65.86% live in Massachusetts (WAFB 1984). The economic impact of ARTs and non-ART civilian employees as full-time wage earners serves as a major determinant in delineation of the boundaries of the ROI.

3.7.3 Employment

Over half of the region's total employment follows the population concentration in Springfield, Chicopee, and Holyoke adjoining the Connecticut River; however, in 1979, these three core areas had per capita annual incomes below the county average of $6731. Recently, the region has seen a decline in some of the traditional industrial sectors and has attempted to attract new industrial activity. Employment trends in the region have generally followed the national pattern; however, the downturn in economic activity starting in 1975 hit the ROI more severely than it did the national economy. Growth in employment since 1976 has been more positive in the region than for the United States as a whole. Indeed, the region was able to continue employment growth in 1979, a period when growth in the United States as a whole was flat. This situation is shown even more dramatically in a comparison of regional unemployment rates to the national average. During the 1975 economic downturn, the local economy suffered a serious rise in unemployment compared to the national rate. In 1977, the region obtained parity with the national rate and has maintained a below-average rate since then (PVPC 1984). In a recent study prepared for the Western Massachusetts Economic Development Conference, total employment growth for the ROI is projected to increase by an average annual rate of 1.44% from 1981 through 1991. Manufacturing employment in the ROI is expected to decline slightly during this period at an annual rate of -0.06%. However, the economic diversity of the region should buffer selected losses in some industrial sectors by expansion in others.

The residential distribution of current Westover employees is summarized in Table 3.8. As indicated in this table, approximately 92.6% of the civilian employees, 77.8% of the ARTs, and 34.4% of the reservists (including ARTs) live in the two-county ROI. These individuals earned approximately 74% of Westover's 1984 payroll of $24 million. The average

Table 3.8. Residential distribution of current Westover AFB employees

Residence	ARTs (%)	Civilians (%)	Reservists (%)
Hampden County	50.7	74.6	28.3
Hampshire County	27.1	17.9	6.0
Total ROI	77.8	92.5	34.3
Other Massachusetts counties	11.8	3.5	31.5
Total Massachusetts	89.6	96.0	65.8
Connecticut	6.9	3.3	10.1
Other Northeast (Including N.Y.)	2.0	0.7	12.6
Total Northeast	98.5	100.0	88.5
Non-Northeast	1.5	0.0	11.5

income of full-time Westover employees is approximately 60% greater than the average income for the ROI, indicating the opportunity for high-income employment at the base.

In addition to the base payroll, Westover spends approximately $12.4 million annually on local contracts and construction activity. Following the Regional Impact Multiplier System procedure and assuming that the base acts as a typical service sector industry, total Westover spending is estimated to generate an additional increase in regional output of approximately $66.2 million.

The base also provides other positive employment benefits for the local community. Recent development of an excess area of the base as an industrial park has created additional employment opportunities. The availability of part-time reserve positions provides training useful in obtaining industrial employment or advancement.

3.7.4 Housing

The two-county ROI had a total of 213,870 housing units of all types in 1980, which represented a 14% increase over 1970. The growth in housing stock reflects an increase in the number of households because population growth was stable during the decade. Approximately one-half (51.3%) of the new units built during the 1970-1978 period were in multi-family (three or more units) structures, reflecting the trend toward smaller families and the resulting demand for smaller residences (PVPC 1984). On a percentage basis, much of the growth has occurred in the outlying rural areas of the ROI; however, in terms of absolute numbers, most residential construction occurred in the most heavily populated communities. In 1980, there were an estimated 11,590 unoccupied housing units, reflecting an occupancy rate of 94.58% for the ROI overall.

3.7.5 Public Services

A well-developed public service infrastructure exists in the region, and no service delivery problems are present in the area as a whole.

Water for potable and industrial use and fire protection is purchased from Chicopee under a contract that provides for a maximum daily demand of 600,000 gal. Current water consumption is approximately 144,000 gal/day. In 1970, the base negotiated a contract with Chicopee for treatment of sanitary and pretreated industrial wastewater. The contract provides for a maximum discharge of 1.2 million gal/day.

Westover AFB provides its own security and fire protection services and has mutual support agreements with the surrounding communities to provide assistance in the event of a major fire.

3.7.6 Education

Educational pressures within the ROI are generally the result of decreasing rather than increasing enrollments. Between 1970 and 1980, the number of children between the ages of 5 and 19 declined from 168,316 to 144,744, a decrease of 23,572 or 14%.

3.7.7 Transportation

The communities surrounding Westover AFB have substantial populations and well-developed transportation systems. The main artery feeding traffic to and from the base is Memorial Drive (U.S. 33), a major north-south, four-lane highway. The most recent average daily traffic counts are from 1980 and indicate that Memorial Drive carried about 13,000 vehicles at James Street (nearest the main gate of the base), 20,000 vehicles at Jamrog Drive, and 25,000 vehicles at Westover Road. Local streets providing access to Westover AFB at the main gate on Central Avenue and a second gate on Ludlow Road are relatively uncongested. A third gate near the golf course is kept open to accommodate workers for one-half hour in the morning and again in the late afternoon. The total number of people entering the base is estimated to be about 3200, including local business employees and many military retirees living in the area.

3.8 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

An archaeological reconnaissance survey of Westover AFB conducted in 1981 (Thorbahn 1981) resulted in the delineation of several areas considered to be archaeologically sensitive and in the identification of one prehistoric site in the Drop Zone area and one historic site in the vicinity of Cooley Brook. Detailed evaluation of these sites before disturbance by construction activity or transfer from government ownership was recommended. Eligibility of these sites for listing in the National Register of Historic Places could not be determined by the reconnaissance-level survey. More detailed investigation has not been conducted to date. Current base operations are not considered to be affecting either these sites or the areas considered to be archaeologically sensitive.

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4. ENVIRONMENTAL CONSEQUENCES

4.1 CHANGES IN MISSION AND AIRCRAFT OPERATIONS

4.1.1 Change in Mission of the 439th Tactical Airlift Wing

As noted in Sect. 2.1.1, implementation of the proposed action would result in the reorganization of the 439th Tactical Airlift Wing (TAW) as a Military Airlift Wing (MAW), conversion of unit aircraft equipage from the C-130E to the C-5A, and reconfiguration of the unit to support a worldwide airlift capability. The primary peacetime mission of the unit would continue to be maintenance of combat-ready personnel, aircraft, and support equipment capable of rapid utilization in the event of mobilization. In this case, the 439th MAW would carry out strategic rather than tactical (direct combat support) missions primarily involving the transport of personnel, equipment, and other material from the continental United States to the theater of operations.

As an Air Force Reserve unit, the primary functions of the 439th MAW would continue to be training and maintenance of personnel qualifications. As part of the Air Reserve Force, the 439th MAW would continue to support the Air Force mission; however, support activities would change to be consistent with the strategic mission. Under the new mission, primary support would be provided to the Military Airlift Command in providing long distance transport of military cargo. Crews and aircraft from the 439th MAW would carry out transport missions similar to those conducted by Military Airlift Command personnel and aircraft and by associate reserve units located at Military Airlift Command installations.

Support of the Military Airlift Command mission would not result in a significant change in the primary mission of Westover Air Force Base (AFB). In the majority of Military Airlift Command support missions, aircraft from Westover AFB would fly to other locations to pick up cargo, deliver it to a distant location (usually overseas), pick up additional cargo for return to the United States, deliver it to its destination, and return to Westover. Only in a few instances would cargo be delivered to Westover for transshipment to its ultimate destination.

4.1.2 Changes in Aircraft Operations

4.1.2.1 Changes in military aircraft operations

Implementation of either military action would result in a decrease in the number of aircraft operations at Westover AFB. As indicated in Sect. 2.1.2 (Table 2.1), implementation of the proposed military action (16 C-5As) would result in a reduction in the number of local training sorties from the current level of approximately 30 per week to an average of 4 per week and a decrease in the local flying hour program from 75 hr/week to approximately 20 hr/week. Implementation of the alternate military action (8 C-5As) (Sect. 2.2.2) would result in an average of approximately two local training sorties per week and approximately 10 hr/week of local flying (Table 2.5).

Projected operations on an "average busy day" are summarized in Table 4.1 for the proposed and alternate military actions. No change in the number of operations of transient military or civil aviation aircraft using Westover AFB would be expected to result from either military action. Comparison of the projected operations in Table 4.1 with the current operations shown in Table 3.2 indicates that the proposed mission change would result in a decrease in total daily operations from the current level of about 178/day to about 86/day (a reduction of approximately 52%). Total annual operations would be reduced from the current level of about 36,300/yr to about 26,300/yr (a reduction of approximately 28%). (The difference in the percentage reductions is the result of the greater contribution of transient aircraft operations.) Implementation of the alternate mission change would result in a decrease in daily operations to about 70/day (-60%), and annual operations would decrease to about 22,200/yr (-39%).

The change in both type of aircraft and mission resulting from either military action would result in a change in the activities conducted during a typical local training sortie for the C-5A as opposed to a typical C-130 training sortie. Because the C-5A does not have a tactical mission requiring landings in combat areas, the requirement for assault landings (in which the aircraft flies downwind parallel to the runway at low altitude, executes a descending 180-degree turn at the end of the runway, and lands in the direction opposite to the approach) would be eliminated. Similarly, the C-5A does not have a cargo drop mission, and use of the drop zone by aircraft assigned to Westover would be eliminated. Approximately 60% of the local training operations for the C-5A would employ instrument approaches and would be flown at higher altitudes than those employing visual approaches. For most of the flight track, the aircraft would be at an altitude of 3000 ft above ground level (AGL), or higher, and would not contribute significantly to ground noise levels. To reduce noise levels in areas under the flight paths for visual flight rules (VFR) operations, the pattern altitude would be increased by approximately 300 ft to 1500 ft AGL.

A typical C-5A training sortie would provide training for four flight crews. Initially, two crews would board the aircraft, start the engines, taxi to the end of the runway, perform an engine runup, and then take off. The aircraft would fly for approximately 2 1/4 hr, with flight crews changing places at approximately the midpoint of the flight. At the end of the 2 1/4-hr period, the aircraft would land and then taxi to the operations area where two additional flight crews would board the aircraft and the original crews would deplane. The engines would remain running during the crew change. Following the crew change, the aircraft would taxi to the end of the runway, and take off and fly for approximately 2 1/4 additional hours, with the aircrews changing places at approximately the midpoint of the flight. At the conclusion of the flight, the aircraft would land, taxi to the ramp area, and the engines would be shut down. Including the time required for startup and engine check, engine running crew change, and shutdown, a typical training sortie would last approximately 5 hr.

During the sortie, the aircraft would make two takeoffs from a full stop, two landings resulting in full stops, and approximately 18 touch-and-go landings or low approaches. (In a touch-and-go landing, the

Table 4.1. Projected aircraft operations for proposed and alternate military actions at Westover AFB

Aircraft	Annual average operations (number per day): Departures (Takeoffs)	Arrivals (Landings)	Closed patterns: Takeoffs	Closed patterns: Landings	Drop[a] zone	Total operations: per day	Total operations: annual
Assigned aircraft							
C-5A							
Proposed (16 PAA)	10.15	10.15	6.4	6.4	0	33.1	8,440[b]
Alternate (8 PAA)	5.08	5.08	3.2	3.2	0	16.6	4,420[c]
Transient military aircraft							
Heavy cargo (C-5A)	0.03	0.03	0.01	0.01	0	0.08	29[d]
Medium cargo (C-135, C-141)	3.4	3.4	0	0	0	6.8	2,482[d]
Light cargo (C-130)	3.4	3.4	0	0	1.7[a]	10.2	4,723[a,d]
Fighter/Trainer (F-4, F-15, FB-111, A-4, A-10, T-37, etc.)	7.3	7.3	0.70	0.70	0	16	5,840[d]
Commercial and general aviation							
DC-8	2.0	2.0	0	0	0	4.0	1,144[d]
3-engine jet	0.03	0.03	0	0	0	0.06	17[e]
Business jet (LR-35)	1.0	1.0	0	0	0	2.0	572[e]
2-engine turbo prop	3.0	3.0	0	0	0	6.0	1,716[e]
Single prop	4.0	4.0	0	0	0	8.0	2,288[e]
TOTAL OPERATIONS							
proposed	34.31	34.31	7.11	7.11	1.7[a]	86.24	26,251
alternate	29.24	29.24	3.91	3.91	1.7	69.74	22,231

[a]Includes an approach and departure and is counted as two operations.

[b]Basis: $\frac{40\text{ opns}}{\text{sortie}} \times \frac{4\text{ sorties}}{\text{wk}} \times \frac{52\text{ wk}}{\text{yr}} + \frac{2\text{ opns}}{\text{mission}} \times \frac{5\text{ mission}}{\text{wk}} \times \frac{52\text{ wks}}{\text{yr}} = \frac{8{,}440\text{ opns}}{\text{yr}}$

[c]Basis: $\frac{40\text{ opns}}{\text{sortie}} \times \frac{2\text{ sorties}}{\text{wk}} \times \frac{53\text{ wk}}{\text{yr}} = \frac{2\text{ opns}}{\text{mission}} \times \frac{2.5\text{ mission}}{\text{wk}} - \frac{52\text{ wks}}{\text{yr}} = \frac{4{,}420\text{ opns}}{\text{yr}}$

[d]Basis: 365 days/yr

[e]Basis: $\frac{5.5\text{ days}}{\text{wk}} \times \frac{52\text{ wk}}{\text{yr}} = \frac{286\text{ days}}{\text{yr}}$

aircraft touches down on the runway, rolls for several hundred feet, and then takes off again without stopping. In a low approach, the aircraft descends to approximately 50 ft above the runway and then departs without touching down on the runway. For purposes of noise evaluation, low approaches are considered to be the same as landings.) Thus, during a typical sortie, the aircraft would make 20 departures and 20 landings.

Of the 20 departures, approximately 12 would result in the aircraft leaving the airfield traffic pattern and being vectored to an approach course by the air traffic control center at Bradley International Airport. For these departures, the aircraft would climb to an altitude of 3,000 ft AGL and would remain at that altitude until intersecting the glide slope for approach to the runway at a point approximately 10 nautical miles (60,000 ft) from the threshold (landing end) of the runway. Upon reaching an altitude of 3,000 ft AGL, flight tracks would be determined by Bradley ATC and would vary depending on traffic and weather conditions. At this point, the aircraft would be in cruise configuration and at an airspeed of approximately 200 to 250 knots. Under these conditions, sound exposure levels (SEL) at a point directly under the aircraft would be approximately 93 dB, and approximately 138 overflights on the same flight track would be required to increase the 24-hr equivalent noise level (or DNL, since all operations are assumed to be between the hours of 7 a.m. and 10 p.m.) to a level of 65 dB. For purposes of the noise analysis, departures to an altitude of 3,000 ft are assumed to be equally distributed between three departure courses: a straight-out departure in which the aircraft remains on the runway heading and two tracks on which the aircraft remains on the runway heading until approximately 12,000 ft from the brake release point (beginning of the runway) and then executes either a left or right turn of 45 degrees with a radius of 6,000 ft and then continues on that heading. Thus, locations on the flight tracks within 12,000 ft of the brake release point are assumed to be overflown by all 12 departures, while those farther away would be overflown by 4 of the 12. Because runway 05/23 is 11,600 feet long, turns would be initiated approximately 400 ft beyond the end of the runway, and only locations within about one mile of the end of the runway would be significantly affected by all operations. The aircraft would be at an altitude of about 800 ft at the end of the runway and would reach an altitude of 3,000 ft at a distance of 28,000 ft from brake release or 16,400 ft (3.1 mi.) from the end of the runway.

In addition to the 12 departures for radar vectoring to instrument approaches, each sortie would also include approximately eight visual flight rules (VFR) closed patterns in which the aircraft remains under control of the tower at Westover. When flying VFR closed patterns on runway 23 (expected to occur 80% of the time), the aircraft would climb to an altitude of 1,500 ft AGL and remain at that altitude until descent for the landing approach. When flying the VFR closed pattern, the aircraft would remain on the runway heading until approximately 13,000 ft from the brake release point (to avoid overflying the state park during the turn), then execute a left turn of 135 degrees (with a radius of 6,000 ft) to approximately follow the Massachusetts Turnpike for a distance of approximately 5,000 ft. The aircraft would then turn left 45 degrees to a course parallel to the runway and approximately 12,000 ft from the runway centerline. The aircraft would then fly a "downwind leg" of approximately 17,000 ft, turn left 90 degrees (with a radius of 6,000 ft), fly a "crosswind leg" of approximately 2,000 ft, and then turn left 90 degrees

(radius 6,000 ft) to a course on the extended runway centerline for the landing approach. Thus, locations under the VFR closed pattern would be overflown eight times during each training sortie. Points close to the base would thus be overflown a total of 20 times during each sortie.

For purposes of computer modeling, it is assumed that each VFR pattern follows exactly the same course because this assumption produces the maximum average noise levels at locations on the flight track. In practice, it is unlikely that this will occur under any circumstances, and additional dispersion of flight tracks could be introduced to minimize repeated overflights of the same locations on the downwind and crosswind legs. This would increase the area and number of persons exposed to aircraft noise but would reduce the number of persons repeatedly exposed to the highest noise levels.

Implementation of either mission change would result in a change in runway utilization. Because runway 15/33 is only 50 ft longer than the minimum required for touch-and-go operation by the C-5A and because the C-5A aircraft can operate safely in crosswinds, this runway will not be used for C-5A operations on a routine basis. Because operations on runway 23 permit operations at higher altitudes over the densely populated areas of Chicopee and Springfield to the southwest of the base, runway 23 will be used for most of the operations. Although an analysis of wind conditions at Westover AFB indicates that runway 23 could be used about 95% of the time, the noise analysis is based on the use of this runway for only 80% of the operations to provide flexibility in conducting required training operations. This assumption also results in conservative (higher) estimates of the noise levels in the more densely populated areas to the southwest of the base.

4.1.2.2 Changes in civil aviation operations

Projected levels of WMDC aircraft activity which may be reached if the Air Force permits an increase in the hours of airfield operation are indicated in Table 4.2, which provides a summary of operations by time of day, type of aircraft, and type of operation (landings and takeoffs). The projected aircraft operations and schedules presented in Table 4.2 are based on the provisions of the mitigation plan proposed by WMDC and provide the basis for the analyses presented in this document. Also presented in Table 4.2 for comparison purposes are the original projections on which the analyses in the DEIS were based.

Table 4.3 indicates the level of aircraft activity expected in 1995 if the Air Force decides not to implement either the proposed or alternate mission change but approves WMDC's request for extension of the airfield operating hours and if civil aviation operations are developed to the levels indicated in the WMDC Master Plan. Comparison with the current operations summarized in Table 3.2 indicates that the combined civil and military operations would increase from the current level of about 178/day to about 270/day, an increase of 52%. Military operations would continue to be conducted primarily between the hours of 7 a.m. and 10 p.m. while about 28 of the projected 82 additional civil operations per day would occur between the hours of 10 p.m. and 7 a.m. (as indicated in Table 4.2). Thus, "daytime" operations would increase by approximately 36% (to 242/day).

Table 4.2 Civil aviation operations predicted to occur by 1995 if proposed MWDC action is implemented

Time period	Total operation: No. Ops. L[a]	Total operation: No. Ops. T/O[b]	DC-9-80 L	DC-9-80 T/O	B727-200 L	B727-200 T/O	B737-300 L	B737-300 T/O	B747-100Q L	B747-100Q T/O	DC-10-40 L	DC-10-40 T/O	DC-8-70 L	DC-8-70 T/O	LR-35 L	LR-35 T/O	TBP2 L	TBP2 T/O
Based on mitigation plan submitted by MWDC																		
2200-0000	14	0	2	0	0	0	2	0	0	0	3	0	3	0	3	0	1	0
0000-0500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0500-0700	4	10	2	2	0	0	1	1	0	0	0	2	0	2	1	2	0	1
0700-0900	13	22	5	5	0	1	5	5	0	1	0	2	0	2	2	4	1	2
0900-1300	9	12	3	2	0	0	3	2	0	0	0	1	0	1	1	2	0	1
1300-1800	9	9	2	4	0	0	2	3	0	0	0	0	0	0	1	1	2	0
1800-2200	7	4	1	2	1	0	1	3	1	0	1	0	2	0	2	1	1	1
Total Ops.	56	56	15	15	1	1	14	14	1	1	5	5	5	5	10	10	5	5
Day Ops.	38	46	11	13	1	1	11	13	1	1	2	3	2	3	6	8	4	4
Night Ops.	18	10	4	2	0	0	3	1	0	0	3	2	3	2	4	2	1	1
2200-0000	14	0	2	0	0	0	2	0	0	0	3	0	3	0	3	0	1	0
0500-0700	4	10	2	2	0	0	1	1	0	0	0	2	0	2	1	2	0	1
As projected without mitigation																		
2200-0000	13.00	0	1.90	0	0.80	0	1.80	0	1.50	0	1.50	0	2.00	0	3.00	0	0.50	0
0000-0500	2.00	1.00	0.18	0.09	0.16	0.08	0.16	0.08	0.30	0.15	0.30	0.15	0.40	0.20	0.50	0.25	0	0
0500-0700	2.00	8.00	1.00	1.04	0	0.48	1.00	0.98	0	0.90	0	0.90	0	1.20	0	2.00	0	0.50
0700-0900	13.00	22.00	4.68	4.99	0.16	0.88	4.66	4.88	0.30	1.65	0.30	1.65	0.40	2.20	1.50	4.25	1.00	1.50
0900-1300	10.00	12.00	2.86	2.36	0.32	0.32	2.82	2.32	0.60	0.60	0.60	0.60	0.80	0.80	1.50	3.00	0.50	2.00
1300-1800	9.00	9.00	2.18	3.59	0.16	0.08	2.16	3.58	0.30	0.15	0.30	0.15	0.40	0.20	2.00	0.75	1.50	0.50
1800-2200	7.00	4.00	1.27	2.00	0.24	0	1.24	2.00	0.45	0.00	0.45	0	0.60	0	1.75	0	1	0
Total Ops.	56.00	56.00	14.07	14.07	1.84	1.84	13.84	13.84	3.45	3.45	3.45	3.45	4.60	4.60	10.25	10.25	4.50	4.50
Day Ops.	39.00	47.00	10.99	12.94	0.88	1.28	10.88	12.78	1.65	2.40	1.65	2.40	2.20	3.20	6.75	8.00	4.00	4.00
Night Ops.	17.00	9.00	3.08	1.13	0.96	0.56	2.96	1.06	1.80	1.05	1.80	1.05	2.40	1.40	3.50	2.25	0.50	0.50
2200-0000	13.00	0	1.90	0	0.80	0	1.80	0	1.50	0	1.50	0	2.00	0	3.00	0	0.50	0
0500-0700	2.00	8.00	1.00	1.04	0	0.48	1.00	0.98	0	0.90	0	0.90	0	1.20	0	2.00	0	0.50

[a] L = landing.

[b] T/O = takeoff.

Table 4.3. Projected total aircraft operations development of civil aviation operations (WMDC action) in combination with current military operations (no change in mission)

Aircraft	Annual average operations (number per day)						
	Departures (Takeoffs)	Arrivals (Landings)	Closed patterns		Drop zone	Total operations	
			Takeoffs	Landings		per day	annual
Assigned aircraft							
C-130E	8.5	8.5	48.0	48.0	6.0[a]	125[a]	18,460[a,b]
Transient military aircraft							
Heavy cargo (C-5A)	0.03	0.03	0.01	0.01	0	0.08	29[c]
Medium cargo (C-135, C-141)	3.4	3.4	0	0	0	6.8	2,482[c]
Light cargo (C-130)	3.4	3.4	0	0	1.7[a]	10.2	3,723[a,c]
Fighter/Trainer (F-4, F-15, FB-111, A-4, A-10, T-37, etc.)	7.3	7.3	0.70	0.70	0	16	5,840[c]
Commercial and general aviation							
DC-9-80	15	15	0	0	0	30	8,580
B727-200	1	1	0	0	0	2	572
B737-300	14	14	0	0	0	28	8,008
B747-100Q	1	1	0	0	0	2	572
DC-10-40	5	5	0	0	0	10	2,860
DC-8-70	5	5	0	0	0	10	2,860
LR-35	10	10	0	0	0	20	5,720
2-engine prop	5	5	0	0	0	10	2,860
TOTAL OPERATIONS	78.63	78.63	48.71	48.71	7.7	270.08	62,566

[a]Drop zone operations include an approach and a departure and are counted as two operations.

[b]$\frac{11 \text{ opns}}{\text{sortie}} \times \frac{30 \text{ sorties}}{\text{wk}} \times \frac{52 \text{ wks}}{\text{yr}} = \frac{2 \text{ opns}}{\text{mission}} \times \frac{12.5 \text{ million}}{\text{wk}} \times \frac{52 \text{ wks}}{\text{yr}} = \frac{18{,}460 \text{ opn}}{\text{yr}}$

[c]365 days/yr

As noted above, the mitigation plan proposed by WMDC includes runway utilization to minimize the number of persons exposed to aircraft noise. Although runway use is normally determined primarily by wind speed and direction with the active runway chosen to permit landings and takeoffs into the wind, jet aircraft have the ability to land and take off with tailwinds (the component of the total wind speed that is in the direction in which the aircraft is traveling) of up to about 10 knots. An analysis of wind speed and directions at Westover AFB indicates that winds with components parallel to runway 05/23 greater than 10 knots occur less than 5% of the time. Thus, approximately 95% of the time, the active runway could be selected to minimize noise impacts. The mitigation plan proposed by WMDC is based on a "head-to-head" operating mode in which aircraft would normally land on runway 23 and take off on runway 05, thus avoiding the more densely populated areas of Chicopee and Springfield to the southwest of the runway. Although this type of operation increases the complexity of air traffic control and is not feasible at airports with large numbers of operations, it is considered feasible at Westover because of the relatively low number of operations (particularly at night when noise is most critical) and the ability to schedule and control both military and civil aircraft operations to minimize conflicts. Although wind conditions would permit "head-to-head" operations more than 95% of the time, the analysis of noise impacts is based on the assumption that such operations could be conducted 90% of the time at night and 80% of the time during the day to minimize conflicts with military operations.

4.1.2.3 Cumulative changes in aircraft operations

Cumulative aircraft operations that may result from the implementation of the proposed and alternate military action (16 aircraft) in combination with the development of civil aviation operations are summarized in Table 4.4. The scheduling of WMDC aircraft operations would not be affected by the change in military aircraft operations and would be the same as indicated in Table 4.2. As shown by comparison of Table 4.4 with Table 3.2, implementation of the proposed mission change in combination with the development of civil aviation operations would result in essentially no change in the number of daily operations relative to current levels (the decrease in military operations would offset the increase in civil aviation operations). Annual operations would increase from the current level of about 36,300 to about 52,500 (+45%). Implementation of the alternate mission change would result in a decrease of about 9% in the number of daily operations (from 178 to 162) and an increase of about 34% in annual operations (from 36,300 to 48,500).

4.2 NOISE

Noise is considered the major issue associated with implementation of either military action change or a decision to permit 24-hr operation of the airfield as requested by WMDC for development of air cargo operations and expansion of civil aviation activity. A number of issues related to noise exposure were identified at the public scoping meeting, and a detailed analysis of potential noise impacts has been conducted. The results of this analysis are summarized in this section, and supporting information and data are provided as appendices. Appendix A provides a

Table 4.4. Projected total aircraft operations for proposed and alternate military actions in combination with development of civil aviation operations (WMDC action)

Aircraft	Annual average operations (number per day)						
	Departures (Takeoffs)	Arrivals (Landings)	Closed patterns		Drop zone	Total operations	
			Takeoffs	Landings		per day	annual
Assigned aircraft							
C-5A							
Proposed (16 PAA)	10.15	10.15	6.4	6.4	0	33.1	8,440
Alternate (8 PAA)	5.08	5.08	3.2	3.2	0	16.6	4,420
Transient military aircraft							
Heavy cargo (C-5A)	0.03	0.03	0.01	0.01	0	0.08	29
Medium cargo (C-135, C-141)	3.4	3.4	0	0	0	6.8	2,482
Light cargo (C-130)	3.4	3.4	0	0	1.7[a]	10.2	3,723
Fighter/Trainer (F-4, F-15, FB-111, A-4, A-10, T-37, etc.)	7.3	7.3	0.70	0.70	0	16	5,840
Commercial and general aviation							
DC-9-80	15	15	0	0	0	30	8,580
B727-200	1	1	0	0	0	2	572
B737-300	14	14	0	0	0	28	8,008
B747-100Q	1	1	0	0	0	2	572
DC-10-40	5	5	0	0	0	10	2,860
DC-8-70	5	5	0	0	0	10	2,860
LR-35	10	10	0	0	0	20	5,720
2-engine prop	5	5	0	0	0	10	2,860
TOTAL OPERATIONS							
proposed	80.28	80.28	7.11	7.11	1.7[a]	178.18	52,546
alternate	75.21	75.21	3.91	3.91	1.7[a]	161.68	48,526

[a]Includes an approach and departure and is counted as two operations.

description of the measurements (metrics) used in assessing noise impacts and provides examples of the noise levels produced by typical sources in indoor and outdoor environments and the typical range of community noise levels (DNL). Appendix B provides a summary of recent research on the effects of noise exposure. Appendix C provides recommendations with respect to the compatibility of various land uses with day/night weighted average noise level (DNL) levels >65 dB. Appendix D provides the results of the NOISEMAP analyses which were used as the basis for this analysis.

Section 4.2.1 discusses the issues identified for detailed analysis based on the public scoping process and gives a review of pertinent literature. Section 4.2.2 describes the impacts expected to result from implementation of the proposed (16-aircraft) and alternate (8 aircraft) military actions if no change in civil aviation activity takes place. Section 4.2.3 describes the impacts expected to result from implementation of the action proposed by WMDC and the resultant development of civil aviation operations in the absence of any change in military operations. Section 4.2.4 describes the impacts expected to result from implementation of the proposed or alternate military action in combination with the development of civil aviation operations.

Based on this analysis, it is concluded that the principal impact expected to result from either the military action or the development of civil aviation operations will be annoyance to some residents to whom aircraft noise is unpleasant and intrusive. Sleep disturbance resulting from nighttime air cargo operations would be a significant factor in the level of annoyance resulting from the development of civil aviation operations. Because military training activities would be confined to daytime hours, sleep disturbance would not be a significant factor in the impacts resulting from either military action. Increases in aircraft noise would be expected to impact existing land uses (primarily residential development and educational institutions) and could impose some constraints on future development. Some reduction in property values may occur in areas exposed to increased aircraft noise. With the exception of annoyance, no significant adverse effects on humans and no significant adverse impacts to wildlife, domestic animals, or cultural resources would be expected to result.

Development of civil aviation operations in combination with either military action would result in cumulative increases in noise impacts. Increases in DNL levels and daytime noise exposures would be expected to increase the level of annoyance and potential impacts to existing and future land uses and property values relative to either action alone. Because military training activities would be confined to daytime hours, there would be no increase in nighttime noise levels and associated impacts. With the exception of annoyance, no significant adverse effects on humans and no significant adverse impacts to wildlife, domestic animals, or cultural resources would be expected to result.

4.2.1 Noise-Related Issues Identified for Analysis

Noise-related issues identified during the public scoping process include:

- annoyance resulting from aircraft noise,

- speech interference,
- conflicts with existing land uses,
- restraints on future land use,
- sleep disturbance,
- hearing loss,
- effects on domestic animals and wildlife,
- health effects other than hearing loss, and
- reductions in property values.

Each of these issues was considered in the development of this analysis. Appendix B presents a summary of a review of recent research related to the effects of noise on annoyance, speech interference, sleep disturbance, hearing, and domestic animals and wildlife. Based on this review and the projected noise levels, it was concluded that no significant hearing loss or adverse impacts to domestic animals or wildlife would be expected to result from either the military or WMDC actions, either alone or in combination, and these issues are not addressed in detail. Exposure of two bird species of special interest, the upland sandpiper and the grasshopper sparrow, to increased noise levels would probably be unavoidable. The resident bird population has had an opportunity to become accustomed to aircraft activity, including commercial air cargo aircraft and occasional operations by C-5A aircraft. Because the change in aircraft operations would occur over a relatively long period of time and would provide an additional opportunity for the birds to become accustomed to the increased noise levels, the resulting adverse impact should be insignificant.

Nonauditory effects are those not directly associated with actual hearing. A recent review conducted by the Federal Aviation Administration (FAA) summarized the results of a series of contemporary research studies which hypothesize correlation between noise exposure in general (in many cases aircraft noise exposure) and various human behavioral effects (Newman and Beattie 1985). This review found that:

> While some studies show a significant correlation, other studies show none. Although research continues, there does not exist a succession of studies which corroborate the "cause and effect" theory. While the reader should be aware of research in this area, the topics reviewed in this section [section on non-auditory effects] are considered to be beyond the normally accepted and recognized aircraft noise effects.

The FAA concluded that "Although many airport neighbors have claimed a direct health impact from aviation noise, there is little valid scientific basis for such claims." Based on the available literature, it was concluded that there is no basis for prediction of any nonauditory health effects resulting from exposure to aircraft noise at the levels projected to result from either the military or WMDC operations and this issue is not addressed further.

A number of studies during 1960-1970 have addressed the effect of noise levels on property values. These studies were recently reviewed by the FAA (Newman and Beattie 1985) and indicated a range of reductions in property values from approximately 0.6 to 2.6% per decibel increase in DNL above a level of 55 dB. The review also concluded that more recent

studies (1967-1970) tend to show a smaller reduction in value per decibel increase (0.7 to 0.8% per decibel) and suggest that increases in value for commercial purposes may be partially offsetting the decrease in residential value or that noise-sensitive persons have moved out of the affected area. The FAA review (Newman and Beattie 1985) concludes that

> The bottom line is that noise has been shown to decrease the value of property by only a small amount -- approximately 1% decrease per decibel (DNL, above a level of DNL 55). . . . Because there are many other factors that affect the price and desirability of a residence, the annoyance of aircraft noise remains just one of the considerations that affect the market value of a home.

It is not possible to determine the applicability of these studies to the proposed actions. Experience of the Air Force at areas throughout the country does not support the application of this conclusion to areas near Air Force bases. However, some reductions in property value may occur as a result of the proposed actions.

Westover AFB has been an established, active flying facility for over 45 years. Most homes, hospitals, schools, etc., now affected by aircraft noise have been constructed with full knowledge of the existence of Westover AFB. Property values in these areas, therefore, already reflect, to a great degree, valuation based on aircraft overflights, noise, crash potential, etc. Numerous factors affect the market value of a home, with noise being just one consideration. The Air Force experience at other military installations has not supported a loss of property value when a different type or larger number of aircraft has replaced existing aircraft. In fact, property values generally continue to increase because of greater employment and demand for housing; however, the rate of appreciation in value may be somewhat lower than that of nonaffected properties. This view is also supported by most realtors in the Westover area, including the president of the Greater Holyoke-Chicopee Board of Realtors. They conclude that local land values will rise with implementation of the proposed actions.

The Air Force does not have a soundproofing program and has no authority to pay claims for decreases in property values. The United States pays only if the overflights and noise are so severe as to amount to a "taking" of an interest in the property. The interest taken is usually in the form of an easement, and the flights must be frequent, directly over the affected property, and below 500 ft. Taking claims may be filed through the Office of Public Affairs at Westover AFB or directly with the claims office at ESD/JA, Hanscom AFB, Massachusetts 01730. These claims typically are not settled administratively; the property owner usually must file a lawsuit for inverse condemnation because the Air Force usually does not agree that a taking has occurred.

4.2.2 Noise Impacts from Proposed (16 C-5A Aircraft) and Alternate (8 C-5A Aircraft) Military Actions

The only significant adverse impacts expected to result from implementation of either the proposed (16 C-5A aircraft) or the alternate (8 C-5A aircraft) military action would be related to increases in noise levels resulting from operation of the C-5A aircraft. The principal

impact to humans would be annoyance to persons who find aircraft noise unpleasant and intrusive. No other significant effects on humans would be expected; nor would significant adverse impacts to wildlife, domestic animals, or structures be likely to result. The increases in noise levels would result in some impacts to existing land uses (primarily residential development) and may create some constraints on future development in areas surrounding the base. Some decreases in property values may occur in areas subject to increased noise levels.

Because most members of reserve flight crews have full-time civilian jobs, most local flying activity is scheduled for weekend training assemblies or after normal working hours during the week. Neither mission change would result in a change to this pattern; however, the number of training sorties would be reduced from the current level of approximately 30 per week to 4 per week for the proposed (16 C-5A) action and 2 per week for the alternate (8 C-5A) action. No military activity would be routinely scheduled between the hours of 10 p.m. and 7 a.m.; therefore sleep interference would be minimal.

Measures to reduce noise exposures have been incorporated into planned flight patterns and limited additional mitigation measures may be feasible to reduce specific impacts identified as operations are developed. Implementation of the proposed (16-aircraft) military action would result in an increase in the area exposed to DNL levels >65 dB (the maximum level recommended for unrestricted residential development) from the current level of approximately 3.3 sq. mi. to approximately 9.2 sq. mi. The number of persons exposed to DNL levels >65 dB would increase from the current level of fewer than 100 to approximately 3,550. Approximately 30 persons would be exposed to DNL levels >75 dB [the maximum level considered acceptable for residential use with the incorporation of noise reduction (attenuation) measures in residential construction]. Of the 3,550 persons exposed to DNL levels >65 dB, approximately 700 would be expected to be highly annoyed. A few additional persons in areas with DNL levels <65 dB would also be highly annoyed. Implementation of the alternate military action (8 aircraft) would result in an increase in the area exposed to DNL levels >65 dB to approximately 5.7 sq. mi. and the exposure of approximately 1,600 residents to DNL levels >65 dB; none would be exposed to levels >75 dB. Of these individuals, approximately 350 would be expected to be highly annoyed by aircraft noise. A few additional persons in areas with DNL levels <65 dB would also be highly annoyed.

Because the majority of military flight operations would take place during 5-hr local training sorties, 5-hr equivalent noise levels (Leq-5) were also considered. Approximately 16,200 people could be exposed to Leq-5 levels >65 dB during operations on runway 23, and approximately 47,500 could be exposed during operations on runway 05. Noise levels during local training sorties could interfere with activities in which verbal communication is important (such as classroom instruction, business conferences, and religious activities) and with listening to television and radio programs or recorded music. Local training sorties would be scheduled about four times per week for the proposed (16 C-5A) military action and about twice per week for the alternate (8 C-5A) action. Operations on runway 05, which would affect the largest number of people, would be expected to occur less than 20% of the time. As noted previously, most local flying activity would be scheduled for training

weekends and after normal working hours during the week. Thus, residential uses and recreational activities would likely be affected more frequently than educational or business activities.

4.2.2.1 Predicted noise levels

As discussed in Appendix A, the noise produced by a single aircraft operation is measured in terms of the sound exposure level, a noise level that would produce in 1 sec sound energy equivalent to the total noise event. SEL values for Air Force and civil aircraft are provided in Appendix A, which also indicates the relative loudness of typical noise sources in both indoor and outdoor environments. There is no general relationship between the sound exposure level (SEL) and the maximum decibel level measured during a noise event. For aircraft overflights, maximum noise levels (ALm) would typically be 5 to 7 dB below the SEL. By definition, noise levels that exceed the SEL value would have durations of <1 sec. For an average overflight by a C-5A aircraft in the airport traffic area, the duration of the period in which the noise level would be greater than 65 dB(A) would be approximately 20 to 30 sec. Peak noise levels during the overflight may exceed 100 dB(A) for brief periods.

DNL contours expected to result from aircraft operations for the proposed and alternate military actions were generated by the Air Force Engineering Services Center using the methodology described in Sect. 3.2. The predicted ground-level contours are indicated in Figs. 4.1 and 4.2 for the proposed (16 C-5As) and alternate (8 C-5As) military actions respectively. As indicated in Appendix D, the proposed military action would result in an increase of approximately 176% in the area exposed to noise levels in excess of 65 dB DNL (from approximately 3.3 sq. mi. to approximately 9.2 sq. mi.). Implementation of the alternate military action would result in an increase of approximately 71% (to approximately 5.7 sq. mi.).

Because local training activity would take place only approximately 4 days/week and would occur during a period of 5 hr, 5-hr equivalent noise level (Leq-5) contours for typical local training sorties with operations on runways 23 or 05 were prepared and analyzed. The contours and area calculations are presented in Appendix D. Approximately 17.3 and 16.4 sq. mi. would be exposed to Leq-5 levels >65 dB by operations on runways 05 and 23 respectively.

4.2.2.2 Population exposed to aircraft noise

As indicated in Sect. 3.2.1, only about 100 people live in areas with DNL levels above 65 dB as a result of current aircraft operations; none of these residents are in areas where DNL levels are greater than 70 dB.

To provide an estimate of the number of area residents who would be affected by aircraft noise, the noise contours illustrated in Figs. 4.1 and 4.2 were used in combination with census data to determine the approximate number of persons within each contour interval. The results of this analysis are presented in Appendix D. If the proposed military action (16 aircraft) were implemented, the number of persons exposed to DNL levels >65 dB would increase from the current level of less than 100 to about 3,550. Approximately 30 persons would be exposed to DNL levels

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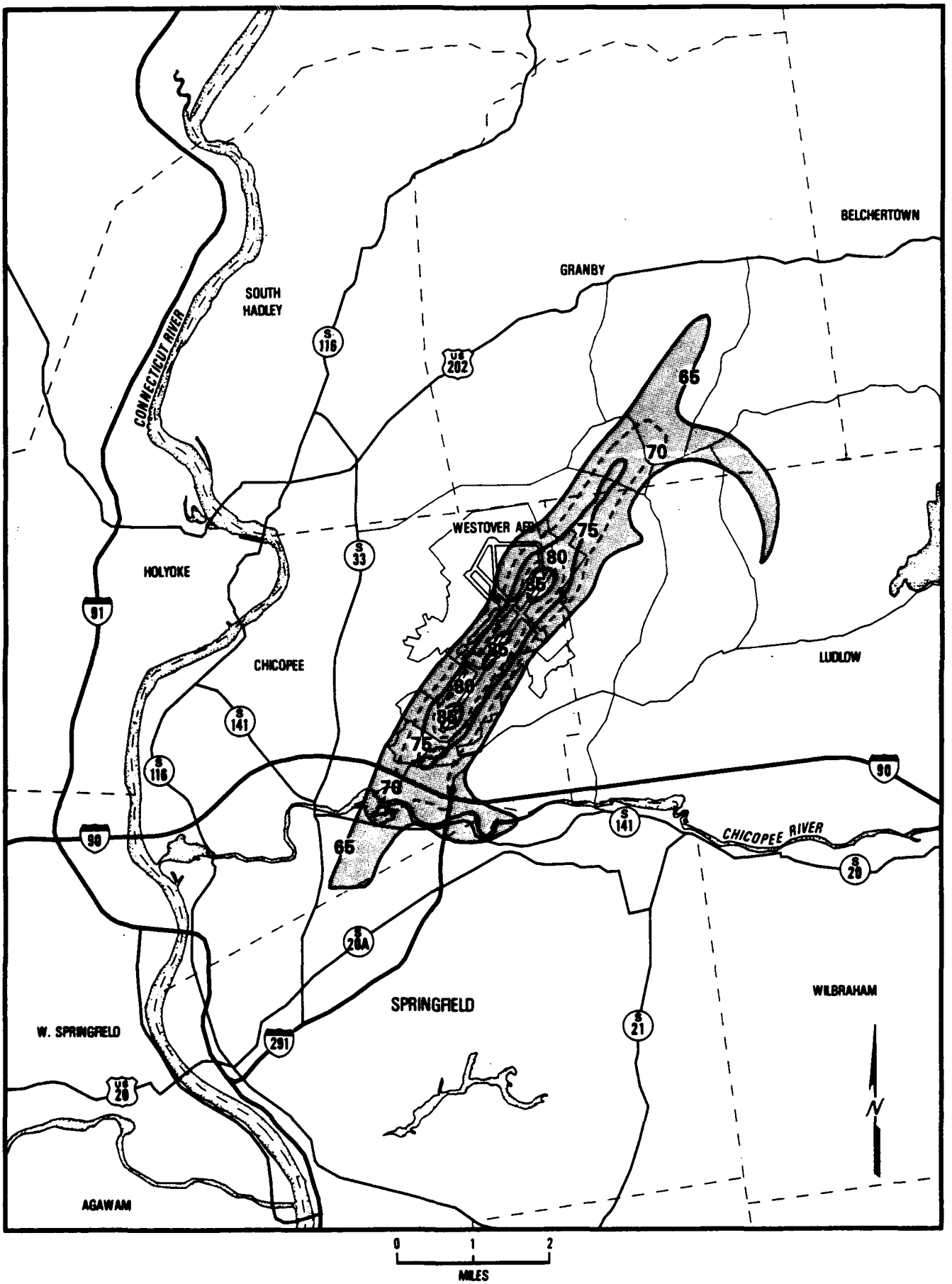

Fig. 4.1. DNL contours for proposed military operations (16 C-5A).

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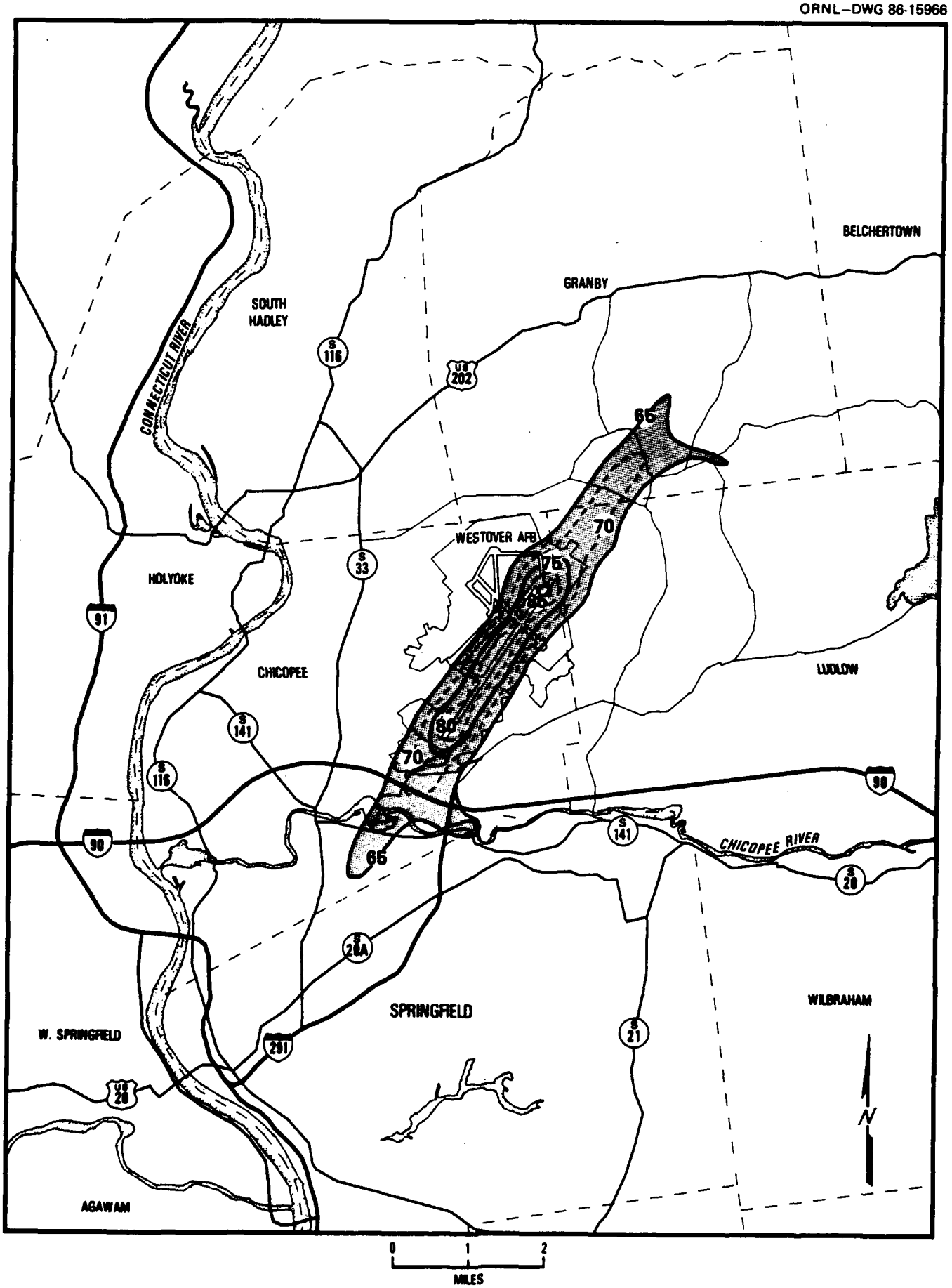

Fig. 4.2. DNL contours for alternate military operations (8 C-5A).

>75 dB (the maximum level considered acceptable for residential use with the incorporation of noise attenuation measures in residential structures). Implementation of the alternate military action would result in exposure of about 1,600 residents to DNL levels >65 dB; none would be exposed to levels >75 dB.

For both military actions, the highest DNL levels in residential areas would occur in the approach zone for runway 23 in the area of Granby bounded by East, Taylor, and Truby Streets. This same area is most affected by current operations. The maximum levels (approximately 77 dB and 73 dB) would occur on East Street where it is crossed by the extended runway centerline about 1500 feet east of Sherwood Drive.

The same technique used to estimate the population residing within the various DNL contour intervals was used to estimate the population residing within the 5-hr Leq contours. The results of these estimates are presented in Appendix D and indicate that approximately 16,200 persons would be exposed to Leq-5 noise levels >65 dB by operations on runway 23 (expected to occur 80% of the time). Because operations on runway 05 would involve landing approaches over densely populated areas of Springfield and Chicopee, a larger number of residents (about 47,500) would be exposed to Leq-5 noise levels >65 dB. Of these, approximately 940 could be exposed to levels >80 dB.

4.2.2.3 Effects of noise exposure from either military action

4.2.2.3.1 Annoyance

An estimate of the percent of the population that would be annoyed by the projected aircraft noise was made on the basis of the CHABA (Committee on Hearing, Bioacoustics, and Biomechanics) Guidelines (NAS 1977) discussed in Appendix B. The results of this analysis (see Appendix D) indicate that of the approximately 3,550 persons predicted to be exposed to DNL levels >65 dB by the proposed military action (16 aircraft), approximately 770 (22%) would be expected to be highly annoyed by aircraft noise. For the alternate military action (8 aircraft), about 350 (22%) of the 1,600 persons exposed to DNL levels >65 dB would be highly annoyed. As noted in Appendix B, some individuals in areas with DNL levels <65 dB would also be expected to be highly annoyed by noise. Because noise levels in many of the areas affected by aircraft noise would be in the range of 55 to 65 dB in the absence of aircraft noise, estimation of the level of annoyance in areas with DNL levels below 65 dB is not considered feasible.

4.2.2.3.2 Speech interference

Aircraft operations associated with either of the military actions would be expected to result in intrusive events that would last for approximately 25 sec and that would result in significant speech interference for a period of approximately 15 sec. For both military actions, local aircraft operations would occur primarily during training sorties lasting approximately 5 hr each. Training sorties would average four per week for the proposed military action (16 aircraft) and two per week for the alternate military action (8 aircraft). During a typical training sortie, an aircraft would make one takeoff and one full-stop landing plus

a number of low approaches and touch-and-go landings. Depending on training requirements, a typical training sortie could include up to 20 takeoffs and landings (the majority of these operations would be touch-and-go landings or low approaches followed by missed approach departures). Thus, facilities located in the approach and departure corridors could be flown over as many as 20 times during a 5-hr training sortie. Overflights would normally occur at intervals of approximately 15 to 20 min when the aircraft is performing local training operations. Depending on the pattern being flown and the number of aircraft in the pattern, overflights could occur at intervals as short as 6 to 7 min. People residing in these areas could find such an interval to be particularly annoying. Variation in training activities to increase the interval between overflights could reduce the level of annoyance.

A number of schools would be affected by aircraft operations for either of the military actions. Predicted noise levels at area schools are indicated in Appendix D, Table D.1. As indicated in Table D.1, no schools are located in areas where the DNL level would be >65 dB; however, a number of schools would be exposed to 5-hr equivalent noise levels (Leq-5) >65 dB. The largest number of schools would be affected by operations on runway 05, which would be expected to occur less than 20% of the time. Published studies of the effects of noise on educational facilities have focused on schools heavily impacted by flying activity near major commercial airports; the studies have not resulted in the development of a quantitative relationship between noise and student performance. Although noise levels resulting from either military action would be expected to be significantly lower than those for which studies have been conducted, any additional noise interruptions will detract from the teaching environment. As noted previously, most local flying activity would be scheduled for training weekends and after normal working hours during the week. Only one or two local sorties would normally occur during school hours for the proposed action and less than one per week would be likely for the alternate action. Since these sorties would not be scheduled for the same day or times on a regular basis, specific activities would not be interrupted repeatedly.

Speech interference would probably be a relatively minor source of annoyance to persons using Chicopee Memorial State Park for recreational activities during the summer months when the primary activities are swimming and picnicking. Background noise levels at such times would generally be relatively high, and the duration of the aircraft noise would be relatively short (20 to 30 sec). The level of annoyance would likely be lower than would result from interference with other activities (e.g., hiking and biking) normally associated with lower background noise levels. During other seasons, annoyance would probably result more from the intrusive nature of aircraft noise in an otherwise natural setting rather than from speech interference.

4.2.2.3.3 Sleep interference

Essentially all routine military training activity would be scheduled to be completed before 10 p.m. Some mission flights may depart or return between the hours of 10:00 p.m. and 7:00 a.m.; however, the number is expected to be small and the aircraft would normally depart from the area or make a full-stop landing and not conduct training activities during

this period. Therefore, interference with sleep as a result of military aircraft operations should be minimal.

Some hospital patients may be asleep during the times when military operations are conducted, and some sleep disturbance may result. The FAA has concluded that "A level of 40 dB(A) is a conservative estimate of the threshold level of noise for sleep disturbance of patients in hospitals and public health facilities. Noise exposure below this level is not expected to interfere with sleep." As indicated in Appendix D, Table D.1, exterior maximum noise levels would be approximately 5 to 10 dB lower than the SEL values indicated in the table. Hospitals typically have higher attenuation values than residential structures. Assuming an attenuation level of approximately 30 dB and that maximum dB(A) levels are approximately 5 dB below the SEL values, operations that produce SEL values greater than 75 dB could be expected to cause some sleep disturbance to hospital patients.

Runway 05 is expected to be used less than 20 percent of the time for local training sorties. Based on an average of 4 training sorties per week, operations on runway 05 would occur less than once per week; therefore, approaches over the hospitals in Springfield would occur less than once per week. Each sortie would involve approximately 12 approaches, which would affect Baystate Hospital (100 dB SEL) and Mercy Hospital (99 dB SEL) in Springfield. VFR closed pattern operations would occur approximately 8 times per sortie and would affect Hubbard Memorial Hospital (89 dB SEL) in Ludlow and Springfield Municipal Hospital (95 dB SEL). SEL levels at Baystate and Mercy hospitals in Springfield would be approximately 74 and 76 dB, respectively, and no significant sleep interference would be expected.

Runway 23 is expected to be used for approximately 80% of the local training sorties (either 3 or 4 times per week). Of the 12 departures during a training sortie, approximately half would employ straight out departures which would affect Baystate (96 dB SEL), Mercy (96 dB SEL) and Springfield Municipal (76 dB SEL) in Springfield. Providence Hospital in Holyoke would be affected by approximately 3 departures employing right turns (95 dB SEL), and Springfield Municipal Hospital (96 dB SEL) would be affected by about 3 departures employing left turns.

As noted in Sect. 4.2.2, because most members of reserve flight crews have full-time civilian jobs, most local flying activity is scheduled for weekend training assemblies or after normal working hours during the week. Neither the proposed nor alternate mission change would result in a change in this pattern. Requirements that each pilot carry out a minimum of 2 night landings every six months also require that some training operations be conducted after dark. Thus, one or two local training sorties each week would probably be conducted after 4:30 p.m. and could result in some disturbance to hospital patients. If disturbance of hospital patients results from military operations, the Air Force will endeavor to adjust training schedules, flight operations, and flight tracks to minimize impacts. Some disturbance to hospital patients will probably be unavoidable; however, the Air Force does not believe that noise levels will be unacceptable.

4.2.3.4 Impacts on Land Use

The U.S. Department of Housing and Urban Development (HUD) provides noise criteria for new construction and major remodeling assistance, subsidy, and insurance. Under these criteria (U.S. HUD 1984), areas of 75 dB DNL or greater are considered unacceptable for federal assistance for residential purposes unless special approval is given for noise attenuation in new construction. Federal assistance for residential development in areas exposed to DNL levels of 70 to 75 dB is "strongly discouraged" and is "discouraged" in areas exposed to levels of 65 to 70 dB. Areas of DNL level below 65 dB are considered generally acceptable for residential use.

A DNL level of 55 dB has been identified by EPA and other federal agencies (including HUD and DOT) as a goal for outdoor noise levels in residential areas based on protection of public health and welfare. This goal was established without regard to cost or feasibility of attainment. In their "Levels Document" (EPA 1974), EPA concludes that DNL values that do not exceed 55 dB are sufficient to protect human health and welfare in sensitive areas.

In June 1980 the Federal Interagency Committee on Urban Noise recognized that although several federal programs include noise standards or guidelines as part of their eligibility and performance criteria, the primary responsibility for integrating noise considerations into the planning process rests with local governments, which generally have exclusive control over actual land development. The Committee further recognized that the purpose of considering noise in the land use planning process is not to prevent development but rather to encourage development that is compatible with various noise levels, the objective being to guide noise-sensitive land uses away from the noise and encourage nonsensitive land uses where there is noise. The committee admits that another input to the planning process is the statement of public health and welfare goals in EPA's "Levels" Document. The levels are to be used by individual communities to incorporate public health and welfare goals into the planning process. These levels do not <u>in themselves</u>, however, form the sole basis for appropriate land-use actions because they do not consider cost, feasibility, the noise levels from any particular source, or the development needs of the community and because they do include an adequate margin of safety.

The Federal Interagency Committee on Urban Noise (consisting of DOT, DOD, EPA, VA and HUD) recognizes that a DNL of 55 dB is a goal for outdoors in residential areas in protecting the public health and welfare with an adequate margin of safety. However, it is not a <u>regulatory</u> goal. It is a level defined by a negotiated scientific consensus without concern for economic and technological feasibility or the needs and desires of any particular community.

Another reason that DNLs between 55 and 65 dB were unrealistic is that urban to suburban noise exposure levels typically range from 52 to 67 dB, dense urban areas with heavy traffic typically range from 63 to 72 dB and downtown areas in major metropolitan areas typically range from 71 to 80 dB. The majority of the areas affected by aircraft operations would be

expected to have DNL levels in excess of 55 dB based on population density.

Implementation of either military action would be expected to result in increased noise levels, which would impact existing land uses (principally residential development). The highest DNL levels would occur northeast of the runway, in the area of Granby bounded by East, Taylor, and Truby Streets. These areas would be exposed to DNL levels of up to 77 dB for the proposed military action and up to 73 dB for the alternate military action. These areas have been developed for residential use; however, the number of residences is relatively low. Approximately 100 to 125 residences in this area would be affected by the proposed military action; approximately 100 would be affected by the alternate military action.

Existing residential developments in areas of Chicopee to the southeast of the base would be exposed to DNL levels >65 dB. Only about 15 residences would be exposed to levels >70 dB; however, this area has been heavily developed and approximately 1,200 residences would be exposed to DNL levels >65 dB.

Increases in noise levels may also reduce the desirability of some land areas for future residential development. This impact would be most significant in areas of Ludlow to the east of the runway and in Granby to the north and east of the runway. These areas are currently relatively undeveloped, but could potentially be developed for residential use. Increases in noise levels could impose some limitations on development for other purposes. With the exception of the areas in the approach zone for runway 23, most land uses would be acceptable if appropriate noise attenuation measures are included in new construction.

As discussed in Sect. 4.2.2.3.2, noise levels during local training sorties could interfere with activities in which verbal communication is important (such as classroom instruction, business conferences, and religious activities) and with listening to television and radio programs or recorded music. Local training sorties would be scheduled about four times per week for the proposed (16 C-5A) military action and about twice per week for the alternate (8 C-5A) action. Operations on runway 05, which would affect the largest number of people, would be expected to occur less than 20% of the time. As noted previously, most local flying activity would be scheduled for training weekends and after normal working hours during the week. Thus, residential and recreational uses would likely be affected more frequently than educational or business uses.

In addition to the normal variation in flying activities, it may be feasible to further reduce impacts by the refinement of flight paths to reduce repeated overflights of a facility during a single training mission. Due to specific flight requirements and the operational characteristics of the aircraft, refinement of flight tracks may not be feasible in every case. To the extent consistent with training requirements and other constraining factors such as weather, flight safety, and operational considerations, it may be feasible to schedule training activities to minimize overflights of some facilities.

4.2.3 Noise Impacts from Potential WMDC Operations

The only significant adverse environmental impacts expected to result from development of civil aviation operations to the levels identified by WMDC would be related to increases in noise levels in areas surrounding the base. Although the predicted noise levels would result in increased levels of annoyance and sleep disturbance to some area residents, no other significant adverse effects on humans, including hearing loss and non-auditory health impacts, are considered to be likely to result. The predicted noise levels would result in impacts to existing land uses, particularly residential development and could impose constraints on future land uses. Reductions in property value may occur in areas exposed to increased noise levels. No significant adverse impacts to domestic animals, wildlife, or structures would be expected to occur as a result of the increases in noise levels.

The area exposed to DNL levels >65 dB would increase from approximately 3.3 sq. mi. to approximately 6.8 sq. mi., and the number of persons exposed to DNL levels >65 dB would increase from less than 100 to approximately 1,500. No residents would be exposed to DNL levels >75 dB. Of the persons exposed to DNL levels >65 dB, approximately 350 would be expected to be highly annoyed. As noted in the discussion of annoyance resulting from the proposed military actions, some persons in areas with DNL levels <65 dB would also be highly annoyed by noise; however, estimation of the number of such persons is not feasible. Although sleep disturbance was considered in the development of the relationship between DNL levels and annoyance and is thus included in the estimate, sleep disturbance may increase the number of persons predicted to be highly annoyed.

Sleep disturbance would be a factor in the level of annoyance resulting from the development of civil aviation operations to the levels indicated in the WMDC Master Plan. Depending on the type of aircraft, the type of operations (landings or takeoffs), the time of year (winter or summer), and the runway in use, from 300 to 19,200 persons could be awakened by one or more aircraft operations during the period between 10 p.m. and 7 a.m. The largest number of residents could be awakened by takeoff operations on runway 23 and by landings on runway 05. As noted in Sect. 2.2.2 and Sect 4.1.2.2, subsequent to the issuance of the DEIS, WMDC has proposed a mitigation plan that would minimize takeoffs on runway 23 and landings on runway 05. Takeoffs on runway 23 and landings on runway 05 are projected to occur less than 10% of the time during nighttime hours and less than 20% of the time during daytime hours. Under the mitigation plan proposed by WMDC, only about 500 persons would be expected to be awakened by a single operation on 90% of the nights on which flights occur. Because there would be up to 28 operations during the period from 10 p.m. to 7 a.m., some individuals would be expected to be awakened more than once and some individuals may be awakened by some operations and not by others. Therefore, the total number of individuals awakened and the total number of awakenings cannot be estimated.

These estimates are based on data obtained using subjects in a laboratory environment; limited data from a study conducted in the vicinity of the Roissy Paris Airport suggest that the actual number of awakenings resulting from a single operation would be lower than predicted on the basis of laboratory data (Vallet 1980). Because individual

residents would be affected by 2 to 14 aircraft operations in a 2-hr period, some individuals would likely be awakened more than once and the total number of individuals awakened would likely be greater than the number awakened by a single event.

The changes in aircraft types and runway utilization proposed by WMDC in the mitigation plan (Appendix J) submitted subsequent to the issuance of the DEIS significantly reduce the impacts expected to result from the development of civil aviation operations and have been used as the basis for the analysis presented below. More detailed information is presented in Appendix K, Supplemental Noise Analysis. Appendix D provides an analysis of the noise levels predicted to result from civil aviation operations without mitigation measures, and Appendix K provides an analysis of the effectiveness of the proposed mitigation plan.

4.2.3.1 Predicted noise levels

Increases in air cargo operations, particularly nighttime operations, would result in increases in the areas exposed to DNL levels >65 dB. DNL contours for potential civil aviation operations, generated using the NOISEMAP program and the data in Tables 4.2 and 4.3, are shown in Fig. 4.3. As indicated in Appendix K, expansion of civil aviation operations to the potential levels indicated by WMDC with no change in military operations would result in exposure of an area of approximately 6.8 sq. mi. to DNL levels >65 dB. This represents an increase of approximately 104% relative to the area exposed to similar levels by current operations.

Because about 28 operations would take place between the hours of 10 p.m. and 7 a.m., with the majority of the landings taking place between 10 p.m. and midnight and the majority of takeoffs between 5 a.m. and 7 a.m., the equivalent noise levels resulting from nighttime operations was also evaluated (See Appendix K). In the calculation of DNL levels, a 10-dB penalty is applied to nighttime operations to account for the higher level of annoyance associated with intrusive noise events that occur at night; a similar weighting was included in the calculation of the nighttime equivalent noise level. Weighted noise level contours and area calculations for operations between the hours of 10 p.m. and 7 a.m. are presented in Appendix K. As indicated in this Appendix, an area of about 6.2 sq. mi. would be exposed to weighted Leq-9 levels exceeding 65 dB. This represents a reduction of approximately 32% from the 9.2 sq. mi. predicted to be exposed to similar levels by operations as originally projected (Appendix D).

4.2.3.2 Population exposed to noise from potential WMDC operations

The same technique described in Sect. 4.2.2.2 was used to estimate population exposure to noise resulting from operation of aircraft using WMDC facilities. The results of this analysis are presented in Appendix K. If civil aviation operations are developed to the levels indicated in the WMDC Master Plan (with no change in military aircraft operations), approximately 1,500 persons would be exposed to DNL levels >65 dB. Of these, approximately 300 would be exposed to levels between 70 and 75 dB. None would be exposed to levels in excess of 75 dB. The maximum predicted DNL level in residential areas would be approximately

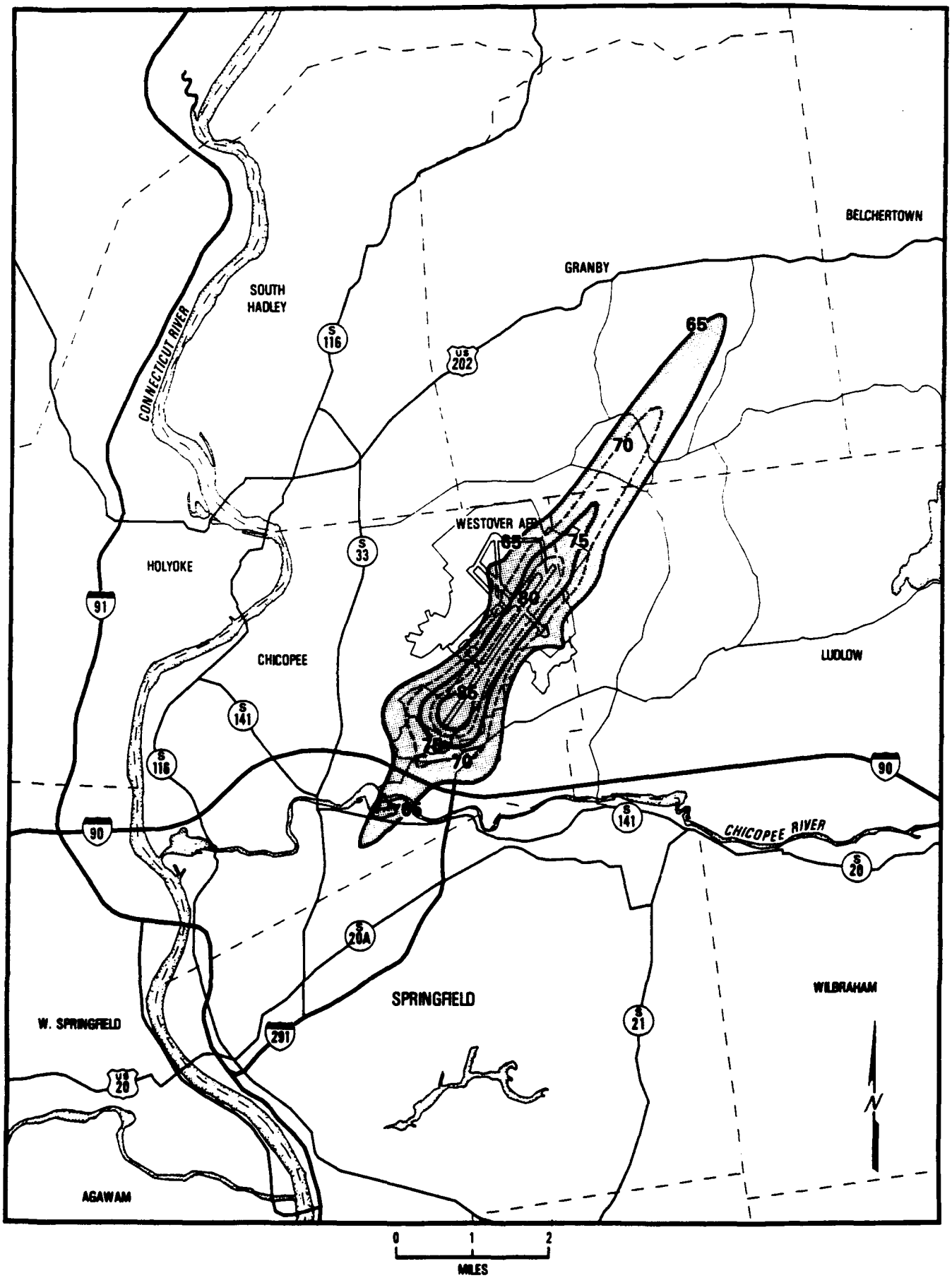

Fig. 4.3. DNL contours for potential WMDC operations (with mitigation) with current military operations (C-130s + transients).

73 dB. The predicted exposure of about 1,500 persons to DNL levels >65 dB represents a reduction of approximately 77% relative to the 6,500 persons predicted to be exposed to similar levels by operations as originally projected (Appendix D).

Population exposures to short-term noise levels were also evaluated, and the results of this evaluation are presented in Appendix K. On an annual average basis, approximately 550 persons would be exposed to 9-hr equivalent noise levels (weighted) by operations between 10 p.m. and 7 a.m. This represents a reduction of approximately 95% from the 10,800 persons predicted to be exposed to similar levels by operations as originally projected (Appendix D) and indicates the effectiveness of the mitigation plan in reducing population exposure to nighttime aircraft noise. The largest numbers of people would be affected by landings using runway 05 and takeoffs using runway 23 which result in overflight of densely populated areas of Springfield and Chicopee. The mitigation plan proposed by WMDC would result in use of these runways during nighttime hours less than 10% of the time and less than 20% of the time during daytime hours.

4.2.3.3 Effects of noise exposure from potential WMDC operations

Annoyance, particularly as a result of nighttime operations, is expected to be the most significant impact resulting from the development of civil aviation operations to the potential levels indicated by WMDC. Sleep disturbance would be a significant factor in the level of annoyance resulting from civil aviation operations at night. Impacts to existing land uses, primarily residential development and educational facilities, would also result, and some decrease in the value of residential property in the affected areas may result.

4.2.3.3.1 Annoyance

An estimate of the percent of the population that would be annoyed by noise was made on the basis of the CHABA Guidelines (NAS 1977) discussed in Appendix B. Of the approximately 1,500 persons predicted to be exposed to DNL levels >65 dB by the projected civil aviation operations, approximately 350 would be predicted to be highly annoyed by aircraft noise. Sleep disturbance may result in significant annoyance to more persons than predicted on the basis of the relationships discussed in Appendix A. As indicated previously, some persons in areas with DNL levels less than 65 dB would also be expected to be highly annoyed by noise; however, this number cannot be predicted.

4.2.3.3.2 Speech interference

Impacts of civil aviation operations would be expected to be similar to those described in Sect. 4.2.2.3.3 of military aircraft operations. Operations between 10 p.m. and midnight could be expected to interfere with television viewing and likely would be particularly annoying to affected residents. Impacts on educational facilities and business activities would also be similar in nature to those described for the proposed military action when overflights occur. The mitigation plan proposed by WMDC would reduce the frequency of operations over areas to the south of the base to approximately one day per week. Only two

educational facilities, Granby High School and St. Hyacinths Academy, would be affected by aircraft operations on most days. Noise levels at these facilities are expected to be less than 75 dB, and no significant interference with classroom activities would be expected. Since the primary land use in the areas to the northeast of the base is residential, interference with business activities would be minimal.

4.2.3.3.3 Sleep interference

As discussed in Appendix B, the DNL level has been found to be the best noise metric for evaluating community response to noise. The increased levels of annoyance associated with nighttime noise intrusions is a principal reason for the 10-dB penalty applied to nighttime operations in the calculation of the DNL level. The effects of nighttime noise are thus included in the estimates of the number of persons highly annoyed presented in Sect. 4.2.3.3.1.

Since noise must penetrate the home to disturb sleep, interior noise levels will be lower than outside levels due to the adsorption of sound energy (attenuation) by the structure. The amount of attenuation provided by the building is dependent on the type of construction and whether windows are open or closed. For residential structures typical of those in the vicinity of Westover AFB, EPA recommends attenuation factors of 17 dB for summertime (windows open) conditions and 27 dB for wintertime (windows closed) conditions (EPA 1974).

As discussed in Sect. 4.2.2.1 and Appendix A, aircraft noise events are described in terms of the A-weighted sound exposure level (SEL), a noise level that would produce in a period of 1 sec sound energy equivalent to that of the total noise event. All SEL values referenced in this document are "A-weighted" to best correspond to the response of the human ear. As noted in Sect. 4.2.2.1, SELs are not the same as the maximum noise level (ALm) which would be measured during a specific noise event, and there is no general relationship between the SEL and ALm values. To provide an estimate of the number of persons who would be awakened by aircraft noise events, data reported by Goldstein and Lukas (1980) were used to develop a relationship between exterior noise levels (SEL) and the percent of exposed persons who would be expected to be awakened (See Appendix B). These data indicate that a single aircraft noise event producing an exterior noise level of 80 dB SEL could result in a probability of awakening of up to 20% under summertime conditions and up to 9% under wintertime conditions. As discussed in Appendix D, values for the Boeing B-747 aircraft were used as representative of the noise levels produced by large cargo aircraft in the estimates of sleep disturbance presented in the DEIS. The mitigation plan proposed by WMDC would prohibit the nighttime operation of Stage II aircraft (which do not meet the most restrictive noise emission standards) and would limit the 9-hr equivalent noise levels (Leq-9) for operations in the period through 1995 to the level predicted on the basis of projected operations by Stage III aircraft. The estimates of sleep disturbance presented in this section have been revised on the basis of the SEL values expected to result from operation of the DC-10-40 aircraft, which produces the maximum noise level of any aircraft expected to operate at Westover AFB during the nighttime hours. The mitigation plan would also restrict scheduled operations

during the period between 1 and 5 a.m. to minimize sleep disturbance during the middle of the night.

Some persons exposed to SEL values lower than 80 dB may also be awakened, and other persons may experience some disturbance (as evidenced by a change in sleep stage measured under laboratory conditions) without being awakened. However, based on the following conservative assumptions, estimates of the number of persons who would be awakened by a single noise event of 80 dB SEL and above are considered to be reasonable measures of community response. The numbers of people expected to be awakened were computed assuming that all of those potentially affected in the summer have windows open, and no allowance was made for any noise attenuation due to terrain, buildings, or other interferences to noise propagation. In addition, no allowance was made for people becoming accustomed to aircraft noise. Although laboratory studies show that there is wide variation in individual response to noise and results are sometimes contradictory, evidence indicates that this phenomenon (called "habituation") occurs, both during a single night and over repeated nights (Griefahn 1980). The data developed by Goldstein and Lukas (1978) and used to estimate the percentages of persons awakened by various SEL levels were based on studies conducted on subjects in a laboratory environment. As discussed in Appendix B, an in situ study conducted by Vallet et al (1978) using subjects living in the vicinity of the Roissy Paris Airport indicate that the percentage of subjects awakened was lower than that predicted on the basis of laboratory data.

The nighttime noise environment resulting from the potential development of air cargo and other civil aviation operations would result from repeated overflights rather than from a single operation. As indicated in Sect. 4.1.2.2 (Table 4.2), a total of 10 takeoffs and 18 landings were assumed to occur during the period from 10 p.m. to 7 a.m.

Even if people become habituated to aircraft noise and are not as easily awakened as when first exposed, repeated exposure would be expected to increase the impact. This conclusion is supported by data showing that repeated exposures during the night continue to degrade the quality of sleep (Griefahn 1980). Whether this increase in impacts is enough to negate any habituation effect cannot be determined. Additionally, the significance of changes in level of sleep (as measured by electroencephalographic changes) as an indicator of significant effects on people is largely unknown, although one researcher has reported that these changes may be related to the quality of sleep (Lukas 1975). Everyone has personal experience indicating that sleep disruption can produce irritability, fatigue, and poor work performance. However, in a 1981 review, EPA concluded that "None of the suspected effects has been fully explored or measured," and "Chronic sleep disturbance is a potentially severe health problem, yet little is known about the long-term effects of sleep disturbance on health . . . ." (EPA 1981).

Similarly, it cannot be determined how many people, in total, will be awakened by repeated overflights on a single night. Because the depth of sleep varies during the night, some people may be awakened by one flight and not by another and some individuals may be awakened by more than one flight. In addition, departures on runway 23 are assumed to follow varying flight tracks and not all of the operations will affect the entire

population exposed. Thus, the total number of people who may be awakened during the night would likely exceed the number predicted to be awakened by a single flight. No data or techniques to quantify this effect are available.

As indicated in Sect. 4.1.2.2 (Table 4.2), it was assumed for purposes of this analysis that almost all nighttime operations would occur during two 2-hr periods: the first between 10 p. m. and midnight (all landings) and the second between 5 and 7 a.m. (primarily takeoffs). Because the noise levels resulting from takeoff and landing operations are different and different areas are affected, separate estimates were prepared for the two periods. Since the population in the vicinity of the base is not evenly distributed, the number of residents exposed to aircraft noise is dependent on the runway that is in use when the operations occur; separate estimates were prepared for each operation on each runway during these 2-hr periods. The results of these analyses are discussed below.

Operations between 10 p.m. and midnight. As indicated in Sect. 4.1.2.2 (Table 4.2), a total of 14 landings are projected to occur during the period between 10 p.m. and midnight. Because the population density is highest in the areas of Chicopee and Springfield to the southwest of the base, more people would be exposed to noise by landings on runway 05 (approaches over Springfield and Chicopee) than by landings on runway 23 (approaches over Granby and Belchertown). All landing operations would follow similar flight tracks, and the same individuals would be affected by all operations.

Because of the lower population density to the northeast of the base, only about 1,500 residents would be exposed to exterior SEL levels above 80 dB when aircraft are landing on runway 23 (estimated to occur approximately 90% of the time). Of the persons exposed to exterior SEL levels >80 dB, approximately 400 would be predicted to be awakened by a single event under summertime conditions and approximately 250 under wintertime conditions.

When aircraft are operating on runway 05 (estimated to occur approximately 10% of the time or about once every two weeks) approximately 18,000 residents would be exposed to exterior SEL levels above 80 dB by landings. Of these, it is predicted that approximately 4,500 would be awakened by a single operation under summertime (windows open) conditions and approximately 2,600 would be awakened under wintertime (windows closed) conditions.

Operations between 5 and 7 a.m. As indicated in Sect. 4.1.2.2 (Table 4.2), 10 takeoffs and 4 landings are now projected to occur during the period between 5 and 7 a.m. Because the population density is highest in the area southwest of the base, the largest numbers of people would be affected by takeoffs on runway 23 and by landings on runway 05. As indicated previously, the mitigation plan proposed by WMDC would incorporate "head-to-head" operations in which aircraft would land and take off heading in opposite directions (i.e., they would land on runway 23 and take off on runway 05) to the maximum extent possible. This type of operation increases the complexity of air traffic control but is

considered feasible, particularly at night because of the low number of operations and the absence of military air traffic.

For takeoffs on runway 05, approximately 1,900 persons would be exposed to exterior SEL values greater than 80 dB by takeoff operations. Of these, approximately 500 would be predicted to be awakened under summertime conditions and approximately 300 under wintertime conditions. Because takeoffs on runway 05 are assumed to follow a straight-out departure path, the same individuals would be affected by all operations and some may be awakened more than once. Because the populations in the area affected by takeoffs on runway 05 are concentrated in the areas near the base, dispersion of the departure flight tracks (by turning) would not significantly reduce the number of persons awakened but would increase the total number exposed to aircraft noise. During the period between 5 and 7 a.m., runway 05 would be projected to be used for takeoffs 90% of the time.

For takeoffs on runway 23 (estimated to occur less than 10% of the time or about once every two weeks), a total of about 76,000 residents would be exposed to exterior SEL values greater than 80 dB by one or more takeoff operations. Of these, approximately 19,200 would be predicted to be awakened one or more times under summertime conditions and approximately 10,800 under wintertime conditions. Because takeoffs on runway 23 are assumed to be distributed between three flight tracks, the number of intrusive events at specific locations would vary from two to five in areas several miles from the base to ten per period in locations near the southwest end of the runways. Limiting the departures to a single flight track would reduce the number of persons exposed to aircraft noise but would increase the frequency of overflights and the number of times an individual may be awakened. Departures on a straight-out flight track would expose about 51,000 residents to increased noise levels, and about 13,000 and 7,500 would be predicted to be awakened under summer and winter conditions respectively. Departures that employ a left turn shortly after the aircraft passes over the end of the runway would result in similar exposures and number of persons awakened. Departures employing a right turn after takeoff would expose only about 24,000 persons to SEL levels >80 dB and about 6,500 and 3,800 persons would be predicted to be awakened under summer and winter conditions respectively. Although departures employing a right turn would minimize the number of persons awakened, these departures are less desirable from an air traffic control standpoint; it is not considered feasible to require all departures to employ a right turn departure procedure.

A total of four landings are also projected to occur during this time period. The numbers of persons affected by these operations and the percent awakened would be approximately the same as for the landing operations that occur between 10 p.m. and midnight.

As noted in Appendix K (Table K.1), hospitals in Springfield and Holyoke could be exposed to SEL levels of 65 to 85 dB by nighttime operations. As noted in Appendix B, a maximum interior noise level of 45 dB is recommended to prevent sleep disturbance in hospitals. Peak noise levels at these locations would be expected to be approximately 70 to 85 dB. Based on a typical attenuation level of approximately 25 to 30 dB for hospital facilities that have not been acoustically insulated,

interior noise levels at these facilities would likely exceed the recommended level and patients could be expected to experience some sleep disturbance. The mitigation plan proposed by WMDC would reduce the frequency of operations that could disturb the sleep of hospital patients to approximately one night every two weeks. Impacts to hospital facilities could be minimized by using departures on runway 23 which include a left turn within approximately 1 mile of the end of the runway.

4.2.3.3.4 Impacts on land

Increases in noise levels resulting from development of civil aviation operations to the levels identified in the WMDC Master Plan would impact existing land uses and could impose constraints on future development. Sleep disturbance from night operations would result in increased impacts to current residential land uses in areas surrounding the base.

Impacts on land use would be similar to those described for the proposed and alternate military actions. Approximately 550 existing residences would be affected by DNL levels >65 dB. Of these, about 425 are in Chicopee and are in areas that have already been extensively developed. Areas in Granby and Ludlow which have not been extensively developed would also be affected, and the increased noise levels could limit the desirability of these areas for residential development.

4.2.4 Cumulative Noise Impacts from Implementation of Either Military Action in Combination with WMDC Operations

As in the case of each of the individual actions, the only significant adverse cumulative impacts expected to result from implementation of the reorganization of the 439th TAW in combination with the development of civil aviation operations at Westover AFB would be related to increases in noise levels in areas surrounding the base. Although the predicted noise levels would increase levels of annoyance, no other significant effects on humans would be likely to occur. The predicted noise levels would impact existing land uses, particularly residential development, and may impose constraints on future land uses. Reductions in property value may also occur. No significant adverse impacts to domestic animals, wildlife, or structures would be expected to occur as a result of the increases in noise levels. Because military aircraft would not operate at night on a routine basis, sleep disturbance would be the same as for the development of civil aviation operations with no change in military operations.

If development of civil aviation activity occurred in combination with the proposed (16-aircraft) reorganization of the 439th TAW, the area exposed to DNL levels >65 dB would increase to approximately 11.8 sq. mi. This represents an increase of approximately 73% relative to the area exposed to similar levels by civil aviation operations with no change in military operations and an increase of approximately 28% relative to the area exposed by the proposed Air Force operations alone. Approximately 5,900 persons would be exposed to DNL levels >65 dB by combined military (16 C-5A) and civil aircraft operations. If the alternate military action were implemented, the area exposed to DNL levels >65 dB would increase to about 8.8 sq. mi. and approximately 3,400 persons could be exposed to DNL levels >65 dB by the combined operations.

4.2.4.1 Predicted noise levels

Single-event noise levels would be the same as those indicated in Appendix D, Tables D.1 and D.8, and in Appendix K, Table K.1. DNL contours resulting from the implementation of either military actions in combination with the development of civil aviation operations to the potential levels indicated in the WMDC Master Plan and in accordance with the mitigation plan proposed by WMDC are shown in Figs. 4.4 and 4.5 respectively. As indicated in Appendix K, if development of civil aviation operations occurred in combination with the proposed (16-aircraft) reorganization of the 439th TAW, the area exposed to DNL levels >65 dB would increase to approximately 11.8 sq. mi. This represents an increase of approximately 73% relative to the area exposed to equivalent levels by increase in civil aviation operations in combination with current military operation and an increase of approximately 28% relative to the area exposed by the proposed Air Force action alone.

If development of civil aviation operations occurred in combination with the alternate (8-aircraft) reorganization of the 439th TAW, the area exposed to DNL levels >65 dB would increase to approximately 8.8 sq. mi. This represents increases of 54% and 29% relative to the exposures resulting from the alternate military and civil aviation operations respectively.

During local training sorties, the daytime noise environment would be dominated by either of the military aircraft actions. Military training operations would normally occur during a 5-hr period and noise contributions of civil aviation operations during this time period would be insignificant. Since military training operations would not be scheduled for nighttime hours and other military operations would take place at night infrequently, nighttime noise levels and resulting impacts would be the same as for civil aviation operations alone.

4.2.4.2 Population exposed to cumulative aircraft noise

Because the population is not evenly distributed in the areas surrounding the base, increases in population exposure to DNL levels >65 dB would be greater on a percentage basis than the increases in area. As indicated in Appendix K, approximately 5,900 persons would be exposed to DNL levels >65 dB by proposed military (16 C-5A) and civil aircraft operations. This represents increases of 66% and 290% relative to the exposures resulting from proposed military and civil operations alone respectively. The projected population exposure for combined operations in accordance with the proposed mitigation plan represents a decrease of approximately 49% relative to the projected exposure of 11,500 persons presented in the DEIS on the basis of projected operations without mitigation.

If the alternate military action were implemented in combination with development of civil operations, approximately 3,400 persons would be exposed to DNL levels >65 dB, representing increases of 114% and 123% relative to the exposures resulting from alternate military and civil aviation operations alone respectively.

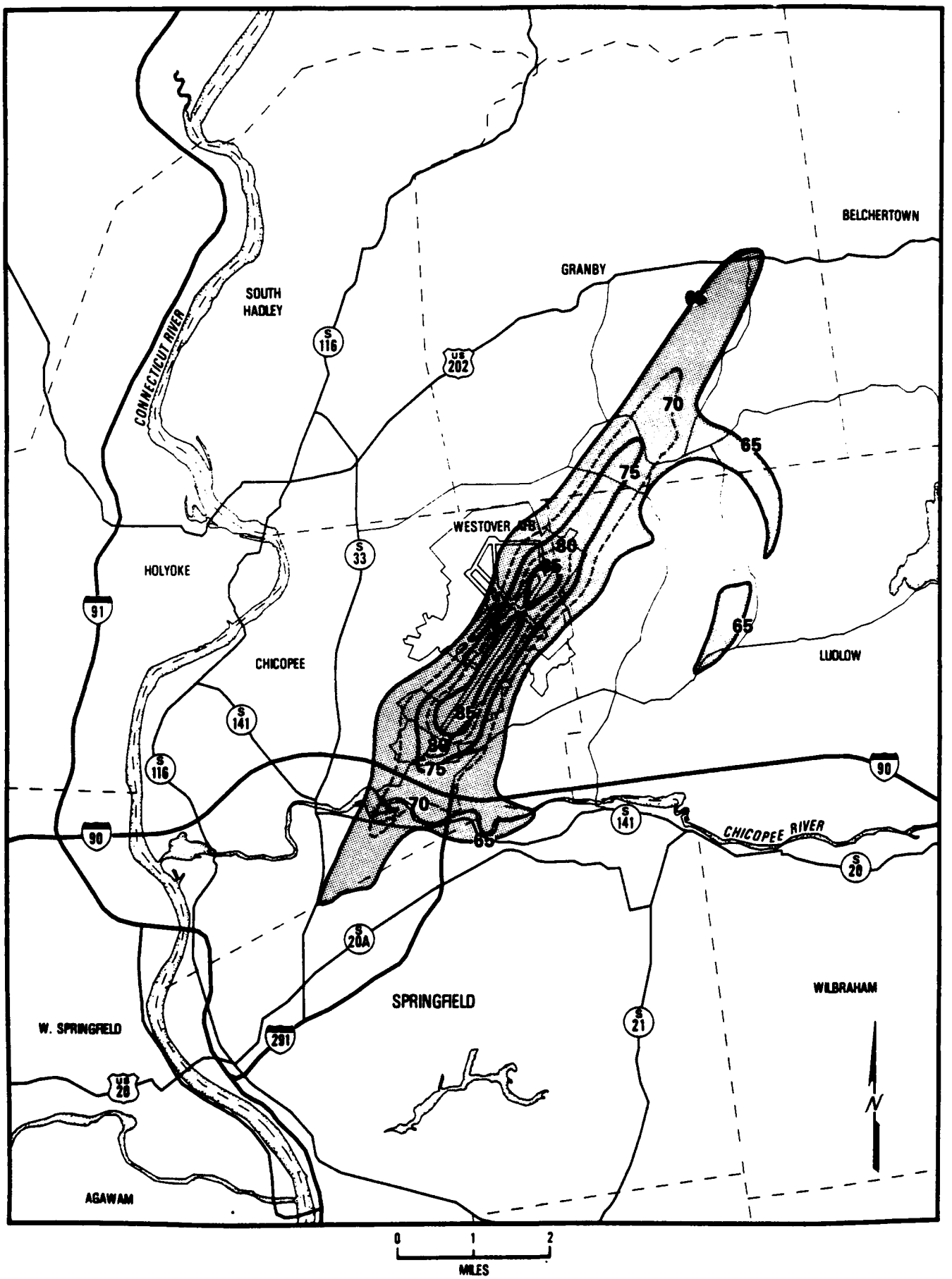

Fig. 4.4. Cumulative DNL for proposed (16 C–5A) military operations plus potential WMDC operations (with mitigation).

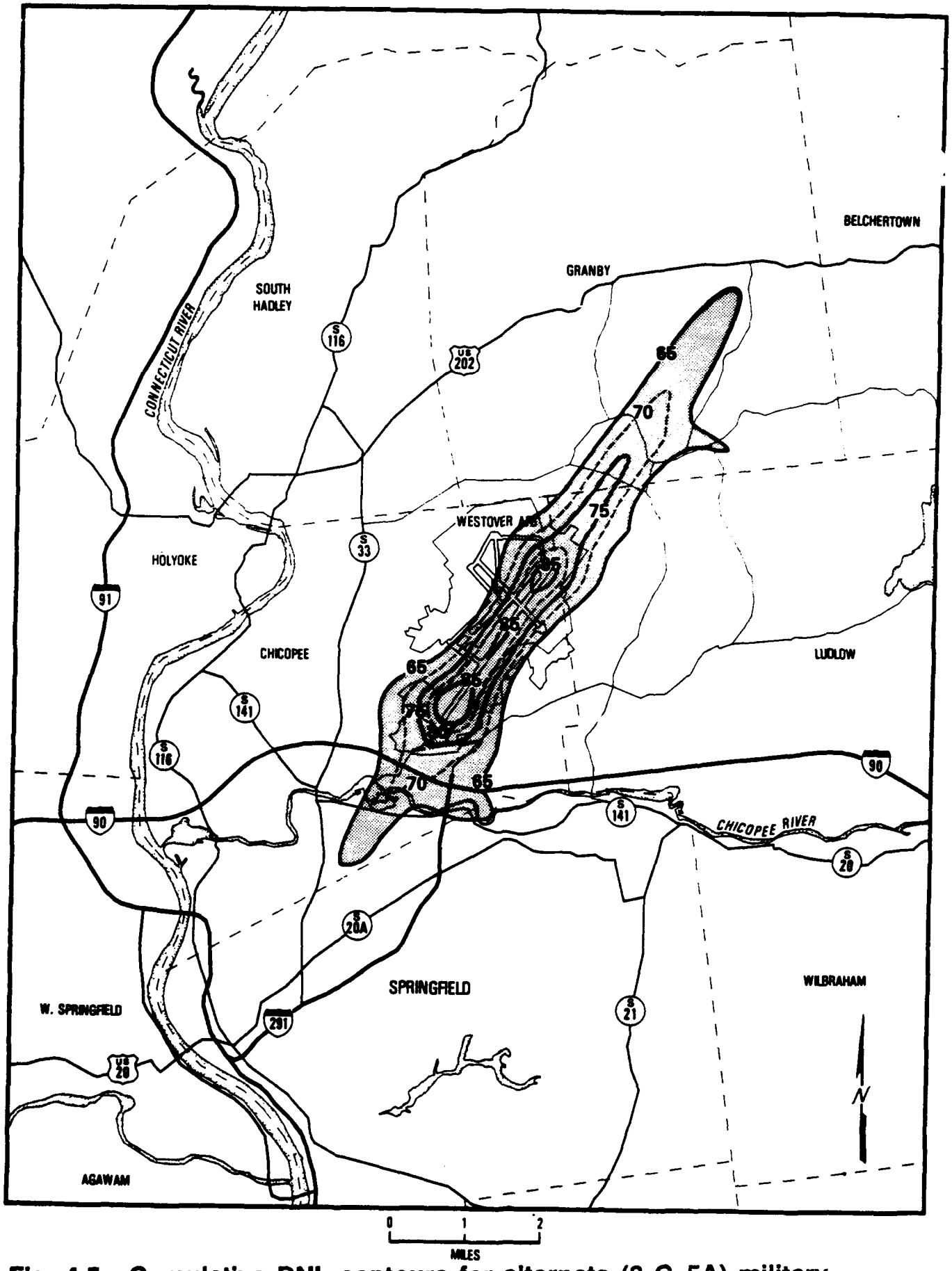

Fig. 4.5. Cumulative DNL contours for alternate (8 C-5A) military operations plus potential WMDC operations (with mitigation).

Because Air Force operations would normally be limited to daytime hours, population exposures during nighttime hours would be the same as for civil aviation operations alone.

4.2.4.3 Effects of cumulative noise exposure

Cumulative impacts are expected to be only slightly greater than the impacts resulting from development of civil operations alone. Impacts during daytime hours would be dominated by Air Force C-5A operations which would be concentrated into a 5-hr period. Since Air Force operations would essentially be confined to daytime hours, impacts at night would be the same as those resulting from civil aviation operations alone.

4.2.4.3.1 Annoyance

Of the approximately 5,900 persons exposed to DNL levels >65 dB by implementation of the proposed military action in combination with development of civil aviation operations in accordance with the proposed mitigation plan, about 1,350 would be predicted to be highly annoyed by noise. If the alternate military action were implemented in combination with the development of civil aviation operations in accordance with the mitigation plan, approximately 760 of the approximately 3,400 persons exposed to DNL levels >65 dB would be expected to be highly annoyed. As noted previously, some persons in areas with DNL levels <65 dB would also be highly annoyed by noise; however, the number of such persons cannot be predicted.

4.2.4.3.2 Speech interference

Although the effects of individual aircraft operations would be the same as for the individual actions, the increased frequency of aircraft operations would be expected to cause increases in annoyance to area residents and interference with educational and business activities due to speech interference.

4.2.4.3.3 Sleep interference

Because Air Force operations would essentially be confined to daytime hours, sleep disturbance would be the same as for civil operations alone.

4.2.4.3.4 Impacts on land use

Cumulative increases in DNL levels resulting from implementation of either proposed military action in combination with development of civil aviation operations may be expected to impact existing and future land uses, particularly residential development.

If the proposed military action were implemented in combination with the development of civil aviation operations in accordance with the mitigation plan proposed by WMDC, approximately 2,150 residences would be exposed to DNL levels >65 dB. Of these, approximately 190 would be located in areas with DNL levels of 70 to 75 dB and approximately 60 would be in areas with DNL levels >75 dB. Of the residences in areas with DNL levels >65 dB, the majority (about 1,940) are located in Chicopee and about 150 of these residences are located in areas where DNL levels would

be in the range of 70 to 75 dB. None of the residences in Chicopee would be exposed to DNL levels >75 dB. The highest DNL levels would be predicted to occur in the area of Granby to the northeast of the base. About 155 residences are located in areas where DNL levels would be >65 dB. Of these, about 35 are located in areas where DNL levels would be 70-75 dB and about 60 are in areas where levels would be >75 dB (the maximum predicted value is 77 to 78 dB). Increases in noise levels in the areas of Granby and Belchertown which are currently undeveloped could reduce the desirability of these areas for future residential development.

If the alternate military action were implemented in combination with the development of WMDC operations (with mitigation), approximately 1,250 residences would be located in areas with DNL levels >65 dB. Of these, about 90 would be in areas with levels of 70-75 dB, and about 45 would be in areas with levels of >75 dB. The majority of these residences (about 1,100) are located in Chicopee, and about 30 of these are located in areas where levels would be 70-75 dB. None of the residences in Chicopee are in areas where levels would be >75 dB. The highest DNL levels would be predicted to occur in the area of Granby to the northeast of the base. About 150 residences are located in areas where DNL levels would be >65 dB. Of these, about 50 are located in areas where levels would be 70-75 dB, and about 45 are located in areas where levels would be >75 dB (the maximum predicted level in residential areas would be about 77 dB).

4.3 SAFETY

4.3.1 Aircraft Accidents

4.3.1.1 Effects of military aircraft operations

Implementation of either proposed military action would result in a positive impact on airspace management and air traffic safety. As noted in Sect. 4.1.2.1, the proposed mission change would result in a decrease in total daily aircraft operations from the current level of about 178/day to about 86/day (a reduction of 52%). Total annual operations would also be reduced from the current level of about 36,300/yr to about 26,300/yr (a reduction of 28%). The alternate mission change would reduce daily operations to about 70/day (-60%) and annual operations to about 22,200/yr (-39%). The reduction in aircraft operations would reduce the complexity of air traffic control and the probability of an accident involving aircraft collisions.

Data provided by the Inspection and Safety Center at Norton AFB for C-5A operations during the 10-year period from 1975 through 1984 indicate that only one C-5A has been involved in an accident that resulted in a fatality or destruction of the aircraft. Based on an average of approximately 55,000 Air Force flying hours/year, this is equivalent to an occurrence rate of less than 0.2/100,000 flying hours. During the same period, a total of 16 C-130 aircraft were involved in accidents that resulted in destruction of the aircraft. Based on an average of approximately 375,000 Air Force flying hours/year, this is equivalent to an occurrence rate of approximately 0.4 occurrences/100,000 flying hours.

In addition to the lower accident rate, implementation of either military action would result in a reduction in the number of local flying hours and would further reduce the probability of an aircraft accident in the vicinity of Westover AFB.

Implementation of either military action would reduce the probability that an aircraft accident would occur. However, the potential consequences of an accident involving a C-5A are greater because of the greater size, weight, speed, and fuel capacity of the C-5A as compared to the C-130E.

4.3.1.2 Effects of WMDC aircraft operations

Increases in WMDC aircraft activity would be expected to have a small negative impact on airspace management and air traffic safety. As indicated in Sect. 4.1.2.2, daily operations would increase from the current level of about 178/day to about 270/day, an increase of 52%. Military operations would continue to be conducted primarily between the hours of 7 a.m. and 10 p.m., while about 28 of the projected 112 civil aviation operations would take place between 10 p.m. and 7 a.m. Thus, operations during the period of joint use would increase by about 36% (to 242/day). As noted in Sect. 4.1.2.2, the mitigation plan proposed by WMDC is based on the use of "head-to-head" operations for civilian aircraft to minimize overflights of densely populated areas. Because many of the military aircraft operations involve "touch-and-go" landing in which the aircraft does not come to a stop after touchdown, the use of a "head-to-head" operating mode is not feasible for local military training operations. Implementation of the mitigation plan proposed by WMDC would require careful coordination of military and civilian aircraft operations to minimize the probability of aircraft collisions. Because the prevailing wind conditions at Westover AFB favor operations on runway 23, the greatest potential conflict is between landings on runway 23 and takeoffs on runway 05. Conflicts can be minimized by requiring departing aircraft to hold on the taxiway until approaching aircraft have landed and until traffic in the airfield pattern has been vectored to a holding pattern or out of the area. Many of the military operations are scheduled for weekends when civil aviation operations would be at a minimum and for late afternoon and evening when the number of civil aviation departures is lowest and operations could be scheduled to minimize potential conflicts.

Because of the increase in the number of operations and the potential for conflict between military and civilian operations resulting from the preferential runway utilization included in the mitigation plan, the probability of a serious aircraft accident occurring in the vicinity of Westover AFB would increase slightly. The consequences of an accident involving a heavily loaded cargo aircraft would also be somewhat greater than those resulting from an accident involving a C-130 aircraft on a typical training mission. Although the risk of an aircraft accident would increase relative to current operations, the overall level of risk resulting from increases in WMDC civil aviation activity in combination with current military operations would be lower than that at many other military and civilian airports and would not be considered unacceptable.

4.3.1.3 Cumulative effects of the military action and development of WMDC operations

Cumulative impacts on airspace management and air traffic safety would result in little change relative to current operations. The increase in WMDC operations would be offset by the decrease in military operations, and the level of daily operations would remain at about 178/day for the proposed mission change and would decrease to about 162/day (-9%) for the alternate mission change. Annual operations would increase from the current level of 36,300 to about 52,500 (+45%) for the proposed mission change and to about 48,500 (+34%) for the alternate mission change. The decrease in the number of military training operations would reduce the complexity of the airspace management effort required to implement the proposed mitigation plan and the probability of an aircraft collision.

The potential consequences of an aircraft accident, should one occur, would be greater than for current operations because of the larger size, fuel capacity, and weight of the C-5A and commercial cargo aircraft. The consequences of an individual aircraft accident would be the same as for the individual actions; however, the increase in the number of operations would increase the probability of a serious accident. The risk of a serious accident would be similar to that at many other military installations and civilian airports and would not be considered unacceptable.

4.3.2 Dropped Objects

4.3.2.1 Effects of the proposed military action (16 C-5As)

Data provided by the Military Airlift Command indicate that the dropped object rate for Military Airlift Command C-5A aircraft has averaged 5.97 per 1,000 departures over the period from 1980 through 1985. The rate has shown a decreasing trend during this period; the average for the period 1983 to 1985 was 4.22 per 1,000 departures. The rates for the C-130 aircraft were 1.42 and 1.47 per 1,000 departures for the same periods respectively. The higher rates for the C-5A aircraft are attributable, at least in part, to the fact that there are more components on the larger C-5A aircraft; therefore, a higher probability exists that one of the components will become detached during any given operation.

Based on the lower number of operations and data for the 6-year period from 1980 through 1985, implementation of either military action should result in a decrease in the number of objects expected to be dropped in a given time period.

4.3.2.2 Effects of development of WMDC operations

No data on dropped object rates for civil aviation aircraft were available for analysis. Because of the small size of general aviation aircraft, dropped objects are not considered to be a significant problem.

Development of WMDC operations, and particularly air cargo operations, would be expected to result in an increase in the probability of an object being dropped in a given time period. The probability of such an occurrence would be the same as for similar operations at other airports

serving similar types of aircraft and would not be expected to present a significant risk to the public.

4.3.2.3 Cumulative effects of the proposed military action (16 C-5As) and development of WMDC operations

Implementation of the proposed military action in combination with the development of WMDC operations would result in an increase in the probability of an object being dropped in a given time period. The increase in probability resulting from the increased civil aviation operations would be at least partially offset by decreases resulting from the reduction in military operations.

4.3.3 Aircraft Accident Potential Zones and Compatible Land Uses

4.3.3.1 Aircraft accident potential zones

As noted in Sect. 3.3.3, a 3000 x 3000 ft clear zone is recommended for operation of heavy cargo aircraft (including the C-5A). Implementation of the military actions, either alone or in combination, would require expansion of the clear zone to 3000 x 3000 ft. There would be no change in the dimensions of the accident potential zones (APZs) (see Sect. 3.3.3.1).

4.3.3.2 Clear zones

As noted in Sect. 3.3.3.2, pursuant to Air Force policy of purchasing land in the clear zones, funding has been authorized for acquisition of land within a 2000 x 3000 ft clear zone at the end of each runway at Westover AFB. Although a 3000 x 3000 ft clear zone is generally used for 4-engine aircraft operations, a width of 2000 ft was approved for Westover AFB because the C-130 accident history only warranted 2000-ft clear zones. Because of the large size of the C-5A aircraft, beddown at Westover would require expansion of the clear zone to a width of 3000 ft. The bathing beach and portions of the picnic areas in Chicopee Memorial State Park would be included in this clear zone for the approach to runway 05. These facilities promote high concentrations of people within the clear zone and are incompatible with the objectives and recommendations of the Air Installation Compatible Use Zone (AICUZ) program. By the fall of 1988, the Air Force will displace the landing threshold for runway 05 by approximately 1200 ft to remove the bathing beach and picnic areas from the clear zone.

Displacement of the threshold could be accomplished through implementation of temporary operating procedures in appropriate military and FAA regulations and publications or through permanent modifications to the runway and instrument landing system. Because displacement of the landing threshold would be necessary for extended periods, the Air Force has determined that permanent displacement of the threshold would be appropriate. Upgrading of the new touchdown area from aspnaltic concrete to reinforced concrete may be required to accommodate continuous use by C-5A aircraft. Because the exact details of this project have not yet been determined, this cost has not been included in the total construction cost estimates.

It should be noted that high-intensity recreational activities are considered incompatible within APZ I and that displacement of the threshold would reduce, but would not eliminate, the conflict between the existing uses of the park and the recommendations of the AICUZ program. The AICUZ Handbook (USAF 1984) states:

> Accident Potential Zone I has compatibility with a wide variety of industrial/utilities, wholesale trade, open space, recreation and agricultural uses. However, uses that concentrate people in small areas are not acceptable.

However, the Handbook also points out that the land-use guidelines provided are only recommendations and recognizes that other factors must be considered:

> These compatibility guidelines must not be considered as definitive or inflexible standards. They are the framework within which land use compatibility questions can be addressed and resolved. . . . These basic guidelines cannot resolve all land-use-compatibility questions, but they do offer a reasonable framework from which to work.
>
> There is no question that these guidelines are relative. Ideally there should be no "people intensive uses" in either of these APZs. The free market and private property systems prevent this where there is land development demand. To go beyond these guidelines, however, increases risk substantially by placing more people in areas where there may ultimately be an aircraft accident.

In each case, a site-specific analysis should be conducted which gives full considerations to local conditions, including the time period of aircraft operations and land-use activities, topography, and other factors. These basic guidelines cannot resolve all land-use-compatibility questions, but they do offer a reasonable framework from which to work (USAF 1984). The Air Force considered the following site-specific factors in its analysis leading to the threshold displacement:

1. The C-5A aircraft has an excellent safety record. As noted in Sect. 4.3.1, during the period from 1975 through the present, only one C-5A has been involved in an accident which resulted in a fatality or destruction of the aircraft, and this accident occurred during cruise operations. Thus, the probability of an accident in the vicinity of Westover is small.

2. The beach and picnic areas are located within approximately 300 ft of the edge of the APZ. The probability of an accident is lowest at the edge of these zones.

3. On an annual basis, approximately 80% of the operations on runway 05/23 use runway 23. When using runway 23, aircraft approach from the northeast (over Granby) and depart to the southwest (over the park). As noted in Sect. 3.3.3.1, approximately 61% of the aircraft accidents included in the Air Force study occurred during the landing phase as compared to 39% for the takeoff phase. Thus, the

probability of an accident occurring in the park is lower than for the comparable area at the opposite end of the runway.

4. The majority of air cargo operations would occur at times when the beach and picnic areas were not in use.

5. As noted above, operational considerations tend to minimize approaches over the beach and picnic areas of the park. Additional procedures could be implemented to further reduce overflights during periods of highest park use. These procedures include:

   a. When wind conditions require the use of runway 05 and park use is high, approaches to runway 05, which route aircraft to the west of the extended runway centerline, could be practiced in preference to straight-in approaches. This slight shift would further reduce the probability of an accident in the clear zone area at the end of runway 05. This shift would not be practical on a permanent basis because the operational requirements could not then be met.

   b. During periods of heavy park use, circling approaches to runway 05 could be limited to those which do not overfly the beach area.

   c. To the extent feasible (as determined by maintenance of aircrew qualifications and other training requirements), training activities during summer months could be scheduled to minimize aircraft operations during periods of highest park use.

Based on these factors, the Air Force has concluded that displacement of the landing threshold for runway 05 would not result in excessive risk to the public.

Comments on the DEIS submitted by the Massachusetts Department of Environmental Management indicate that the displacement of the runway threshold and changes in operations to minimize operations on runway 05 during periods of highest park use will not result in any serious negative effect on the future operation and use of Chicopee Memorial State Park. The Air Force is planning to proceed with negotiations with the Department of Environmental Management to secure an agreement that activities within the new clear zone will continue to be low-intensity activities such as hiking and bicycle trails and that no incompatible (people-intensive) activities will be developed in this area. Displacement of the threshold for runway 05 will remove the beach and picnic areas from the clear zones, and no restrictions on current uses of these areas or other current park uses will be required.

The Air Force is also proceeding with negotiations with the City of Chicopee to secure an agreement permitting the Air Force to remove or top trees, if necessary, in that portion of the golf course which is within the clear zone for the approach to runway 33 and to ensure that incompatible uses will not be developed in this area. This action would not be affected by the decision with respect to either proposed action.

4.3.3.3 Compatibility of land uses in accident potential zones I and II

Implementation of either military action or an increase in civil aviation activities would not affect the compatibility or incompatibility of existing or future land uses within APZ I or II with respect to aircraft accident hazards. The displacement of the runway threshold would reduce the number of existing residences in Chicopee which are included within APZ II and would thus increase the compatibility of current land use in this area. Increases in noise resulting from either military action would increase the incompatibility of uses such as residential development which are sensitive to both noise and aircraft hazards. If either proposed action is implemented, the Air Force will issue a revised Air Installation Compatible Use Zone (AICUZ) Report to identify conflicting land uses resulting from increases in noise levels and to provide guidance for implementation of a comprehensive planning process to assure that the development of incompatible land uses is minimized.

4.3.4 Bird-Aircraft Strike Hazards

As noted in Sect. 3.3.4, birds, particularly gulls, are attracted to the seven nearby landfills and congregate on the runways at Westover AFB during periods of bad weather. Although bird strikes are considered unlikely to result in the crash of a C-5A aircraft, the potential exists for serious damage to jet engines as a result of bird strikes. The base has recently been directed by Headquarters AFRES to review its Bird-Aircraft Strike Hazard (BASH) program (required by AFR 127-15) to develop procedures for reducing the bird strike hazard. A preliminary evaluation was conducted in July 1986 which concluded that Westover personnel have developed and are implementing a BASH plan which can effectively reduce hazards to aircraft. The report of this evaluation provided recommendations for improving the effectiveness of the BASH program. The principal recommendation was the initiation of a program to work cooperatively with surrounding communities to assure that surrounding landfills are operated in accordance with applicable regulations requiring daily covering of wastes and that procedures are developed to minimize the active area of the landfills to further reduce their attractiveness to large birds such as gulls. The Air Force is proceeding with the implementation of the recommendations contained in this report.

4.4 AIR QUALITY

Implementation of either military action would result in reduction in emissions of all air pollutants except oxides of nitrogen; however, the reductions would be small in relation to regional emission levels, and changes in air quality would likely be undetectable. Development of civil aviation operations would result in increases in emission levels which, although large in relation to current emission levels, would be small in relation to regional emission levels and would not be expected to have a significant effect on local or regional air quality. If either military action is implemented in combination with the development of civil aviation operations, the increases resulting from WMDC operations would be partially offset by the reductions in emissions from military operations.

Neither military action would result in a change in fire training activities or in significant increases in emissions not associated with aircraft operations and vehicular traffic. Construction activities for both the military and WMDC actions would result in the potential for short-term increases in fugitive dust emissions. Dust suppression procedures (such as water spraying of areas disturbed by construction activities) to minimize fugitive dust.

4.4.1 Aircraft Operations

For purposes of estimating air quality impacts, emissions associated with both the landing-takeoff (LTO) cycle and "touch-and-go" operations were considered. The LTO cycle incorporates the ground operations of idle, taxi, landing run, and takeoff run, as well as the flight operations of takeoff, climbout to approximately 3600 ft, and touchdown. Emissions up to an altitude of 3600 ft are considered by the Environmental Protection Agency to be most likely to influence ground-level concentrations. Touch-and-go operations involve an approach to less than 300 ft AGL.

4.4.1.1 Effects of the proposed military action (16 C-5As)

Estimated emissions per LTO cycle and touch-and-go operation for the C-130 and C-5A aircraft are indicated in Table 4.5. Estimated annual pollutant emission rates and expected net changes resulting from implementation of the military action are indicated in Table 4.6. Emission estimates were based on the emission data in Table 4.5 and the operational data in Tables 2.1 and 2.5 which indicate an average of 1 LTO cycle and 6 touch-and-go operations per local sortie for C-130 operations and an average of 2 LTO cycles and 18 touch-and-go operations per local sortie for the proposed C-5A operations.

Implementation of either military action would be expected to have a negligible impact on air quality. As noted in Table 2.1, the proposed military action (16 C-5As) would result in a reduction in the number of local sorties from 30 per week to 4 per week and a decrease in local flying hours from 75 hr/week to 20 hr/week. Although the mass emission rates for all pollutants except particulate matter are greater for the C-5A than for the C-130E, the smaller number of aircraft operations for the alternate (8 C-5A) military action would result in a net reduction in emission for all pollutants except oxides of nitrogen (NOX), which would increase by approximately 39 tons/year (111%). Total emissions would be reduced by approximately 17% (from 250 to 209 tons/year). If the proposed military action (16 C-5A) is implemented, total emissions would be reduced by approximately 58% (from 250 to 104 tons/year); emissions of oxides of nitrogen would increase by approximately 6% (from 35 to 36 tons/year).

Because the emissions resulting from aircraft operation occur over a relatively large area and represent only a small percentage of the total emissions in the region, changes in pollutant concentrations at ground level and resultant impacts (both positive and negative) on air quality would likely be negligible.

The question of aircraft fuel "dumping" impacts was raised at the public scoping meeting. Dumping of fuel would be required only under

Table 4.5. Comparison of estimated air pollutant emission rates for current (C-130E) and proposed (C-5A) aircraft at Westover AFB

Aircraft	Estimated pollutant emissions per operation (lb per operation)				
	CO	HC	NOX	PM	SOX
C-130E					
LTO cycle	103.6	66.2	21.8	3.3	4.2
Touch & go	6.4	3.3	3.1	0.4	0.5
C-5A					
LTO cycle	220.5	79.4	66.2	0.1	5.5
Touch & go	14.1	4.6	28.7	0.0	1.3

Acronyms used in this table are

LTO landing-takeoff (includes ground operation of idle, taxi, landing run and takeoff run as well as flight operations of takeoff, climbout to approximately 3,600 ft, approach from an altitude of approximately 3,600 ft and touchdown)
CO carbon monoxide
HC hydrocarbons
NOX oxides of nitrogen
PM particulate matter
SOX sulfur dioxide

Source: AFESC 1985.

Table 4.6. Comparison of estimated annual pollutant emissions for current, proposed, and alternate missions at Westover AFB

	Estimated pollutant emissions (tons/year)					
	CO	HC	NOX	PM	SOX	TOTAL
Current mission: 16 PAA C-130E aircraft						
Annual emissions	127.2	77.7	34.6	4.7	6.1	250.4
Proposed mission change: 16 C-5A aircraft						
Annual emissions	97.1	34.1	73.1	0.1	4.2	208.6
Change						
(tons/year)	-30.2	-43.6	+ 38.5	-4.6	-1.9	-41.8
(%)	-24	-56	+111	-98	-31	-17
Alternate mission change: 8 PAA C-5A aircraft						
Annual emissions	48.5	17.1	36.5	0.0	2.1	104.3
Change						
(tons/year)	-78.7	-60.7	+ 1.9	-4.7	-4.0	-146.1
(%)	-62	-78	+ 6	-99	-66	-58

Acronyms used in this table are

LTO landing-takeoff (includes ground operation of idle, taxi, landing run and takeoff run as well as flight operations of takeoff, climbout to approximately 3,600 ft, approach from an altitude of approximately 3,600 ft and touchdown)
CO carbon monoxide
HC hydrocarbons
NOX oxides of nitrogen
PM particulate matter
SOX sulfur dioxide

Source: AFESC 1985.

emergency conditions and would be unlikely to occur. Three conditions might warrant fuel dumping: (1) loss of one or more engines on takeoff; (2) a landing gear failure requiring a "gear-up" landing; and (3) a situation in which a crash was considered imminent. Because the majority of aircraft performing local training sorties and departing or returning from mission sorties would not be carrying cargo, the loss of two engines on takeoff would probably be required before the pilot would consider it necessary to dump fuel before an emergency landing. The probability of such an occurrence is considered remote. In the event of a landing-gear failure requiring a gear-up landing, fuel would be dumped prior to landing. However, this condition would not interfere with flight operations and, unless there were other problems requiring an immediate landing, fuel would normally be dumped at high altitude and would vaporize before reaching the ground. Ground-level concentrations would be small and would not likely result in significant adverse impacts. If a crash were considered imminent, fuel would be dumped, both to reduce aircraft weight and to reduce the consequences of fire resulting from a crash. Although it is possible that some liquid fuel would reach the ground under these circumstances, the consequences would be small in relation to the benefit of preventing or reducing the severity of a crash.

4.4.1.2 Effects of development of WMDC operations

Estimated pollutant emission rates for nonmilitary aircraft expected to operate at Westover AFB are indicated in Table 4.7. Estimated annual pollutant emissions for current and projected operations are provided in Table 4.8. Emission estimates were based on the emissions data in Table 4.7 and operations data in Table 4.3.

As indicated in Table 4.8, development of civil aviation operations would result in increases in the emission of all pollutants. Total emissions would increase by approximately 733 tons/year. Carbon monoxide emissions would increase by about 386 tons/year; emissions of hydrocarbons and oxides of nitrogen would increase by approximately 173 and 152 tons/year respectively. Emissions of particulate matter and sulfur dioxide would increase by about 5 and 17 tons/year respectively. Although these increases are large in relation to current emission levels, the projected emissions would still be small in comparison with regional emissions and no significant impacts to local or regional air quality would be expected. Comments on the DEIS by the Western Regional Office of the Massachusetts Department of Enviromental Quality Engineering indicated concurrence with this conclusion, stating that "It is the opinion of the Department that the analysis used by the Department of the Air Force in determining . . . air pollution emissions represents modern air pollution methodology and accurately reflects individual and cumulative impacts of the proposed actions."

As noted in Sect. 3.4, the entire State of Massachusetts is classified as attainment for oxides of nitrogen and for sulfur dioxide. Portions of the City of Springfield are classified as nonattainment for particulates and carbon monoxide and the entire state is classified as nonattainment for ozone. Although operations as originally proposed (80% of takeoffs on runway 23) would not be expected to contribute significantly to the levels of particulates or carbon monoxide in the areas of Springfield classified as nonattainment, the mitigation plan

Table 4.7. Pollutant emission rates for civil aviation aircraft operation (WMDC action)

Aircraft	Estimated pollutant emissions per LTO cycle (lb)				
	CO	HC	NOX	PM	SOX
DC-9-80	37.30	8.96	19.76	0.78	2.18
B727-200	55.95	13.44	29.64	1.17	3.27
B737-300	37.30	8.96	19.76	0.78	2.18
B747-100Q	108.92	22.40	107.48	5.20	7.96
DC-10-40	116.88	47.10	49.59	0.21	4.98
DC-8-70	262.64	218.24	25.68	1.17	3.27
LR-35	11.26	3.74	3.74	0.00	0.92
TBP2	7.16	5.08	0.82	0.00	0.18

Acronyms used in this table are

LTO landing-takeoff (includes ground operation of idle, taxi, landing run and takeoff run as well as flight operations of takeoff, climbout to approximately 3,600 ft, approach from an altitude of approximately 3,600 ft and touchdown)
CO carbon monoxide
HC hydrocarbons
NOX oxides of nitrogen
PM particulate matter
SOX sulfur dioxide

Source: EPA 1985.

Table 4.8. Comparison of estimated annual pollutant emissions for current and proposed WMDC civil aviation operations

Aircraft	Operations per day	Estimated pollutant emission (tons/year) CO	HC	NOX	PM	SOX
		Current operations				
DC-8-70	2.00	75	62	7	0.3	0.9
LR-35	1.00	2	1	1	0.0	0.1
TBP2	7.00	7	5	1	0.0	0.1
Total	10.00	84	68	9	0.3	1.3
Total current emissions: 163 tons/year						
		Proposed operations				
DC-9-80	15.00	80	19	42	2	5
B727-200	1.00	8	2	4	0	0
B737-300	14.00	75	18	40	2	4
B747-100Q	1.00	16	3	15	1	1
DC-10-40	5.00	84	34	35	0	4
DC-8-70	5.00	188	156	18	1	2
LR-35	10.00	16	5	5	0	1
TBP2	5.00	5	4	1	0	0
Total	56.00	471	241	161	5.13	18
Total emissions: 896 tons/year						
Change vs current operations		386	173	152	5	17
Total change:		733 tons/year				
		449 %				

Note: Totals may not agree due to rounding. Values indicated as 0.0 are less than 0.05 tons/year.

Acronyms used in this table are

LTO landing-takeoff (includes ground operation of idle, taxi, landing run and takeoff run as well as flight operations of takeoff, climbout to approximately 3,600 ft, approach from an altitude of approximately 3,600 ft and touchdown)
CO carbon monoxide
HC hydrocarbons
NOX oxides of nitrogen
PM particulate matter
SOX sulfur dioxide

Source: ORNL staff estimate based on data in Tables 4.2, 4.3, and 4.6.

proposed by WMDC would result in 90% of all operations taking place over the relatively undeveloped areas to the northeast of the base and would further reduce contribution to ambient pollutant levels in Springfield. Although ozone is not produced directly by aircraft engines, both oxides of nitrogen and hydrocarbons contribute to the formation of atmospheric ozone through a complex series of photochemical reactions. The State of Massachusetts is being required by the U.S. Environmental Protection Agency to revise its State Implementation Plan (SIP) to demonstrate reasonable further progress toward achieving compliance with the National Ambient Air Quality Standards (NAAQS) in all areas classified as nonattainment. The SIP must provide for achieving compliance while accommodating growth in regional industrial and commercial activities, including transportation. Because the area is currently in compliance with the standard for oxides of nitrogen, it is likely that reductions in hydrocarbon emissions will be required. New emission sources must meet more restrictive standards than existing sources; however, additional restrictions on existing sources of hydrocarbon emissions probably will be required if compliance with the ozone standard is to be attained. Mobile sources (such as aircraft and motor vehicles) are subject to emission standards established by the EPA on a nationwide basis, and further reductions in emission levels are generally not feasible for existing equipment. Therefore, the reductions will have to be achieved by reducing emissions from stationary sources such as petroleum storage and handling facilities (including service stations) and industries that use large quantities of hydrocarbon materials. Because the increases in hydrocarbon emissions projected to result from increases in aircraft operations are small in relation to regional emissions, it is unlikely that an increase in aircraft operations would affect the level of reduction in regional emissions required to comply with the standard for ozone.

The emission estimates presented in Table 4.7 were developed for the Environmental Protection Agency (EPA 1985) and are based on operations typical of major metropolitan airports. The emission estimates for a typical landing-takeoff cycle include both air and ground operations and consider the rate of emissions during each phase of the cycle and the time spent in each phase (i.e., taxiing, takeoff roll, climbout, etc.). Actual pollutant emissions resulting from increased civil aviation operations at Westover AFB would be expected to be lower than those projected on the basis of these emission factors because of the reduction in the time spent in ground operations as a result of the lack of congestion at Westover AFB. The emission factors are based on an average time spent taxiing of 18 minutes, which is typical of most major airports. Because of the low traffic levels at Westover, taxiing time would be less than 10 minutes under almost all conditions. The mitigation plan proposed by WMDC would further reduce time in ground operations because aircraft would normally begin takeoffs and complete landings at the end of the runway closest to the WMDC facilities.

4.4.1.3 Cumulative effects of either military action and the development of WMDC operations

Table 4.9 summarizes the changes in pollutant emission rates expected to result from either military action in combination with development of WMDC operations. With the exception of oxides of nitrogen, increases in pollutant emissions from civil aviation operations would be offset by

Table 4.9. Changes in pollutant emissions resulting from WMDC action in combination with proposed and alternate military actions

	Changes in annual air pollutant emissions (tons/year)					
	CO	HC	NOX	PM	SOX	TOTAL
Current emissions						
Military operations	127.2	77.7	34.6	4.7	6.1	250.3
WMDC operations	84.0	68.0	9.0	0.4	1.0	162.4
Total	211.2	145.7	43.6	5.1	7.1	412.7
Changes resulting from proposed actions						
WMDC operations only	+386	+173	+152	+5	+17	+733
Military only						
Proposed	-30	-44	+39	-5	-2	-42
Alternate	-79	-61	+2	-5	-4	-146
Cumulative effects of WMDC operations in combination with military actions						
Proposed military	+356	+129	+191	0	+15	+691
Alternate military	+307	+112	+154	0	+13	+587

Acronyms used in this table are

LTO landing-takeoff (includes ground operation of idle, taxi, landing run and takeoff run as well as flight operations of takeoff, climbout to approximately 3,600 ft, approach from an altitude of approximately 3,600 ft and touchdown)
CO carbon monoxide
HC hydrocarbons
NOX oxides of nitrogen
PM particulate matter
SOX sulfur dioxide

Source: ORNL staff estimate based on data in Tables 4.2, 4.3, and 4.6.

reductions in emissions from military operations and would result in a small positive cumulative effect. The increase of up to approximately 39 tons/year in emissions of oxides of nitrogen would represent less than a 12% increase relative to emissions from WMDC operations and would not be expected to be significant.

4.4.2 Construction

Adverse air quality impacts resulting from construction activity required for either the military or the WMDC action would probably be insignificant. Short-term increases in ground-level pollutant emissions could be expected to occur during the construction or modification of support facilities required to implement the military action. These increases would occur as the result of operation of construction equipment, application of paint and protective coatings, use of solvents, and fugitive dust emissions from areas disturbed by construction. Impacts resulting from these increases would likely be short-term and restricted to the base area and are, therefore, considered to be minor. Increases in emissions associated with construction activity could be minimized through the use of construction equipment that complies with applicable emission standards and the application of good construction practices, including an appropriate fugitive dust control program. Both the Air Force and WMDC will include a fugitive dust control program in all construction activities.

4.4.3 Traffic

Increases in both full-time and part-time (reserve) employment associated with either military action would result in an increase in the amount of vehicular traffic entering the base and an accompanying increase in the emission of air pollutants. Implementation of the proposed military action (16 C-5As) would result in an increase of less than 500 in the number of full-time employees traveling to the installation daily (from approximately 1,000 to approximately 1,500/day). The number of reserve positions authorized would increase by approximately 1200 (from 1825 to 2998); however, because there are normally two unit training assemblies per month, the number of reservists at each assembly would increase by approximately 600/day. Development of WMDC activity would result in creation of approximately 570 additional jobs to support these operations. These operations would normally require a three-shift operation and would be expected to result in an increase of less than 250 vehicles entering the base during normal operating hours. Should traffic congestion occur, shift schedules could be adjusted to minimize conflict between military and WMDC operations.

Motor vehicles are a principal source of carbon monoxide emissions and short-term (1-hr) pollutant concentrations are of particular concern with respect to changes in traffic flows. To provide an evaluation of the potential for adverse air quality impacts resulting from increases in traffic, the Federal Highway Administration Caline 3 procedure (DOT 1981) was used to estimate the 1-hr average carbon monoxide (CO) concentrations resulting from traffic rates of 1,000 to 1,500 vehicles/hour. These traffic conditions would occur only if all employees (or reservists) arrived or departed during a 1-hr period and the majority used the same gate. Because three gates are available for employee access, it is highly

unlikely that more than approximately 60% would use a single gate. Under average stability conditions and with the wind parallel to the roadway, CO concentrations at a point 15 meters (approximately 50 ft) from the roadway centerline would increase from approximately 3.5 to 5.25 ppm. The National Ambient Air Quality Standards (NAAQS) for CO specify a 1-hr average concentration limit of 35 ppm (not to be exceeded more than once per year) and an 8-hr average concentration of 10 ppm (also not to be exceeded more than once per year). Based on a comparison of the predicted values with the NAAQS, it is considered unlikely that increases in traffic volume resulting from either mission change or development of civil aviation operations, alone or in combination, would significantly affect air quality.

4.5 MANAGEMENT OF HAZARDOUS MATERIALS, WASTE, AND WASTEWATER

No significant solid or chemical waste impacts (either positive or negative) are expected to result from implementation of either the military or the WMDC actions.

4.5.1 Fuel Spills

Handling of large quantities of aircraft fuel presents the potential for spills or leaks which may enter the storm drainage system and eventually reach surface waters, resulting in damage or destruction of aquatic organisms and reduction in water quality.

4.5.1.1 Effects of proposed military action (16 C-5As)

Although the C-5A has a higher fuel consumption rate than the C-130E (approximately 3500 gal/hr, as opposed to 650 gal/hr for the C-130E), this rate would be offset by the reduction in the number of local flying hours and by the fact that approximately one-half of the fuel for mission sorties would be obtained at the destination or at intermediate locations. If the proposed military action (16 C-5A) is implemented, it is predicted that fuel consumption would increase to approximately 10 million gal/year, or about twice the current consumption rate of approximately 5.1 million gal/year. Implementation of the alternate (8 C-5A) military action would not be expected to result in a significant increase in annual fuel consumption.

The reduction in the number of sorties would reduce the number of fueling operations and the associated potential for accidental spills. If the proposed mission change were implemented, the hydrant fueling system would be expanded and upgraded to serve the entire ramp area, and aircraft would normally be fueled through this system. This would essentially eliminate the use of tank trucks for aircraft fueling and further reduce the potential for fuel spills. A major potential cause of spills during transfer operations is overfilling of tanks. Although the C-5A has a fuel capacity of 51,150 gallons, the normal loading for a local training sortie would be about 17,000 gallons. The C-5A has a total of 12 fuel tanks, the largest of which has a capacity of 4,861 gallons. The individual tanks are normally isolated from each other to prevent interflow except during fueling operations or flight operations; however, a pressure override is incorporated in the system to permit overflow into another tank if one

tank is overfilled. The total capacity of the C-5A fuel system is greater than the 50,000-gallon capacity of the individual storage tanks in the hydrant fueling system. Thus, it is unlikely that a fuel spill would result from overfilling of the aircraft fuel tanks. Fueling procedures for the C-5A require the presence on board the aircraft of an engineer qualified in fueling operations and the presence of an observer on the ground during the entire time the fueling operation is in progress. Aircraft are normally refueled following flight operations and are parked on the ramp with a normal fuel load. Special containers are placed under the aircraft to contain any seepage of fuel while the aircraft is parked. The maximum quantity of fuel likely to be released from a parked aircraft is 4,861 gallons, the capacity of the largest tank.

As noted in Sect. 3.5.1, the base maintains both a Spill Contingency Control and Countermeasures Plan, designed to prevent accidental releases of fuel or hazardous materials, and a Spill Contingency Plan which specifies actions to be taken in the event of a spill to contain the spilled materials, ensure prompt cleanup, and minimize environmental consequences. If either proposed mission change is implemented, these plans will be reviewed and revised as required to incorporate changes resulting from the construction of new facilities, changes in operations, and changes in the storage and handling of fuel and other hazardous materials.

Oil-water separators have been constructed in the storm drainage system serving the major portion of the base (Sect. 3.5.1). Although the quantity of fuel spilled from the proposed C-5A operations could be greater than the quantity spilled in current operations, the separators should contain the bulk of the spill. Therefore, the quantity of fuel reaching Cooley Brook should be approximately the same as for spills resulting from current operations. As also noted in Sect. 3.5.1, the discharges from the oil-water separators serving the areas in which Air Force operations are conducted are permitted by the State and are monitored on a regular basis. The results of the monitoring program are submitted to the State on a quarterly basis and indicate that discharges from the separators are in compliance with the limitation on oil and grease of 15 mg/L. Implementation of either military action would not be likely to result in changes in the probability of adverse impacts to water quality or aquatic life in either Cooley Brook or the lake in Chicopee Memorial State Park as a result of fuel spills.

4.5.1.2 Effects of WMDC operations

Development of WMDC aircraft operations would result in increases in fuel consumption and the number of fueling operations and would thus increase the probability of a fuel spill. The quantities of fuel transferred in each operation would be similar to those for the current cargo operations, and the maximum quantity of fuel likely to be spilled would not be significantly increased. The drainage system serving the areas utilized by WMDC is also provided with an oil/water separator similar to those in the Air Force system, and the probability of large quantities of fuel reaching Cooley Brook would not be significantly increased.

4.5.1.3 Cumulative impacts of the proposed military action (16 C-5As) in combination with development of WMDC operations

Implementation of both proposed actions in combination would result in a small increase in the probability of a fuel spill occurring, but would not result in an increase in the probable consequences relative to the individual actions.

4.5.2 Hazardous Wastes

Increases in aircraft and support equipment maintenance activities associated with either the military or WMDC action would result in increased generation of waste oil, solvents, hydraulic fluids, and other chemical wastes. The total quantities of waste generated would continue to be small and could be accommodated by available treatment and disposal facilities or by the construction of additional facilities using available technology. No significant adverse impacts would be expected to result from the military or WMDC action, either alone or in combination.

4.5.2.1 Effects of proposed military action (16 C-5As)

Estimates of the amounts and types of various wastes generated by aircraft maintenance and related activities were based on information from Dover AFB, which currently has 36 assigned C-5A aircraft. Quantities of chemicals which would be used at Westover cannot be directly derived from these data because there would be significant differences in the activities conducted. For example, Westover would not perform jet engine intermediate maintenance. Engines requiring that level of service would be removed and shipped elsewhere. The types of waste would be similar to those associated with current activities (Table 3.6); however, the total quantity would be approximately 3,000 gal/month. The largest increase would be in the generation of waste hydraulic fluid, waste oils, and waste jet fuel (JP-4).

As noted in Sect. 3.5.2, the base has recently implemented a Comprehensive Hazardous Waste Management Plan. It is anticipated that these wastes would continue to be disposed of in accordance with the Management Plan through contracts with private contractors appropriately licensed to transport, treat, and dispose of hazardous chemical wastes. These contracts are negotiated by the Defense Reutilization and Marketing Office (DRMO), a tenant at Westover. The DRMO is also responsible for disposal of wastes generated by other Department of Defense activities in the Westover area and is seeking a permit as a Transportation, Storage, and Disposal Facility in conjunction with this function. This action is unrelated to the proposed military actions. If either mission change is implemented, the base could continue to function as a generator only, even if the DRMO activity is not permitted as a TSD facility. Therefore, no adverse impacts would be expected to result from the increases in generation of hazardous wastes resulting from either mission change.

4.5.2.2 Effects of WMDC operations

Increases in WMDC operations would result in increases in the generation of hazardous wastes associated with those operations. Although quantities cannot be accurately estimated now, the types and volumes would

be expected to be similar to those resulting from the proposed military action (16 C-5As), and no significant adverse impacts would be expected to result. Aircraft operators would be responsible for arranging for disposal of hazardous wastes in accordance with applicable regulations. No wastes generated by civil aviation operations would be stored on Westover AFB or disposed of through the Defense Reutilization and Marketing Office at Westover AFB.

4.5.2.3 Cumulative effects of the proposed military action (16 C-5As) in combination with development of WMDC operations

The total quantity of hazardous wastes generated by proposed military operations and by the development of WMDC aviation operations would be expected to be less than 5,000 gal/month, and no significant cumulative adverse impacts would be likely to result.

4.5.3 Sanitary and Industrial Wastewater and Storm Drainage

No significant impacts would be expected to result from the implementation of the military or the WMDC action either separately or in combination. Increases in personnel levels and industrial operations (i.e., maintenance, aircraft washing, and corrosion control activities) associated with either the military or WMDC actions would be expected to result in moderate increases in the consumption of potable water and the generation of sanitary and industrial wastewater.

4.5.3.1 Effects of proposed military action (16 C-5As)

The largest increase in industrial wastewater would result from aircraft washing and corrosion control operations, including a limited amount of paint stripping. Implementation of either military action would result in the replacement of the existing corrosion control facility with a new facility to be constructed in an existing hangar. Construction would be programmed to begin in October 1987, with completion in December 1988. Until the new facility is completed, aircraft would not be washed at Westover AFB. The new facility would be equipped with systems to contain and/or treat the wastes generated by aircraft washing, paint stripping, and deicing operations.

Aircraft washing operations at Dover AFB require an average of about 15,000 gal/day of water to wash four or five aircraft, or about 3,000-4,000 gal/aircraft. About 28 gal of an alkaline soap are used to wash each aircraft. At Dover, each aircraft is washed approximately every 75 days. Based on this frequency, one plane would be expected to be washed at Westover AFB approximately every 5 days if the proposed (16-aircraft) military action is implemented and every 10 days if the alternate (8-aircraft) military action is implemented.

As noted in Sect. 3.5.4, the City of Chicopee has recently advised the base that discharges to the municipal sewer system from industrial activities at Westover AFB will be permitted on an individual facility basis and has identified the information required for permit applications. The base is proceeding with collection of the information necessary for preparation of the permit applications and will secure permits for all of its discharges to the municipal system. If either mission change is

implemented, the base will submit applications for permits for all new discharges and for modification of permits for existing facilities if the discharges change in volume or concentrations of permitted constituents or if new materials will be discharged. Based on the information contained in the permit applications, the City of Chicopee will establish limitations and monitoring requirements for each discharge which will ensure that operation of the municipal treatment system is not adversely affected by discharges from Westover AFB.

4.5.3.2 Effects of development of WMDC operations

Development of WMDC aviation operations would also result in increases in the generation of industrial and sanitary wastewater. Increases would be expected to be similar to those resulting from the proposed military action (16 C-5As), and no significant adverse impacts would be expected to result.

It is anticipated that wastewater resulting from aircraft maintenance operations would be discharged to the sanitary sewer system for treatment at the municipal sewage treatment plant. These discharges would be permitted by the City of Chicopee in accordance with its procedures for permitting other industrial discharges and would include discharge limitations and monitoring requirements to ensure that the operation of the municipal treatment system is not adversely affected. Depending on the type of maintenance activities conducted at the WMDC facilities, construction of pretreatment facilities may be required. Appropriate pretreatment control technology is available and could be provided in conjunction with the development of other required support facilities. Depending on the nature of the operations and the pretreatment requirements, WMDC may construct and operate a treatment facility for its tenants or may require each tenant to be responsible for the pretreatment of its own wastes, as has been the practice with other industries in the industrial park developed by WMDC.

4.5.3.3 Cumulative effects of the proposed military action (16 C-5As) in combination with development of WMDC operations

No significant cumulative impacts would be expected to result from the increase in wastewater generation rates resulting from implementation of the proposed military action in combination with the development of WMDC aviation operations.

4.5.4 Solid Wastes

The increase in employment and maintenance operations resulting from either the military or WMDC actions would result in an increase in the generation of nonchemical solid wastes (refuse). Area sanitary landfills have adequate capacity to accommodate the increase in solid wastes, and impacts are likely be negligible.

4.6 TERRESTRIAL, AQUATIC, AND WETLAND RESOURCES

Implementation of either the military or the WMDC action would be expected to have only minor potential for impacts on terrestrial plants or animals because (1) the actions would constitute only a minor level of increased disturbance; and (2) with the exception of upland sandpipers and grasshopper sparrows that nest on the base and bald eagles and common loons at Quabbin Reservoir (see Sect. 3.6), there are no particularly important species or environmental resources on or near the base which might be affected. Neither of the proposed actions would result in overflights of the Quabbin Reservoir area at altitudes below 3,000 ft.

Disturbance of the grassland areas used for nesting by the upland sandpiper and the grasshopper sparrow could result in significant adverse impacts; however, the planned construction would take place in areas that are already developed and should not disturb nesting areas.

None of the actions would result in construction outside of the original boundaries of the base. Thus, none of the wetlands, swamps, and other relatively good wildlife habitats near the base (see Sect. 3.6) would be expected to be adversely impacted. Neither military action would affect floodplains or wetlands; thus, determinations under Executive Orders 11988 or 11990 are not required.

Construction of additional facilities to implement any of the actions would result in only minor increases in the rate and total volume of stormwater runoff. Because the increase in the total developed area would be small in relation to the area already developed, impacts resulting from increased runoff would likely be insignificant. Disturbance of currently vegetated areas during the construction period would create the potential for increased erosion and accompanying increases in sediment loading in stormwater runoff. Because the developed area of the base is relatively level, the potential for increased erosion is small and could be further reduced through the implementation of readily available erosion/sediment control techniques. Resulting impacts would likely be minor.

No significant cumulative impacts would be expected to result from implementation of either of the military actions in combination with the development of civil aviation operations (WMDC action).

4.7 SOCIOECONOMIC IMPACTS

As discussed in Sect 3.7, the region of influence (ROI) for analysis was defined as the two-county area of Hampden and Hampshire counties because these are the residential communities for the large majority of the air reserve technicians (ARTs) and civilian employees of Westover AFB as well as a significant minority of the reservists assigned to Westover AFB units. The majority of the socioeconomic impacts resulting from either the military or the WMDC action would be expected to occur within this ROI.

Three principal economic impacts could result from implementation of either the military or WMDC action. The most significant is the positive impact on direct and indirect income in the ROI which would result from

the increase in permanent, full-time employment. A positive impact would also result from temporary increases in direct and indirect employment associated with the construction. Changes in land use and possible decreases in property values which could result from increases in aircraft noise were discussed in Sect. 4.2.

4.7.1 Demographics

As noted in Sect 3.7.2, the estimated 1985 population of the ROI was 603,218 persons. Although implementation of either the military or the WMDC action would be expected to cause a small net increase in the population of the ROI, demographic impacts should be small in this densely populated area. As discussed in Sect. 4.2, increases in noise levels could affect population distribution in areas near the base which would be exposed to noise levels in excess of 65 dB (DNL).

4.7.1.1 Effects of either military action

If the proposed military action (16 C-5As) were implemented, the residential distribution of ARTs and non-ART reservists would likely be about the same as the current residential distributions for these categories. The majority of the new civilian positions would likely be filled by persons already living in Hampden and Hampshire counties. The largest projected increases in population would be expected to result from the in-migration of persons from outside the ROI to fill a portion of the new positions that would be created. In the past, over one-half of the ART positions have been filled by individuals who were hired elsewhere and moved into the communities surrounding the base. Because of the relatively large number of ART positions (319) that would be created and the relative scarcity of personnel with the requisite skills, it is anticipated that approximately 75% (240 individuals) of the new ARTs would relocate to the Westover area from outside the ROI.

Because the additional income from unit training assembly (non-ART) reserve positions would generally be insufficient to justify the expense of moving, few, if any, reservists would be expected to relocate from outside the ROI to secure one of the new positions. It is possible that a few reservists would relocate within the ROI for convenience; however, the impacts of such relocations would likely be insignificant in relation to the normal shifts in population within the region.

Because of the availability of housing and services in close proximity to Westover AFB, it is likely that all of the new ART personnel would move into the ROI. Even if all 332 of the new positions were filled by persons moving into the region and assuming that the average household size of 2.88 individuals for the current ART work force would hold for the new households, a maximum of approximately 1,000 people could be expected to move into the ROI as a result of the proposed mission change. This represents a change of approximately 0.17% relative to the estimated 1985 population of 603,218 in the ROI and would be expected to have negligible impact on regional demographics.

If the alternate military action (8 C-5A) were implemented, a smaller number of new positions (129) would be created and a smaller number of persons would be expected to move into the region. Assuming that all new

full-time positions were filled by persons from outside the region, implementation of the alternate mission change would result in a maximum of approximately 375 persons moving into the area. This represents a change of approximately 0.06% relative to the current population and would also be expected to have negligible impact on regional demographics.

As described in Sect 2.1.4, implementation of either military activity would require construction or modification of several facilities. In view of the large population in the area, it is probable that personnel with the requisite construction skills would be available within commuting distance of the base. Based on the projected availability of skilled labor and the relatively short-term nature of the construction activities, few, if any, personnel would be expected to move into or relocate within the ROI to obtain construction employment.

4.7.1.2 Effects of development of WMDC operations

Although development of civil aviation (WMDC) operations could result in the development of up to 680 new jobs in the region, as noted in Sect 2.1.2, the majority of these positions would be classified as "semi-skilled" and could be filled by persons already in the local labor force. Few, if any, additional personnel would be expected to move into the area as a result of the creation of these additional jobs. Therefore, development of civil aviation operations would be expected to have a negligible effect on demographics in the densely populated area surrounding Westover AFB.

4.7.1.3 Cumulative effects of either military action in combination with development of WMDC operations

Because the number of persons expected to move into the region as a result of the development of civil aviation operations would be small in relation to the number expected to move into the area as a result of either military action, the cumulative effects would be only slightly greater than those expected to result from the proposed military action (16 C-5As) alone and would not be significant.

4.7.2 Land Use

Potential land-use impacts resulting from increased noise levels are discussed in Sect. 4.2, and potential impacts resulting from implementation of the AICUZ program are discussed in Sect. 4.3.

Although some additional facilities would have to be constructed to support any of the actions, these facilities would be constructed within the developed area of the original base. Neither military action would result in the expansion of the current installation boundaries or significant changes in land use within the installation. Facilities to support WMDC operations would be constructed on land owned by WMDC which was originally developed as part of the base, and no additional land would be required.

The in-migration of a maximum of approximately 1,350 persons as a result of the proposed military activity (16 aircraft) would represent

such a small increase in the population of the ROI that no significant changes in land use would likely be necessary to accommodate them.

With the exception of the changes in land use which might result from increases in noise levels (Sect. 4.2), implementation of either of the military actions or the WMDC action, either alone or in combination, would not be expected to result in significant changes in land use in the area surrounding Westover AFB.

4.7.3 Employment

Implementation of either the military or WMDC actions would be expected to have a positive impact on both direct and indirect employment in the ROI. The increases in direct employment would result in increases in permanent indirect employment in the region. Construction activities would also result in short-term increases in both direct and indirect employment.

4.7.3.1 Effects of either military action

Implementation of the proposed military action (16 aircraft) alone would result in a net increase in the number of personnel assigned to the base. As indicated in Table 2.2, it is estimated that the net increase in employment would involve approximately 13 civilian employees, 319 ARTs with joint civilian and reserve appointments, and 681 non-ART reservists. Implementation of the alternate military action (8 aircraft) alone would involve an increase of 5 civilians, 124 ARTs, and 469 non-ART reserve positions. Although either military action would actually involve the creation of a larger number of new positions and the elimination of some of the current positions, it is anticipated that the majority of the current personnel whose positions would be eliminated could be retrained to fill positions authorized for the new mission.

The additional civilian positions would be clerical and administrative ones filled under normal civil service procedures and would have no requirement for military affiliation. Air Reserve Technician positions are also full-time civil service jobs in various technical and management areas related to aircraft operations and maintenance and to airfield operations. As a condition of their civilian employment, however, ARTs are required to be members of the Air Force Reserve and are assigned to units at Westover AFB. ARTs are not active duty military personnel. Because many of the part-time reservists already have the skills required to fill the new ART positions, it is anticipated that many of these positions would be filled by reservists who are residents of the local area. The civilian jobs held by these reservists would then be available to be filled by other persons living in the area.

Persons not currently members of the reserves who meet basic eligibility requirements may apply for reserve membership and, if selected, be trained at government expense in an occupational specialty while on active duty with full pay and allowances. Upon completion of their training, they would be employed full-time as civilian ARTs and would continue their reserve training with a Westover unit. The non-ART, part-time reserve positions would, likewise, be primarily recruited from the local population, and persons selected for these positions would also

receive training at government expense while on active military duty with full pay and allowances. Upon completion of training, they would be discharged from active duty but would have an obligation to remain members of the Active Reserve for a period determined by the type of training provided. There would, however, be no obligation to remain a member of a Westover unit.

Implementation of the proposed (16 C-5As) military action would be expected to result in an increase in base payroll of approximately $13.4 million. If the alternative military action were implemented, the increase in payroll would amount to approximately $6.0 million/year.

The increases in direct income would also generate increases in secondary employment. Following the multiplier procedure used in Sect. 3.7.3, implementation of the proposed military action would be expected to result in the creation of approximately 225 to 250 additional indirect jobs in activities such as wholesale and retail sales, manufacturing, and services. If the alternative military action were implemented, approximately 100 to 125 additional indirect jobs would be created.

Construction and modification projects with a total estimated cost of approximately $46.9 million for material and labor would be required to implement the proposed (16 C-5As) military action (Sect. 2.1.4 and Table 2.3). After adjustment for approximately $2.5 million in currently planned projects which would not be required, implementation of either military action would result in additional expenditures of approximately $44.4 million for materials and labor. Because many of the projects involve renovation or modification rather than new construction, and consequently are labor intensive, it was assumed that one-half of the total expenditures would be for labor services. For this analysis, it is assumed that all projects would be completed within the calendar year for which funds were appropriated. For the 3-year period, this level of construction activity would require a total of about 800 person-years of construction workers' effort. Using the construction sector multiplier for the Hartford Connecticut Bureau of Economic Analysis area as an approximation to the ROI, it is estimated that the total construction expenditure would support additional indirect employment totaling approximately 700-800 person-years over the duration of the construction period. Construction projects would be conducted by civilian contractors selected through competitive procurement. Although the Air Force has no control of contractor hiring policies beyond requirements for compliance with applicable equal employment opportunity standards, it is likely that the successful bidder would use local labor for the majority of the construction work and in accordance with local labor practices.

Implementation of the alternate (8 C-5As) military action would result in construction expenditures for materials and labor of approximately $40.9 million and would support direct and indirect employment totaling approximately 670 and 550 to 600 person-years respectively.

It is unlikely that the total increase in the base personnel would occur in one year. Moreover, construction activity would take place in three fiscal years, peaking in the second. Consequently, the timing of the direct and indirect activity, as well as the level of activity, should

be evaluated. Total employment impact would likely increase during the period 1986 through 1988, decline slightly in 1989 as construction activity is completed, and increase in 1990 as the final increment of full-time employees is added to the base payroll. By 1991, the full complement of base personnel would be employed and the impact would stabilize. A projection of employment growth for the ROI prepared for the Western Massachusetts Economic Development Conference without consideration of an increase in employment or construction activity at Westover AFB indicates a relatively moderate employment growth rate of 1.44%/year during the study period (see Sect. 3.7.3). This growth rate translates into approximately 3600 new jobs every year for the ROI, totaling 18,400 new jobs by 1991.

In summary, the proposed military action at Westover would result in the creation of approximately 332 direct and 225 to 250 indirect new permanent full-time jobs in the ROI by 1990. Implementation of the alternate military action would result in the creation of approximately 129 direct and 100 to 125 indirect full-time jobs in the ROI. These changes represent increases of approximately 3.0% and 1.2% respectively, relative to the 18,400 new job opportunities projected to become available in the absence of any mission change. This would be a small but positive effect for the region. With a smooth expansion of the permanent labor and construction labor forces at the base, this growth would not be expected to adversely impact other development efforts in the ROI.

4.7.3.2 Effects of the development of WMDC operations

As indicated in Sect. 2.1.2, development of civil aviation operations at Westover AFB to the levels indicated in the WMDC Master Plan could result in the creation of approximately 680 additional jobs by the year 1995. The majority of these additional jobs would be classified as "semi-skilled" and could be filled by persons in the local labor force. The projected increase in direct employment would result in an increase in direct employment income in the region of approximately $9.2 million (1985 dollars). Based on the multiplier approach used in the preceding section, this increase in direct employment income would be expected to result in the creation of approximately 150 to 180 additional permanent indirect jobs in the region.

WMDC has estimated that expenditures totaling approximately $32 million would be required for equipment and construction of support facilities for support of expanded civil aviation operations. Although requirements for additional facilities have not been defined, this level of expenditure would be expected to require approximately 600 to 650 person years of direct construction employment and to support approximately 400 to 600 person years of indirect employment during the construction period.

4.7.3.3 Cumulative impacts of either military action in combination with development of WMDC operations

Implementation of the proposed military action (16 C-5As) in combination with the development of civil aviation (WMDC) operations would have a significant positive impact on regional employment. Increases in

full-time direct employment totaling more than 1,000 jobs would result in increases in income totaling approximately $22.6 million/year would support approximately 375 to 430 additional permanent indirect jobs in the area. In addition, construction activities would provide approximately 1,400 person years of direct employment and 1,100 to 1,400 person-years of indirect employment.

Implementation of the alternate military action (8 C-5As) in combination with the development of WMDC operations would result in the creation of more than 800 direct and 250 to 305 indirect permanent jobs. Construction activities would provide approximately 1,300 person-years of direct employment and 950 to 1,200 person-years of indirect employment.

The implementation of either action in combination with the development of civil aviation operations would not be expected to create conflicts with labor requirements for other development in the area. Depending on the type of operations developed by WMDC, it is possible that non-ART reservists who are members of the Westover units but who are not currently employed in aviation-related fields may obtain employment with air carriers operating at Westover. The jobs currently held by these persons would then be available to be filled by other persons in the area.

4.7.4 Housing

Implementation of either the military or the WMDC action would not be expected to have a significant impact on the availability or cost of housing in the ROI. However, as discussed in Sect. 4.2, increases in community noise levels resulting from implementation of either the military or the WMDC action (alone or in combination) could adversely affect the desirability and value of housing units in areas exposed to increased noise levels.

If either military action is implemented, all of the additional employees would be civil service personnel and none of these persons would be eligible for military housing. Personnel moving into the area from beyond commuting distances would become residents of the communities within commuting distance of the base. As noted in the discussion of demographics, few, if any, personnel would be expected to move into the area to obtain construction employment or to secure one of the new part-time reserve positions. Implementation of the proposed military action (16 C-5As) would result in the creation of approximately 332 new full-time positions. If all of these positions were filled by persons moving into the ROI, the demand for housing units would represent only 0.16% of the 1980 housing stock of 213,870 units. In the same year, there were 11,590 unoccupied housing units within the ROI, approximately 35 times the maximum projected demand. If the alternative military action were implemented, the available housing stock would be approximately 9 times the maximum projected demand of 129 units. Although the available housing units would not all be of the type or quality desired by the new personnel, the projected demand would be so small that housing shortages or significant increases in housing costs would be unlikely to result from implementation of either military action. Because the increase in employment would take place over a period of approximately 3 years beginning in late 1987, there should be ample time for construction of additional housing units to meet the increased demand.

Because the majority of the additional jobs created by the development of civil aviation operations would be filled by persons already living in the area, no significant impacts would be expected to result from the implementation of the action proposed by the WMDC, either alone or in combination with the proposed military action (16 C-5As).

4.7.5 Public Services

As discussed in Sect. 3.7.5, an adequate public service infrastructure is considered to exist in the ROI, and no severe service delivery problems appear to be present in the area as a whole. Implementation of either military action or the action proposed by WMDC would not be expected to result in significant increases in demands for public services.

4.7.5.1 Effects of either military action

The maximum projected addition of approximately 1,350 new residents in 467 households, which would result if the proposed military action (16 C-5As) were implemented, would not be expected to adversely affect the level of public services provided to current or new residents in the ROI. No new capital expenditures would likely be required, and the incremental increase in demand for services within the numerous communities in the ROI would probably be negligible.

Although both water consumption and volumes of sanitary and industrial wastes would likely increase if either the proposed or alternate military action were implemented, no adverse impacts to availability of adequate water supplies or the availability of capacity in the publicly owned sewage treatment system would be expected to result. Both potable water consumption and discharges of sanitary and industrial wastewater would be well below the maximums specified by the contracts with Chicopee (600,000 and 1,200,000 gal/day respectively), and the capacities of the municipal systems would be adequate to accommodate the increased loadings without significant impact. As noted in Sect. 4.5.3, all discharges of industrial wastewater would be permitted in accordance with requirements established by the City of Chicopee, and permits would include discharge limitations and monitoring requirements to assure that operation of the treatment plant not be adversely affected.

As noted in Sect. 4.5, consumption of potable water and volumes of wastewater and solid wastes would increase slightly but would still be well within the capacities of the available facilities. As noted in Sect. 3.7.5, Westover AFB provides its own security and fire protection services. Either mission change would result in an increase in the number of security personnel (Sect. 2.1.1.3) and improvements to fire protection facilities and equipment (Table 2.3) and would not result in any demand for such services from local agencies. Under the existing mutual support agreement, the additional fire-fighting equipment would be available to support local fire departments in the event of an emergency outside the installation.

4.7.5.2 Effects of development of WMDC operations

Both water consumption and volumes of sanitary and industrial wastewater generated by WMDC operations would increase if civil aviation operations were developed to the levels indicated in the WMDC Master Plan. The capacities of the municipal systems should be adequate to accommodate the increased loadings without significant impact. Discharges of industrial wastewater to the municipal treatment system would be permitted in accordance with the requirements of the City of Chicopee.

The Air Force currently provides response capabilities for all aircraft-related emergencies at Westover AFB, including any involving civil aviation aircraft on a cost-reimbursement basis. If the hours of airfield operation are increased to 24 hr/day as requested by WMDC, it is expected that emergency response support would continue to be provided by the Air Force. Thus, no impact on local agencies would be expected.

4.7.5.3 Cumulative effects of either military action in combination with WMDC operations

No significant increase in demand for public services would be expected to result if either military action were implemented in combination with development of WMDC aviation operations.

4.7.6 Education

No adverse impacts on educational facilities would be expected to result from implementation of either action (military or WMDC), either separately or in combination.

Implementation of either military action would be expected to result in a small but positive impact on public elementary and secondary school enrollments, which have been declining in the ROI for the last few years. Assuming an average of two school-age children in every three family units expected to move into the ROI, a maximum enrollment increase of approximately 220 students would be expected to result if the proposed military action were implemented. Because an adequate educational infrastructure exists in the communities surrounding the installation and also because enrollment has been declining for several years, it is unlikely that capital expenditures would be required to accommodate the additional student enrollment. Financial aid to schools from federal and state sources is based primarily on average daily attendance and would be expected to increase, thus helping to defray any additional operating expenses; because the school systems are funded primarily through property taxes, the increased demand for housing would generate additional revenue for education.

Since the majority of the additional jobs created by the development of WMDC operations would be filled by persons already in the local labor force, no significant increase in school enrollment would be expected to result. If either military action were implemented in combination with the development of WMDC operations, the total increase in school enrollment would be only slightly greater than the increase resulting from the mission change alone, and no significant cumulative impacts would be likely to occur.

4.7.7 Transportation

No significant impacts on local transportation systems would be expected to result from either the military or the WMDC action, either alone or in combination.

4.7.7.1 Effects of either military action

Implementation of the proposed (16-aircraft) military activity would result in an increase of approximately 332 in the number of full-time employees at Westover AFB. Even if all of these employees drove to work separately, and allowing for increases in business support activities and additional reservists on base during the week, traffic entering the base might increase by 600 vehicles/day, or approximately 18%. Traffic flows on the access roads leading to the base might increase by as much as 50%. Because the base has three gates and the access roads are used primarily by Westover employees, traffic congestion on these access roads would probably not be a problem. Impacts on major thoroughfares are also expected to be insignificant. Assuming, as a reasonable worst case, that none of the new employees carpooled, 60% used the Ludlow gate, and two-thirds came from the south, traffic on Memorial Drive just south of the Westover Road interchange would increase by less than 2%. Based on this analysis, no adverse traffic impacts would be expected to result from either military action.

Transportation impacts during the construction period should be about the same as those created by base operations resulting from the proposed military action. Assuming that construction employment peaked at about 400 jobs, the traffic increase should approximately equal that created by the change in base mission.

4.7.7.2 Effects of the development of WMDC operations

Development of WMDC operations would result in small increases in traffic volumes in the vicinity of the base due to increases in employment, passenger service, and air cargo operations. If operations were developed to the levels indicated in the WMDC Master Plan, approximately 570 additional employees would travel to and from the base area daily. Because operations would be on a 24-hr/day basis, increases in employee traffic during an 8-hr period would likely be less than a maximum of 250 to 300 vehicles. This level of increase would not be expected to cause a significant increase in traffic congestion.

Development of passenger service could result in as many as 500 passengers per day traveling to and from Westover by the year 1995; however, this increase would take place relatively slowly as service was developed. Because departures and arrivals would occur throughout the day and peak times for arrivals and departures of passengers and employees would probably not coincide, this volume of traffic would not be expected to result in increases in traffic congestion.

Because the majority of the air cargo would be transshipped rather than originating or terminating at Westover, increases in traffic related to air cargo operations would be small. Peak volumes would probably occur

at times corresponding to the peak arrival and departure times (10 p.m. to midnight and 5 a.m. to 7 a.m.) and would not conflict with arrival of employees or passengers. Thus, no significant impacts would be likely.

4.7.7.3 Cumulative effects of either military action in combination with development of WMDC operations

Increases in traffic volumes resulting from the development of civil aviation (WMDC) operations in combination with either military action would present the potential for some traffic congestion on the secondary roads leading to the base and WMDC area. Because increases in traffic volumes related to WMDC operations would occur slowly and schedules for shift changes could be coordinated with Air Force work schedules, no significant cumulative impacts would likely occur.

4.8 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

Implementation of either military action or the WMDC action, individually or in combination, would not be expected to result in any significant impact on historical or archaeological resources. Required construction activities would take place in areas that have already been disturbed by base construction. No activity would be expected in areas delineated as sensitive or in the vicinity of the two identified sites (Sect. 3.8). Although noise levels would increase, they would not be expected to cause structural damage or to interfere with the enjoyment of these resources.

The Massachusetts Historical Commission has reviewed information submitted by the Air Force and the archaeological reconnaissance survey report prepared by Brown University and has concluded that "Since the proposed construction is unlikely to affect significant historic or archaeological properties, no further review of this proposal is required in compliance with Section 106 of the National Historic Preservation Act of 1966." (Letter, Massachusetts Historical Commission to Thomas G. Hargis, Lt. Col., USAF, December 31, 1986).

4.9 MITIGATING MEASURES

This analysis has identified only two impact areas for which specific mitigation measures are considered appropriate: aircraft noise and the potential consequences of an aircraft accident.

4.9.1 Mitigation measures for either military action

If either military action is implemented, military flight operations will incorporate changes from standard operating procedures to reduce population exposure to aircraft noise and to minimize the potential consequences of an aircraft accident. As noted in Sect. 4.2, an alternate VFR closed pattern flight track that reduces the population exposure to aircraft noise has been developed, and the Air Force has committed to using this alternate flight track if either military action is implemented. The altitude for the VFR closed pattern would also be increased by approximately 300 ft (from 1,200 ft AGL to 1,500 ft AGL) to

reduce ground noise levels. As noted in Sect. 4.3.3.2, the landing threshold for runway 05 will be permanently displaced to avoid inclusion of the bathing beach and picnic areas of Chicopee Memorial State Park within the clear zone, which is the area of greatest aircraft accident hazard. This action would reduce, but not completely eliminate, the hazard in this area and would allow continued recreational use of the park by area residents. Sect. 4.3.3.2 also describes operational modifications that could be implemented to reduce the probability of an aircraft accident in Chicopee Memorial State Park during periods of highest park use.

Aircraft noise impacts possibly could be reduced further through additional refinement of flight tracks to avoid noise-sensitive facilities and through modification of training schedules to avoid aircraft operations during periods of greatest noise sensitivity. The feasibility of implementing such modifications depends on a number of factors, including training requirements, flight safety considerations, and aircraft performance capabilities and limitations. Thus, it is not considered appropriate to make a commitment to further operational modifications at this time. If either military action is implemented, the Air Force will evaluate the need for further operational modifications as flight operations and training schedules are developed.

4.9.2 Mitigation measures for WMDC operations

As noted in Sect. 2.1.2, subsequent to issuance of the DEIS, WMDC developed a mitigation plan to reduce the impacts of increases in civil aviation operations (Sect. 4.1.2.2 and Appendix J). This plan includes the following major provisions:

- prohibiting scheduled operations by Stage II large turbojet (e.g., B-727-200 and B-747-100) aircraft between the hours of 10 p.m. and 7 a.m.;
- restricting scheduled operations between the hours of 1 a.m. and 5 a.m.;
- establishing preferential runway utilization to minimize population impacted by aircraft operations. To the maximum extent permitted by weather conditions and military aircraft operations, runway 23 would be used for landings and runway 05 for departures;
- requiring that aircraft initiate takeoffs from the beginning of the runway to increase altitudes and minimize ground-level noise over populated areas; and
- limiting 9-hr (10 p.m. to 7 a.m.) equivalent noise levels (Leq-9) to the level projected to result from the operation of all "Stage III" aircraft by the time the maximum number of operations is reached.

Analysis of the impacts expected to result from operations in accordance with this mitigation plan (See Appendix K) indicates a significant reduction in impacts relative to the levels identified in the DEIS for

operations without mitigation (See Appendix D). Section 4.2 provides a comparison of the mitigated and unmitigated impacts of civil aviation operations, alone and in combination with the proposed and alternate military operations.

In addition to the measures contained in the mitigation plan, WMDC is also committed to a cooperative effort with both air carriers and the local communities to identify and implement measures that would further reduce noise impacts. Such measures would include, but not be limited to, the following:

Scheduling nighttime operations to reduce impact. Although all operations between the hours of 10 p.m. and 7 a.m. are weighted equally (penalized by 10 dB) in the calculation of DNL levels, operations near the end of this period (i.e., before 11 p.m. or after 6 a.m.) would be expected to be less annoying than operations in the middle of the nighttime hours. Although it would not be reflected in the DNL levels, a reduction in impact would be expected to result from scheduling the majority of the morning operations between the hours of 6 and 7 a.m. because fewer people would be asleep at this time than between 5 and 6 a.m.

Development of flight tracks to minimize noise impacts. Reductions in impacts at specific locations could be reduced by varying flight tracks to reduce the number of overflights. While this would reduce the magnitude of the impact at a specific location, it would increase the area exposed to aircraft noise and the number of people affected.

Variation in aircraft operating parameters. The aircraft altitude profiles and power settings used in the noise analysis are based on aircraft performance criteria and have been developed to minimize noise impacts; thus, further reductions in area noise levels through variation in these parameters generally are not considered to be feasible. As operations are developed, however, WMDC will work with both the air cargo carriers and local communities to develop procedures to minimize impacts at sensitive locations wherever possible.

4.10 UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

Implementation of either of the military actions or the WMDC action, either alone or in combination, would result in adverse environmental impacts which could be mitigated but could not be avoided.

4.10.1 Unavoidable adverse impacts resulting from either military action

- Increases in aircraft noise and related impacts. As noted in Sect. 4.2, implementation of the proposed or alternate military action would result in the exposure of approximately 3,550 and 1,600 persons, respectively, to DNL levels >65 dB. Approximately 700 and 350 persons, respectively, would be expected to be highly annoyed by the aircraft noise, and some reduction in housing values in affected areas could occur. Even if

additional mitigation measures were employed, some increase in exposure of area residents to increased noise levels would be unavoidable.

- Increases in the potential consequences of an aircraft accident. Because of the larger size of the C-5A relative to the C-130, implementation of either military action would result in an increase in the potential consequences of an aircraft accident involving an aircraft assigned to the 439th MAW. The potential consequences of an accident in Chicopee Memorial State Park will be reduced through implementation of the measures identified in Sect. 4.9; however, some increase in consequences would be unavoidable. The resulting hazards are considered to be equivalent to those existing around other Air Force installations and civilian air terminals.

- Increases in the generation of wastes and wastewater. Implementation of either military action would be expected to result in increases in the quantities of solid wastes, hazardous chemical wastes, and wastewater. Although these increases are considered to be unavoidable, they are not considered likely to result in significant adverse impacts with respect to either disposal facilities or to the environment.

4.10.2 Unavoidable adverse impacts resulting from development of WMDC operations

- Increases in aircraft noise and related impacts. As noted in Sect. 4.2, development of civil aviation operations, particularly air cargo operations, could result in the exposure of approximately 1,500 persons to DNL levels >65 dB. Approximately 350 of the persons exposed to DNL levels >65 dB would be predicted to be highly annoyed. Some individuals in areas with DNL levels below 65 dB would also be highly annoyed by noise; however, this number cannot be accurately predicted. Reductions in property value may occur in some areas. Sleep disturbance resulting from nighttime operations would be a factor in the level of annoyance. The mitigation plan proposed by WMDC would limit the number of persons exposed to noise levels that would be expected to have a significant probability of awakening approximately 1,900 persons for 90% of the nighttime operations. Of these, about 500 individuals are predicted to be awakened by a single operation; however, some individuals may be awakened several times per night. Operations on runway 23 are predicted to be necessary less than 10% of the time (about once every two weeks) and are predicted to result in awakening up to 19,200 persons one or more times per night. Even if additional mitigation measures were employed, an increase in exposure of residents to aircraft noise would be unavoidable if civil aviation operations were developed to the levels indicated in the WMDC Master Plan.

- Increase in the probability and consequences of aircraft accidents. The increase in the number of aircraft operations would result in an increase in the probability of a serious

aircraft accident occurring in the vicinity of Westover AFB. The larger size of commercial air cargo aircraft in comparison to the C-130 would increase the potential consequences of an accident, should one occur. Although the potential consequences could be mitigated, some increase in risk to the public would be unavoidable. The level of risk would be comparable to that in the vicinity of other Air Force installations and civilian air terminals.

- Increases in air pollutant emissions. Based on emission factors developed by the Environmental Protection Agency, projected increases in civil aviation operations could result in an increase of approximately 733 tons/year in emissions of air pollutants associated with aircraft operations. Carbon monoxide emissions could increase by approximately 386 tons/year; emission of hydrocarbons and oxides of nitrogen would increase by approximately 173 and 152 tons/year respectively. Emissions of particulate matter and sulfur dioxide would increase by about 5 and 17 tons per year respectively. Although those increases would be unavoidable, they would not be expected to have a significant impact on regional or local air quality or to interfere with progress toward attainment of the ambient air quality standard in areas currently designated as non-attainment.

- Increases in the generation of wastes and wastewater. Increases in civil aviation activity would result in increases in the quantities of solid wastes, hazardous chemical wastes, and wastewater generated by WMDC operations. Although these increases would be unavoidable, they are not considered likely to result in significant adverse impacts with respect to either disposal facilities or to the environment.

4.10.3 Unavoidable cumulative adverse impacts

- Increases in aircraft noise and related impacts. The most significant cumulative adverse impact expected to result from implementation of either military action in combination with development of civil aviation (WMDC) operations would be an increase in exposure of the public to aircraft noise. As noted in Sect. 4.2, the area exposed to DNL levels >65 dB would increase relative to the areas affected by either action individually. Increases in daytime equivalent noise levels would also occur. Since military operations would be limited to daytime hours, no cumulative increase in nighttime noise levels would occur relative to the levels resulting from civil aviation operations alone. Both proposed actions have incorporated mitigation measures to reduce noise impacts. Development of further mitigation measures could reduce the impacts to some extent, but some cumulative impact would be unavoidable.

  If the proposed military action (16 C-5As) were implemented, the area exposed to DNL levels >65 dB would increase to approximately 11.8 sq. mi. and approximately 5,900 persons would be exposed to levels >65 dB. If the alternate military action (8

C-5As) were implemented, the area above 65 dB would increase to approximately 8.8 sq. mi., and approximately 3,400 persons would be exposed to DNL levels >65 dB.

Cumulative increases in noise levels would result in increases in the level of annoyance to persons living near the base, in conflicts with current and future land uses, and in possible reduction in property values relative to either action alone.

Although increases in noise resulting from other activities such as transportation would contribute to noise levels, it is unlikely that any other action would have a significant cumulative impact on a regional basis.

- Increase in the potential consequence of an aircraft accident. Implementation of either military action in combination with development of civil aviation operations would result in a reduction in the number of aircraft operations relative to the development of civil aviation operations in combination with the current military operations and a reduction in the probability of an aircraft accident. The consequences of an accident would be the same as for either action alone, however, the potential for a serious accident would be greater than for either action alone due to the increase in the number of operations by large aircraft. Although the risk of a serious aircraft accident would increase, the level of risk would be similar to that at many other military and civilian facilities and is not considered unacceptable.

4.11 RELATIONSHIP BETWEEN SHORT-TERM USE OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

Only minor, further disturbance of already developed areas would be involved in the construction of additional facilities for either military or WMDC actions. For this reason, no significant impact on long-term environmental productivity would be expected.

4.12 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

Neither of the military actions nor the WMDC action would require a major irreversible or irretrievable commitment of resources. Those resources that would be irreversibly and irretrievably committed include fuel used in construction and a small amount of concrete used for added paving or foundations of facilities. Although minor permanent facilities would be constructed, these could be decommissioned and most of the resources reused. If either of the military or WMDC operations were discontinued, the natural environment would reestablish itself in most of the areas that would be disturbed, except for small areas occupied by buildings, parking lots, or other paved areas.

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APPENDIX A

SOUND METRICS

APPENDIX A

SOUND METRICS

A.1 NOISE METRICS USED IN THIS ANALYSIS

The following metrics used in this analysis are described in the subsections below:

(1) Single-Event Maximum Sound Levels
(2) Single-Event Energy Dose
(3) Cumulative Energy Average Metrics

Additional metrics used by the Federal Aviation Administration (FAA) are described in Aviation Noise Effects (Newman and Beattie 1985), and detailed mathematical formulations for each metric are presented in The Handbook of Noise Ratings (Pearson 1974). The relationships between the noise metrics used in this analysis and some of the other metrics which have been used in characterization of noise levels are summarized in Sect. A.2.

A.1.1 A-Weighted Sound Level

The A-weighted sound level (ALm, historically dBA) expressed in decibels (dB) is the measurement used to characterize single-event maximum sound levels. As noted in Sect. 3.2, the A-scale de-emphasizes the low- and high-frequency portions of the sound spectrum and provides a good approximation of the response of the average human ear, correlating well with the average person's judgement of the relative loudness of a noise event.

On the decibel scale, an increase of 3 dB represents a doubling of sound energy. In reality, an increase of 3 dB is only moderately detectable by the human ear. It has been found that a difference on the order of 10 dB represents a subjective doubling of loudness. Thus, an increase of 3 dB corresponds to a doubling of sound energy, while an increase of 10 dB corresponds to a doubling in subjective loudness (USAF 1978). Table A.1 provides a comparison of the relative loudness of typical noises encountered in the indoor and outdoor environments.

A.1.2 Sound Exposure Level

Subjective tests indicate that human response to noise is a function not only of the maximum level, but also of the duration of the event and its variation with respect to time. Significant evidence indicates that two noise events with equal sound energy will produce the same response. For example, a noise with a constant level of 85 dB lasting for 10 min would be judged to be equally as annoying as a noise event with a level of 82 dB and a duration of 20 min (i.e., one-half the energy lasting for twice the time period). This is known as the "equal energy principle."

Table A.1 Sound levels [dB(a)] and relative loudness of typical noises in outdoor and indoor environment

dB(A)	Overall level	Community (outdoor)	Home or industry (indoor)	Loudness (human judgment of different sound levels)
120	Uncomfortably loud	Military jet aircraft take-off with afterburner from aircraft carrier at 50 ft (130)	Oxygen torch (121)	32 times as loud as 70 dB(A)
110		Turbo-fan aircraft at takeoff power at 200 ft (118)	Riveting machine (110) Rock-n-Roll band (108-114)	16 times as loud as 70 dB(A)
100	Very loud	Jet flyover at 1000 ft. (103) Boeing 707 DC-8 at 6080 ft before landing (106) Bell J-2A helicopter at 100 ft (100)		8 times as loud as 70 dB(A)
90		Power mower (96) Boeing 737 DC-9 at 6080 ft before landing (97) Motorcycle at 25 ft (90)	Newspaper press (97)	4 times as loud as 70 dB(A)
80		Car wash at 20 ft. (89) Prop plane flyover at 1000 ft (88) Diesel truck 40 mph at 50 ft (84) Diesel train 45 mph at 100 ft (83)	Food blender (88) Milling machine (85) Garbage disposal (80)	2 times as loud as 70 dB(A)
70	Moderately Loud	High urban ambient sound (80) Passenger car 65 mph at 25 ft (77) Freeway at 50 ft from pavement edge 10 a.m. (76-6)	Living room music (76) TV-audio, vacuum cleaner (70)	70 dB(a)
60		Air conditioning unit at 100 ft (60)	Cash register at 10 ft (65-70) Electric typewriter at 10 ft (64) Dishwasher (Rinse) at 10 ft (60) Conversation (60)	1/2 as loud as 70 dB(A)
50	Quiet	Large transformers at 100 ft (50)		1/4 as loud as 70 dB(A)
40		Bird calls (44) Lowest limit urban ambient sound (40)		1/8 as loud as 70 dB(A)
10	Just Audible	[dB(A) scale interrupted]		
0	Threshold of Hearing			

Source: M. C. Branch, et al., Outdoor Noise and the Metropolitan Environment, Department of City Planning, City of Los Angeles, 1970, p. 2.

The sound exposure level (SEL) is a measure of the physical energy of the noise event which takes into account both intensity (loudness) and duration. The SEL is based on the A-weighted sound level above a specified threshold which is at least 10 dB below the maximum value measured during the noise event and is expressed as the 1-sec energy averaged equivalent sound level (Leq-1 sec).

Table A.2 provides a comparison of the SEL values measured at a slant distance of 1000 ft from military and commercial aircraft operating at takeoff thrust. By definition, SEL values are normalized to a duration of 1 sec and should not be confused with either the average or maximum noise levels associated with a specific event. For example, an event with a duration of 20 sec and an SEL value of 111.5 dB (the value in Table A.2 for the C-5A aircraft) would have an energy averaged equivalent sound level of 98.5 dB. There is no general relationship between the SEL value and the maximum decibel level (ALm) measured during a noise event. By definition, noise levels which exceed the SEL value must have durations of <1 sec. For aircraft overflights, maximum noise levels would typically be 5 to 7 dB below the SEL value.

A.1.3 Cumulative energy average metrics

Cumulative energy average metrics correlate well with aggregate community response to the noise environment. They may be derived from single event noise levels or computed from measured data. They were not designed as single source measures and they do not relate accurately to speech interference, sleep disturbance, or other phenomena requiring analysis using single event data (Newman and Beattie 1985).

A.1.3.1 Equivalent sound level

The equivalent sound level (Leq) is the energy averaged noise level (usually A-weighted) integrated over a specified time period. The term "equivalent" indicates that the total acoustical energy associated with a varying sound (measured during the specified period) is equal to the acoustical energy of a steady sound level of Leq for the same period of time. The purpose of the Leq is to provide a single number measure of noise averaged over a specified time period (Newman and Beattie 1985).

A.1.3.2 Day-night average noise level

The Day-Night average noise level (DNL) is the energy averaged noise level (Leq) measured over a period of 24 hr, with a 10-dB penalty applied to nighttime (10 p.m. to 7 a.m.) sound levels to account for increased annoyance by noise during the night hours. The annual average DNL (DNL y-avg) is the value specified in the FAA FAR Part 150 noise compatibility planning process (Newman and Beattie 1985)and provides the basis for the land-use compatibility planning guidelines in the Air Force AICUZ program (AICUZ Handbook 1984). The typical range of DNL levels is illustrated in Fig. A.1.

Table A.2 SEL values for Air Force and civil aircraft[a]

Aircraft type	SEL (dB)
Jet bomber/tanker/transport	
B-52F, G	120.5
C-5	111.5
C-135B	106.5
KC-135A	117.0
Other jet aircraft with afterburners	
F-4	116.5
F-14	110.5
F-15	112.0
FB-111	107.5
T-38	105.5
Other jet aircraft without afterburners	
T-37	98.0
T-39	103.0
Propeller aircraft	
C-130	90.0
Civil jet aircraft	
707, DC-8	110.0
727	108.0
737, DC-9	106.0
747	109.0
DC-10, L-1011	100.0
Learjet, jet commander, Gulfstream II	106.0

Source: AFESC 1984.

[a]At nominal takeoff thrust and airspeed and at a slant distance of 1,000 ft from the aircraft.

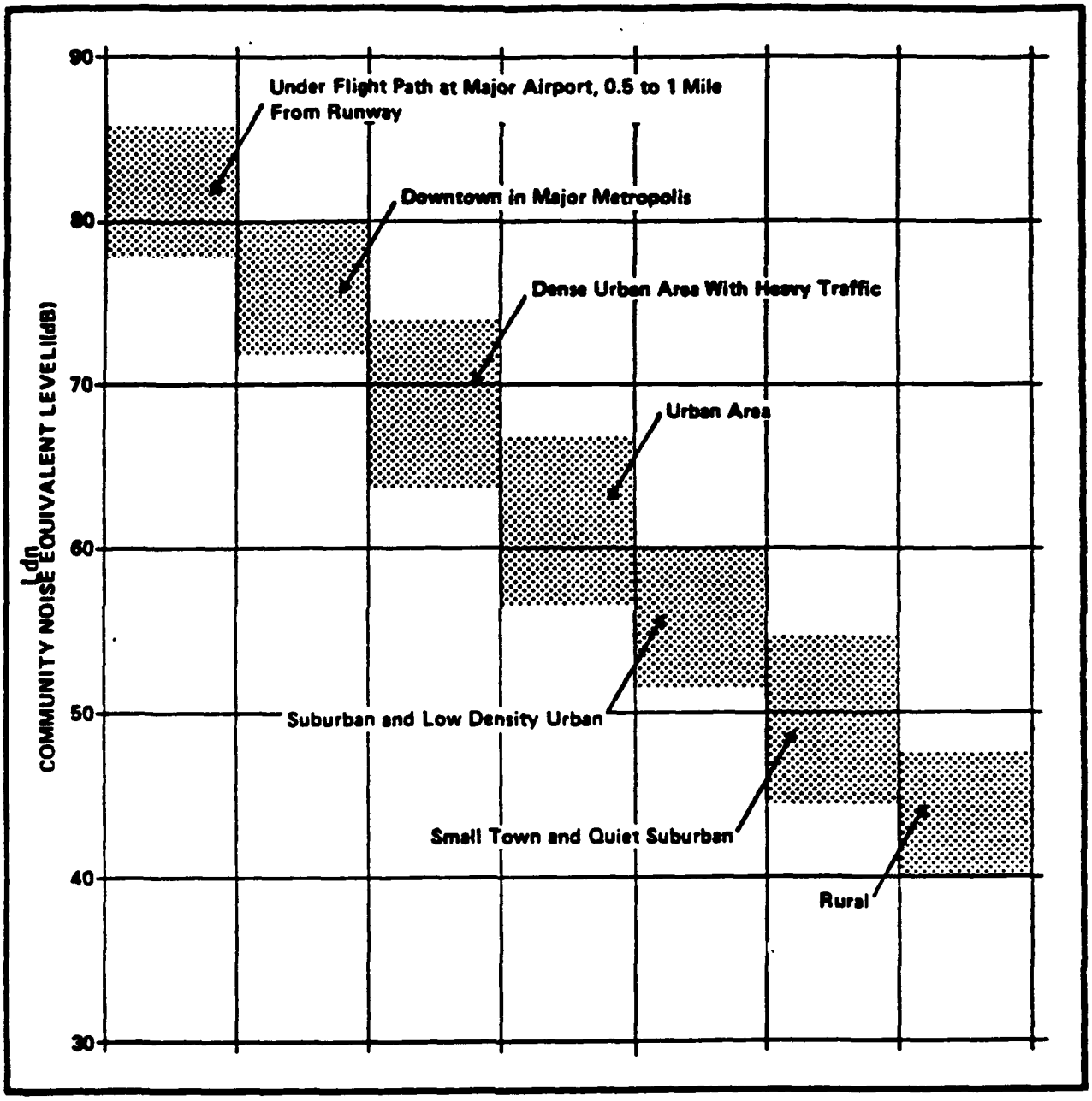

Fig. A.1. Typical range of outdoor community noise exposure levels (DNL)

Source: AFM 19-10, pages 4-18.

A.2 RELATIONSHIPS BETWEEN SOUND METRICS

Noise metrics may be divided into three general categories: single-event maximum noise level metrics, single-event energy dose metrics, and cumulative energy average metrics.

A.2.1 Single event maximum noise level metrics

A.2.1.1 A-weighted sound level

The A-weighted sound level (ALm, historically dBA) expressed in decibels (dB) is the most commonly used single-event maximum sound level metric. The A-weighted sound pressure level is a sound pressure level that has been filtered or weighted to de-emphasize the low- and high-frequency portions of the sound spectrum; it provides a good approximation of the response of the average human ear, correlating well with the average person's judgment of the relative loudness of a noise event.

A.2.1.2 Perceived Noise Level (PNL) and Tone-Corrected Perceived Noise Level (PNLT)

The perceived noise level (PNL), expressed in decibels, is a rating of noisiness that has been used almost exclusively in aircraft noise assessment. PNL is computed from sound pressure levels measured in octave or one-third octave frequency bands. This rating is most accurate in estimating the perceived noisiness of broadband sounds of similar time duration which do not contain strong discrete frequency components. Currently it is used by the Federal Aviation Administration (FAA) and foreign governmental agencies in the noise certification process for all turbojet-powered aircraft and for large propeller-driven transports. The perceived noise level is expressed in decibels. These units translate the subjectively linearly additive noisiness scale to a logarithmic decibel-type scale, where an increase of 10 dB in PNL is equivalent to a doubling of its perceived noisiness. The PNL is formally defined in the Society of Automotive Engineers (SAE) Aerospace Recommended Practice 865A "Definition and Procedures for Computing the Perceived Noise Level of Aircraft Noise."

The tone-corrected perceived noise level (PNLT) is basically the perceived noise level adjusted to account for the presence of discrete frequency components. PNLT was developed to aid in the prediction of perceived noisiness for aircraft flyovers and vehicle noise which contain pure tones or have pronounced irregularities in their spectrums. The method for calculating PNLT adopted by the FAA involves calculation of the PNL of a sound and the addition of a tone correction based on the tonal frequency and the amount that the tone exceeds the noise in the adjacent one-third octave bands. The PNLT is formally defined in ANSI S6.4-1973 "Definition and Procedures for Computing the Effective Perceived Noise Level for Flyover Aircraft Noise."

A.2.1.3 D-Weighted Sound Level: DLm [historically db(D)]

The D-weighted sound pressure level is sound pressure level that has been frequency filtered to reduce the effect of the low-frequency portion of the sound spectrum and to recognize the increased annoyance at higher frequencies. The D-level was developed as a simple approximation of perceived noise level (PNL) for use in assessing aircraft noise. PNL can be estimated from the D-level by the equation: PNL = dB(D) + 7.

A.2.2 Single-Event Energy Dose Metrics

Subjective tests indicate that human response to noise is a function not only of the maximum level of the event, but also of the duration of the event and its variation with respect to time. Significant evidence indicates that two noise events with equal sound energy will produce the same response. To facilitate comparison of noise events with differing durations, energy dose metrics are expressed in terms of the level of a constant tone that would provide an equivalent amount of sound energy in a reference time period. Energy dose metrics based on the A-weighted sound level (ALm) and tone-corrected perceived noise level (PNLT) have been developed.

A.2.2.1 Sound Exposure Level (SEL)

The sound exposure level (SEL) is the A-weighted sound level integrated over the duration of a noise event above a specified threshold which is at least 10 dB below the maximum value measured during the event and normalized to a reference duration of 1 second. Thus, it represents the level of a continuous noise with a duration of 1 second which would produce a total amount of sound energy equivalent to the measured event.

A.2.2.2 Effective Perceived Noise Level (EPNL)

The effective perceived noise level (EPNL) is a single-number measure of the noisiness of complex aircraft flyover noise which approximates human annoyance response. It is calculated by the integration of the tone-corrected perceived noise levels (PNLT) measured during a single noise event such as an aircraft overflight. The EPNL includes correction terms for the duration of an aircraft flyover and the presence of audible pure tones or discrete frequencies (such as the whine of a jet aircraft) in the noise signal. The reference time signal duration is 10 seconds (as opposed to 1 second for SEL). The EPNL is used by the FAA as the noise certification metric for large transport and turbojet aircraft and helicopters.

A.2.3 Cumulative Energy Average Metrics

A.2.3.1 Equivalent Sound Level (Leq)

The equivalent sound level, Leq, is the energy average noise level (usually A-weighted) integrated over some specified time. The term <u>equivalent</u> indicates that the total acoustical energy associated with a

varying sound (measured during a specified time period) is equal to the acoustical energy of a steady sound of level Leq decibels for the same period of time. The purpose of Leq is to provide a single number measure of noise averaged over a specified time period that must always be specified.

A.2.3.2 Day-Night Average Sound Level (DNL)

The Day-Night average noise level (DNL) is the energy averaged noise level measured over a period of 24 hr, with a 10-dB penalty applied to nighttime (10 p.m. to 7 a.m.) sound levels to account for the increased annoyance by noise during the night hours.

A.2.3.3 Noise-Exposure Forecast (NEF)

The noise-exposure forecast (NEF) performs the same role as DNL but is developed using EPNL as the intermediate single-event dose metric. The NEF incorporates a weighting factor that effectively imposes a 12.2-dB penalty on sound occurring between 10 p.m. and 7 a.m. This corresponds to a nighttime event multiplier of 16.7. NEF correlates extremely well with DNL, and the equivalency DNL = NEF + 35 is often used.

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APPENDIX B

EFFECTS OF NOISE EXPOSURE

APPENDIX B

EFFECTS OF NOISE EXPOSURE

Effects of Noise Exposure on Humans

During the public scoping meeting held at the Bellamy School in Chicopee, Massachusetts, on Thursday, September 26, 1985, several individuals expressed concern over the effects of noise on human beings. Potential effects have been examined. Methods of quantifying effects of noise have undergone extensive scientific development during the past several decades. The most reliable measures at present are noise-induced hearing loss and annoyance.

Annoyance

Noise annoyance is defined by the U.S. Environmental Protection Agency (EPA) as any negative subjective reaction to noise on the part of an individual or group (EPA 1978). "Except in the case of speech interference, however, the degree of interference is hard to specify and difficult to relate to the level of noise exposure" (EPA 1978). "Aircraft noise may . . . be found annoying because it may startle people, cause houses to shake, or elicit fear of a crash" (EPA 1978).

A recent Federal Aviation Administration (FAA) review (Newman and Beattie 1985) concludes that "the typical response of humans to aircraft noise is annoyance. Annoyance response is remarkably complex and, considered on an individual basis, displays wide variability for any given noise level. Fortunately, when one considers average annoyance reactions within a community, one can develop aggregate annoyance response/noise level relationships."

For the purpose of identifying noise levels necessary to protect human health and welfare, annoyance is quantified by using the percentage of people who are "highly annoyed" by the noise. This is considered to be the best estimate of the general adverse response of people and, in turn, is viewed as reflecting activity interference and the overall desire for quiet. The Committee on Hearing, Bioacoustics, and Biomechanics provides an estimate of the percent of the population expected to be annoyed by various levels of aircraft noise (NAS 1977).

DNL interval (db)	Average percent highly annoyed
65-70	21
70-75	32
75-80	46
80-85	63

The analyses in this document are based on this guidance.

Individual response to noise is subject to considerable natural variability. Over the past 35 years, researchers have identified a number of emotional and physical factors which contribute to the variation in reaction to noise.

Emotional variables include

(1) feelings about the necessity or preventability of the noise,
(2) judgement of the importance and value of the activity producing the noise,
(3) activity at the time an individual hears a noise,
(4) attitudes about environment,
(5) general sensitivity to noise,
(6) belief about the effect of noise on health, and
(7) feeling of fear associated with the noise.

Physical variables include

(1) type of neighborhood,
(2) time of day,
(3) season,
(4) predictability of the noise,
(5) control over the noise source, and
(6) length of time an individual is exposed to a noise.

Speech Interference

Speech interference associated with aircraft noise is a primary source of annoyance to individuals on the ground. The disruption of leisure activities (such as listening to the radio, television, music, and conversation) gives rise to frustration and irritation. Quality speech communication is obviously also important in the classroom, office, and industrial settings. Researchers have found that aircraft noise of 75 dB annoyed the highest percentage of the population when it interfered with the television sound. Eighty percent of the test population reported being annoyed. Also high on the list of annoyances for the surveyed population was flickering of the television picture and interference with casual conversation by aircraft noise (Newman and Beattie 1985).

Sleep Interference

Sleep interference is one of the factors contributing to aircraft noise annoyance. Airport nighttime restrictions have been employed to minimize this annoyance. In the case of nighttime operations, an exterior maximum sound level (ALm) of 72 dB is identified as an acceptable sleep interference condition for windows-closed conditions. This corresponds to an interior ALm of about 55 dB.

In 1983, the FAA requested NASA Langley Research Center to review the literature and "state of the art" in sleep interference research. This study was part of a larger reevaluation of weightings proposed for nighttime noise events. The pertinent findings of this study are as follows (Kryter 1980):

- Arousal from Sleep: The study revealed that, while research has yielded widely varying conclusions as to what the threshold of arousal from sleep is, the level of a noise which can interfere with falling to or waking from sleep ranges from 35 to 70 dB.

The varied results of researchers arise because several factors affect how easily a person will be awakened from sleep. A person's age is a prominent factor affecting arousal. Children sleep the heaviest, the elderly the lightest. Thus, older people have a much lower arousal threshold than do younger people.

- As one might expect, there is also a rise in the threshold of arousal as sleep stages deepen. The average difference in the arousal threshold from being awake to the deepest level of sleep is about 17.5 dB. Lastly, because of the cyclical nature of sleep stages, an individual's susceptibility to arousal varies throughout the night. However, in a normal 8-hr sleep night, more time is spent in lighter stages of sleep in the last half than in the first half. This implies that airport use restrictions limiting early morning flight from 3 a.m. to 7 a.m. are particularly important. Although people are also susceptible to arousal at the beginning of a sleep period when they are just trying to fall asleep, arousal is, in general, more likely during the late hours of sleep.

- Measuring Sleep Interference: Some studies have shown that the single-event energy dose of a noise event (SEL) and not the maximum level (ALm) is a better predictor of sleep interference (Lukas 1977, Horonjeff 1978). These findings have been contradicted in a report by Ohrstrom and Rylander, who assert that peak levels should be used to determine tolerable night levels of noise (Ohrstrom 1982). Researchers continue to debate this question.

- Adaptation: Studies conducted to determine adaptation to the sleep arousal noise threshold over a number of successive nights revealed only slight adaptation. Researchers speculate that perhaps even this small degree of adaptation involved subjects' acclimatization to the laboratory setting and instruments rather than to the noise.

- It is generally accepted that people adapt psychologically to new environmental noises. This adaptation involves learning how often and when environmental noises are likely to occur and how to adjust behavior patterns to prevent sleep arousal or other effects of noise. Research suggests that adaptation to noise is constant. In one study, for example, cessation of aircraft landing operations between 11 p.m. and 6 a.m. at Los Angeles International Airport had no appreciable effect on subjects' reports of sleep interference (Kryter 1982).

An earlier review of sleep interference was also carried out under FAA support in 1977 as part of a Congressional mandate to assess the feasibility of soundproofing schools and hospitals in the vicinity of airports (Wyle 1977). Key observations and conclusions from that study are as follows:

- Although effects of noise on sleep are not completely understood, the noise environment of a hospital area must be

considered, because sleep is crucial to patient recovery. A level of 40 dBA is a conservative estimate of the threshold level for sleep disturbance of patients in hospitals and public health facilities. Noise exposure below this level is not expected to interfere with sleep.

- Other studies have also attempted to set noise levels for sleep disturbance and have basically supported this limit. The U.S. EPA set 35 dB as the A-weighted disturbance level for a steady noise; it also concluded that a single-event maximum level (ALm) of 40 dB results in a 5% probability of awakening. Figure B.1 is a composite of laboratory data for sleep interference versus maximum A-weighted noise levels.

Based on this review, the FAA concluded that

1. The threshold level of a noise which will cause arousal from sleep depends on the sleep stage and the age of the subject, among other things. Noise levels which cause sleep disturbance cover a range of 35 to 70 dB (ALm).

2. Little or no physiological adaptation to sleep interference from noise occurs, although adaptation to new sleep environments does occur.

3. Psychological annoyance from the effects of sleep interference from aircraft noise is probably more significant than the direct physiological consequences.

4. The recommended interior noise levels for hospitals is between 34 and 47 dB; for other sleeping environments, the maximum acceptable intrusive noise level is 55 dB.

As noted in Appendix A, aircraft noise is characterized in terms of the A-weighted sound exposure level (SEL): a noise level with a duration of one second which would produce sound energy equivalent to that of the total aircraft noise event. As discussed in Appendix A, the SEL is not the same as the maximum (ALm) or average (Leq) noise levels that would be measured during a specific noise event. To provide a basis for estimation of the number of people who could be awakened by a specific noise event, data developed by Goldstein and Lukas (1980) were used to develop a relationship between the SEL value and the percent of exposed persons who would be awakened by the noise event. These data indicated that the percent awakened by a specific interior noise level can be expressed by the following equation:

$$\text{Percent Awakened} = 1.1(\text{ASEL}) - 49.5,$$

where ASEL = the interior A-weighted sound exposure level.

Since noise must penetrate the home to disturb sleep, interior noise levels will be lower than outside levels due to the adsorption of sound energy (attenuation) by the structure. The amount of attenuation provided by the building is dependent on the type of construction and whether

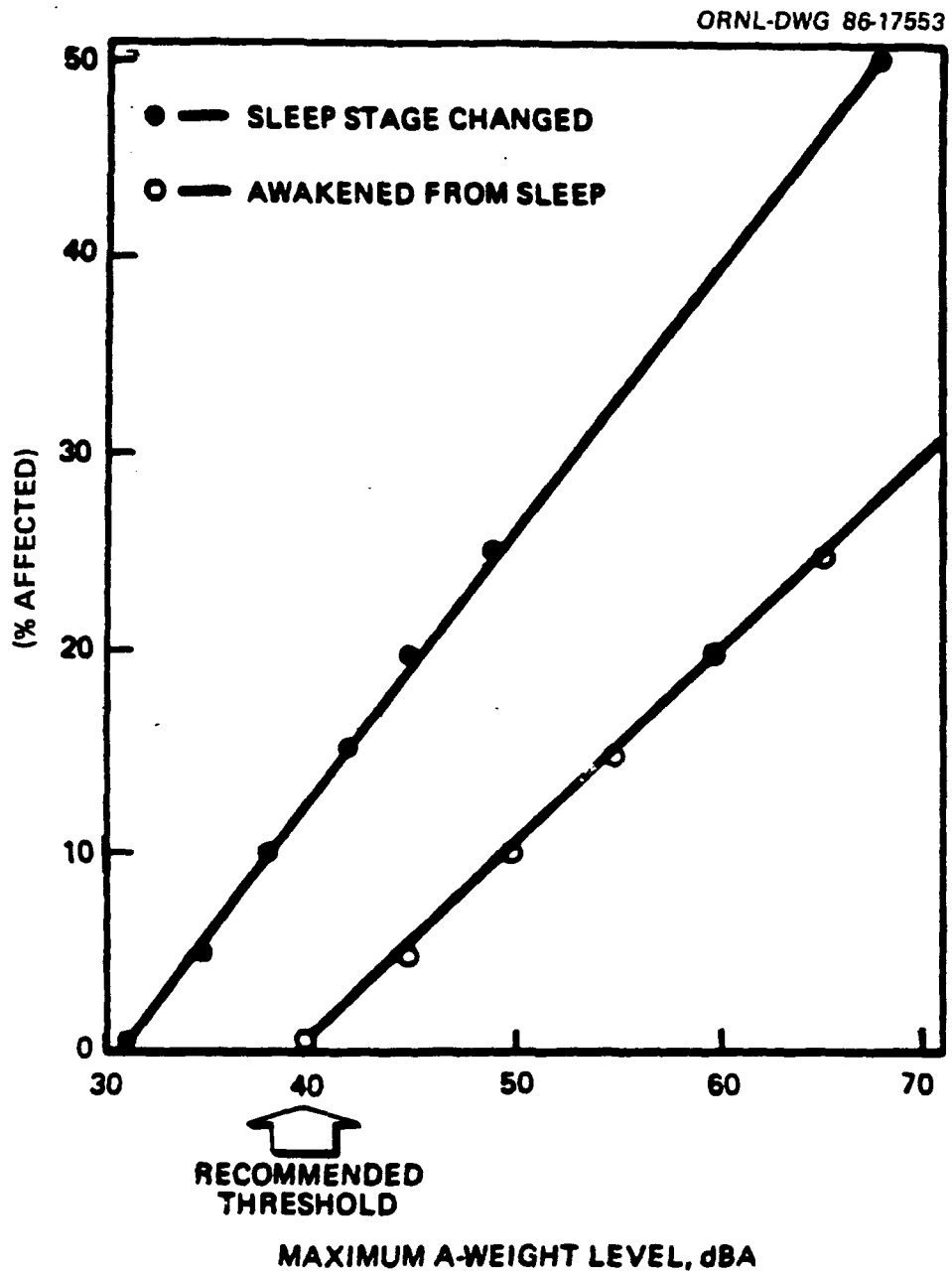

Fig. B.1. Composite of laboratory data for sleep interference versus maximum A-weighted noise level.

Source: Wyle Labs 1977.

windows are open or closed. For residential structures typical of those in the vicinity of Westover AFB, EPA recommends attenuation factors of 17 dB for summertime (windows open) conditions and 27 dB for wintertime (windows closed) conditions.

Incorporating the attenuation factors into the above equation gives the following relationships for the percent awakened under summertime and wintertime conditions:

$$\text{Percent Awakened (summer)} = 1.1(\text{ASEL} - 17) - 49.5$$

$$= 1.1(\text{ASEL}) - 68.2$$

$$\text{Percent Awakened (winter)} = 1.1(\text{ASEL} - 27) - 49.5$$

$$= 1.1(\text{ASEL}) - 79.2$$

These relationships were used to estimate the average percent of people within various SEL intervals who would be expected to be awakened by a single aircraft noise event:

Exterior SEL Interval	Average Percent Awakened	
	Summer	Winter
80-85	23	12
85-90	28	17
90-95	34	23
95-100	39	28
100-105	45	34
105-110	50	39

Hearing Loss

Hearing loss can be either temporary or permanent. A noise-induced temporary threshold shift is a temporary loss of hearing experienced after a relatively short exposure to excessive noise. A noise-induced threshold shift means that the detection level of sound has been increased. Recovery is fairly rapid after cessation of the noise. A noise-induced permanent threshold shift is an irreversible loss of hearing caused by prolonged exposure to excessive noise. This loss is essentially indistinguishable from the normal hearing loss associated with aging. Permanent hearing loss is generally associated with destruction of the hair cells of the inner ear. Based on EPA criteria, hearing loss is not expected for people living within noise contours below DNL levels of 75 dB. Further, as stated in the EPA "Levels Document," changes in hearing levels of <5 dB are generally not considered noticeable or significant (EPA 1974).

An outdoor DNL of 75 dB is considered as the threshold above which the risk of hearing loss is evaluated. Following the guidelines recommended by the Committee on Hearing, Bioacoustics, and Biomechanics (NAS 1977), the average change in threshold of hearing for areas exposed to DNL noise levels of 75 dB and above has been evaluated. Results show that an average of 1-dB hearing loss could be expected for people exposed

to DNL 75 dB and above. For the most sensitive 10% of the exposed population, the maximum anticipated hearing loss would be 4 dB. These hearing-loss projections must be considered worst-case predictions because the calculations are based on an average daily outdoor exposure of 16 hr (7:00 a.m. to 10:00 p.m.) over a 40-year period. It is doubtful that any individual will spend this amount of time outdoors within the DNL 75 dB and above noise contours. Changes in hearing levels of less than 5 dB are generally not considered by EPA to be noticeable or significant (EPA 1974). Therefore, based on a worst-case scenario, no appreciable hearing losses are expected to result from implementation of either the proposed or alternate mission change.

Effects on Domestic Animals and Wildlife

It has been known for many years that certain noises may cause physiological responses in some domestic animals. The primary domestic animals in Hampden and Hampshire counties are poultry, swine, and cattle. Each of these species has been the subject of noise studies.

EPA has reviewed the literature on noise effects in domestic animals (Dufour 1980). In general, there is an overall trend for domestic animals to adapt to intermittent (aircraft or aircraft-like) noise under 120 dB. Busnel (1978) reviewed effects around large airports and found no evidence to indicate noise-related adverse effects.

Possible adverse effects of noise exposure on wildlife include stress, hearing loss, interference with communication, physiological changes, behavioral reactions or changes, reduced reproductive success, and reduction of populations within the areas affected by the noise. The impact of noise exposure will generally be greater if the noise events are unexpected, if the noise events occur suddenly, if noise levels are high, and if the individual animal is inexperienced with noise. The impacts may also vary with the source of the noise and with the duration and frequency pattern of the noise (Fletcher 1978; Shotton 1982; EPA 1980).

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APPENDIX C

GUIDELINES FOR CONSIDERING NOISE IN LAND-USE PLANNING AND CONTROL

APPENDIX C

GUIDELINES FOR CONSIDERING NOISE IN LAND-USE PLANNING AND CONTROL

Department of Housing and Urban Development (HUD) Program and Policy

The major purpose of the Department of Housing and Urban Development's (HUD) noise regulations (24 CFR Part 51 Subpart B) is to ensure that activities assisted or insured by the Department achieve the goal of a suitable living environment. HUD also supports the efforts of other agencies in noise control.

The regulations generally apply to all HUD actions and provide minimum national standards to protect citizens against excessive noise in their communities and places of residence. The basic policy is that HUD assistance for construction of new noise sensitive uses is generally prohibited for projects with "unacceptable" noise exposures and is discouraged for projects with "normally unacceptable" noise exposure. Unacceptable noise exposure is defined as a noise level above 75 dB [day/night-average sound level (DNL) in decibels]. A "normally unacceptable" level is one >65 dB but not exceeding 75 dB. These noise levels are to be based on noise from all sources, highway, railroad, and aircraft.

Attenuation measures are normally required before projects in the "normally unacceptable" zone can be approved. Attenuation measures that reduce the external noise at a site are preferred, whenever practicable, over measures that only provide attenuation for the interior spaces. HUD's noise regulations also apply to modernization and rehabilitation. For major or substantial rehabilitation projects in the "normally unacceptable" and "unacceptable" noise zones, HUD will actively seek incorporation of noise attenuation features into the project. In the "unacceptable" noise zones, HUD will strongly encourage conversion of proposed sites to more compatible land uses.

HUD also requires that Comprehensive Planning Assistance grantees give adequate consideration to noise as an integral part of the urban environment, with particular emphasis being placed on the importance of compatible-land-use planning in relation to airports, highways, and other sources of high noise. Recipients of community development block grants under Title I of the Housing and Community Development Act of 1974 must also take into consideration the noise criteria and standards in the environmental assessment process.

Land-Use Compatibility Guidelines

Table C.1 classifies noise levels into a set of noise zones according to the most commonly used environmental noise descriptors. Noise zones are identified in order of increasing noise level by the letters "A" through "D." The DNL descriptor can be used for all noise sources. The Equivalent Sound Level (Leq) is included because some highway noise data can be expected to be in terms of an equivalent sound level for the highway "design hour"; see Table C.1 for a description of when Leq (design hour) is equivalent to DNL for planning purposes. The Leq descriptor itself is not unique to highways and can be applied to any noise source.

Table C.1. Noise zone classification

Noise Zone	Noise Exposure Class	Noise Descriptor			HUD Noise Standards
		DNL[1] Day-Night Average Sound Level	L_{eq}(hour)[3] Equivalent Sound Level	NEF[4] Noise Exposure Forecast	
A	Minimal Exposure	Not Exceeding 55	Not Exceeding 55	Not Exceeding 20	"Acceptable"
B	Moderate Exposure	Above 55[2] But Not Exceeding 65	Above 55 But Not Exceeding 65	Above 25 But Not Exceeding 30	
C-1	Significant Exposure	Above 65 Not Exceeding 70	Above 65 Not Exceeding 70	Above 30 But Not Exceeding 35	"Normally Unacceptable"[5]
C-2		Above 70 But Not Exceeding 75	Above 70 But Not Exceeding 75	Above 35 But Not Exceeding 40	
D-1	Severe Exposure	Above 75 But Not Exceeding 80	Above 40 But Not Exceeding 80	Not Exceeding 45	"Unacceptable"
D-2		Above 80 But Not Exceeding 85	Above 80 But Not Exceeding 85	Above 45 But Not Exceeding 50	
D-3		Above 85	Above 85	Above 50	

[1]CNEL — Community Noise Equivalent Level (California only) uses the same values.

[2]HUD, DOT and EPA recognize L_{dn} = 55 dB as a goal for outdoors in residential areas in protecting the public health and welfare with an adequate margin of safety (Reference: EPA "Levels" Document.) However, it is not a *regulatory* goal. It is a level defined by a negotiated scientific consensus without concern for economic and technological feasibility or the needs and desires of any particular community.

[3]The Federal Highway Administration (FHWA) noise policy uses this descriptor as an alternative to L_{10} (noise level exceeded ten percent of the time) in connection with its policy for highway noise mitigation. The L_{eq} (design hour) is equivalent to DNL for planning purposes under the following conditions: 1) heavy trucks equal ten percent of total traffic flow in vehicles per 24 hours; 2) traffic between 10 p.m. and 7 a.m. does not exceed fifteen percent of the average daily traffic flow in vehicles per 24 hours. Under these conditions DNL equals L_{10} - 3 decibels.

[4]For use in airport environs only; is now being superceded by DNL.

[5]The HUD Noise Regulation allows a certain amount of flexibility for non-acoustic benefits in zone C-1. Attenuation requirements can be waived for projects meeting special requirements.

Source: DOT 1980.

The Noise Exposure Forecast (NEF) descriptor is used for aircraft noise only and is being superseded by DNL. The Community Noise Equivalent Level (CNEL) descriptor (for the State of California) uses values similar to DNL.

Table C.2 contains suggested land-use compatibility guidelines. The table arrays land uses on the left with the noise zones of Table C.1 across the top. Land-use compatibility is expressed as being "compatible," "incompatible," and "compatible with restrictions." The system as presented in the table is comprised of two-digit categories identifying land-use activity in the most generalized way (e.g., "10 Residential"). Within some of the two-digit categories are sub-categories identifying activity in greater detail. Compatibility as expressed in this table represents a consolidation of existing federal agency guidelines. This table serves as a point of departure in making several types of determinations, including whether various land uses should be allowed at particular sites based upon the noise levels at those sites. Detailed planning should be based on the procedures and specific general planning guidance found in appropriate federal agency documents as well as the needs, desires, and site characteristics of the particular community. Table C.3 provides an indication of possible community reaction in residential environments at various levels. Another input to the planning process is the statement of public health and welfare goals in EPA's "Levels" Document (EPA 1978). The levels can be used by individual communities to incorporate public health and welfare goals into the planning process. These levels do not by themselves, however, form the sole basis for appropriate land-use actions because they do not consider cost, feasibility, the noise levels from any particular source or the development needs of the community and do include an adequate margin of safety. The levels should be considered by all communities in their planning, including those which now enjoy quiet and wish to preserve it, as well as those which are relatively noisy and wish to mitigate the problem.

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Table C.2. Suggested land use compatibility guidelines

Land Use		Noise Zones/DNL Levels in L_{dn}						
SLUCM No.	Name	A 0-55	B 55-65	C-1 65-70	C-2 70-75	D-1 75-80	D-2 80-85	D-3 85+
10	**Residential**							
11	Household units.							
11.11	Single units — detached	Y	Y*	25[1]	30[1]	N	N	N
11.12	Single units — semidetached	Y	Y*	25[1]	30[1]	N	N	N
11.13	Single units — attached row	Y	Y*	25[1]	30[1]	N	N	N
11.21	Two units — side-by-side	Y	Y*	25[1]	30[1]	N	N	N
11.22	Two Units — one above the other	Y	Y*	25[1]	30[1]	N	N	N
11.31	Apartments — walk up	Y	Y*	25[1]	30[1]	N	N	N
11.32	Apartments — elevator	Y	Y*	25[1]	30[1]	N	N	N
12	Group quarters	Y	Y*	25[1]	30[1]	N	N	N
13	Residential hotels	Y	Y*	25[1]	30[1]	N	N	N
14	Mobile home parks or courts	Y	Y*	N	N	N	N	N
15	Transient lodgings	Y	Y*	25[1]	30[1]	35[1]	N	N
16	Other residential	Y	Y*	25[1]	30[1]	N	N	N
20	**Manufacturing**							
21	Food and kindred products — manufacturing	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
22	Textile mill products — manufacturing	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
23	Apparel and other finished products made from fabrics, leather, and similar materials — manufacturing	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
24	Lumber and wood products (except furniture) — manufacturing	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
25	Furniture and fixtures — manufacturing	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
26	Paper and allied products — manufacturing	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
27	Printing, publishing, and allied industries	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
28	Chemicals and allied products — manufacturing	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
29	Petroleum refining and related industries	Y	Y	Y	Y[2]	Y[3]	Y[4]	N

*The designation of these uses as "compatible" in this zone reflects individual Federal agencies' consideration of general cost and feasibility factors as well as past community experiences and program objectives. Localities, when evaluating the application of these guidelines to specific situations, may have different concerns or goals to consider.

Table C.2. Suggested land use compatibility guidelines (continued)

Land Use		Noise Zones/DNL Levels in L_{dn}						
SLUCM No.	Name	A 0-55	B 55-65	C-1 65-70	C-2 70-75	D-1 75-80	D-2 80-85	D-3 85+
30	**Manufacturing (cont'd)**							
31	Rubber and misc. plastic products — manufacturing	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
32	Stone, clay and glass products — manufacturing	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
33	Primary metal industries	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
34	Fabricated metal products — manufacturing.	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
35	Professional, scientific, and controlling instruments; photographic and optical goods; watches and clocks — manufacturing	Y	Y	Y	25	30	N	N
39	Miscellaneous manufacturing	Y	Y	Y	Y[2]	Y[3]	Y[4]	
40	**Transportation, communication and utilities**							
41	Railroad, rapid rail transit and street railway transportation	Y	Y	Y	Y[2]	Y[3]	Y[4]	Y
42	Motor vehicle transportation	Y	Y	Y	Y[2]	Y[3]	Y[4]	Y
43	Aircraft transportation	Y	Y	Y	Y[2]	Y[3]	Y[4]	Y
44	Marine craft transportation	Y	Y	Y	Y[2]	Y[3]	Y[4]	Y
45	Highway and street right-of-way	Y	Y	Y	Y[2]	Y[3]	Y[4]	Y
46	Automobile parking	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
47	Communication	Y	Y	Y	25[5]	30[5]	N	N
48	Utilities	Y	Y	Y	Y[2]	Y[3]	Y[4]	Y
49	Other transportation, communication and utilities	Y	Y	Y	25[5]	30[5]	N	N
50	**Trade**							
51	Wholesale trade	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
52	Retail trade — building materials, hardware and farm equipment	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
53	Retail trade — general merchandise	Y	Y	Y	25	30	N	N
54	Retail trade — food	Y	Y	Y	25	30	N	N
55	Retail trade — automotive, marine craft, aircraft and accessories	Y	Y	Y	25	30	N	N
56	Retail trade — apparel and accessories	Y	Y	Y	25	30	N	N
57	Retail trade — furniture, home furnishings and equipment	Y	Y	Y	25	30	N	N
58	Retail trade — eating and drinking establishments	Y	Y	Y	25	30	N	N
59	Other retail trade	Y	Y	Y	25	30	N	N

Table C.2. Suggested land use compatibility guidelines (continued)

Land Use		Noise Zones/DNL Levels in L_{dn}						
SLUCM No.	Name	A 0-55	B 55-65	C-1 65-70	C-2 70-75	D-1 75-80	D-2 80-85	D-3 85+
60	**Services**							
61	Finance, insurance and real estate services	Y	Y	Y	25	30	N	N
62	Personal services	Y	Y	Y	25	30	N	N
62.4	Cemeteries	Y	Y	Y	Y[2]	Y[3]	Y[4,11]	Y[6,11]
63	Business services	Y	Y	Y	25	30	N	N
64	Repair services	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
65	Professional services	Y	Y	Y	25	30	N	N
65.1	Hospitals, nursing homes	Y	Y*	25*	30*	N	N	N
65.1	Other medical facilities	Y	Y	Y	25	30	N	N
66	Contract construction services	Y	Y	Y	25	30	N	N
67	Governmental services	Y	Y*	Y*	25*	30*	N	N
68	Educational services	Y	Y*	25*	30*	N	N	N
69	Miscellaneous services	Y	Y	Y	25	30	N	N
70	**Cultural, entertainment and recreational**							
71	Cultural activities (including churches)	Y	Y*	25*	30*	N	N	N
71.2	Nature exhibits	Y	Y*	Y*	N	N	N	N
72	Public assembly	Y	Y	Y	N	N	N	N
72.1	Auditoriums, concert halls	Y	Y	25	30	N	N	N
72.11	Outdoor music shells, amphitheaters	Y	Y*	N	N	N	N	N
72.2	Outdoor sports arenas, spectator sports	Y	Y	Y[7]	Y[7]	N	N	N
73	Amusements	Y	Y	Y	Y	N	N	N
74	Recreational activities (incl. golf courses, riding stables, water recreation)	Y	Y*	Y*	25*	30*	N	N
75	Resorts and group camps	Y	Y*	Y*	Y*	N	N	N
76	Parks	Y	Y*	Y*	Y*	N	N	N
79	Other cultural, entertainment and recreation	Y	Y*	Y*	Y*	N	N	N
80	**Resource production and extraction**							
81	Agriculture (except livestock)	Y	Y	Y[8]	Y[9]	Y[10]	Y[10,11]	Y[10,11]
81.5 to 81.7	Livestock farming and animal breeding	Y	Y	Y[8]	Y[9]	N	N	N
82	Agricultural related activities	Y	Y	Y[8]	Y[9]	Y[10]	Y[10,11]	Y[10,11]
83	Forestry activities and related services	Y	Y	Y[8]	Y[9]	Y[10]	Y[10,11]	Y[10,11]
84	Fishing activities and related services	Y	Y	Y	Y	Y	Y	Y
85	Mining activities and related services	Y	Y	Y	Y	Y	Y	Y
89	Other resource production and extraction	Y	Y	Y	Y	Y	Y	Y

Table C.2. Suggested land use compatibility guidelines (continued)

Notes for Table C.2.

1. a) Although local conditions may require residential use, it is discouraged in C-1 and strongly discouraged in C-2. The absence of viable alternative development options should be determined and an evaluation indicating that a demonstrated community need for residential use would not be met if development were prohibited in these zones should be conducted prior to approvals.

   b) Where the community determines that residential uses must be allowed, measures to achieve outdoor to indoor Noise Level Reduction (NLR) of at least 25 dB (Zone C-1) and 30 dB (Zone C-2) should be incorporated into building codes and be considered in individual approvals. Normal construction can be expected to provide a NLR of 20 dB, thus the reduction requirements are often stated as 5, 10 or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year round. Additional consideration should be given to modifying NLR levels based on peak noise levels.

   c) NLR criteria will not eliminate outdoor noise problems. However, building location and site planning, design and use of berms and barriers can help mitigate outdoor noise exposure particularly from ground level sources. *Measures that reduce noise at a site should be used wherever practical in preference to measures which only protect interior spaces.*

2. Measures to achieve NLR of 25 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.

3. Measures to achieve NLR of 30 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.

4. Measures to achieve NLR of 35 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.

5. If noise sensitive use indicated NLR; if not use is compatible.

6. No buildings.

7. Land use compatible provided special sound reinforcement systems are installed.

8. Residential buildings require a NLR of 25.

9. Residential buildings require a NLR of 30.

10. Residential buildings not permitted.

11. Land use not recommended, but if community decides use is necessary, hearing protection devices should be worn by personnel.

Table C.2. Suggested land use compatibility guidelines (continued)

Key to Table C.2

SLUCM	**Standard Land Use Coding Manual**
Y (Yes)	**Land Use and related structures compatible without restrictions.**
N (No)	**Land Use and related structures are not compatible and should be prohibited.**
NLR (Noise Level Reduction)	**Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.**
Y^x (Yes with restrictions)	**Land Use and related structures generally compatible; see notes 2 through 4.**
25, 30, or 35	**Land Use and related structures generally compatible; measures to achieve NLR of 25, 30 or 35 must be incorporated into design and construction of structure.**
25*, 30* or 35*	**Land Use generally compatible with NLR; however, measures to achieve an overall noise reduction do not necessarily solve noise difficulties and additional evaluation is warranted.**

Source: DOT 1980.

Table C.3. Effects of noise on people (residential land uses only)

Effects[1] / Day-Night Average Sound Level in Decibels	Hearing Loss	Speech Interference		Annoyance[2]	Average Community Reaction[4]	General Community Attitude Towards Area
		Indoor	Outdoor			
	Qualitative Description	% Sentence Intelligibility	Distance in Meters for 95% Sentence Intelligibility	% of Population Highly Annoyed[3]		
75 and above	May Begin to Occur	98%	0.5	37%	Very Severe	Noise is likely to be the most important of all adverse aspects of the community environment.
70	Will Not Likely Occur	99%	0.9	25%	Severe	Noise is one of the most important adverse aspects of the community environment.
65	Will Not Occur	100%	1.5	15%	Significant	Noise is one of the important adverse aspects of the community environment.
60	Will Not Occur	100%	2.0	9%	Moderate to Slight	Noise may be considered an adverse aspect of the community environment.
55 and below	Will Not Occur	100%	3.5	4%		Noise considered no more important than various other environmental factors.

1. "Speech Interference" data are drawn from the following tables in EPA's "Levels Document": Table 3, Fig. D-1, Fig. D-2, Fig. D-3. All other data from National Academy of Science 1977 report "Guidelines for Preparing Environmental Impact Statements on Noise, Report of Working Group 69 on Evaluation of Environmental Impact of Noise."
2. Depends on attitudes and other factors.
3. The percentages of people reporting annoyance to lesser extents are higher in each case. An unknown small percentage of people will report being "highly annoyed" even in the quietest surroundings. One reason is the difficulty all people have in integrating annoyance over a very long time.
4. Attitudes or other non-acoustic factors can modify this. Noise at low levels can still be an important problem, particularly when it intrudes into a quiet environment.

NOTE: Research implicates noise as a factor producing stress-related health effects such as heart disease, high-blood pressure and stroke, ulcers and other digestive disorders. The relationships between noise and these effects, however, have not as yet been quantified.

Source: DOT 1980.

APPENDIX D

ANALYSIS OF NOISE IMPACTS

APPENDIX D
ANALYSIS OF NOISE IMPACTS

Increases in noise levels in areas surrounding Westover Air Force Base (AFB) are considered to be the major issue associated with implementation of either military action or a decision to permit 24-hr operation of the airfield as requested by Westover Metropolitan Development Corporation (WMDC) for development of air cargo operations and scheduled passenger service and expansion of general aviation operations. The NOISEMAP methodology described in Sect. 3.2 was used to provide estimates of the noise levels which would be expected to result from projected aircraft operations. Contour maps indicating predicted noise levels were prepared by the Air Force Engineering Services Center at Tyndall AFB, Florida, based on the operations data summarized in Sect. 4.1 (Tables 4.1, 4.2, and 4.3) and additional information including aircraft flight tracks, altitude and power profiles, and runway utilization. These contour maps were used to provide estimates of the number of area residents exposed to various noise levels and to estimate noise levels at schools and hospitals, facilities which are considered to be particularly sensitive to noise. The results of these analyses are presented in this Appendix and provide the basis for the impact estimates presented in Sect. 4.2.

The noise levels expected to result from implementation of the proposed and alternate military actions (with no change in civil aviation operations) are presented in Sect. D.1. Section D.2 discusses the noise levels that could result if civil aviation operations were developed to the levels indicated in the WMDC Master Plan (with no change in military aircraft operations) as originally proposed. As noted in Sect. 2.1.2.1, subsequent to the issuance of the Draft Environmental Impact Statement (DEIS), WMDC developed a mitigation plan to reduce the noise impacts of civil aviation operations. This mitigation plan is presented in Appendix J, and the noise impacts are analyzed in Appendix K. Section D.3 describes the noise levels which could result from the development of civil aviation operations as originally proposed in combination with either the proposed or alternate military actions.

D.1 NOISE LEVELS AND EXPOSURES FROM THE PROPOSED (16 C-5A AIRCRAFT) AND ALTERNATE (8 C-5A AIRCRAFT) ACTIONS

D.1.1 Predicted Noise Levels

D.1.1.1 Single-event noise levels

As discussed in Appendix A, noise levels produced by individual aircraft operations are best characterized by the Sound Exposure Level (SEL), the loudness of a constant noise source which would deliver an equivalent amount of sound energy in a period of 1 sec. The SEL provides a convenient basis for comparison of noise events which have different durations and which vary in intensity.

In evaluating SEL data, it must be noted that there is no general relationship between the SEL value and either the maximum or average noise levels which would be measured during an aircraft flyover. In areas relatively near the flight tracks, noise intrusions resulting from

aircraft operations would typically have a duration of 20 to 30 sec and maximum noise levels would be 5 to 7 dB lower than the indicated SEL value. Equivalent noise levels for the duration of the event would be expected to be 13 to 15 dB lower than the SEL value. In areas farther away from the flight tracks, durations would typically be 30 sec or more; maximum noise levels would be 7 to 10 dB lower than the SEL value, and equivalent noise levels would be 15 to 20 dB lower.

SEL values at locations surrounding the base could exceed 110 dB for takeoffs and operations on the visual flight rules (VFR) closed patterns and 105 dB for landing operations. Maximum noise levels would be approximately 100 to 105 db during these operations, and average levels would be in the range of 90 to 98 dB. Based on the data presented in Table A.1, these levels would be classified as loud to very loud. Average noise levels would be similar to the levels produced by operation of power lawnmowers.

Because noise levels at schools and hospitals are of particular concern, SEL values predicted to result at facilities in the vicinity of Westover AFB are indicated in Table D.1. This table also indicates predicted 5-hr equivalent noise levels, which are discussed in Sect. D.1.1.3.

Limited noise measurements were made by A. F. Meyer and Associates, Inc., during C-5A aircraft operations at Westover AFB on December 17, 1985. Measurements made at locations on the departure, VFR closed pattern, and approach flight tracks for runway 23 indicated noise levels that were below those predicted by the NOISEMAP program. It should be noted that the noise data used in this program represent long-term averages of the levels expected under a wide range of conditions, whereas measurements made at any specific time and location may be influenced by weather, vegetation, and other attenuating features at the measurement location, as well as aircraft operating parameters. The measured values were not corrected to the standard conditions used in the NOISEMAP program and cannot be directly compared to the levels predicted by this analysis. Thus, although the measured values were somewhat lower than those predicted by the NOISEMAP program, this analysis is based on the values predicted by NOISEMAP.

D.1.1.2 Day-night average noise levels

As noted in Appendix A, community reaction to noise, including aircraft noise, has been found to correlate well with the DNL. In calculating the DNL, noise levels resulting from operations between 10 p.m. and 7 a.m. are weighted by 10 dB to account for the increased level of annoyance resulting from noise intrusions during these hours. DNL contours predicted to result from aircraft operations for the proposed (16-aircraft) and alternate (8-aircraft) military actions are indicated in Figs. D.1 and D.2 respectively. These represent an annual average based on 5 days of flying operations per week. Since flight operations would take place on only 4 days/week for the proposed (16-aircraft) military action, the DNL contours indicated in Fig. D.1 are approximately 1 db lower than the 24-hr equivalent noise level which would occur on days when flight operations took place. Differences in DNL levels of 1 dB would not

normally be detectable by an individual. The contours in Fig. D.2 are based on an average of two local training sorties per week for the alternate (8-aircraft) military action. Equivalent noise levels on days when flying operations occurred would be the same as for the proposed action (i.e., approximately 1 dB higher than the DNL levels indicated in Fig. D.1).

The highest DNL levels would occur in the area to the northeast of the runway under the approach to runway 23 because of the concentration of aircraft activity (approaches and VFR closed pattern operations) in this area. The maximum DNL levels in residential areas would occur in the area of Granby bounded by East, Taylor, and Truby Streets, the area which is most affected by current operations. The residences exposed to the highest DNL levels (approximately 77 dB for the proposed action and 73 dB for the alternate action) are located on East Street approximately 1500 ft east of Sherwood Drive.

Table D.2 provides a comparison of the areas within 5-dB DNL contour intervals for the current, proposed, and alternate military operations. As indicated in this table, implementation of the proposed military action would result in an increase of approximately 176% in the area exposed to DNL levels >65 dB (from approximately 3.3 to 9.2 sq. mi.). Implementation of the alternate action would result in an increase of about 72% (to approximately 5.7 sq. mi.). No schools or hospitals would be exposed to DNL levels >65 dB for either military action.

D.1.1.3 Five-hour equivalent noise levels

If either military action were implemented, the duration of local proficiency training flight operations would be increased from the current level of 2.5 hr to 5 hr; however, the number of training sorties would be reduced from approximately 30 per week to 4 per week for the proposed (16-aircraft) action and two per week for the alternate (8-aircraft) action. Because local flying activity would be concentrated in a few periods rather remaining at the relatively constant level associated with current operations, the 5-hr equivalent noise levels (Leq-5) that would result from a typical local training sortie were also evaluated. Equivalent noise level contours for local training operations are shown in Figs. D.3 and D.4 for operation on runways 05 and 23 respectively. Table D.3 indicates the areas within the various contours for operations on each runway. Equivalent noise levels at area schools and hospitals are indicated in Table D.1.

D.1.2 Population Exposure to Aircraft Noise

Fewer than 100 people are estimated to be exposed to DNL levels >65 dB by current military and civilian aircraft operations. To provide an estimate of the number of area residents exposed to noise by current and proposed military aircraft operations, the DNL and Leq-5 contours indicated in Figs. D.1 and D.2 were overlaid on census maps. These maps indicate the location of census "blocks," which are areas bounded by four streets and also are the smallest areas for which census information is published. When portions of a block were located in more than one contour interval, the percentage of the block area within each contour interval

was estimated and an equivalent percentage of the population of the block was assigned to each interval. In areas such as Ludlow and Granby, where many of the census blocks are larger than typical "city blocks," the census data were supplemented by inspection of topographic maps and aerial photographs taken in September of 1985.

Tables D.4 and D.5 indicate the estimated number of residents in each affected community living within the various DNL contour intervals predicted to result from the proposed and alternate military actions respectively. As indicated in Table D.4, implementation of the proposed (16-aircraft) action would be predicted to result in the exposure of approximately 3,550 area residents to DNL levels >65 dB. Of these, approximately 170 would be exposed to DNL levels >70 db and approximately 30 would be exposed to levels >75 dB (the highest exposure is estimated to be about 77 dB). Implementation of the alternate (8-aircraft) action would result in the exposure of approximately 1600 residents to DNL levels >65 dB. Approximately 100 people would be exposed to levels >70 dB; however, none would be exposed to levels above 75 dB (the highest exposure is estimated to be about 73 dB).

The same technique was used to estimate the number of residents in areas exposed to Leq-5 levels above 65 dB. The results of this analysis are presented in Tables D.6 and D.7 for operations on runways 05 and 23, respectively. Because operations on runway 05 would result in approaches and VFR closed patterns over densely populated areas of Springfield and Chicopee, a significantly larger number of residents (approximately 47,500 vs 16,200) would be exposed to Leq-5 levels above 65 dB by operations on runway 05, as compared to operations on runway 23. Operations on runway 05 would be expected to occur approximately 20% of the time (3 or 4 days/month).

Table D.1. Exterior noise levels[a] at facilities in the vicinity of Westover AFB for C-5A aircraft operations

Area Facility	Sound exposure level (SEL) (dB)										Five-hour equivalent level (Leq-5) (dB)	
	Operations on runway 23[b,c]					Operations on runway 05[b,c]					Operations on[b,c]	
	Landing	Closed Pattern	Takeoffs Straight	Takeoffs Right	Takeoffs Left	Landing	Closed Pattern	Takeoffs Straight	Takeoffs Right	Takeoffs Left	RW 05	RW 23
Hospitals												
Holyoke												
Holyoke Hospital	a	a	a	71	a	a	a	a	70	a	a	a
Providence Hospital	a	a	69	95	a	a	a	a	a	a	a	a
V.A. Hospital	a	a	a	70	a	a	a	a	68	a	a	a
Ludlow												
Hubbard Memorial Hospital	a	82	a	a	67	a	89	a	a	68	a	a
Springfield												
Baystate Springfield	a	74	96	75	74	100	74	71	69	69	66	a
Mercy Hospital	a	74	96	74	74	99	76	71	69	69	70	a
Municipal Hospital	a	70	76	67	96	69	95	a	a	a	a	a

[a]Values are indicated for schools exposed to exterior SEL values >75 dB and Leq-5 values >65 dB by aircraft operations; values indicated as "a" would be <65 dB. Exterior maximum noise levels (ALm) would be approximately 5 to 10 dB lower than the SEL and interior noise levels about 25 dB lower in summertime (windows open) conditions and about 35 dB lower in wintertime (windows closed) conditions due to attenuation by the building.

[b]Training sorties (lasting about 5 hr each) would occur four times per week for the proposed action and twice per week for the alternate action. About 80% of the sorties would use runway 23 and about 20% would use runway 05. All operations during a sortie would normally be on the same runway. Most sorties would be scheduled on training weekends or after about 4:30 p.m. during the week.

[c]A typical sortie would include about 12 takeoffs and landings plus 8 closed pattern operations. Takeoffs would be distributed between straight-out departures (50%) and departures using right and left turns (25% each).

Table D.1 (Continued)

Area Facility	Sound exposure level (SEL) (dB)										Five-hour equivalent level (Leq-5) (dB)	
	Operations on runway 23[b,c]					Operations on runway 05[b,c]					Operations on[b,c]	
	Landing	Closed Pattern	Takeoffs Straight	Takeoffs Right	Takeoffs Left	Landing	Closed Pattern	Takeoffs Straight	Takeoffs Right	Takeoffs Left	RW 05	RW 23
Shriners Hospital	a	76	96	76	77	101	78	72	70	70	70	a
Wesson Memorial	a	70	82	67	75	83	74	a	a	a	a	a
Schools												
Agawam												
Agawam H.S.	a	a	95	a	a	96	a	65	a	a	a	a
Agawam J.H.S.	a	67	98	67	62	100	67	66	a	a	65	a
Danahy E.S.	a	66	92	67	65	94	65	65	a	a	a	a
Phelps E.S.	a	a	85	a	65	84	65	a	a	a	a	a
Pierce E.S.	a	a	90	a	a	90	a	a	a	a	a	a
Robinson Park E.S.	a	a	90	65	a	90	a	a	a	a	a	a
Chicopee												
Alvord Sch.	66	85	97	92	84	96	95	78	78	79	65	a
Assumption Sch.	a	76	85	86	73	85	69	72	67	66	a	a
Barry E.S.	a	79	85	103	79	78	76	75	77	76	a	66
Belamy Sch.	a	68	72	81	72	66	67	75	76	75	a	a
Belcher Sch.	67	88	102	93	87	102	101	81	81	81	71	65
Bowe E.S.	a	74	85	83	72	84	71	67	65	65	a	a
Bowie Sch.	71	82	82	82	83	74	81	83	84	81	a	a
Chapin Sch.	a	a	69	82	65	a	a	66	70	67	a	a
Chicopee H.S.	a	80	92	87	77	87	84	74	73	73	a	a
Comp. H.S.	a	75	80	93	76	72	70	75	77	76	a	a
Elms College	a	77	89	84	75	89	a	70	69	69	a	a
Hampden Sch.	a	a	68	81	a	a	a	66	70	66	a	a
Holy Name H.S.	a	76	95	85	73	85	72	67	67	66	a	a

Table D.1 (Continued)

Area Facility	Sound exposure level (SEL) (dB)										Five-hour equivalent level (Leq-5) (dB)	
	Operations on runway 23[b,c]					Operations on runway 05[b,c]					Operations on[b,c]	
	Landing	Closed Pattern	Takeoffs Straight	Takeoffs Right	Takeoffs Left	Landing	Closed Pattern	Takeoffs Straight	Takeoffs Right	Takeoffs Left	RW 05	RW 23
Kirby Annex	a	65	72	92	65	a	a	a	65	a	a	a
La Voie E.S.	a	73	78	93	74	70	69	74	75	74	a	a
Lithwin E.S.	70	90	85	87	87	77	85	86	85	85	a	a
Memorial Sch.	a	67	69	71	76	a	68	69	77	70	a	a
Mt. Carmel Sch.	a	a	68	80	65	a	a	67	72	68	a	a
Stefanik E.S.	a	68	74	97	66	a	a	a	65	a	a	a
Streiber Sch.	a	72	73	71	76	68	71	76	78	75	a	a
St. Georges E.S.	66	86	97	97	85	94	95	79	80	80	65	a
St. Joan of Arc E.S.	a	73	79	97	73	72	69	72	73	72	a	a
St. Patricks E.S.	65	84	92	101	83	89	89	77	78	77	a	a
St. Stanislaus E.S.	a	78	90	87	77	89	80	72	71	71	a	a
Szetela E.S.	a	74	81	100	73	74	70	68	69	68	a	a
Granby												
Granby E.S.	74	68	65	a	a	a	70	79	69	94	a	a
Granby H.S.	88	72	67	65	65	a	73	88	72	68	a	a
St. Hyacinths Seminary	99	73	70	67	67	a	72	95	73	a	a	70
Holyoke												
Donahue E.S.	a	a	65	82	a	a	a	a	65	a	a	a
McMahon Sch.	a	a	a	77	a	a	a	a	66	a	a	a
Springdale Sch.	a	a	a	77	a	a	a	a	70	a	a	a
Ludlow												
Chapin E.S.	a	100	67	85	67	a	105	66	72	72	71	62
East St. E.S.	a	77	a	a	a	a	83	a	a	a	a	a

Table D.1 (Continued)

Area Facility	Sound exposure level (SEL) (dB)										Five-hour equivalent level (Leq-5) (dB)	
	Operations on runway 23[b,c]					Operations on runway 05[b,c]					Operations on[b,c]	
	Landing	Closed Pattern	Takeoffs Straight	Takeoffs Right	Takeoffs Left	Landing	Closed Pattern	Takeoffs Straight	Takeoffs Right	Takeoffs Left	RW 05	RW 23
Ludlow H.S.	a	81	a	69	a	a	89	a	69	a	a	a
Ludlow J.H.S.	a	105	68	76	68	a	105	67	72	74	71	71
St. John E.S.	a	81	a	65	a	a	87	a	a	65	a	a
Vetrans Park E.S.	a	79	a	68	a	a	86	a	68	a	a	a
Springfield												
Acushnet Ave. Sch.	a	70	77	a	73	77	72	a	a	a	a	a
American Int'l College	a	75	77	67	88	73	83	a	a	a	a	a
Armory St. M.S.	a	75	95	75	78	97	79	71	70	70	70	a
Balliet E.S.	a	77	73	66	94	a	100	a	a	65	66	a
Bowles E.S.	66	87	96	83	92	95	107	78	77	78	75	a
Brightwood E.S.	a	70	91	73	71	93	70	68	65	65	a	a
Brookings E.S.	a	72	74	a	79	73	75	a	a	a	a	a
Buckingham Sch.	a	75	78	66	84	76	80	a	a	a	a	a
Carew Sch.	a	72	95	69	74	100	75	71	68	68	a	a
Deberry E.S.	a	75	78	66	82	78	78	a	a	a	68	a
Dorman E.S.	a	76	77	69	100	68	105	65	66	67	a	a
Duggan J.H.S.	a	71	69	a	94	a	86	a	a	a	74	a
Eastern Ave. Sch.	a	74	74	a	82	72	77	a	a	a	a	a
Forest Park J.H.S.	a	69	70	a	78	65	75	a	a	a	a	a
Freidman M.S.	a	69	68	a	93	a	83	a	a	a	a	a
Glenwood E.S.	65	79	99	80	79	105	80	74	74	74	70	a
Glickman M.S.	a	68	75	a	82	a	82	a	a	a	a	a
Harris Sch.	a	a	66	a	96	a	74	a	a	a	a	a
Holy Cross E.S.	a	65	67	a	96	a	76	a	a	a	a	a
Holy Family School	a	75	75	a	84	105	78	a	a	a	a	a
Holy Name Sch.	a	68	69	a	82	a	76	a	a	a	a	a
Homer St. E.S.	a	75	75	66	90	69	85	a	a	a	a	a

Table D.1 (Continued)

Area Facility	Sound exposure level (SEL) (dB)										Five-hour equivalent level (Leq-5) (dB)	
	Operations on runway 23[b,c]					Operations on runway 05[b,c]					Operations on[b,c]	
	Landing	Closed Pattern	Takeoffs Straight	Takeoffs Right	Takeoffs Left	Landing	Closed Pattern	Takeoffs Straight	Takeoffs Right	Takeoffs Left	RW 05	RW 23
Howard St. Sch.	a	68	82	66	82	84	71	a	a	a	a	a
Immaculate Con. E.S.	a	84	a	65	68	a	92	a	a	70	a	a
Jefferson Ave. Sch.	a	74	95	74	84	102	74	71	69	68	67	a
J.H.S.	a	74	95	74	85	102	75	71	69	69	69	a
Kensington Ave. Sch.	a	70	72	a	80	66	76	a	a	a	a	a
Kiley J.H.S.	a	a	a	a	78	a	66	a	a	a	a	a
Lincoln Sch.	a	74	95	85	74	100	68	71	69	69	65	a
Lynch E.S.	a	74	67	a	80	a	92	a	a	69	a	a
Memorial E.S.	a	68	69	a	95	a	80	a	a	a	a	a
Morris E.S.	a	81	75	69	90	65	105	68	69	70	70	a
Myrtle St. E.S.	a	101	68	71	75	a	105	70	70	77	70	67
Our Lady of Mt. Carmel Sch.	a	70	80	65	73	82	72	a	a	a	a	a
Pottenger E.S.	65	83	95	80	87	94	109	75	75	75	75	a
Sacred Heart E.S.	a	75	73	67	92	a	105	65	65	67	70	a
School St. Sch.	a	70	83	67	74	93	73	a	a	a	a	a
Sixteen Acres E.S.	a	a	a	a	74	a	75	a	a	a	a	a
Springfield College	a	75	73	a	87	67	80	a	a	a	a	a
St. Aloysius Sch.	a	95	66	69	74	a	105	67	67	75	70	a
St. Josephs Sch.	a	68	82	6	71	84	71	a	a	a	a	a
St. Matthews E.S.	a	100	68	71	71	a	98	70	a	73	70	66
Tapley E.S.	a	70	82	69	82	71	81	a	a	a	a	a
Trade H.S.	a	70	76	67	85	69	93	a	a	a	a	a
Ursuline Academy	a	70	79	65	75	79	73	a	a	a	a	a
Van Sickle J.H.S.	a	79	95	80	84	95	95	74	74	74	68	a
Warner E.S.	a	77	a	a	73	a	89	a	a	71	a	a
Washington Sch.	a	a	67	a	86	a	74	a	a	a	a	a
White St. Sch.	a	68	68	a	85	a	77	a	a	a	a	a

Table D.1 (Continued)

Area Facility	Sound exposure level (SEL) (dB)										Five-hour equivalent level (Leq-5) (dB)	
	Operations on runway 23[b,c]					Operations on runway 05[b,c]					Operations on[b,c]	
	Landing	Closed Pattern	Takeoffs Straight	Takeoffs Right	Takeoffs Left	Landing	Closed Pattern	Takeoffs Straight	Takeoffs Right	Takeoffs Left	RW 05	RW 23
West Springfield												
Ashley E.S.	a	68	73	93	a	a	a	a	a	a	a	a
Cowing J.H.S.	a	70	95	70	70	97	68	67	65	65	a	a
Fausey E.S.	a	a	72	75	a	70	a	a	a	a	a	a
Main St. E.S.	a	70	95	70	71	97	72	68	65	65	65	a
Memorial E.S.	a	68	95	68	68	100	68	67	a	a	65	a
Mittineague E.S.	a	a	85	68	a	a	a	a	a	a	a	a
Park Ave. E.S.	a	70	95	70	70	98	68	67	65	65	65	a
St. Thomas E.S.	a	a	83	68	a	84	a	a	a	a	a	a
Tatnam E.S.	a	a	70	a	a	a	a	a	a	a	a	a
West Springfield H.S.	a	a	76	72	a	77	a	a	a	a	a	a
West Springfield J.H.S.	a	68	94	70	70	95	68	67	65	a	a	a
Wilbraham												
Pines Sch.	a	78	a	a	68	a		a	a	66	a	a

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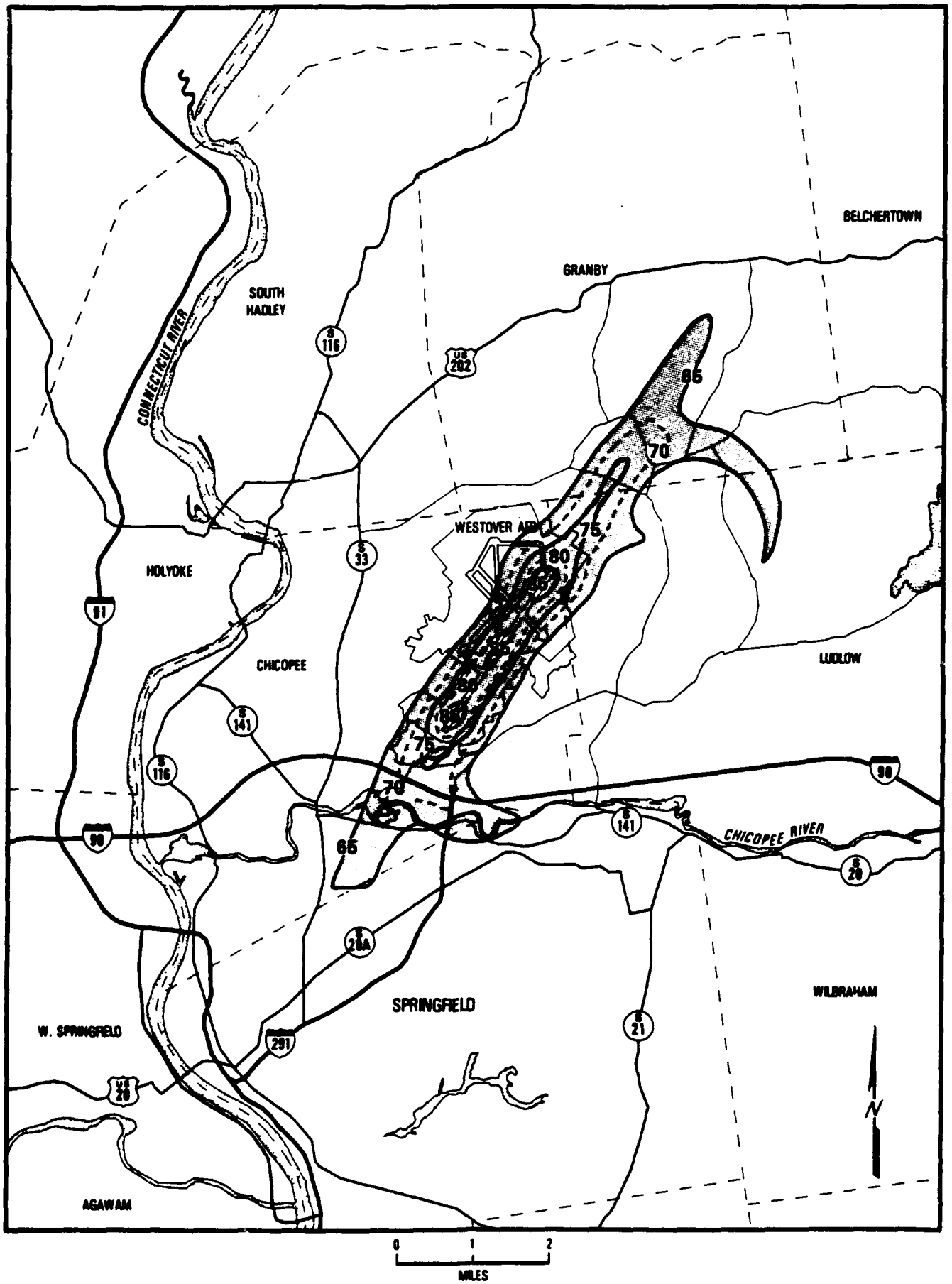

Fig. D.1. DNL contours for proposed military operations (16 C-5A).

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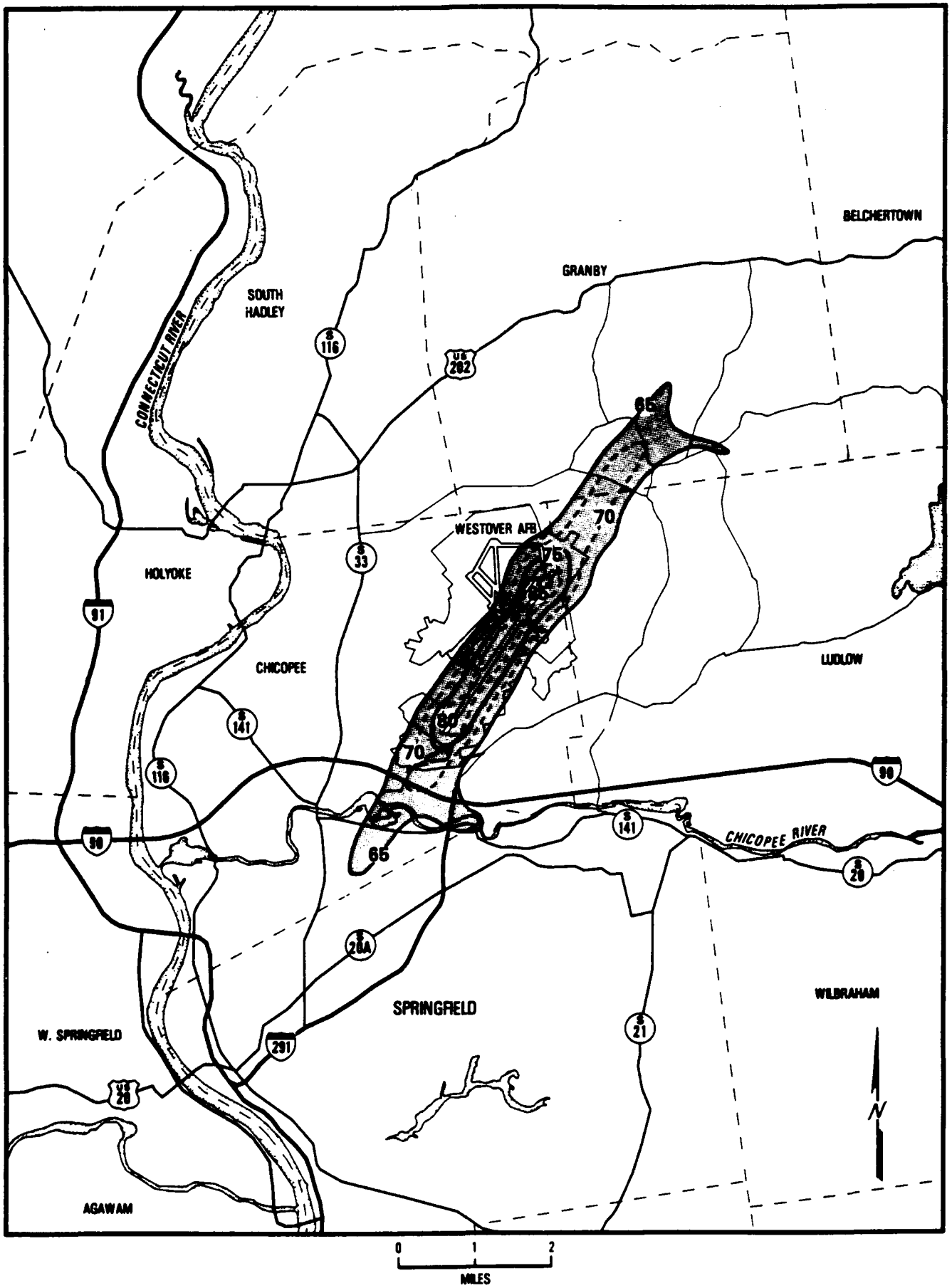

Fig. D.2. DNL contours for alternate military operations (8 C-5A).

Table D.2. Areas with DNL noise levels above 65 dB for proposed and alternate military aircraft operations

DNL contour interval	Area within contour		Cumulative area	
	Acres	Sq. mi.	Acres	Sq. mi.
Current mission: 16 C-130E aircraft				
>85	29	0.05	29	0.05
80-85	131	0.20	159	0.25
75-80	369	0.58	528	0.83
70-75	468	0.73	996	1.56
65-70	1,143	1.79	2,140	3.34
Total	2,140	3.34		
Proposed mission: 16 C-5A aircraft				
>85	18	0.03	18	0.03
80-85	461	0.72	479	0.75
75-80	935	1.46	1,414	2.21
70-75	1,611	2.52	3,025	4.73
65-70	2,873	4.49	5,898	9.22
Total	5,898	9.22		
Alternate mission: 8 C-5A aircraft				
>85	14	0.02	14	0.02
80-85	381	0.60	395	0.62
75-80	418	0.65	813	1.27
70-75	951	1.49	1,764	2.76
65-70	1,908	2.98	3,672	5.74
Total	3,672	5.74		

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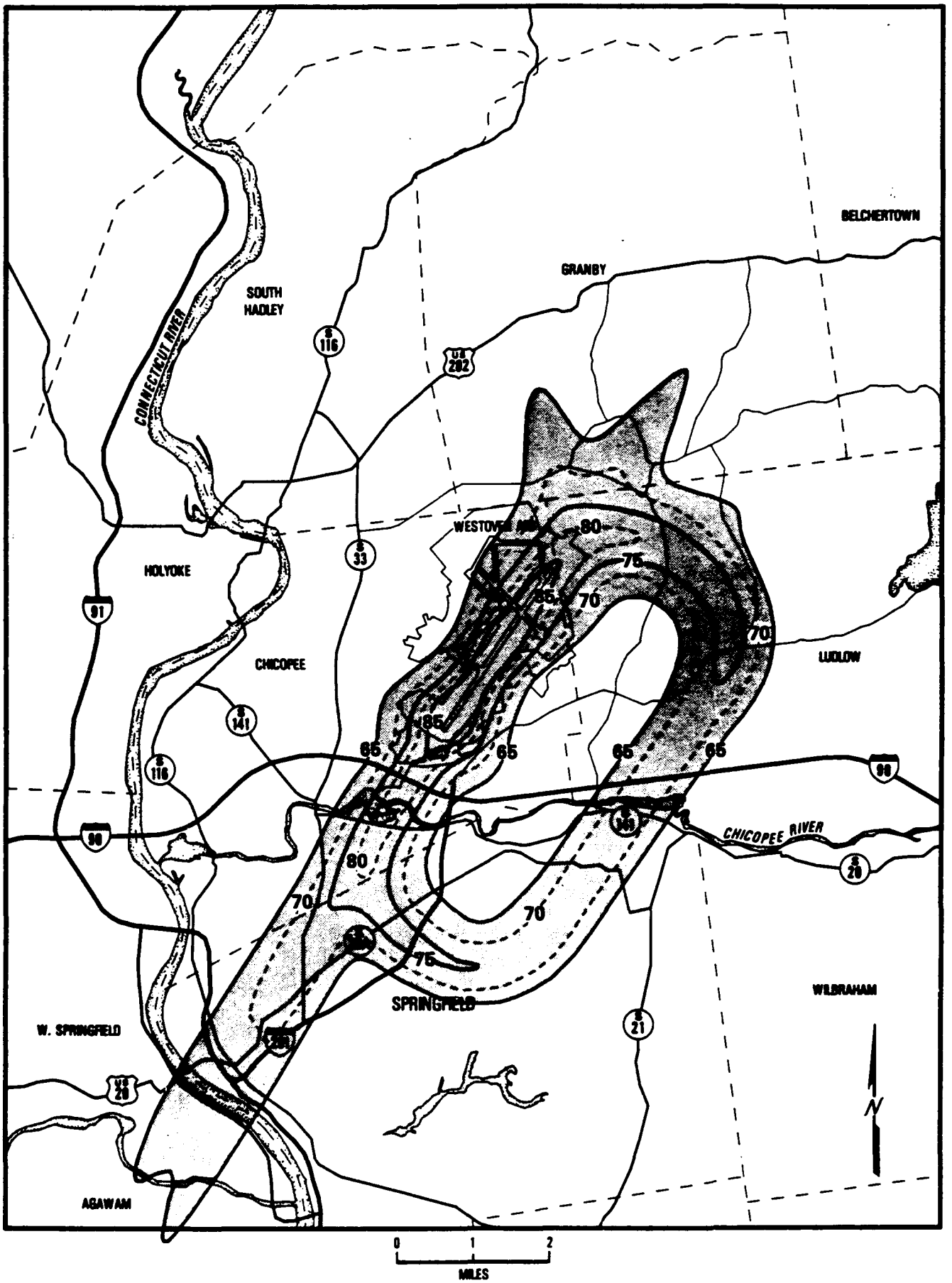

Fig. D.3. Leq-5 contours for typical C-5A sortie on runway 05.

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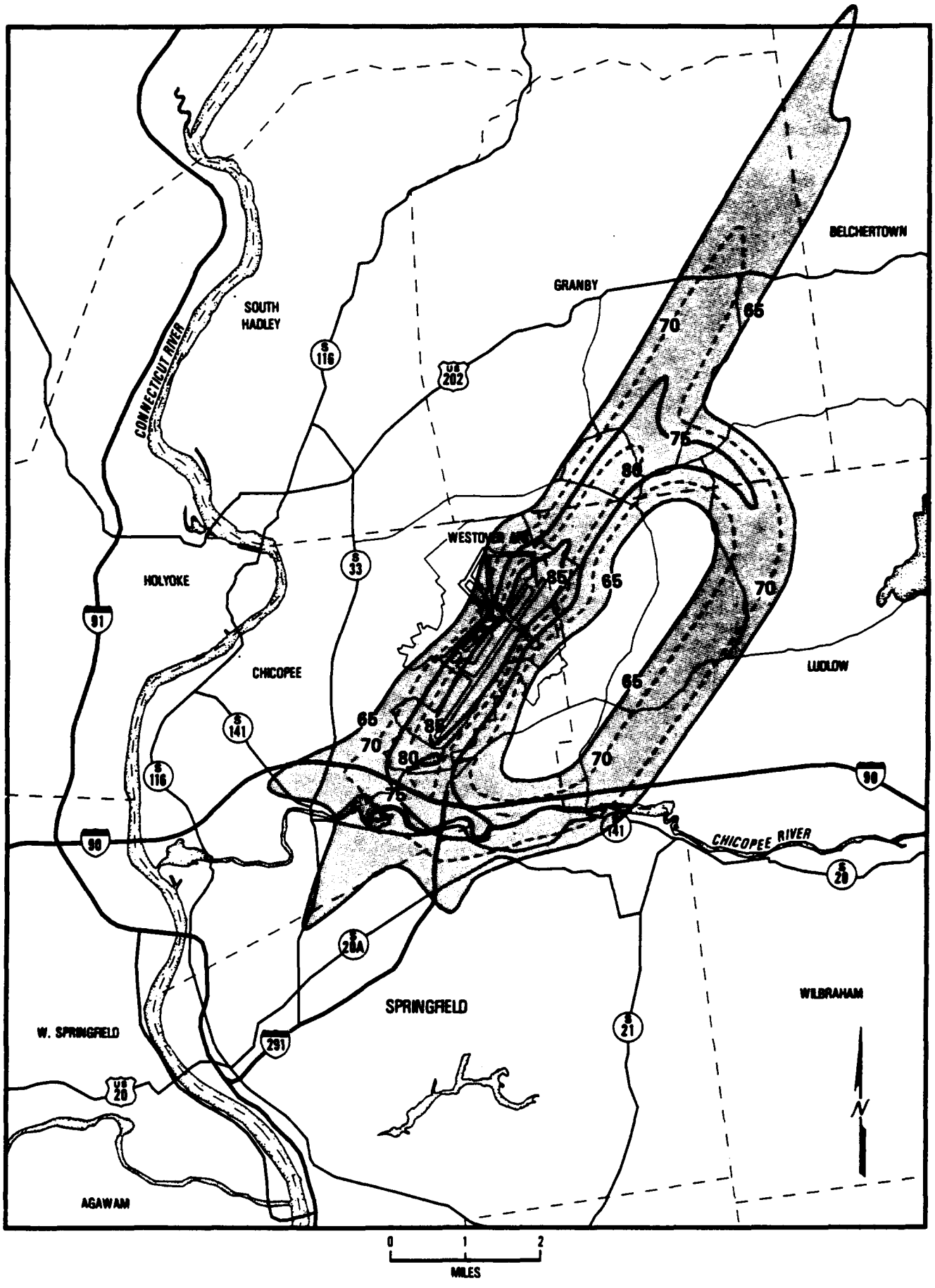

Fig. D.4. Leq-5 contours for typical C-5A sortie on runway 23.

Table D.3. Areas with Leq-5 noise levels above 65 dB for typical C-5A training sorties

Leq-5 contour interval (unweighted)	Area within contour		Cumulative area	
	Acres	Sq. mi.	Acres	Sq. mi.
	For operations on runway 05			
>85	720	1.13	720	1.13
80-85	1,014	1.58	1,734	2.71
75-80	2,321	3.63	4,055	6.34
70-75	5,293	8.27	9,349	14.61
65-70	7,820	12.22	17,169	26.83
Total	17,169	26.83		
	For operations on runway 23			
>85	746	1.17	746	1.17
80-85	978	1.53	1,724	2.69
75-80	1,797	2.81	3,521	5.50
70-75	5,211	8.14	8,732	13.64
65-70	7,517	11.75	16,249	25.39
Total	16,249	25.39		

Table D.4. Population exposed to DNL noise levels above 65 dB for proposed (16 C-5A) military aircraft operations

Community	Noise level (dB)				Total
	65-70	70-75	75-80	>80	
Agawam	0	0	0	0	0
Chicopee	3,206	38	0	0	3,244
Granby	178	99	27	0	304
Ludlow	0	0	0	0	0
Springfield	0	0	0	0	0
W. Springfield	0	0	0	0	0
Total	3,384	137	27	0	3,548
% annoyed	21	32	46	63	
Number annoyed	635	44	12	0	691

Table D.5. Population exposed to DNL noise levels above 65 dB for alternate (8 C-5A) military aircraft operations

Community	Noise level (dB) 65-70	70-75	75-80	>80	Total
Agawam	0	0	0	0	0
Chicopee	1,296	0	0	0	1,296
Granby	173	102	0	0	275
Ludlow	0	0	0	0	0
Springfield	0	0	0	0	0
W. Springfield	0	0	0	0	0
Total	1,469	102	0	0	1,571
% annoyed	21	32	46	63	
Number annoyed	309	33	0	0	342

Table D.6. Population exposed to Leq-5 noise levels above 65 dB for typical C-5A training sortie on runway 05

Community	Noise level (dB) 65-70	70-75	75-80	>80	Total
Agawam	203	0	0	0	203
Chicopee	3,122	3,025	2,303	937	9,387
Granby	237	0	0	0	237
Ludlow	1,787	2,167	303	0	4,257
Springfield	15,477	9,766	3,327	0	28,570
W. Springfield	4,823	0	0	0	4,823
Total	25,649	14,958	5,933	937	47,477

Table D.7. Population exposed to Leq-5 noise levels above 65 dB for typical C-5A training sortie on runway 23

Community	Noise level (dB)				Total
	65-70	70-75	75-80	>80	
Belchertown	83	0	0	0	83
Chicopee	8,987	620	41	0	9,648
Granby	204	202	151	219	776
Ludlow	1,213	2,177	35	35	3,460
Springfield	1,843	426	0	0	2,269
W. Springfield	0	0	0	0	0
Total	12,330	3,425	227	254	16,236

D.2 NOISE LEVELS AND EXPOSURES FROM CIVIL AVIATION OPERATIONS

D.2.1 Predicted Noise Levels

D.2.1.1 Single-event noise levels

As indicated in Table 4.2, development of civil aviation operations would result in the operation of a variety of aircraft at Westover AFB. Because of this variety of aircraft, it was not considered practical to identify single-event noise levels for all aircraft operations. Noise levels for the Boeing B-747 aircraft are higher than the levels for all other aircraft projected to operate at WMDC facilities, with the exception of Boeing 727 aircraft which have not been retrofitted with quiet engines. Operations of B-727 aircraft are projected to account for <8% of the large jet aircraft operations that may occur at WMDC facilities; thus, the SEL values for the B-747 aircraft are considered to be representative of the levels produced by the majority of aircraft operations. SEL values for the DC-10 aircraft would be approximately the same as those for the B-747, while values for the DC-8, DC-9 and B-737 aircraft would be approximately 1 to 2 dB lower.

SEL values at schools and hospitals in the vicinity of Westover AFB predicted to result from B-747 operations are indicated in Table D.8. Differences between SEL values and maximum and average noise levels would be approximately the same for commercial aircraft as for the C-5A (i.e., maximum levels approximately 5 to 7 dB less than SEL values and average levels approximately 13 to 20 dB lower).

D.2.1.2 Day-night average noise levels

DNL contours which could result from development of civil aviation operations to the levels identified in the WMDC Master Plan (with no change in operations of base-assigned or transient military aircraft) are indicated in Fig. D.5. Table D.9 provides a comparison of the areas within the various DNL contours for current and potential operations. The area within the 65-dB contour would increase by approximately 149% (from 3.3 to 8.3 sq. mi.).

Although the maximum DNL level (approximately 76 dB) would occur in the area to the northeast of the base (along East Street approximately 1500 ft east of Sherwood Road), the greatest increase in DNL levels would occur in the areas of Chicopee affected by takeoffs on runway 23.

D.2.1.3 Equivalent noise levels

Because approximately 46% of the total civil aviation operations and 80% of the air cargo operations were assumed to take place between the hours of 10 p.m. and 7 a.m., equivalent noise levels for these periods were also estimated for day (7 a.m. to 10 p.m.) and night (10 p.m. to 7 a.m.) operations. In calculating DNL levels, a penalty of 10 dB is applied to nighttime operations to account for the increased level of annoyance associated with intrusive noise events occurring at night. A similar weighting was applied in the estimation of equivalent noise levels resulting from nighttime operations. Figure D.6 indicates the 15-hr

equivalent noise level contours for daytime operations (including current operations of assigned and transient military aircraft). Figure D.7 indicates the 9-hr equivalent noise levels (weighted) that could result from civil aviation operations if the WMDC request for extension of the airfield operating hours is approved. The areas within these contours are summarized in Tables D.10 and D.11 respectively.

Because the majority of the nighttime operations would occur between the hours of 10 p.m. and midnight (primarily landings) and between 5 and 7 a.m. (primarily takeoffs), 2-hr equivalent noise levels were also calculated for operations on each runway during these periods. The Leq-2 (weighted) contours for operations between 10 p.m and midnight are indicated in Figs. D.8 and D.9 for operations on runway 05 and runway 23, respectively. Similar contours for operations between 5 and 7 a.m. are indicated in Figs. D.10 and D.11 for runway 05 and runway 23 respectively.

Areas within the various contours are indicated in Table D.12 for operations between 10 p.m. and midnight and in Table D.13 for operations between 5 and 7 a.m.

D.2.2 Population Exposure to Aircraft Noise

The technique described in Sect. D.1.2 was used to estimate the number of residents within the DNL and Leq contours discussed in the preceding sections. The results of these estimates are presented in Tables D.14 through D.20.

Fewer than 100 people are exposed to DNL levels >65 dB by current military and civilian aircraft operations. As indicated in Table D.14, approximately 6,500 persons could be exposed to DNL levels >65 dB if civil aviation operations were developed to the levels indicated in the WMDC Master Plan. Of these, approximately 530 would be exposed to levels above 70 dB. The highest DNL levels in residential areas would be about 73 dB.

Population exposures to 15-hr equivalent noise levels resulting from daytime aircraft operations (including current levels of military aircraft operations) are summarized in Table D.15. Approximately 2,600 persons would be exposed to Leq-15 levels >65 dB. Of these, only about 50 would be exposed to levels between 70 and 75 dB; none would be exposed to levels >75 dB.

Population exposure estimates for operations between 10 p.m. and 7 a.m. are presented in Table D.16. An average of approximately 10,800 persons could be exposed to 9-hr weighted equivalent noise levels >65 dB as a result of nighttime operations. Approximately 3,000 could be exposed to Leq-9 levels between 70 and 75 dB and approximately 200 could be exposed to levels >75 dB.

Population exposure estimates for operations between 10 p.m. and midnight are presented in Tables D.17 and D.18 for operations on runway 05 and 23 respectively. Estimates for operations between 5 and 7 a.m. are presented in Tables D.19 and D.20 for operations on runway 05 and 23 respectively. As indicated in these tables, the largest numbers of residents would be affected by operations on runway 05 (all landings)

which occur between 10 p.m. and midnight and by operations on runway 23 (primarily takeoffs) between 5 and 7 a.m. When runway 23 is in use (assumed to occur 80% of the time), only about 850 persons would be exposed to Leq-2 levels >65 dB by landing operations that occur between the hours of 10 p.m. and midnight; however, approximately 44,000 persons would be exposed to similar levels by operations between 5 and 7 a.m., which consist primarily of takeoffs over the densely populated areas of Chicopee and Springfield. When runway 05 is in use (about 20% of the time), approximately 23,000 persons would be exposed to weighted Leq levels >65 dB by operations between 10 p.m. and midnight and approximately 5,500 would be exposed to similar levels by operations between 5 and 7 a.m.

Table D.8. Exterior noise levels[a] at facilities in the vicinity of Westover AFB for B-747 aircraft operations

	Sound exposure level[a] (SEL) (dB)					
	Operations on runway 23[b]				Operations on runway 05[b]	
		Takeoffs				
Facility	Landing	Straight	Right	Left	Landing	Takeoff
Hospitals						
Holyoke						
Holyoke Hospital	a	a	a	a	a	70
Providence Hospital	a	a	84	a	a	69
V.A. Hospital	a	a	a	a	a	69
Ludlow						
Hubbard Memorial Hospital	a	a	a	a	a	65
Springfield						
Baystate Springfield	a	85	a	a	91	a
Mercy Hospital	a	85	a	a	90	a
Municipal Hospital	a	67	a	85	a	71
Shriners Hospital	a	86	a	66	93	a
Wesson Memorial	a	74	a	67	74	a
Schools						
Agawam						
Agawam H.S.	a	a	a	a	84	a
Agawam J.H.S.	a	85	a	a	86	a

[a]Values are indicated for schools exposed to exterior SEL values >75 dB by B-747 operations which are considered representative of heavy cargo aircraft (See Sect. D.2.1.1.). Values indicated as "a" would be <65 dB. Exterior maximum noise levels (ALm) would be approximately 5 - 10 dB lower than the SEL and interior noise levels about 25 dB lower in summertime (windows open) conditions and about 35 dB lower in wintertime (windows closed) conditions due to attenuation by the building.

[b]Operations by type of aircraft and time of day are indicated in Table 4.2. About 80% of the operations would be on runway 23 and 20% on runway 05. Takeoffs on runway 23 would be distributed between straight out departures (50%) and departures using right and left turns (25% each). Takeoffs on runway 05 are assumed to be straight out.

Table D.8 (Continued)

Facility	Sound exposure level[a] (SEL) (dB)					
	Operations on runway 23[b]				Operations on runway 05[b]	
		Takeoffs				
	Landing	Straight	Right	Left	Landing	Takeoff
Danahy E.S.	a	82	a	a	84	a
Phelps E.S.	a	a	a	a	75	a
Pierce E.S.	a	79	a	a	80	a
Robinson Park E.S.	a	79	a	a	80	a
Chicopee						
Alvord Sch.	a	85	79	73	86	75
Assumption Sch.	a	75	75	a	74	70
Barry E.S.	a	74	90	70	69	80
Belamy Sch.	a	66	71	65	a	78
Belcher Sch.	a	88	79	75	95	76
Chapin Sch.	a	a	72	a	a	75
Chicopee H.S.	a	80	76	68	80	72
Comp. H.S.	a	70	80	67	a	81
Elms College	a	78	73	65	78	69
Hampden Sch.	a	a	72	a	a	85
Holy Name H.S.	a	75	75	a	74	69
Kirby Annex	a	a	81	a	a	73
La Voie E.S.	a	68	80	66	a	79
Lithwin E.S.	a	75	71	75	a	79
Mt. Carmel Sch.	a	a	70	a	a	76
Stefanik E.S.	a	a	86	a	a	73
Streiber Sch.	a	67	69	67	a	77
St. Georges E.S.	a	83	83	74	84	78
St. Joan of Arc E.S.	a	a	85	66	a	78
St. Patricks E.S.	a	79	87	72	76	79
St. Stanislaus E.S.	a	78	76	67	78	72
Szetela E.S.	a	71	87	a	66	74
Granby						
Granby H.S.	86	66	67	66	a	77
St. Hyacinths Seminary	93	a	a	a	a	85
South Hadley						
Mosier Sch.	a	72	72	76	a	a
Mt. Holyoke College	a	71	72	76	a	a

Table D.8 (Continued)

Facility	Sound exposure level[a] (SEL) (dB)					
	Operations on runway 23[b]				Operations on runway 05[b]	
		Takeoffs				
	Landing	Straight	Right	Left	Landing	Takeoff
Springfield						
American Int'l College	a	68	a	78	65	68
Armory St. M.S.	a	85	a	67	89	65
Balliet E.S.	a	a	a	82	a	73
Bowles E.S.	a	84	72	80	85	75
Brightwood E.S.	a	81	a	a	83	a
Carew Sch.	a	86	a	a	90	a
Dorman E.S.	a	67	a	88	a	74
Duggan J.H.S.	a	a	a	83	a	70
Freidman M.S.	a	a	a	83	a	69
Glenwood E.S.	a	86	69	67	95	67
Harris Sch.	a	a	a	86	a	65
Holy Cross E.S.	a	a	a	85	a	65
Holy Name Sch.	a	a	a	74	a	a
Homer St. E.S.	a	67	a	80	a	68
Howard St. Sch.	a	74	a	a	74	a
H.S. 1	a	76	a	66	76	a
H.S. 2	a	74	a	68	74	a
H.S. 3	a	75	a	66	75	a
Immaculate Con. E.S.	a	a	a	a	a	67
Jefferson Ave. Sch.	a	86	a	a	92	a
J.H.S.	a	86	a	a	91	a
Kensington Ave. Sch.	a	a	a	73	a	a
Kiley J.H.S.	a	a	a	71	a	66
Lincoln Sch.	a	85	a	a	90	a
Lynch E.S.	a	a	a	72	a	74
Memorial E.S.	a	a	a	84	a	66
Morris E.S.	a	a	a	79	a	76
Myrtle St. E.S.	a	a	a	66	a	74
Our Lady of Mt. Carmel Sch.	a	73	a	65	72	a
Pottenger E.S.	a	84	69	76	85	72
Sacred Heart E.S.	a	a	a	81	a	74
Springfield College	a	65	a	77	a	67
Trade H.S.	a	67	a	84	a	70
Van Sickle J.H.S.	a	84	68	73	86	69
Washington Sch.	a	a	a	77	a	a
White St. Sch.	a	a	a	76	a	a

Table D.8 (Continued,

Facility	Sound exposure level[a] (SEL) (dB)					
	Operations on runway 23[b]				Operations on runway 05[b]	
		Takeoffs				
	Landing	Straight	Right	Left	Landing	Takeoff
West Springfield						
Ashley E.S.	a	a	82	a	a	68
Cowing J.H.S.	a	84	a	a	86	a
Main St. E.S.	a	84	a	a	87	a
Memorial E.S.	a	85	a	a	87	a
Mittineague E.S.	a	77	a	a	77	a
Park Ave. E.S.	a	84	a	a	87	a
St. Thomas E.S.	a	74	a	a	74	a
West Springfield J.H.S.	a	83	a	a	85	a

ORNL-DWG 86-15969B

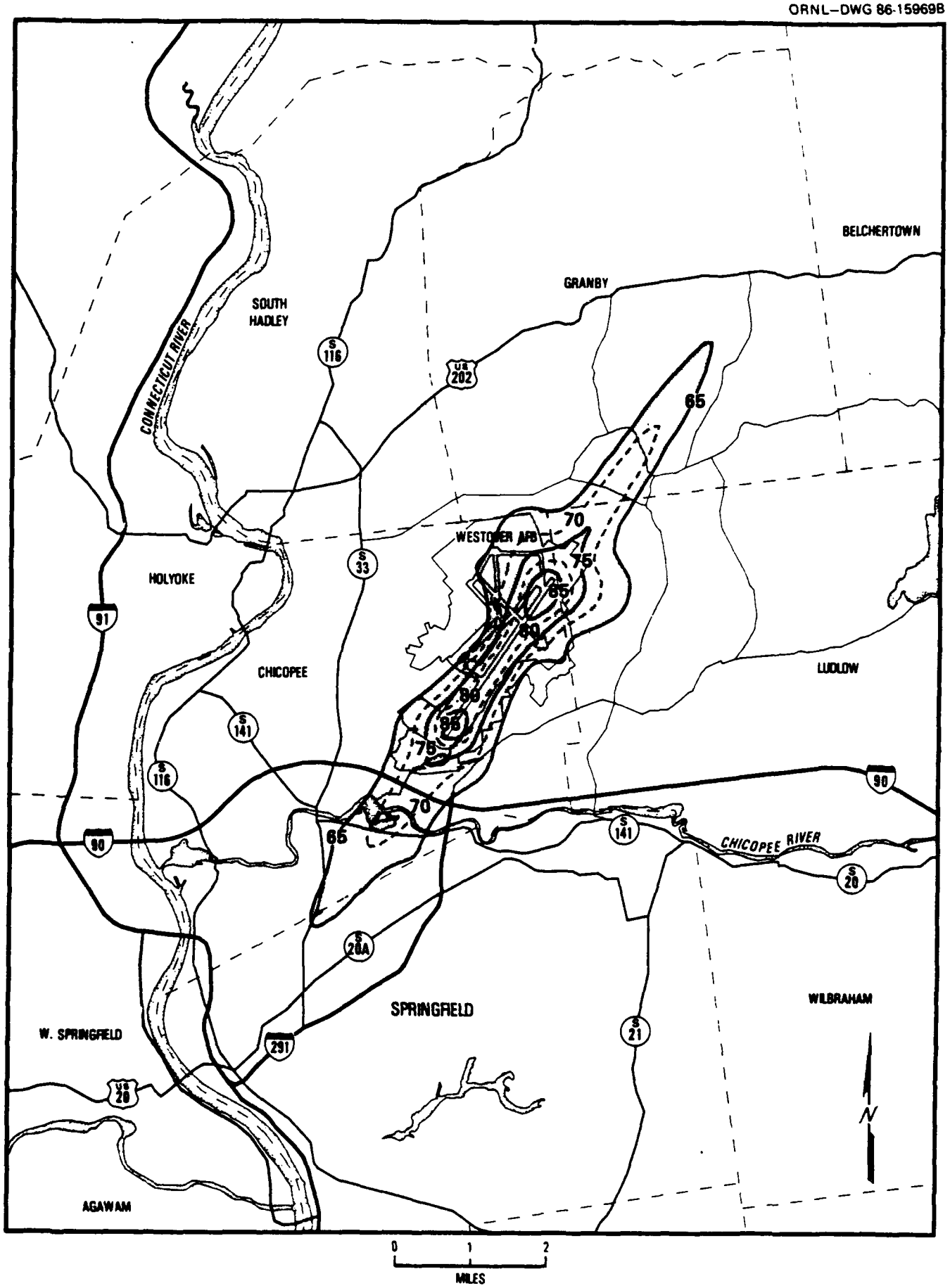

Fig. D.5 DNL contours for potential WMDC operations with current military operations (C-130s + transients).

Table D.9. Areas with DNL noise levels above 65 dB for potential WMDC operations plus current military operations

DNL contour interval	Area within contour		Cumulative area	
	Acres	Sq. mi.	Acres	Sq. mi.
Current operations				
>85	29	0.05	29	0.05
80-85	131	0.20	159	0.25
75-80	369	0.58	528	0.83
70-75	468	0.73	996	1.56
65-70	1,143	1.79	2,140	3.34
Total	2,140	3.34		
With potential commercial and general aviation aircraft operations				
>85	192	0.30	221	0.30
80-85	461	0.72	704	1.02
75-80	576	0.90	1,405	1.92
70-75	1,389	2.17	3,015	4.09
65-70	2,701	4.22	6,068	8.31
Total	5,318	8.31		

ORNL-DWG 86-15970A

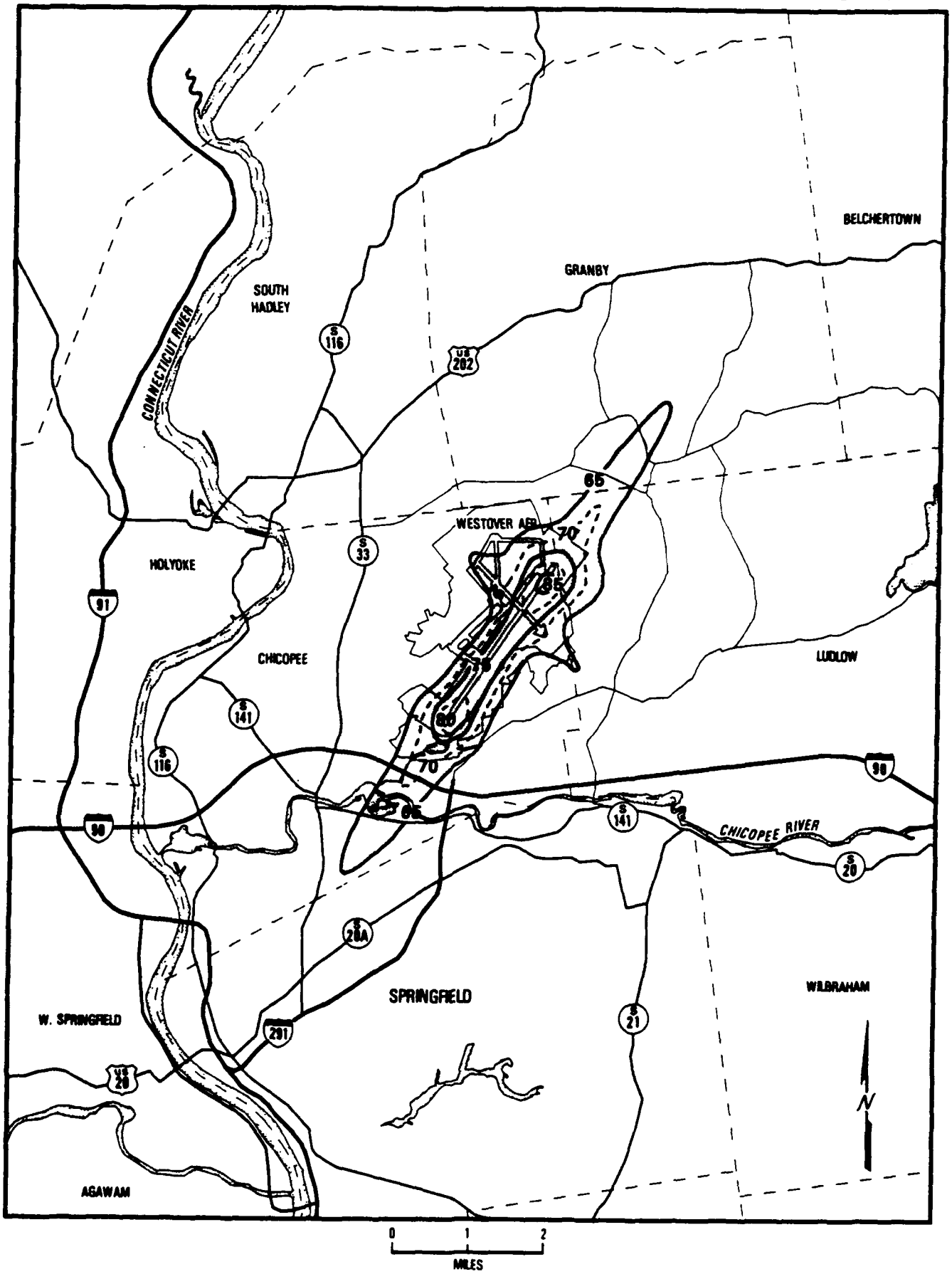

Fig. D.6. Leq-15 contours for potential WMDC daytime operations with current military operations (C-130s + transients).

Table D.10. Areas with daytime Leq-15 noise levels above 65 dB for potential WMDC operations plus current military operations

LDN contour interval Leq-15	Area within contour		Cumulative area	
	Acres	Sq. mi.	Acres	Sq. mi.
>85	29	0.05	29	0.05
80-85	203	0.32	232	0.36
75-80	551	0.86	783	1.22
70-75	748	1.17	1,531	2.39
65-70	1,985	3.10	3,516	5.49
Total	3,516	5.49		

ORNL-DWG 86-15971

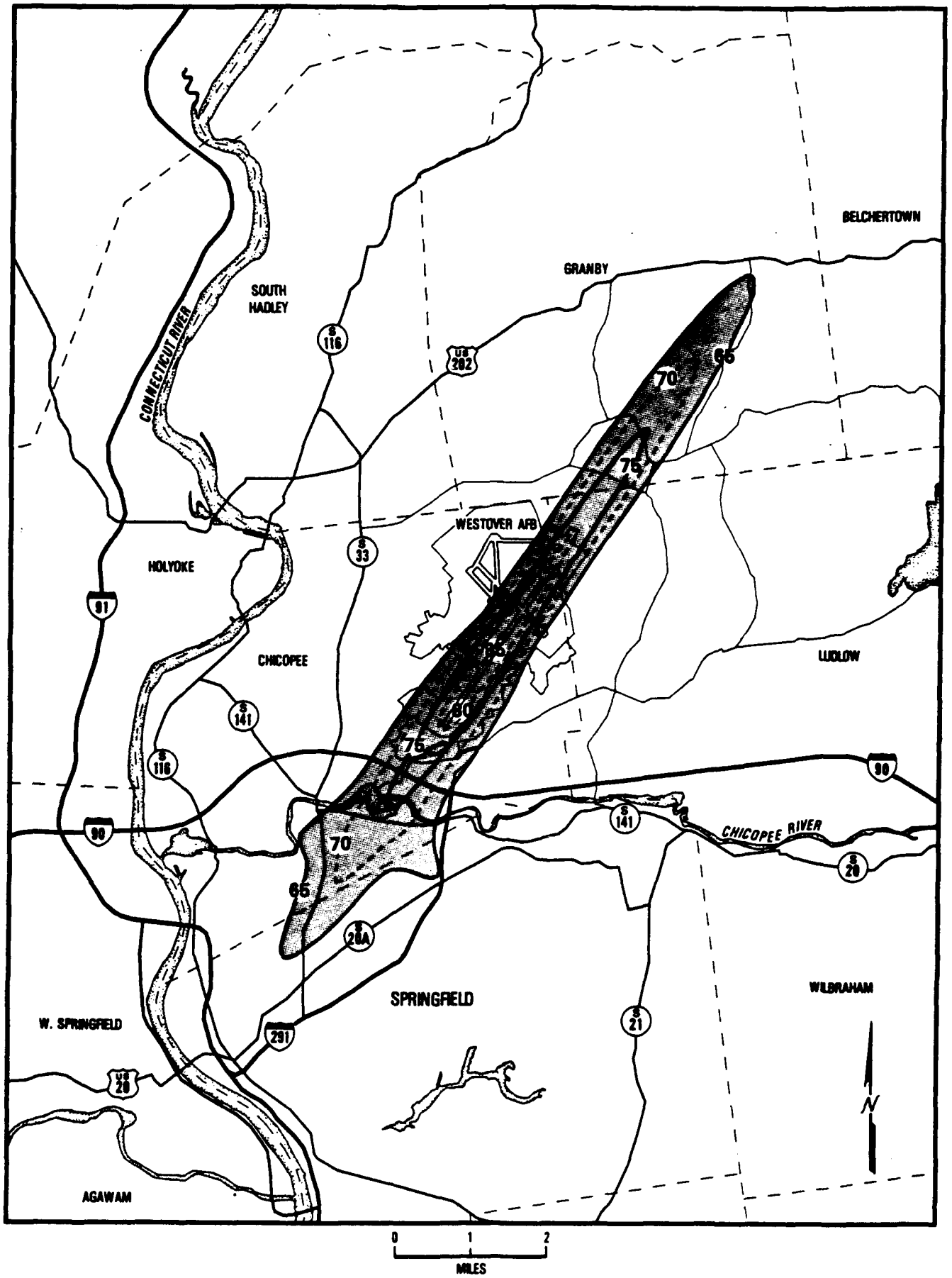

Fig. D.7. Weighted Leq-9 contours for potential WMDC nighttime operations.

Table D.11. Areas with weighted Leq-9 noise levels above 65 dB for potential WMDC operations between 10 p.m. and 7 a.m.

Leq contour interval (weighted)	Area within contour		Cumulative area	
	Acres	Sq. mi.	Acres	Sq. mi.
>85	18	0.03	18	0.03
80-85	461	0.72	479	0.75
75-80	935	1.46	1,414	2.21
70-75	1,611	2.52	3,025	4.73
65-70	2,873	4.49	5,898	9.22
Total	5,898	9.22		

ORNL-DWG 86-15972A

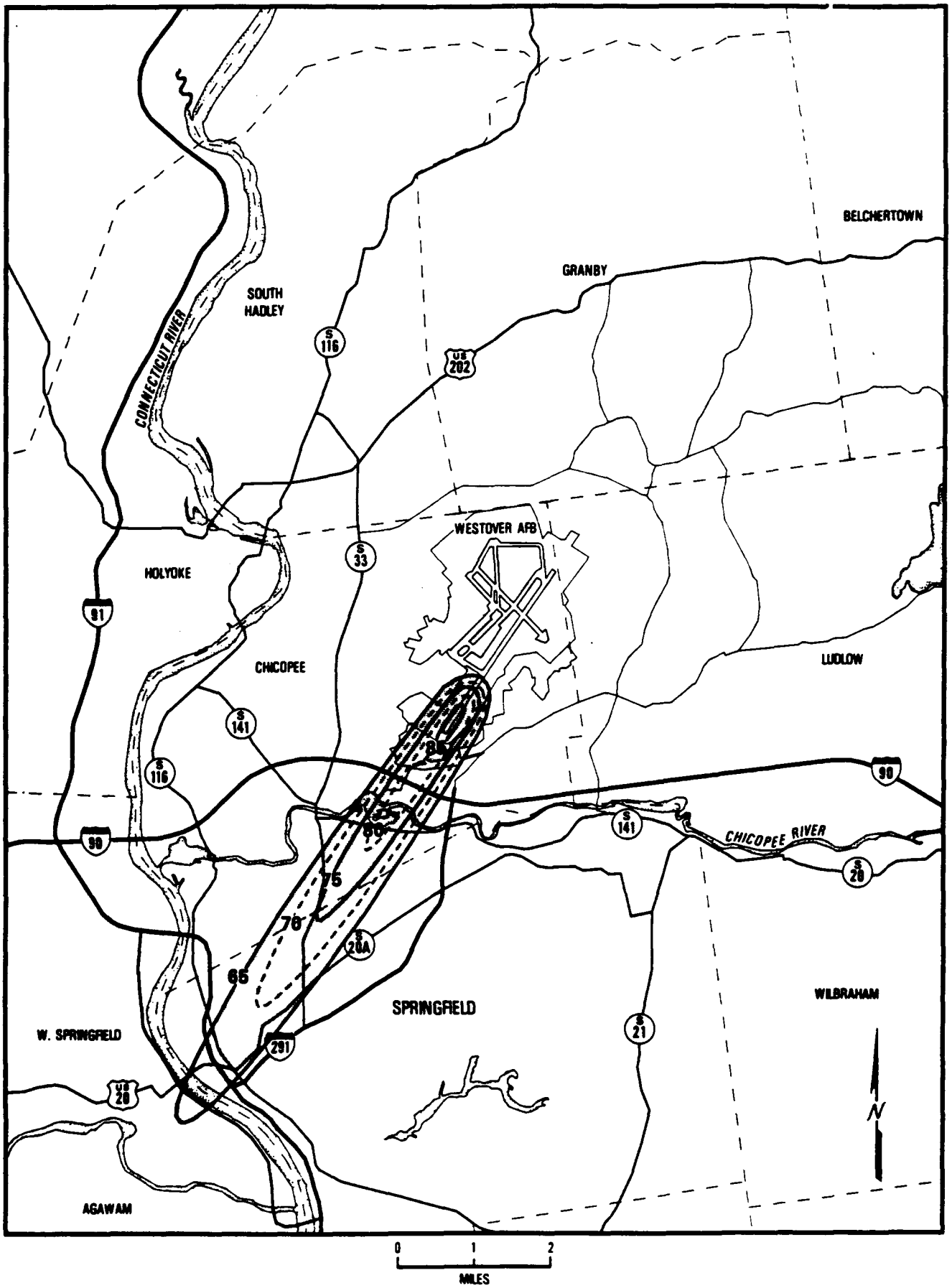

Fig. D.8. Weighted Leq-2 contours for WMDC operations on runway 05 from 10 p.m. to midnight.

ORNL-DWG 86-15973A

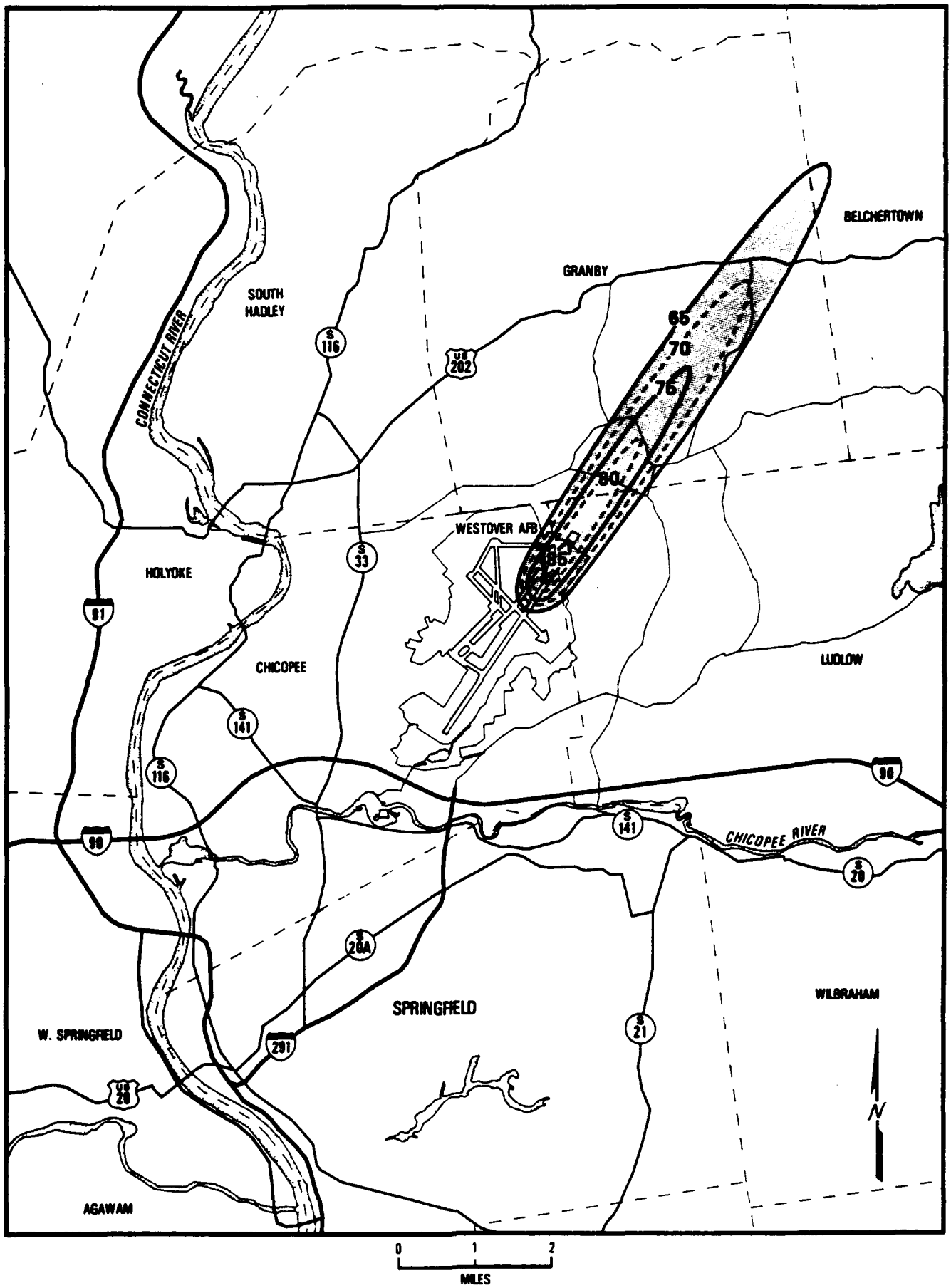

Fig. D.9. Weighted Leq-2 contours for WMDC operations on runway 23 from 10 p.m. to midnight.

Table D.12. Areas with weighted Leq-2 noise levels above 65 dB for potential WMDC operations between 10 p.m. and midnight.

Leq contour interval (weighted)	Area within contour		Cumulative area	
	Acres	Sq. mi.	Acres	Sq. mi.
For aircraft operations on runway 23				
>85	47	0.07	47	0.07
80-85	345	0.54	393	0.61
75-80	533	0.83	926	1.45
70-75	895	1.40	1,821	2.85
65-70	1,602	2.50	3,423	5.35
Total	3,423	5.35		
For aircraft operations on runway 05				
>85	47	0.07	47	0.07
80-85	345	0.54	393	0.61
75-80	533	0.83	926	1.45
70-75	895	1.40	1,821	2.85
65-70	1,602	2.50	3,423	5.35
Total	3,423	5.35		

ORNL–DWG 86-15974A

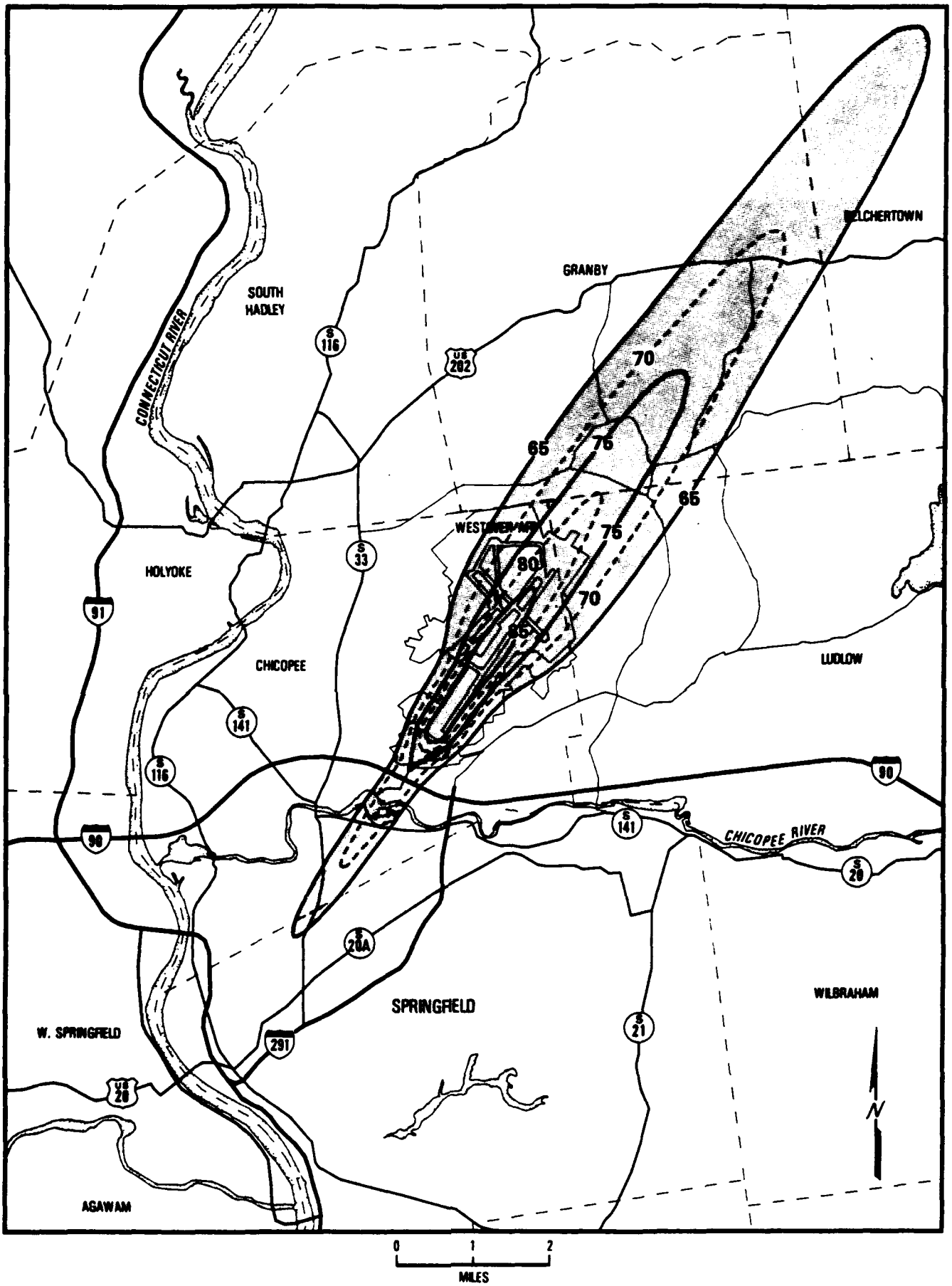

Fig. D.10. Weighted Leq-2 contours for WMDC operations on runway 05 from 5 to 7 a.m.

ORNL-DWG 86-15975A

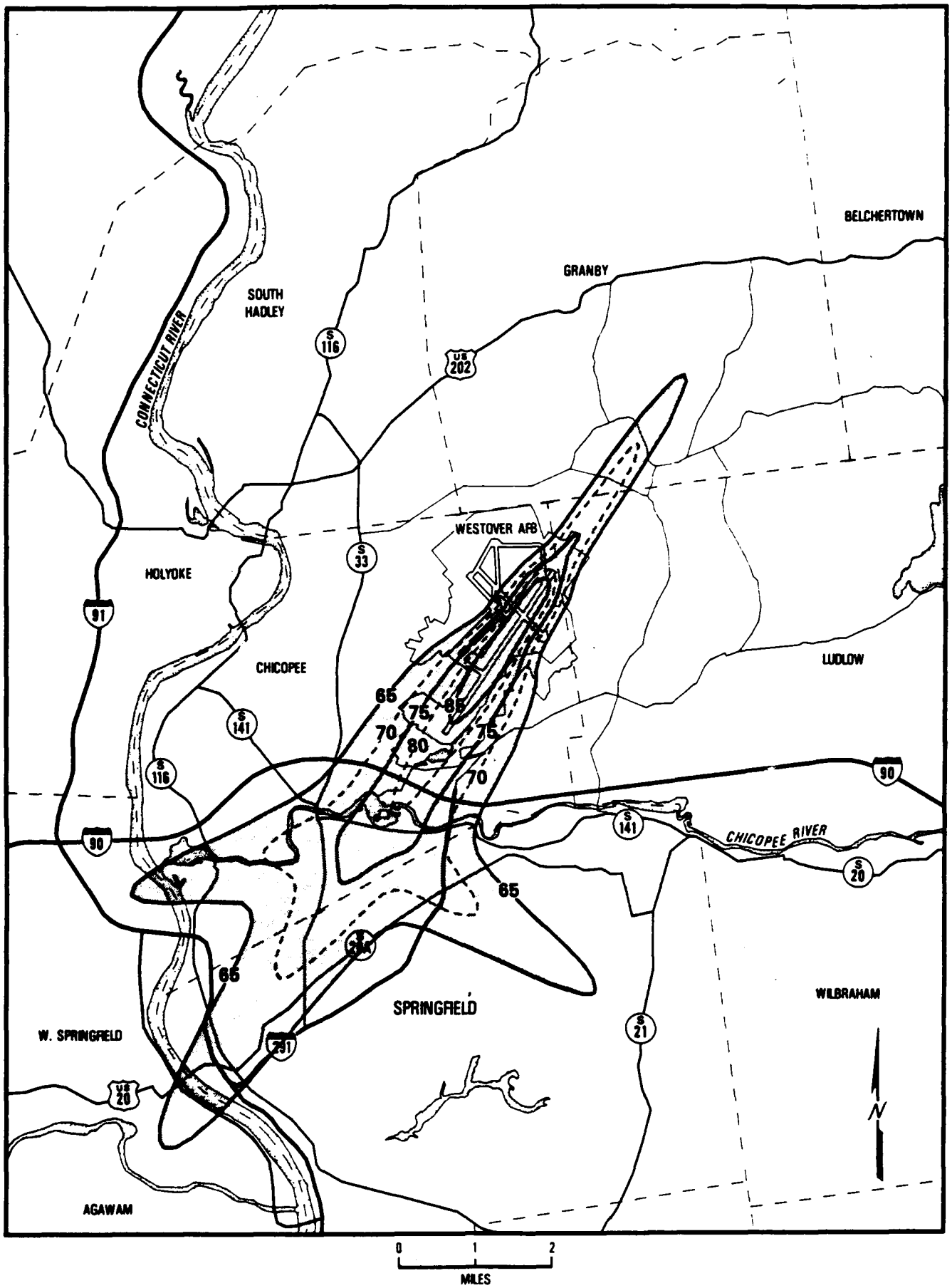

Fig. D.11. Weighted Leq-2 contours for WMDC operations on runway 23 from 5 to 7 a.m.

Table D.13. Areas with weighted Leq-2 noise levels above 65 dB for potential WMDC operations between 5 and 7 a.m.

Leq contour interval (weighted)	Area within contour		Cumulative area	
	Acres	Sq. mi.	Acres	Sq. mi.
	For aircraft operations on runway 23			
>85	439	0.69	439	0.69
80-85	693	1.08	1,132	1.77
75-80	1,543	2.41	2,676	4.18
70-75	2,900	4.53	5,575	8.71
65-70	5,944	9.29	11,520	18.00
Total	11,520	18.00		
	For aircraft operations on runway 05			
>85	395	0.62	395	0.62
80-85	618	0.97	1,014	1.58
75-80	1,225	1.91	2,238	3.50
70-75	2,694	4.21	4,932	7.71
65-70	5,891	9.20	10,823	16.91
Total	10,823	16.91		

Table D.14. Population exposure to DNL noise levels above 65 dB for potential WMDC operations plus current military operations

Community	DNL level (dB) 65-70	70-75	75-80	>80	Total
Chicopee	5,710	250	0	0	5,960
Granby	152	213	0	0	365
Ludlow	109	71	0	0	180
Springfield	10	0	0	0	10
Total	5,981	534	0	0	6,515
% annoyed	21	32	46	63	
Number annoyed	1,256	171	0	0	1,427

Table D.15. Population exposure to Leq-15 noise levels above 65 dB for potential WMDC operations between 7 a.m. and 10 p.m.

Community	Noise level (dB) 65-70	70-75	75-80	>80	Total
Chicopee	2,202	10	0	0	2,212
Granby	257	0	0	0	257
Ludlow	71	35	0	0	106
Total	2,530	45	0	0	2,575

Table D.16. Population exposure to weighted Leq-9 noise levels above 65 dB for potential WMDC operations on runway 05 between 10 p.m. and 7 a.m.

Community	Noise level (dB) 65-70	70-75	75-80	>80	Total
Chicopee	6,257	2,750	14	0	9,021
Granby	182	172	147	0	501
Ludlow	116	35	35	0	186
Springfield	1,066	0	0	0	1,066
Total	7,621	2,957	196	0	10,774

Table D.17. Population exposure to weighted Leq-2 noise levels above 65 dB for potential WMDC operations on runway 05 between 10 p.m. and midnight

Community	Leq-2 level (weighted) (dB) 65-70	70-75	75-80	>80	Total
Chicopee	1,832	2,345	2,599	233	7,009
Springfield	13,339	1,738	0	0	15,077
W. Springfield	916	0	0	0	916
Total	16,087	4,083	2,599	233	23,002

Table D.18. Population exposure to weighted Leq-2 noise levels above 65 dB for potential WMDC operations on runway 23 between 10 p.m. and midnight

Community	Leq-2 level (weighted) (dB)				Total
	65-70	70-75	75-80	>80	
Granby	247	132	138	147	664
Ludlow	43	35	71	35	184
Total	290	167	209	182	848

Table D.19. Population exposure to weighted Leq-2 noise levels above 65 dB for potential WMDC operations on runway 05 between 5 and 7 a.m.

Community	Leq-2 level (weighted) (dB)				Total
	65-70	70-75	75-80	>80	
Belchertown	167	0	0	0	167
Chicopee	3,212	681	0	0	3,893
Granby	454	440	357	0	1,251
Ludlow	36	50	71	35	192
Total	3,869	1,171	428	35	5,503

Table D.20. Population exposure to weighted Leq-2 noise levels above 65 dB for potential WMDC operations on runway 23 between 5 and 7 a.m.

Community	Leq-2 level (weighted) (dB)				Total
	65-70	70-75	75-80	>80	
Chicopee	6,602	6,497	3,351	13	16,463
Granby	142	115	0	0	257
Ludlow	9	9	0	0	18
Springfield	22,495	2,696	10	10	25,211
W. Springfield	2,064	0	0	0	2,064
Total	31,312	9,317	3,361	23	44,013

D.3 NOISE LEVELS AND POPULATION EXPOSURES FROM PROPOSED AND ALTERNATE MILITARY ACTIONS WITH WMDC OPERATIONS

D.3.1 Predicted Noise Levels

D.3.1.1 Single-event noise levels

Single-event noise levels resulting from operation of military and civilian aircraft would be the same as those indicated in Tables D.1 and D.8.

D.3.1.2 Day-night average noise levels

Implementation of either military action in combination with the development of civil aviation operations to the levels identified in the WMDC Master Plan would result in cumulative increases in DNL levels relative to those resulting from military or WMDC operations alone. DNL contours which could result from development of civil aviation operations in combination with the proposed (16-aircraft) and alternate (8-aircraft) military actions are shown in Figs. D.12 and D.13 respectively, and the areas within the various contour intervals are indicated in Tables D.21 and D.22 respectively.

As indicated in Table D.21, implementation of the proposed (16-aircraft) military action in combination with the development of WMDC operations would increase the area within the 65 dB DNL contour to approximately 14.2 sq. mi. This represents an increase of 72% relative to the area exposed to equivalent noise levels by increased civil aviation aircraft operations in combination with current military operations and an increase of approximately 54% relative to the area within the contour resulting from proposed (16 aircraft) operations alone.

If the alternate (8 aircraft) military action is implemented in combination with the development of WMDC civil aviation operations, the area within the 65-dB DNL contour would increase to approximately 11.1 sq. mi. This represents an increase of approximately 34% relative to the exposure resulting from WMDC operations alone and an increase of approximately 123% relative to the effects of military aircraft operations alone.

D.3.1.3 Equivalent noise levels

If either military action is implemented, daytime noise levels would be dominated by the effects of military aircraft operations on those days on which training activities occur. This would occur 4 times per week if the proposed military action were implemented and twice per week if the alternate action were implemented. Because only a few non-military operations would take place during a typical 5 hr training sortie, noise contributions would be insignificant and the Leq-5 contours would be essentially the same as those indicated in Figs. D.3 and D.4.

Because military training operations would not be scheduled for nighttime hours and other military operations would occur only infrequently during these hours, nighttime noise levels would be the same

as those resulting from WMDC operations alone (Figs. D.7 to D.11 and Tables D.11 to D.13).

Implementation of either proposed military action would increase the 15-hr equivalent noise levels for daytime operations. Average Leq-15 contours are shown in Fig. D.14 and contours for operations on runways 05 and 23 are indicated in Figs. D.15 and D.16 respectively. Areas within the various contours are indicated in Table D.22. The area within the average Leq-15 65 dB contour would increase from approximately 5.5 sq. mi. for WMDC operations alone to approximately 18.8 sq. mi. for combined operations, an increase of approximately 156%.

D.3.2 Population Exposed to Cumulative Noise Effects

The population exposed to cumulative noise impacts was estimated using the techniques described in Sect. D.1.2. Estimated cumulative exposures to DNL levels above 65 dB are indicated in Tables D.23 and D.24 for WMDC operations in combination with the proposed and alternate military actions, respectively. If the proposed (16 C-5A) military action is implemented in combination with development of civil aviation operations, about 11,500 persons would be exposed to DNL levels >65 dB. Of these, approximately 200 would be exposed to levels >75 dB. The highest DNL levels in residential areas would be about 77 dB. If the alternate (8 C-5A) military action is implemented in combination with development of civil aviation operations, approximately 8,900 persons would be exposed to DNL levels >65 dB. Of these, about 150 would be exposed to levels >75 dB.

Population exposures to Leq-15 levels greater than 65 dB are presented in Table D.25 for annual average operations and in Tables D.26 and D.27 for operations on runways 05 and 23 respectively.

ORNL-DWG 86-15976

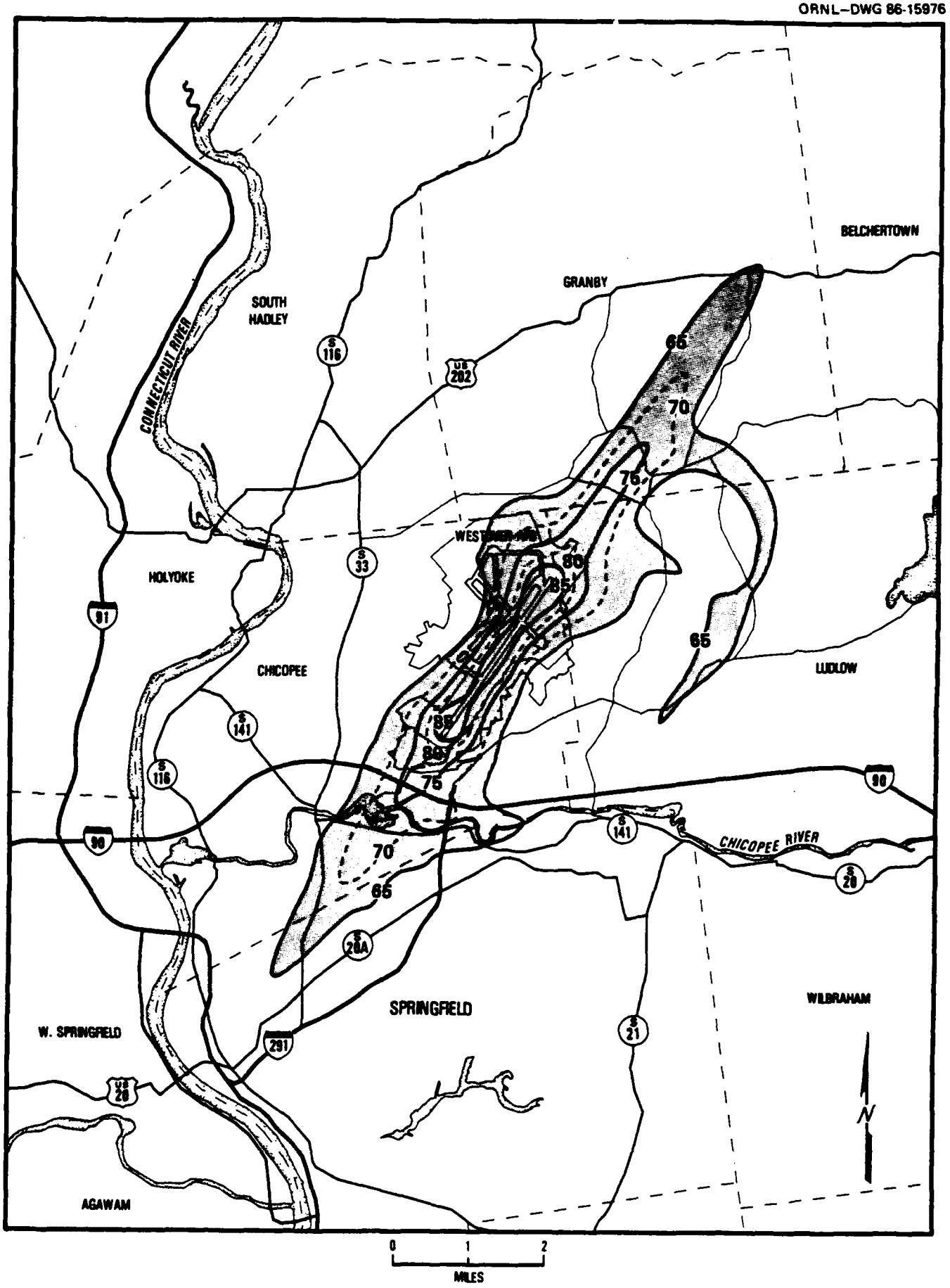

Fig. D.12. Cumulative DNL contours for proposed (16 C-5A) military operations plus potential WMDC operations.

ORNL–DWG 86-15977

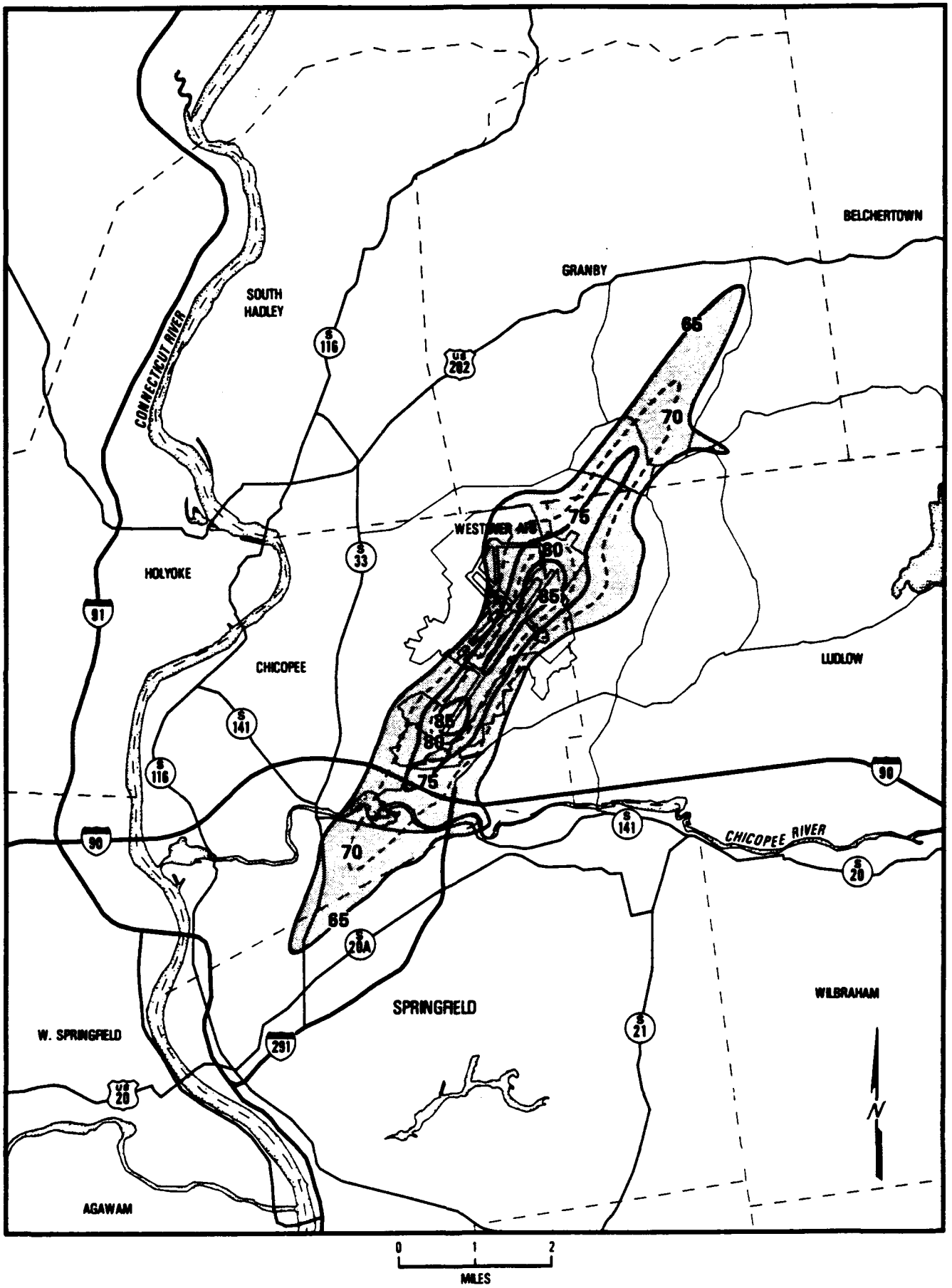

Fig. D.13. Cumulative DNL contours for alternate (8 C-5A) military operations plus potential WMDC operations.

Table D.21. Areas with DNL noise levels above 65 dB for potential WMDC operations in combination with proposed and alternate military operations

DNL contour interval	Area within contour		Cumulative area	
	Acres	Sq. mi.	Acres	Sq. mi.
Current mission: 16 PAA C-130E				
>85	29	0.05	29	0.05
80-85	131	0.20	159	0.25
75-80	369	0.58	528	0.83
70-75	468	0.73	996	1.56
65-70	1,143	1.79	2,140	3.34
Total	2,140	3.34		
Proposed Air Force mission change (16 C-5A aircraft) in combination with potential WMDC aircraft operations				
>85	455	0.71	455	0.71
80-85	484	0.76	939	1.47
75-80	1,004	1.57	1,943	3.04
70-75	2,012	3.14	3,955	6.18
65-70	5,136	8.03	9,091	14.20
Total	9,091	14.20		
Alternate Air Force mission change (8 C-5A aircraft) in combination with potential WMDC operations				
>85	330	0.52	330	0.52
80-85	503	0.79	833	1.30
75-80	887	1.39	1,720	2.69
70-75	1,748	2.73	3,468	5.42
65-70	3,613	5.65	7,081	11.06
Total	7,081	11.06		

ORNL-DWG 86-15978

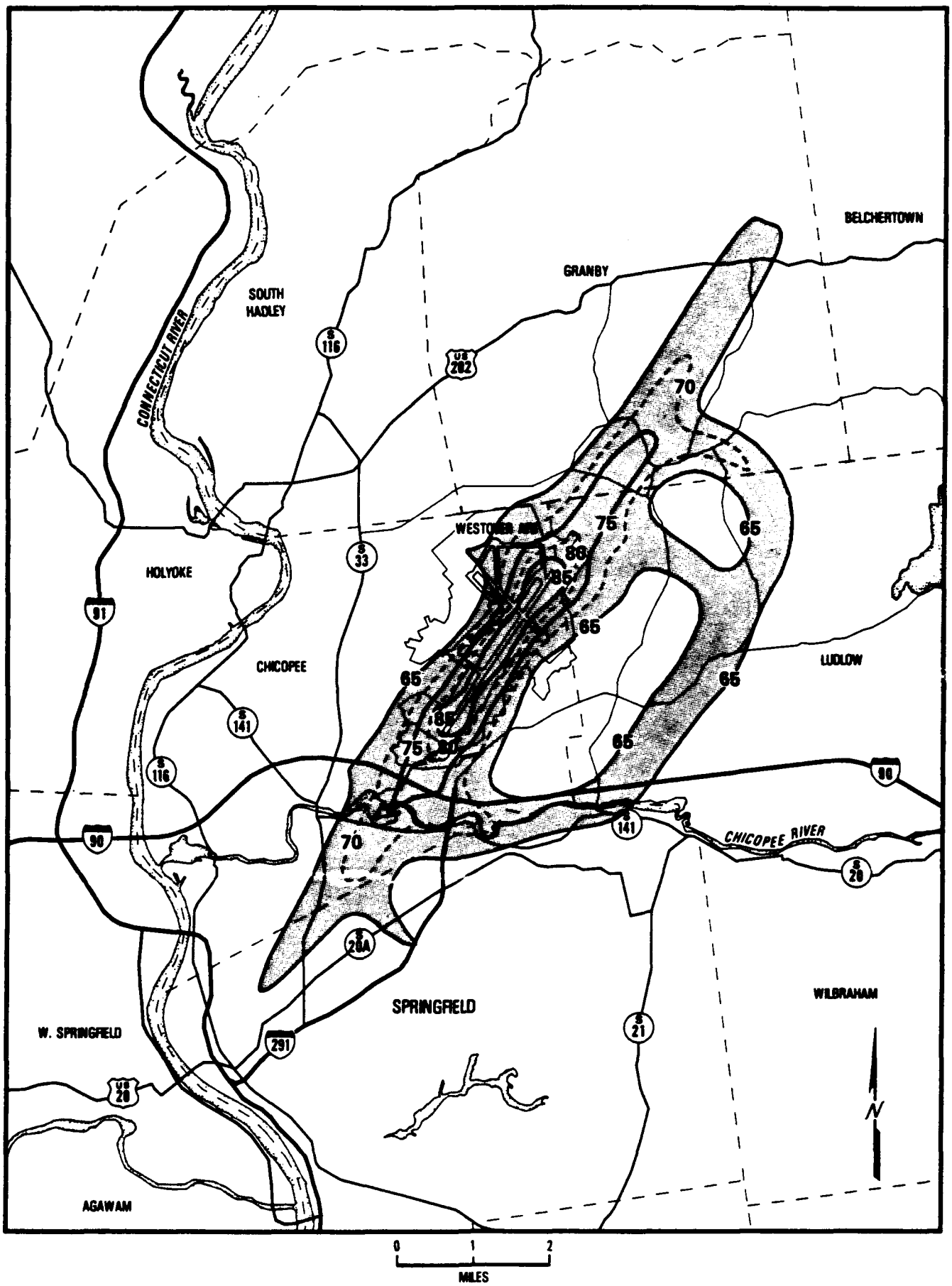

Fig. D.14. Average Leq-15 contours for proposed (16 C-5A) military operations plus potential WMDC operations.

ORNL–DWG 86-15979

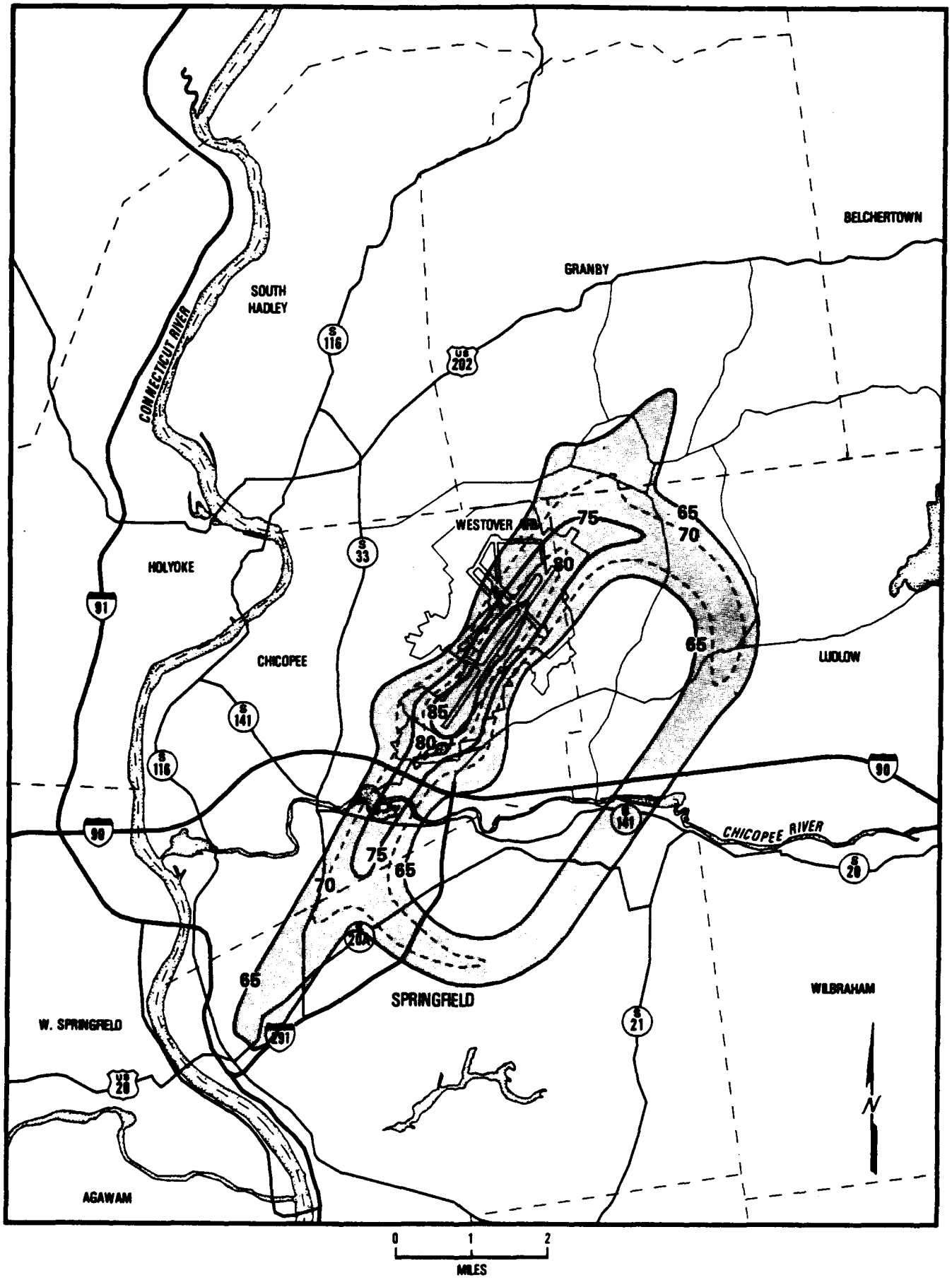

Fig. D.15. Leq-15 contours for combined military and WMDC operations on runway 05.

ORNL–DWG 86-15980

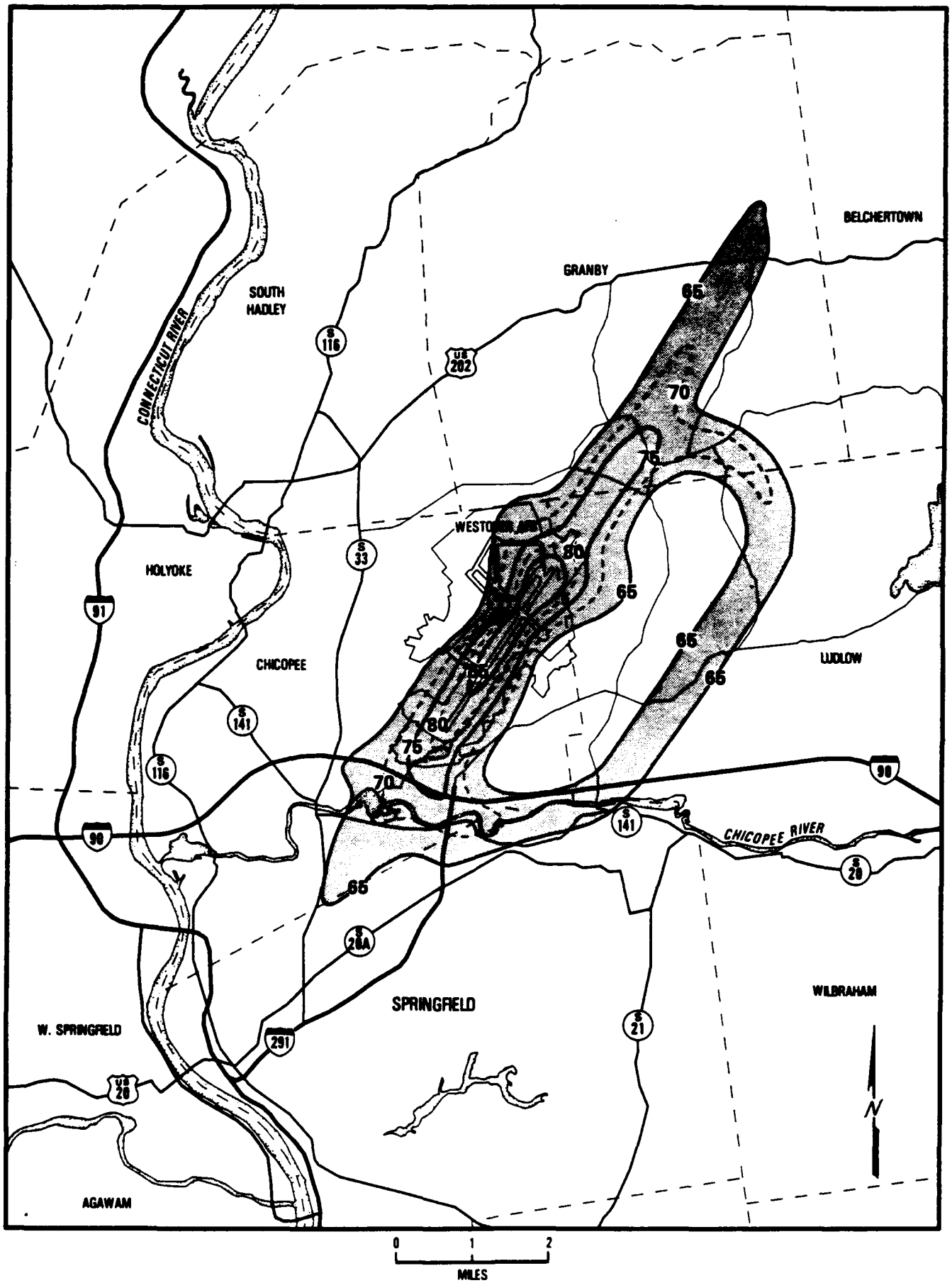

Fig. D.16. Leq-15 contours for combined military and WMDC operations on runway 23.

Table D.22. Areas with Leq-15 levels above 65 dB for potential WMDC operations in combination with proposed and alternate military operations

Leq-15 Contour interval (unweighted)	Area within contour Acres	Area within contour Sq. mi.	Cumulative area Acres	Cumulative area Sq. mi.
Annual average operations (Fig. D. 14.)				
>85	517	0.81	517	0.81
80-85	482	0.75	999	1.56
75-80	1,173	1.83	2,173	3.39
70-75	2,363	3.69	4,536	7.09
65-70	7,512	11.74	12,048	18.82
Total	12,048	18.82		
For operations on runway 05 (Fig. D. 15.)				
>85	385	0.60	385	0.60
80-85	506	0.79	892	1.39
75-80	1,195	1.87	2,087	3.26
70-75	2,690	4.20	4,777	7.46
65-70	6,295	9.84	11,072	17.30
Total	11,072	17.30		
For operations on runway 23 (Fig. D. 16.)				
>85	378	0.59	378	0.59
80-85	509	0.80	887	1.39
75-80	1,181	1.85	2,068	3.23
70-75	2,198	3.43	4,266	6.67
65-70	6,250	9.77	10,516	16.43
Total	10,516	16.43		

Table D.23. Population exposure to DNL noise levels above 65 dB for potential WMDC operations in combination with proposed military operations

Community	Noise level (dB) 75-70	70-75	75-80	>80	Total
Chicopee	6,256	2,505	14	0	8,775
Granby	338	88	151	0	577
Ludlow	399	71	35	0	505
Springfield	1,583	0	0	0	1,583
Total	8,576	2,664	200	0	11,440
% annoyed	21	32	46	63	
Number annoyed	1,801	853	92	0	2,746

Table D.24. Population exposure to DNL noise levels above 65 dB for potential WMDC operations in combination with alternate military operations

Community	Noise level (dB) 65-70	70-75	75-80	>80	Total
Chicopee	6,308	1,283	0	0	7,591
Granby	204	170	115	0	489
Ludlow	151	71	35	0	257
Springfield	544	0	0	0	544
Total	7,207	1,524	150	0	8,881
% annoyed	21	32	46	63	
Number annoyed	1,514	488	69	0	2,071

Table D.25. Population exposure to annual average Leq-15 noise levels above 65 dB for potential WMDC operations in combination with proposed military operations

Community	Noise level (dB) 65-70	70-75	75-80	>80	Total
Chicopee	5,989	2,308	22	0	8,228
Grandy	261	140	251	0	652
Ludlow	3,073	106	106	0	3,285
Springfield	4,533	0	0	0	4,533
Total	13,765	2,554	379	0	16,698

Table D.26. Population exposure to Leq-15 noise levels above 65 dB for potential WMDC and military operations on runway 05

Community	Noise level (dB) 65-70	70-75	75-80	>80	Total
Chicopee	3,090	2,976	1,299	0	7,365
Granby	288	180	0	0	468
Ludlow	2,672	309	35	0	3,016
Springfield	18,167	3,084	0	0	21,251
Total	24,217	6,549	1,334	0	32,100

Table D.27. Population exposure to Leq-15 noise levels above 65 dB for potential WMDC and military operations on runway 23

Community	Noise Level (dB) 65-70	70-75	75-80	>80	Total
Chicopee	5,390	81	0	0	5,471
Granby	221	118	267	0	606
Ludlow	0	0	0	0	0
Springfield	3,458	23	16	0	3,497
Total	9,680	222	283	0	10,185

APPENDIX E

MAILING LIST FOR WESTOVER FINAL EIS

APPENDIX E

Mailing List for Westover EIS

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Department of Housing and Urban Development
Region 1
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Regional Environmental Office
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Department of the Interior
Director, Office of Environmental Project Review
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Federal Aviation Administration
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