DRAFT

CITY OF BURIEN

SEATTLE-TACOMA AIRPORT MASTER PLAN UPDATE STUDIES

ENVIRONMENTAL ISSUES

EXECUTIVE SUMMARY

The environmental issues analysis of the City of Burien Seattle-Tacoma Airport Master Plan Update Studies focused on the following areas:

- noise and vibration;
- air quality;
- water resources: water quality and hydrology; wetlands; and floodplains; and
- aesthetics and visual.

Appropriate EIS sections for each of these areas were reviewed for the following:

1. Evaluate the adequacy of the EIS studies;

2. Establish a baseline for potential project impacts;

3. Assess the impacts for both project construction and operation; and

4. Identify issues in the EIS and recommend methodologies to enhance the analysis.

Following the Environmental Analysis, mitigation measures will be developed and recommended to minimize potential project impacts and to address the issues raised in the environmental analysis. The mitigation measures will be developed as part of a separate task and report (Mitigation Plan).

The results of the environmental analysis are summarized below.

Noise and Vibration

The EIS included information on both noise and vibration. The noise study used accepted models and methods of analysis to develop information on existing and future conditions. The study looked at aircraft and surface noise effects. Additional issues which will be addressed in the Mitigation Plan include the following:

1. Aircraft Noise Effects

- re-evaluation of data using the Integrated Noise Model, Version 5.1 when released because of additional features such as noise data for Boeing 777;

- additional information should be provided on the sound exposure levels (SEL) and the relationship to the day-night average sound level (DNL), and health problems such as speech and sleep interference;

- data and evaluation at the 55 DNL should be provided since EPA has indicated that it is a desirable noise level for protecting public health and welfare and the Flight Plan Project EIS used 55 DNL as a noise assessment criteria;

- additional information should be provided on threshold or time above (TA) noise data in relationship to select DNL levels and sensitive noise receptors such as schools;

- more detailed information should be provided on airplane engine runup noise levels; and

- the number of permanent noise monitoring sites should be increased.

2. Surface Transportation Noise Effects

- should be re-evaluated to include construction activities once fill haul routes are identified;

- more accurate traffic information should be obtained for the roads in the Airport area and then the surface transportation model re-run; and

- permanent road noise monitoring sites need to be established and the resultant data factored into the surface transportation noise effects re-evaluation.

The vibration evaluation was limited and could be improved by looking at both qualitative and quantitative data on:

- human whole body vibration;

- annoyance and interference to humans caused by building vibration; and

- building structural damage.

The noise and vibration cumulative impacts discussion was inadequate. A more extensive discussion of Master Plan Update implementation and other projects in the Airport area should be provided.

Air Quality

The EIS air quality analysis provided information on the following:

- Airport emissions inventory using the Federal Aviation Administration's (FAA) Emissions and Dispersion Modeling System (EDMS) computer model;

- area dispersion analysis using EDMS;

- Airport roadway intersection dispersion analysis using the CAL3QHC air quality computer model;
- human health - air toxics evaluation;
- construction vehicles air quality analysis using the CAL3AHC model;
- Clean Air Act conformity; and
- certification for compliance with air quality standards.

The models used for the analysis and overall approach were appropriate. The analysis issues which will be addressed in the Mitigation Plan include the following:

1. Emissions Inventory/Area Dispersion Analysis

- include more receptor locations in areas which have experienced complaints;
- include more receptors in areas with different terrain, such as to the west of the Airport;
- obtain long term air quality monitoring data from new sites closer to and around the Airport area;
- monitor for AAQS and key air toxic pollutants such as 1,3-butadiene, formaldehyde and benzene; and
- update and re-run model as additional information becomes available.

2. Airport Roadway Intersection Dispersion Analysis

- update and re-run dispersion analysis model as additional information becomes available; and

- need to correct inconsistencies noted by the U.S. Environmental Protection Agency (EPA) between the EIS and South Aviation Support Area EIS.

3. Human Health - Air Toxics Evaluation

- need to develop long term air toxics data throughout different months of the year;
- need to address other health risks besides cancer;
- need to obtain enough data in order to conduct a cancer risk assessment; and
- need to address potential health impacts on sensitive receptors such as schools, nursing homes, hospitals, etc.

4. Construction Vehicle Air Quality Analysis

- need to re-evaluate analysis as source fill areas and haul routes are identified;
- particulate data for the Seattle/Airport area needs to be collected; and
- evaluation should extend further than the immediate area around the Airport.

5. Clean Air Act Conformity

- need to respond to comments by EPA and Puget Sound Air Pollution Control Agency concerning inadequacies of the conformity analysis.

6. Certification of Compliance with Ambient Air Quality Standards

- Governor's Office needs to issue certification.

In addition to the above, the cumulative impacts discussion for air quality was cursory and inadequate. A better discussion needs to be developed which provides more information about other proposed projects in the Airport area and their relationship with Master Plan Update implementation.

Water Resources

The EIS water resources evaluation was based on accepted methodologies and included information on water quality and hydrology, wetlands and floodplains. The evaluation issues which will be addressed in the Mitigation Plan are as follows:

1. Water Quality and Hydrology

   - more water quality information on various parameters should have been provided for both surface water and ground water;
   - additional surface water and ground water monitoring stations should be established to help evaluate potential construction and operation impacts;
   - more detailed information on the wet vaults and biofiltration swales needs to be provided for both construction and operation; and
   - the relationship between the proposed Miller Creek relocation and litigation settlement agreements concerning Creek channelization will have to be resolved.

2. Wetlands

   - information needs to be provided on the wetland provisions of King County's Sensitive Areas Ordinance (King County Ordinance 9614, Sections 97 through 105), in particular on the wetlands rating system; and

- additional justification and information should be provided for mitigation of wetland impacts outside the Miller Creek Watershed.

3. Floodplains

- information on the 500-year floodplain should be provided; and

- as new floodplain information becomes available, the existing information should be updated in order to allow a better evaluation of potential future impacts.

The EIS cumulative impacts discussion of water resources was inadequate. More details should have been provided on proposed projects and the potential interaction with Master Plan Update implementation.

Aesthetics and Visual

Eighteen view sites were established around the Airport to describe existing and future conditions. The evaluation issues which will be discussed in the Mitigation Plan include the following:

- using color photographs instead of black and white photographs;

- establishing more view sites, in particular to the area west of the Airport on elevated ground;

- including more information on the ground shadow which will extend onto new areas; and

- aircraft on the ground and in-flight should have been more clearly shown.

Like the other environmental issues reviewed, the cumulative impacts discussion for aesthetics and visual was inadequate. The discussion should have been expanded to better describe potential impacts of other proposed projects and Master Plan Update implementation.

CITY OF BURIEN

SEATTLE-TACOMA AIRPORT MASTER PLAN UPDATE STUDIES

ENVIRONMENTAL ISSUES

1.0 INTRODUCTION

Task 5 Environmental Analysis of the Scope of Services focuses on the following areas if Alternative 3 of the proposed Seattle-Tacoma (Sea-Tac) Airport Master Plan Update Alternatives are implemented:

- Noise and vibration;
- Air quality;
- Water resources: water quality and hydrology; wetlands; and floodplains; and
- Aesthetics and visual.

For each of these areas, the Scope of Services involved the following:

1. Evaluate the adequacy of the studies which were part of the Master Plan Update's Final Environmental Impact Statement (EIS);

2. Establish a baseline for potential project impacts;

3. Assess the impacts for both project construction and operation; and

4. Identify issues in the EIS and recommend methodologies to enhance the analysis.

Following the Environmental Analysis, mitigation measures will be developed and recommended to minimize potential project impacts and to address the issues raised in the environmental analysis. The mitigation measures will be developed as part of the Mitigation Plan and will be the topic of a separate report.

In order to fully evaluate the appropriate areas of the EIS, each area was reviewed for the following:

- Methodology: assumptions; monitoring stations; baseline data/modeling;
- Existing conditions;
- Future conditions: impacts;
- Cumulative impacts; and
- Mitigation.

The evaluation is based on a review of the different EIS Chapters, appropriate literature information and discussions with the agencies and persons contacted in Appendix A. The information used in this evaluation are listed in Section 6.0 References. The specific EIS Chapters are shown in Table 1-1.

In order to provide a better idea of the discussion of environmental issues in the EIS, this EIS information is summarized followed by comments on the methodology and results, and issues which will be discussed further in the Mitigation Plan.

TABLE 1-1

EIS CHAPTERS REVIEWED FOR

ENVIRONMENTAL ISSUES

EIS		
CHAPTER	SECTION	TITLE
--	--	Executive Summary
I	--	Project Background and Purpose and Need
II	--	Alternatives
III	--	Affected Environment
IV	1	Noise
IV	2	Land Use
IV	7	Human Health
IV	9	Air Quality
IV	10	Water Quality and Hydrology
IV	11	Wetlands
IV	12	Floodplains
IV	19	Earth
IV	20	Solid Waste
IV	21	Hazardous Substances
IV	23	Construction Impacts
IV	24	Aesthetics and Urban Design
V	--	Probable, Unavoidable, Adverse Environmental Impacts and Mitigation Measures
Appendix C	--	Noise Impacts
Appendix D	--	Air Pollutant Methodology
Appendix F	--	Stream Survey Report for Miller Creek
Appendix G	--	HSP-F Hydrological Modeling Analysis
Appendix H-A	--	Jurisdictional Wetland Delineation
Appendix H-B	--	Wetland Function and Values Assessment
Appendix N	--	Aesthetic Views and Photos
Appendix P	--	Natural Resource Mitigation Plan
Appendix Q	--	Water Studies
Appendix Q-A	--	Baseline Groundwater Study
Appendix Q-B	--	Preliminary Water Conservation Plan
Appendix Q-C	--	Concepts for Using a Constructed Aquifer to Manage Airport Stormwater
Appendix R	--	Responses to Public Comments

2.0 NOISE AND VIBRATION

Noise and vibration issues in the EIS are discussed in Chapter IV, Sections 1, 7 and 23, Chapter V, Appendix C and part of Appendix R. In Appendix C, standard aircraft noise descriptors or metrics are described as follows:

- Day-Night Average Sound Level (DNL or Ldn) - the DNL is the Federal Aviation Administration (FAA) specified noise descriptor; it employs the leq or equivalent sound level which is a single numerical noise rating in decibels (dBA) which would contain the same noise energy as the time-varying sound level in a given period of time; the DNL provides a numerical description of the weighted 24-hour cumulative noise energy level using the A-weighted decibel scale over 1 year;

- Leq - this is used to define noise exposure without the penalty of nighttime activity over a specified period of time (e.g., 24 hours, a school day); in general, the closer the 24 hour Leq and DNL values are to each other, the less the impact of nighttime activity; if the DNL is 3 dBA or greater than the Leq, the nighttime noise is considered to be a major contributor to the overall noise environment;

- Sound or Single Event Exposure Level (SEL) - the noise associated with a single aircraft noise event either on the ground or while in flight; noise complaints are generally a result of a SEL;

- Thresholds or Time Above (TA) - represents the number of minutes per average annual day that a location is exposed to noise in excess of given decibel thresholds such as 65 dBA.

These metrics are used to describe sound pressure or amplitude and sound frequency. Sound pressure is a direct measure of the sound magnitude without consideration for other factors that may influence its frequency. A standard unit of measuring sound pressure is the decibel

(dB). Because the range of sound pressures in the environment is so large, these pressures are expressed on a logarithmic scale. This scale compresses the wide range in sound pressures.

Sound frequency is expressed as Hertz (Hz) or cycles per second. Young adults normally have an audible frequency range of 2 to 16,000 Hz; whereas, aircraft noise is between 50 to 5,000 Hz. The human ear has different sensitivities to various frequencies, with some louder or quieter than others. Thus, methods for frequency weighting have been developed with the most common being the A-weighted noise curve or dBA. The A-weighted scale performs this compensation by discriminating against frequencies similar to the human ear. All Federal agencies dealing with community noise use the A-weighted sound level as the basic unit for environmental impact analysis.

In the EIS, it is indicated that noise levels in flight are regulated by the FAA's aircraft certification process. Certain non-flight activity at the Airport is regulated by state and local regulations. Chapter 173-60 of the Washington Administrative Code (WAC) specifies maximum noise levels that one property can project onto another. However, under the code the following are exempt:

- sounds created by aircraft engine testing and maintenance not related to flight operations between 7:00 a.m. and 10:00 p.m. provided that testing and maintenance is conducted at a remote site, whenever possible; and

- sounds originating from aircraft in flight and sounds that originate at airports which are directly related to flight operations.

Therefore, the WAC applies only to aircraft engine testing and maintenance at night which are not related to flight activity.

King County has adopted the WAC regulations within their areas of jurisdiction as shown in Table 2-1.

TABLE 2-1

KING COUNTY MAXIMUM PERMISSIBLE NOISE LEVELS

Land Use Zone of Noise Source	Land Use of Receiving Property/dBA			
	Rural	Residential	Commercial	Industrial
Rural	49	52	55	57
Residential	52	55	57	60
Commercial	55	57	60	65
Industrial	57	60	65	70

The maximum permissible noise levels are:

- Reduced by 10 dBA at night (10 p.m. to 7 a.m.) when the receiving land use zone is residential;
- Reduced by 5 dBA for sounds that are periodic or contain pure tones; and
- Increased by 15 dBA for up to 1.5 minutes, 10 dBA for up to 5 minutes, 5 dBA for up to 15 minutes (all per hour) for noises of short duration.

The U.S. Environmental Protection Agency (EPA) has identified the 55 DNL as the desirable noise level for protecting the public health and welfare with an adequate margin of safety (EPA, March 1974). This is not a regulatory level, but as indicated by the Puget Sound Regional Council and Port of Seattle (October 1992), "... the 55 Ldn is indicative of a desired goal for the noise environment within the communities of the Puget Sound Region."

2.1 Aircraft Noise Effects

2.1.1 Methodology

In the EIS, aircraft noise effects represented "... the land area and number of people and residences above predetermined levels." These levels were defined by Day-Night Average Sound Level (DNL or Ldn) contours of 60, 65, 70 and 75 dBA.

The DNL contours were developed by using the Federal Aviation Administration's (FAA) Integrated Noise Model (INM), Version 4.11. This model version includes information on:

- aircraft fleet mix;
- flight track and runway use statistics;
- flight profiles adjusted for local elevation and temperature;
- aircraft ground activity including taxi movement noise and aircraft run-up noise; and
- ground terrain.

Each contour developed for the EIS assumes that the existing noise abatement program summarized below, will remain in effect in the future. The FAA considers airport noise impacts to be significant if the DNL noise levels increase 1.5 dBA or more within the 65 DNL noise contour.

In the United States two computer-based noise simulation models are currently used which produce DNL contours. The INM was developed by the FAA and is most often used for civil airports; whereas, the NOISEMAP was developed by the U.S. Air Force and is generally used for military air bases. Thus, the INM, Version 4.11, was an appropriate model to use and was the latest version of the INM.

In August, 1995, Version 5.0 of the INM was released. This version is a Windows based program and has some new enhancements including: new graphics user interface; new data preparation and input aids; new graphics and plotting capabilities; and improved and faster noise calculations algorithms. More accurate noise predictions are also supposed to be made.

Version 5.1 of the INM will be available the fall, 1996. This will be a Windows '95 based version and will have at least the following enhancements: ability to plot noise contours on a street map; and an expanded data base of aircraft including the Boeing 777 and MD90. At the time the EIS was done, noise data for a Boeing 767-200 with JJ-9-D was substituted for the Boeing 777 aircraft.

Because of at least the greater accuracy of the INM, Version 5.1; the ability to plot noise contours on a street map; and the expanded data base of aircraft information, the noise model should be rerun using this new version. This will allow confirmation of the data from INM, Version 4.11 and the most up-to-date information available on the newer aircraft noise characteristics.

The noise study did not include an extensive evaluation of sound exposure level (SEL). According to Horonjeff and McKelvey (1994), "In addition to DNL contours, SEL contours can be helpful in addressing issues of sleep and speech interference and for analyzing the effects of noise abatement procedures, such as proposed noise abatement flight tracks. Graphical comparisons of SEL contours of various aircraft types can also provide powerful images for comparing noise emissions of different aircraft types." They also indicate that, "Tabular listings for user-specified ground locations show not only the predicted DNL but also the SEL and DNL contribution of individual aircraft by runway and flight corridor. This information is invaluable to understanding the major contributors to the total DNL. It can also be used to compare the model predictions with data from noise-monitoring locations. Such comparisons

often provide the basis for fine-tuning model inputs as well as promoting public confidence in the computer model and the contours it produces."

In the EIS, the INM was used to show the SEL contours for one approach to Runway 16R and one departure from Runway 16L for five aircraft types which dominate the current and future fleet mixes at the Airport. Based on the comments by Horonjeff and McKelvey (1994), it appears as if it would be useful to have a more extensive discussion of the SEL contours; their relationship to the DNL contours; and their relationship to health problems, in particular, sleep and speech interference. Thus, this should be done concurrent with re-evaluating the noise data using INM, Version 5.1.

The EIS for the Flight Plan Project (Puget Sound Regional Council and Port of Seattle, October, 1992), included noise assessment information associated with the 55 DNL level and a SEL of 80 dBA. This SEL was selected because it is often used to supplement the DNL analysis and 80 dBA corresponds to the level at which sleep disturbance and speech interference start to occur. This EIS used the following overall noise assessment criteria in the analysis:

- population exposed to cumulative noise levels in excess of 55 DNL;
- population that would be newly exposed to cumulative noise levels in excess of 55 DNL;
- population exposed to cumulative noise levels in excess of 65 DNL;
- population that would be newly exposed to cumulative noise levels in excess of 65 DNL; and
- population that would be exposed to single event SEL noise levels in excess of 80 dBA.

The assessment criteria related to the 65 DNL were used in the Master Plan Update Alternative EIS; but the other criteria were not. Since the Flight Plan Project included the proposed third runway as an Airport capacity enhancement measure, the results of this EIS

and assessment criteria should have been included in the Master Plan Update EIS. A more detailed evaluation of the SEL information would be particularly relevant since the information in EIS Table C-28 shows numerous receptors with peak levels above 80 SEL.

In Appendix R of the EIS, it is indicated that computation of noise contours below 60 DNL is unreliable using the INM. Thus, a combination of noise measurement methods may be required to evaluate population exposure at the 55 DNL. This will, in part, depend upon INM, Version 5.1 capabilities.

The EIS approach to aircraft noise focused mostly on flight noise impacts taking into consideration runup noise and aircraft taxing noise. The South Aviation Support Area EIS used the previously mentioned NOISEMAP model to also look at aircraft runup and taxing operations (U.S. Department of Transportation, Federal Aviation Administration and Port of Seattle, March 1994). It would have been useful if this information had also been developed and discussed for the Master Plan Update implementation EIS. The runup evaluation should include a discussion of line maintenance runups, base maintenance runups and runup locations with particular reference to the proposed third runway and facilities proposed as part of Master Plan Update implementation.

Appendix C Noise impacts in the EIS indicates that existing aircraft operations were based on average daily operations. It is not completely clear how many operations per hour this equates to. The air quality analysis used an aircraft peak hour activity level of about 88 operations (43.9 arrivals and 43.9 departures). The relationship, if any, between the noise and air quality aircraft operations or activity levels should be explained better taking into consideration the noise and air quality analyses used the August and June, 1994 Official Airline Guide (OAG), respectively. Also, the discussion should include comments on the Airport being able to accommodate 60 arrivals per hour which was recently mentioned by the Port of Seattle (March 26, 1996; August 1, 1996).

2.1.2 Existing Conditions

The FAA has established the 65 DNL as the critical level for the determination of noise impacts. The 60 DNL level was provided in the EIS for information only to allow a better understanding of aircraft noise levels in the Airport area. It is of interest to note that for the

Flight Plan Project EIS (Puget Sound Regional Council and Port of Seattle, October 1992), the 55 DNL level was used as one of the noise assessment criteria. In this EIS, it was observed that, "A noise level of 55 Ldn and greater indicates the population to which the aircraft noise will be noticeable and some degree of annoyance or adverse community response would be expected to occur. Experience at Sea-Tac showed most areas (but not all) where noise complaints occurred were exposed to Ldn levels of 55 or greater. For a new airport site, the 55 Ldn represents that area in which future residential land use development may consider land use zoning, and other land use control measures to avoid significant noise-related residential land use impacts."

Based on the 65 DNL contour the following was concluded in the EIS for the Master Plan Update implementation:

- this contour includes 12.23 square miles;

- the 65 DNL noise exposure contour extends from north to south from the Duwamish River (just south of the Boeing Field Plant to near 280th Street South); to the west of the Airport the contour tapers to the southeast from the vicinity of 188th Street and 8th Avenue to its southern end; to the east and north of the Airport the noise contour is generally east of and parallel to State Route 509; east and west of the runway ends, the contour bulges outward which reflects the areas from thrust at takeoff to begin the role for departing flights; the contour between the runway ends curves in toward the Airport;

- approximately 31,800 people in 13,620 homes are impacted by noise levels 65 DNL and greater; this represents a 52 percent reduction in population exposure over the 1991 conditions;

- the predominant use of the southerly traffic flow and the prevailing winds results in the largest portion of the 65 DNL contour falling south of the Airport;

- because of increased thrust levels during take-off, noise levels are several decibels higher than approaches and noise contours extend further into communities south of the Airport;

- when traffic is in south flow, the east parallel Runway 16L is used for most departures and the west Runway 16R is used for most arrivals; when traffic is in north flow, Runways 34L and 34R (west and east runways) are used for departures and approaches, respectively; the noise exposure contours show greater exposure along the centerline of the approaches to Runways 16R and 34R; and

- the existing runway utilization is shown in Table 2-2.

Based on a visual examination of the data and results for the existing conditions description, it appears as if the results are appropriate for INM, Version 4.11. As indicated above, the results of this analysis should be compared with data generated by the INM, Version 5.1, which is planned for release the fall, 1996. In addition, the existing conditions description should include a better discussion of the relationship between the DNL, SEL and TA calculations and contours. The EIS indicates that TA "... is helpful in determining the exposure of certain noise sensitive users (schools, sleeping quarters, etc.) to extended periods of noise at various levels which may be disruptive to the activity occurring there." However, the EIS did not address in detail the TA or other noise metrics issues with respect to these sensitive receptors.

As part of checking the noise contours generated by the INM, a comparison was made with the measured noise level at the eleven existing noise monitoring stations. The comparison indicated a relative close relationship between the INM and actual measured data. However, in Appendix R of the EIS, it is indicated that, "Noise monitoring sites are not sufficient in numbers and are not located at distances far enough from the Airport to be used in the delineation of the noise exposure contours. Although there are sufficient sites near the Airport to provide information for input adjustment, the absence of sites at greater distance preclude the full array of data necessary for the modification of input information." Based on this, it appears as if the number of permanent noise monitoring stations is inadequate and should be increased to help validate the INM noise contours.

TABLE 2-2

EXISTING RUNWAY UTILIZATION

SOUTH TRAFFIC FLOW: 65 PERCENT

Runway	Aircraft Category[a]	Arrivals (percent) Day[b]	Arrivals (percent) Night	Departures (percent) Day	Departures (percent) Night
16L					
	Heavy	17.7	1.73	62.6	47.3
	Jets	13.2	20.0	56.5	58.2
	Props	19.1	29.4	58.6	57.1
16R					
	Heavy	47.3	47.7	2.4	17.7
	Jets	51.8	45.0	8.5	6.8
	Props	45.9	35.6	6.4	7.9

NORTH TRAFFIC FLOW: 35 PERCENT

Runway	Aircraft Category	Arrivals (percent) Day	Arrivals (percent) Night	Departures (percent) Day	Departures (percent) Night
34					
	Heavy	2.2	0.0	21.0	21.0
	Jets	7.0	8.4	30.0	29.9
	Props	13.0	8.8	24.8	27.4
34R					
	Heavy	32.8	35.0	14.0	14.0
	Jets	28.0	26.6	5.0	5.1
	Props	22.0	26.3	10.2	7.6

[a] Aircraft category use as follows: heavy - jet powered aircraft with a take-off weight of 300,000 pounds or more; jets - jet powered aircraft with a take-off weight of less than 300,000 pounds; props - all piston or turboprop powered aircraft.

[b] Day indicates 7:00 a.m. to 9:59 p.m.; night indicates 10:00 p.m. to 6:59 a.m.

In addition, the noise monitoring stations have inadequate coverage of the area surrounding the Airport, in particular, to the northwest, west, southwest and northeast of the Airport. The need for more monitoring stations will become particularly important as a result of Airport activities moving approximately 1/2 mile west with Master Plan Update implementation. As part of adding more noise monitoring stations, the system also should be upgraded to replace old noise monitoring equipment. It should be noted that the Port of Seattle is currently evaluating the need for additional monitoring stations and upgrading their equipment (Port of Seattle, August 1, 1996), as discussed in Section 2.5 Mitigation Measures. Representatives from the cities and concerned groups/citizens in the Airport area should participate with the Port in the selection of appropriate monitoring sites that are not limited primarily to the north/south flight paths.

As part of the existing conditions discussion, the EIS provides information on the aircraft noise reduction/abatement programs. These include:

- noise budget program - the Airport will move toward an all Stage 3 aircraft fleet by limiting the amount of noise airlines are allowed to make each year; the goal agreed to in the Noise Mediation Agreement (Port of Seattle and Mestre Greve Associates, March 31, 1990) is to reduce noise by the year 2001;

- nighttime limitations program - this program involves phasing out Stage 2 aircraft during nighttime hours; effective October 1, 1995, Stage 2 jet aircraft may not operate between 10:00 p.m. and 7:00 a.m. unless granted an exemption or variance (e.g., delays due to weather, air traffic control delays, etc.);

- ground noise control program - airplanes are not allowed to back away from gates using engine power, instead they must be pushed away by "tugs"; run-ups during the daytime are allowed only at designated locations on the north and south ends of the Airport (aircraft must face into the wind so that jet blast is directed back across the airfield); between 10:00 p.m. and 7:00 a.m. run-ups are allowed only under special circumstances such as for a departure;

- overflight noise abatement procedures - initial "straight-out" departure corridors are in a narrow flight path; Duwamish/Elliot Bay corridor for arriving and departing flights keep aircraft over water and industrial areas as much as possible; nighttime procedures to keep flights over Puget Sound waters as much as possible.

- flight path monitoring - the Airport's Noise Abatement Office monitors jet flights in the noise abatement corridors;

- noise monitoring - eleven station permanent noise monitoring system to record noise exposure levels in the Airport area; and

- 24-hour noise information line - provides information on noise issues or accepts noise complaints.

In Appendix R of the EIS, it is indicated that the nighttime noise budget and limitations program is designed to address noise issues associated with aircraft categorized as having FAR Part 36 Stage 2 noise levels. Therefore, the program will expire with the completion of the scheduled phase out of these aircraft between 2000 and 2003. These two components are an integral part of the aircraft noise reduction/abatement programs and discussions should be held with the Port about continuing the implementation of the nighttime limitations program beyond the Stage 2 phase out schedule. Depending on the status of the nighttime noise budget program in relation to Stage 3 aircraft, this program also should be continually evaluated and updated based on the different stages of aircraft.

INM Version 4.11 has the capability to compute noise levels due to airplane engine runup operations. This is particularly useful for noise information around airplane maintenance facilities. Because concern has been expressed about noise levels associated with existing runup and maintenance operations, and the proposed south aviation support area activities, a discussion of this feature and data for the Sea-Tac Airport would be useful. This information should be provided for both the existing and future conditions.

2.1.3 Future Conditions

Future conditions were based on the following average day operations:

Year	Average Day Operations
2000	1,038
2010	1,112
2020	1,210

Based on these operations, the runway utilization was predicted as shown in Table 2-3 with Runways 16X and 34X indicating the south and north flow, respectively, on the new third runway. This utilization reflects the requirements for Stage 3 aircraft.

Under the future development condition flight tracks are not expected to differ from the existing flight tracks. These flight tracks also were duplicated for the new third Runway 16X (south flow) and 34X (north flow).

Conclusions concerning the future conditions were as follows:

- Alternative 3 and the other project alternatives would result in an increase of 5 to 7 percent in the 65 DNL noise exposure area over the Do-Nothing alternative;
- the length of the new runway would have little effect on the area within the noise pattern;
- the noise exposure pattern of each future alternative would be 42 to 50 percent smaller than the pattern of the existing condition;
- of the 1,252 sites where DNL levels were computed, thirty-three sites would experience significant increases in 2000, forty in the year 2010, and forty-seven in the 2020 with significant defined as a 1.5 DNL increase in aircraft noise; and

TABLE 2-3

FUTURE RUNWAY UTILIZATION

SOUTH TRAFFIC FLOW: 63.9 PERCENT

Runway	Arrivals (percent)	Departures (percent)
16L	31.9	23.7
16R	19.9	37.6
16X	12.1	2.6

NORTH TRAFFIC FLOW: 35.1 PERCENT

Runway	Arrivals (percent)	Departures (percent)
34L	17.5	14.2
34R	15.3	20.6
34X	3.3	1.3

- aircraft noise levels of 65 DNL and greater would impact the following areas for Alternative 3:

Year	Square Miles	Housing	Population
2000	2.86	4,020	9,890
2010	2.98	4,190	9,860
2020	3.34	4,740	11,240

Based on the review of the information presented in the EIS for the future conditions, the information appears reasonable. As part of the Final Decision on Noise Issues (Puget Sound Regional Council, March 27, 1996), the expert noise arbitration panel indicated that with respect to the INM, a number of assumptions must be made which can affect the outcome. Sensitivity tests can be used to evaluate how much change in a key input value or assumption might affect the outcome. A similar approach would be useful in evaluating the assumptions used in the future noise modeling and the resultant data. Thus, sensitivity tests should be conducted and evaluated. Also, if possible, information on the range and standard deviations of the DNL and other data in the EIS should be presented. The range and standard deviations of the data could provide an indication of potential impacts beyond the noise contours shown in the EIS.

As discussed in Appendix R and previously mentioned, actual noise information for the Boeing 777 was not available and alternate information was used. The INM, Version 5.1 should be used, when available, to re-evaluate the future noise contours since it is supposed to contain this information.

The noise mediation agreement (Port of Seattle and Mestre Greve Associates, March 31, 1990) indicates that as technology with noise barriers develops, the Port of Seattle will evaluate their use. It is not clear if during the future conditions evaluation the use of noise barriers was included. This may be particularly useful in the vicinity of any new maintenance facilities in addition to the use of "hushing" equipment. Appendix R of the EIS also mentions the use of vegetation to help reduce noise. The EIS indicates in Chapter 1 that as part of the

Master Plan Update objectives, Airport noise is to be attenuated through the use of berms and barriers (Port of Seattle, May, 1994).

2.2 Surface Transportation Noise Effects

Surface transportation noise effects focused on the noise issues associated with the proposed surface transportation.

2.2.1 Methodology

For this analysis, the Federal Highway Administration (FHWA) computer program STAMINA 2.0 was used. The model calculated roadway noise levels at 108 user-specified receivers. The input to the model included:

- roadway description - sets of roadway requests were defined within a network of sixteen area thoroughfares;

- traffic volume - traffic on each of the major roadway requests during the peak hour of the day was evaluated based on final Metropolitan Transportation Plan traffic volumes which were updated;

- vehicle classification - proportion of vehicle type, passenger cars, medium trucks and heavy trucks; and

- travel speeds - for minor arterial roads travel speeds were assumed to be equal to the posted speed limit; for major roads including freeways, theoretical speeds were obtained by performing capacity analysis calculations, which correspond to the traffic conditions on the road link; this procedure followed the techniques contained in the Highway Capacity Manual (Transportation Research Board, 1985).

The receiver locations modeled were approximately 50 to 500 feet from a road edge in noise sensitive residential areas or facilities. The selection of these locations was coordinated with the aircraft noise analysis.

The STAMINA program produces peak hour Leq levels for each receiver location. A Leq is approximately 3 to 4 decibels less than a DNL.

Noise levels were calculated for the base year, 1994 and compared to ambient noise measurements conducted as part of the State Route 509/South Access Road Corridor EIS Phase II Study. Following this comparison, the STAMINA model was calibrated to more closely represent existing conditions.

Use of the FHWA STAMINA 2.0 program was appropriate for the surface transportation noise effects study. The data which was used in the model based on the information in the EIS, also seems reasonable.

2.2.2 Existing Conditions

The following summarizes the existing transportation/road noise conditions:

- peak hour surface traffic noise levels range from 48.5 to 73.5 dBA Leq (peak-hr);
- thirty-five sites were identified as being noise impacted according to the FHWA sensitivity criterion of 67 dBA or greater;
- a total of fifty-one sites experience a Leq (peak-hr) in excess of 65 dBA; and
- the highest noise levels are generally located along State Route 518, 509, I-5/Military Road South 154th Way, and International Boulevard.

The existing conditions of the roadway noise evaluation appears to be adequate and provides a good start from which to predict and evaluate future changes. Depending on when the Master Plan Update implementation is started, consideration should be given to remodeling the surface transportation noise with the then current version of STAMINA or the most accepted program. This will allow a comparison with the 1994 existing baseline conditions and the actual conditions at the start of construction. In order to plan for this re-evaluation, the following should be done:

- specific roadway noise monitoring sites should be established at key locations, possibly some of the sites identified as being noise impacted by the FHWA noise sensitivity criterion; the locations of these sites should be coordinated with the establishment of additional aircraft noise monitoring sites; data collection from these noise monitoring sites should begin as soon as possible in order to provide up-to-date baseline information before Master Plan Update implementation construction starts; and

- more accurate traffic information should be obtained for the roads in the Airport area (e.g., vehicle categories and road use); the EIS indicates that relevant data was available only on I-5 and International Boulevard for surveys conducted on August 3, 1987; July 8, 1991; and February 25, 1992.

2.2.3 Future Conditions

For the Do-Nothing Alternative, the transportation analysis indicates that noise levels will continue to be in excess of 65 dBA at the existing locations plus the following:

- by the year 2000 five additional sites would exceed the peak hour-Leq noise level of 65 dBA; these sites will be along Kent Des Moines Road west of International Boulevard and along South 200th Street east of International Boulevard; increases at these sites would be 2 to 3 dBA;

- in the year 2010 noise levels at the 108 receptor sites will range from 50.8 to 74.8 dBA Leq (peak-hr); eight additional sites would exceed the 65 dBA FHWA sensitivity level; all new sites will be located on major arterials such as South 154th Way, Des Moines Memorial Drive South, South 160th Street/Military Road, and South 200th Street; all increases are less than 2 dBA increase over 2000 levels, except for along South 24th Avenue which is 2.7 dBA; and

- by 2020 71 of the 108 receptor sites will experience sound levels in excess of the FHWA level of 67 dBA Leq (peak-hr); noise levels would range from 54.1 to 74.7 dBA Leq (peak-hr); the greatest roadway related noise increases would occur along the new State Route 509/South Access Road.

A comparison between the Do-Nothing alternative and Alternative 3 indicates that:

- in the year 2000 the greatest increase in noise of 4.7 dBA Leq (peak-hr) would occur in the vicinity of one receptor at 8th Avenue South, north of State Route 518; other noise receptors generally had levels similar to or below the Do-Nothing alternative;

- in the year 2010 the 8th Avenue South location exceeds the Do-Nothing alternative location noise level by 2.3 dBA Leq (peak-hr); other noise levels at receptor sites generally continue to be below or at the Do-Nothing alternative levels; and

- by the year 2020 the 8th Avenue South receptor is 0.6 dBA Leq (peak-hr) below the Do-Nothing alternative and other receptor sites continue to be at or below the some Do-Nothing alternative noise levels.

The traffic analysis also used the STAMINA 2.0 model to evaluate earthwork and site preparation activities noise levels. Information was provided on typical noise levels of different types of construction equipment. It was indicated that based on the fill haul routes discussed in the EIS, noise levels will increase as follows on the indicates streets:

- 200th Street: 5.5 dBA;
- Des Moines Memorial Drive between 200th Street and State Route 509: 3.6 dBA;
- 24th Street near 154th Street: 6.4 dBA; and
- South 160th Street east of State Route 509 interchange: 7.6 dBA.

According to the State of Washington Department of Transportation, because these noise increases are temporary, they are not subject to their noise level criterion during the daytime. They are subject to the criterion between 10:00 p.m. and 7 a.m. and the Port has indicated that the Construction and Earthwork Management Plan will include steps to minimize nighttime noise impacts along the haul routes. However, area residents west of the earthwork activities for the third runway will experience construction related noise.

The future conditions for the roadway impact analysis was adequate based on the information available and assumptions used. Like the existing conditions analysis, it is recommended that the future analysis be evaluated again in order to reflect more accurately the information available prior to the start of construction for Master Plan Update implementation. This, is in part, to reflect more accurately actual Sea-Tac area traffic information due to growth, changes in any traffic patterns, etc. The re-evaluation would benefit from the following:

- more accurate information on construction activities, in particular haul routes, so that construction traffic can be included in the roadway noise re-evaluation;
- more accurate information on vehicle classification and their use of the various roadways; and
- the additional monitoring data obtained from the roadway noise monitoring sites.

The re-evaluated future conditions discussion also should include information on the relationship between Master Plan Update implementation and the Port of Seattle's ability to maintain its Airport's reduced noise level goals. This discussion is particularly relevant because of the recent concerns about the Port not sufficiently reducing on-the-ground noise impacts by April 1, 1996 (Puget Sound Regional Council, March 27, 1996).

2.3 Vibration

The EIS vibration analysis was qualitative. A comparison was made between decibel levels recorded in the frequencies between 1 and 80 Hertz (Hz) for several different aircraft currently operating at the Airport. The range of low frequency noise levels for Stage 2 and 3 aircraft were as follows:

	Noise Levels (dBA)		
Aircraft Stage	Take-Off	Climb-Out	Approach
2	75-90	70-85	61-70
3	66-84	65-78	53-71

Based on this comparison, it was concluded that the intensities of vibration will decline as the aircraft fleet becomes entirely Stage 3. This is because the decibel levels at the low frequency levels associated with vibration are less for the aircraft that will makeup the future fleet at the Airport.

This vibration analysis was cursory and was more of a qualitative than a quantitative approach. A more extensive evaluation should be done because of the numerous complaints about vibration from aircraft activities, in particular, in homes and schools. Some of these complaints have been reported in areas such as on 160th Street and 10th, where noise/ vibration impacts will move closer with construction of the third runway.

More information on vibration should be presented because, "These induced vibrations - caused by airborne sound or transmitted through ground or structures - may generate additional annoyance, beyond that due to simple audibility of the impulse, because of "house rattling" and "startle," as well as additional contributions to interference with speech or sleep"

(Committee on Hearing, Bioacoustics and Biomechanics, Assembly of Behavioral and Social Sciences, and The National Research Council, 1977).

Vibration should be evaluated qualitatively and quantitatively for at least the following for residences, schools and hospitals:

- human whole body vibration;
- annoyance and interference to humans caused by building vibration; and
- building structural damage.

With respect to humans, the evaluation should look at impacts on working efficiency, health, safety and comfort. The evaluation should incorporate the information and methodology discussed by the International Organization for Standardization (ISO; International Organization for Standardization, 1985 a and b; 1989).

2.4 Cumulative Impacts

The cumulative input discussion for noise indicated that until specific project plans are completed for several other developments, total cumulative impacts can not be developed. Thus, only the State Route 509/South Airport Access Road development was included in the year 2020 Do-Nothing and other alternatives roadway noise analysis.

This was a cursory approach to discussing cumulative impacts. At least tentative plans for these other developments should be discussed with respect to Airport Master Plan Update implementation. Therefore, the cumulative impacts evaluation should be redone and re-evaluated.

2.5 Mitigation Measures

The EIS indicates that all noise mitigation measures currently in effect to reduce aircraft noise levels will be continued. This includes the previously mentioned noise abatement programs plus the following:

- insulation treatment of homes;
- home sales assistance in the most severely noise impacted areas to make sure that homes sell at fair market value based upon a Port of Seattle hired independent appraiser; and
- insulation of schools, health facilities and churches.

A home acquisition and relocation program was concluded in 1993. This program was conducted from 1974 to 1993 during which the Port of Seattle acquired 1,300 homes and relocated approximately 3,900 residents.

Additional mitigation measures discussed in this section include the need to improve and expand the Airport and road noise monitoring sites to obtain more information on area noise levels. These and other mitigation measures will be discussed in the Mitigation Plan.

It should be noted that the Port of Seattle (August 1, 1996) in its Resolution No. 3212 calls for the following:

- working with the FAA and airlines to continue various noise reduction practices and to evaluate potential additional actions;
- seeking commitment from the FAA to evaluate actions needed to prevent apparent violations of the north flow nighttime departure noise abatement procedures;

- working with communities and Airport users to update the Federal Aviation Regulation (FAR) ISO Noise Compatibility Plan;

- working with the Highline School District to insulate public schools;

- completing "sensitive-use" public buildings and multi-family home insulation pilot programs;

- designing and implementing a noise compatible land use plan for Port of Seattle properties within the current noise acquisition area;

- reviewing methods for mitigating the impacts of low frequency noise and vibration; and

- upgrading the permanent noise monitoring sites from eleven to approximately twenty-five monitoring sites by the end of 1998 (data will include DNL, SEL and TA metrics).

3.0 AIR QUALITY

Air quality issues associated with current Airport operations and the proposed Master Plan Update improvements are of major concern to the surrounding areas. This is, in part, due to the close proximity to the Airport to numerous residential neighborhoods. Implementation of the proposed improvements, in particular, construction of the third runway, also will bring these issues closer to the businesses along First Avenue in the City of Burien and along the southwestern part of 188th Street in the City of SeaTac.

EIS Chapter IV, Sections 7, 9 and 23, Chapter V, Appendix D, and part of Appendix R, focus on the air quality issues of the proposed Master Plan Update improvements.

It should be noted that more than one regulatory agency is responsible for air quality issues in the Puget Sound region. Three agencies have jurisdiction: U.S. Environmental Protection Agency (EPA); Puget Sound Air Pollution Control Authority (PSAPCA); and Washington State Department of Ecology (DOE). Their functions are as follows:

- EPA - has established National Ambient Air Quality Standards (NAAQS) for six criteria pollutants (ozone, carbon monoxide, nitrogen dioxides, particulate matter, sulfur dioxide and lead); air quality standards specify the maximum short-term and long-term concentrates of air contaminants; and EPA sets aircraft emissions standards.

- PSAPCA and DOE - have state and local ambient air quality standards (AAQS) that are at least as stringent as the national standards; and operate thirty-two permanent air quality/meteorology monitoring stations in the Seattle-Tacoma Puget Sound area including seasonal stations (Puget Sound Air Pollution Control Agency, October 1995).

- PSAPCA - responsible for enforcement of air quality standards for stationary sources; monitoring vehicle inspection program; and monitoring conformance plans for the State Implementation Plan (SIP) for conformance with the NAAQS.

3.1 Methodology

In order to determine Airport Master Plan Update implementation potential construction and operation impacts, the air quality analysis involved the following:

- preparation of airport emissions inventory using the Federal Aviation Administration's (FAA) Emissions and Dispersion Modeling System (EDMS) computer model;
- area dispersion analysis using EDMS;
- Airport roadway intersection dispersion analysis using the CAL3QHC air quality computer model;
- human health - air toxics evaluation;
- construction vehicles air quality analysis using the CAL3AHC model;
- Clean Air Act conformity; and
- certification for compliance with air quality standards.

The methodology for each of these is evaluated below followed by information on results in Section 3.2 Air Quality Results.

3.1.1 Airport Emissions Inventory

The FAA's EDMS computer model Version 944 was used to perform the air emissions inventory. Use of this model was confirmed with the EPA, PSAPCA and DOE. Aircraft and vehicle emission rates are included in the EDMS model and are based on information provided in EPA technical reports: Compilation of Air Pollutant Emission Factors (AP-42) and

Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources. The EDMS model also includes vehicle emission factors provided through an EPA mobile source emission program, MOBILE5A.

The Airport emissions inventory is used to summarize the total quantity of each pollutant from Airport activity within a defined area. The EIS indicates that this is not comparable to ambient air quality standards and does not fully explain why. However, the EIS indicates that the "....inventory can provide an indication of the impact development will have on overall air quality."

The aircraft characteristics which were used to define the quantity of pollutants from aircraft activity for the emissions inventory were:

- aircraft activity levels, fleet mix and engine types;
- time in operations mode for taxi/idle/delay; takeoff; climbout; and approach; and
- emission factors from the EPA technical reports based upon engine classification and operational modes.

The EDMS computer model and MOBILE5A computer program are accepted tools in determining an aircraft emissions inventory. In addition, the aircraft characteristics or data which was used was appropriate and adequate.

The aircraft activity level for the air pollutant emissions inventory was based on a peak hour of about 88 operations (43.9 arrivals and 43.9 departures). The relationship between this activity level and a 60 airplane arrival level per hour recently mentioned by the Port of Seattle (March 26, 1996; August 1, 1996) should be discussed in relation to the modeling.

3.1.2 Area Dispersion Analysis

The EDMS computer model evaluates the design and operation of an airport by modeling aircraft emissions during the different operational modes. This includes takeoff, climbout, approach and taxi/idle/delay. Emissions are calculated for up to an altitude of 3,500 feet since emissions above this altitude are not considered to have discernible impacts on ground level air quality.

Vehicle emission rates also are part of the EDMS model which includes MOBILE5A, an EPA mobile source emission program. The emission rates are used to predict air pollutant dispersion from vehicle sources on Airport area roadways and parking lots.

Initially, a screening dispersion analysis was done to determine where there might be potential ambient air quality standard (AAQS) exceedances. This analysis presents worst case conditions in terms of meteorological conditions and Airport operations. The meteorological conditions include: wind direction and speed; temperature; mixing height; and stability class or factor that determines the amount of pollution dispersion (i.e., low to high stability).

The screening analysis involved having a receptor grid in the Airport area for which emission levels are calculated. This receptor grid was confined to approximately 4,900 feet to the east and west of Airport property and approximately 3,000 feet north and south of Airport property not including the land owned by the Airport extending to the north and south of the existing runways.

The receptor grid consisted of 400 receptor locations in a rectangular area around the Airport. Based on this grid, pollutant contours for nitrogen dioxides (NO_2) and carbon monoxide (CO) were developed to determine the locations where the highest concentrations might to found. NO_2 and CO were selected because according to the EIS they are the two primary parameters of concern around the Airport. However, the screening analysis also included particulate matter (PM_{10}) and sulfur dioxide (SO_2).

For the receptor locations which showed a potential problem and receptor locations recommended by EPA, a refined dispersion analysis was done. The dispersion analysis involved the receptor locations for the draft (D) and final (F) EIS shown in Table 3-1.

The purpose of the refined dispersion analysis was to provide a more detailed analysis of the receptor locations which indicated possible exceedances of the AAQS during the screening analysis. The screening analysis indicated that concentrations of NO_2 and CO were of concern and concentrations of PM_{10} and SO_2 were not. Therefore, no further analysis was performed for PM_{10} and SO_2.

This methodology of initially conducting a screening analysis to determine potential areas which exceed AAQS and then conducting a refined analysis of these areas, is an accepted and approved methodology. The data which was used in the modeling appears to be reasonable and the best data available. Also, the final EIS incorporated changes in the air quality dispersion analysis recommended by EPA, PSAPCA and other groups.

With respect to the receptor locations, it is typical to select locations which are shown to potentially violate AAQS. However, it would have been interesting to have included more receptors in more areas which have experienced air quality complaints (i.e., residential areas) and additional areas with different terrain features in the Airport vicinity. The predicted emissions levels would be useful, even though the screening analysis did not show violations of AAQS.

As discussed below, analyses were also conducted for Airport roadway intersections and construction vehicles. However, it was not clear if the area dispersion analysis also included construction vehicles and aircraft operations together. This should be clarified.

TABLE 3-1

REFINED DISPERSION ANALYSIS RECEPTOR LOCATIONS

Receptors	Location
4(D)[a]	Riverton Heights, SeaTac
4A(F)	Highline Nurseries
5D	Highline, Burien
5A(F)	SeaTac Reservoir
9(D)	SW SeaTac
9A(F)	Sea-Tac Industrial Park
10(D)	SeaTac Trailer Park
10A(F)	Des Moines Creek Park
1(F)	Terminal South
13(F)	Terminal Hotel
-(F)	Proposed North Unit Terminal

EPA Receptors	Location
A(F)	South 154th Street (existing and future)
B(F)	South 188th street on either side of Runway 34R Tunnel (east and west)

[a] Receptor locations are designated by D for Draft EIS and F for Final EIS.

3.1.3 Airport Roadway Intersection Dispersion Analysis

Motor vehicles are believed to be a major source of air pollutants in the Airport area. Thus, a separate more detailed analysis was conducted for the following congested roadway intersections along International Boulevard:

- at South 160th Street;
- at South 170th Street;
- at South 188th Street; and
- at South 200th Street.

In addition, the new employee parking area on 24th Street north of State Route (SR) 518 was included.

EPA's approved model CAL3QHC was used to predict CO levels from motor vehicles. The model requires the following data:

- traffic volumes for left and right turns and through traffic;
- level of service determinations;
- signal cycle lengths;
- number of traffic lanes available;
- vehicle speed;
- vehicle emission rates; and
- meteorological conditions (temperature, wind speed, mixing height, and stability class).

Vehicle emission rates/factors were obtained from the EPA mobile source emission program MOBILE5A.

CO levels were evaluated because it is the pollutant emitted in the greatest quantity by motor vehicles and for which short-term health standards exist. Pollutant concentrations were calculated for locations at 12 feet from the edge of a roadway. A total of thirty-two receptor locations were modeled in the vicinity of each intersection.

Like the area air quality dispersion analysis, the roadway intersection dispersion analysis in the final EIS used acceptable methodology. This included incorporating comments on the draft EIS in the final EIS, from regulatory agencies, citizens and community organizations.

3.1.4 Human Health - Air Toxics Evaluation

Appendix D and Chapter IV, Section 7 of the final EIS deals with air quality human health issues. The methodology involved:

- using the results of the emissions inventory and dispersion modeling;
- using data from the Port of Seattle's air toxic monitoring program; benzene and thirty-eight additional air toxics were monitored at thirteen on- and off-airport locations for four days during October through December, 1993;
- using information in the April, 1993 EPA publication, "Estimation and Evaluation of Cancer Risks Attributed to Air Pollution in Southwest Chicago", which deals with the Chicago Midway Airport area;
- comparing the toxic emissions information with the DOE's Acceptable Source Impact Levels (ASILs); and
- an evaluation of residue samples for evidence of jet fuel related products.

This methodology was acceptable based upon the limited available information on potential air toxics health impacts. The methodology could have been improved as follows:

1. The EIS indicates in Chapter IV, Section 7 Human Health: "As the air toxics monitoring program was a preliminary, short-term survey of air toxics over a four day period, it is difficult to assign meaningful significance to short-term measurements as compared to longer-term guidelines. Therefore, as the monitored data was for a limited, short-term period, it is not certain if the actual levels would be exceeded on an annual basis."

   Based on this statement, it would seem reasonable to collect additional, long-term air toxics data throughout different months of the year. Also, limited monitoring sites were off-airport and additional sites should be monitored in particular to the west of the Airport.

   Recently a draft Memorandum of Understanding (MOA) has been developed between PSAPCA, EPA, DOE and the Port of Seattle which discusses an air monitoring program which may include air toxics depending on the results of airplane engine exhaust residue sampling under flight paths (Puget Sound Air Pollution Control Agency, July 1, 1996).

2. The DOE ASILs are established for known or probable carcinogens. The EIS should have contained at least qualitative information on other health risks besides cancer. Based on discussions with citizens and community groups, some health problems appear to be more common in areas near the Airport such as asthma. This should be addressed in more detail.

3. The EIS indicates that insufficient information was available to adequately conduct a meaningful cancer risk assessment. Data should be collected in order to allow this risk assessment to be conducted.

4. The methodology should include an evaluation of potential health impacts on schools, hospitals, nursing homes, and other sensitive areas near the Airport.

5. There have been reports of fuel odors being worse during periods of inclement weather. These reports need to be verified and evaluated further as part of the air toxics issues studies.

6. During discussions with various groups as part of this environmental issues task, there has been repeated comments about vapor recovery at the Airport. This issue should be addressed further since it is unclear what vapor recovery operations there actually are at the Airport. Currently the following vapor recovery operations appear to be in place:

   a. the main jet fuel storage tanks have vapor recovery;

   b. individual airlines have vapor recovery on their fueling operations if they meet PSAPCA throughput requirements;

   c. there are PSAPCA regulatory requirements for floating roof tanks; and

   d. all of the car rental companies located within the Sea-Tac parking garage are registered with PSAPCA and their underground storage tanks have Stage 2 Vapor Recovery System equipment.

3.1.5 Construction Vehicles Air Quality Analysis

The construction vehicle air quality analysis also involved a dispersion analysis using the CAL3QHC model and vehicle emission rates from two EPA models: MOBILE5A and Part 5. The overall methodology used was the same as that used for the roadway intersection analysis.

The methodology for the construction vehicle air quality analysis was appropriate for the construction haul routes shown in the EIS. This involved nine haul routes:

1. SR509 - 160th Street on SR509;
2. SR509 - Des Moines on 160th Street;
3. 8th Avenue - 148th Street on Des Moines;
4. 8th Avenue - 160th Street on Des Moines;
5. 24th Avenue - 16th Avenue on 154th Street;
6. 152nd Street to 154th Street on 24th Avenue
7. 200th - 188th Street on Des Moines;
8. 26th Avenue - Des Moines on 200th Street; and
9. On-Airport Unpaved Haul Route on south side of Airport.

However, it appears that the evaluation is based on the assumption that each of these haul routes may be used. Once the sources of fill material are known and the haul routes approved, the construction vehicle air quality analysis should be re-evaluated and dispersion analysis re-done in order to better predict potential air quality impacts.

3.2 Air Quality Analyses Results

The following summarizes the results of the different air quality analyses and comments on the results:

3.2.1 Airport Emissions Inventory

Airport related emissions are generated by a number of sources including the primary sources: motor vehicles on roadways and in parking lots, and aircraft. The largest source is vehicles on roadways. For the 1994 condition or base year, the emissions of CO, VOCs and NOx are below the SIP 1990 emissions inventory. The future emissions inventory also indicates that for each EIS alternative and time period, aircraft emissions will be below SIP levels.

Based on the information presented in the EIS for the EDMS computer model, the existing and future emissions inventory seems reasonable. Support for the existing conditions air quality was provided by a discussion of DOE/PSAPCA, Port of Seattle and Department of Labor and Industries monitoring programs. However, these are the following issues with these programs and in relation to overall Airport operations:

- The closest DOE/PSAPCA monitoring sites are approximately 5 miles from the Airport; there are no monitoring sites west, northwest and southwest of the Airport; CO, PM_{10}, are the most frequently monitored parameters;

- the Port of Seattle monitoring was only for compliance with Washington Industrial and Safety Health Act (WISHA) standards and primarily involved indoor air quality monitoring for CO and NO_2; there has been additional monitoring for CO in the main parking garage and the terminal area during late November, 1991;

- The Department of Labor and Industries conducted limited screening for CO for WISHA compliance in seven on-Airport locations and eight off-airport locations during December, 1992; and

- PSAPCA collected only three samples of black residue for analysis in January, 1995.

In order to make monitoring information such as this more useful; permanent monitoring stations should be established in and around the Airport area. Parameters monitored should include the AAQS parameters as well as toxic pollutants of concern such as 1,3 - butadiene, formaldehyde and benzene. Additional comments will be made on this monitoring when the mitigation part of the Scope of Services are presented. This expanded monitoring is supported by EPA, DOE and PSAPCA.

The previously mentioned draft MOA between PSAPCA, EPA, DOE and the Port of Seattle discusses an air monitoring program to be conducted over a 24 month period. The program will focus on the following monitoring activities with the indicated schedule:

- 1996 to 1998 winter seasons: monitoring of CO at roadway intersections modeled in the EIS as creating future exceedances of the CO AAQS;
- Summer/Fall 1997: NO_x emissions monitoring associated with aircraft departure backup queues;
- Fall 1996 to Summer 1997: aircraft fuel particle or residue monitoring; and
- schedule to be determined for particulate matter (PM_{10}) monitoring at construction sites and near haul routes in the vicinity of construction.

Depending on the results of the residue monitoring, additional monitoring for air toxics may be conducted. As part of implementing the MOA, public involvement will be solicited via participation in a working group.

3.2.2 Area Dispersion Analysis

The area dispersion analysis focused on a wider range of sources of air emissions than the air pollutant inventory, which focused solely on aircraft emissions. This dispersion analysis provided information on aircraft and support equipment; on- and off-airport parking lots; roadways; training fires; fuel systems; terminal heating and cooling; and aircraft maintenance activities.

The area dispersion analysis for the existing conditions showed the following:

- the highest concentrations of CO occur along the terminal curb front; there are no exceedances of 1- and 8-hour CO standards;

- an exceedance of the NO_2 AAQS was identified at one receptor location on South 154th Street approximately 650 feet north of Runway 162; this receptor is in an area surrounded by Airport property and probably reflected pollutant concentrations from aircraft takeoffs; and

- the screening analysis indicated that concentrations of PM_{10} and SO_2 at all receptor locations were below AAQS.

The results of the area dispersion analysis for the future conditions indicated the following:

- with implementation of the Master Plan Update some receptor locations may experience a slight increase in pollutant concentrations; these concentrations would be expected to be below AAQS;

- the highest NO_2 concentration would occur along South 154th Street; the maximum concentrations would be less than if the third runway is not built;

- the proposed improvements include extension of Runway 16L/34R and NO_2 concentrations would be expected to increase slightly along South 188th Street by the year 2020; and

- Alternative 3 would result in changes in traffic volumes and movements; therefore, the highest CO concentrations would occur in the terminal area; CO concentrations would be expected to be below AAQS.

This information presented in the EIS for the area dispersion analysis for both the existing and future conditions will provide a good baseline to evaluate impacts as the Master Plan Update is implemented, However, in order to do this the dispersion analysis will have to be periodically updated with data as it becomes available.

3.2.3 Airport Roadway Intersection Dispersion Analysis

The Airport roadway intersection dispersion analysis identified CO concentrations for specific concentrations for specific intersections for existing and future conditions. The purpose of the analysis was to evaluate changes in traffic volumes and patterns and their potential impacts on air quality. The results of the analysis indicated that for the existing conditions all sampling locations are below the 1-hour CO standard of 35 ppm; these locations exceed the 8-hour CO standard of 9 ppm with concentrations of approximately 10 to 18 ppm.

Future conditions were evaluated for the years 2000, 2010 and 2020. Like the existing conditions, CO concentrations would continue to be below the 1-hour standard and above the 8-hour standard. The only exception would be the relocated employee parking area on 24th Street which would be below both standards. This parking area is scheduled to be in use in the year 2000.

This roadway intersection dispersion analysis has some inconsistencies based on comments from the EPA (June 6, 1996). The EPA indicated the following:

- "The modeling results for air quality in the SeaTac final EIS conflict with those from the draft EIS for the SR 509/South Access Road Corridor Project at two intersections (both EISs used the same models). The two EIS's model conflicting results for existing conditions and future action alternatives at South 188th and International Boulevard, and South 200th and International Boulevard for the average CO concentrations indicated on page 4-7 in the SR 509 EIS, as compared with the same analyses on page IV.9-11H in the SeaTac final EIS. Both analyses model CO violations for existing conditions, but for future action alternatives the SeaTac analysis shows modeled CO violations where the SR 509 analysis does not."

- "Modeled air quality impacts at South 200th and International Boulevard are shown in the South Aviation Support Area Final EIS (pages 4-106 to 109 and 112), the 28/24th Street Arterial Final EIS (page 3.22) and the CTI Final EIS

(page 4-7, 8). The results vary for each project ranging from 5.0 to 13.3 parts per million CO."

Based on these comments, it appears as if the roadway intersection dispersion analysis should be done over and re-evaluated at least for the EPA indicated intersections/roads.

3.2.4 Human Health - Air Toxics Evaluation

As indicated previously, the human health - air toxics evaluation focused on potential changes in toxic emissions from Airport Master Plan Update implementation by conducting an air toxics emissions inventory and comparing the results with the Washington State Acceptable Source Impact Levels (ASILs). The result of the emissions inventory and dispersion modeling indicated the following with respect to volatile gases (TOG), benzene, 1,3-butadiene and formaldehyde:

- there was insufficient information to conduct a meaningful risk assessment, as previously indicated;

- the maximum air toxics concentrations at all modeled receptors (i.e., terminal/south, terminal/hotel, SeaTac Reservoir, Highline Nurseries, Sea-Tac Industrial Park and Des Moines Creek Park) exceeded the annual ASILs; the majority of emissions at each receptor are produced by motor vehicles which contribute about 70 percent of the toxic emissions, aircraft contribute about 20 percent;

- in the future, emissions from roadway sources are predicated to continue to contribute the majority of air toxic emissions; by the year 2020, motor vehicles are expected to contribute 65 percent of the toxic emissions and aircraft approximately 25 percent;

- Airport activity including heating plants, training fires, fuel facilities and surface coating, produce low levels of air toxic emissions;

- by the year 2000, air toxic emissions are expected to initially decrease as older aircraft are phased-out; and

- implementation of Alternative 3 would generally result in similar or less air toxic emissions in comparison to the Do-Nothing alternative.

The results of the Port of Seattle's 4-day air toxic monitoring program in 1993 indicated the following based on Table 14 in Appendix D of the EIS:

- the mean concentration of the following compounds exceeded the annual DOE Acceptable Source Impact Levels (ASIL): benzene; carbon tetrachloride; 1,2-dichloroethane; and dichloromethane;

- compounds detected which do not have annual or 24-hour ASILs were: CIS-1,2 - dichloroethylene; 1,3,5 - trimethylbenzene; and 1,2,4 - trimethylbenzene;

- none of the sampled compounds exceeded the 24-hour ASIL;

- highest concentrations for benzene were along International Boulevard;

- monitored concentrations for benzene were well below values predicted by a 1991 DOE Study;

- no significant differences in upwind versus downwind concentrations were observed;

- levels of air toxics were within a range exhibited in other similarly sized urban areas such as St. Louis, Houston and Boston;

- the monitored air toxic pollutant profiles were indicative of automobile exhaust and not due to aircraft exhaust.

The final EIS also indicated that formaldehyde was above the annual ASIL and acrolein was above the 24-hour ASIL. However, these compounds were not listed in the aforementioned Table 14.

The 1993 monitoring also sampled for CO and found that levels were below the 8-hour AAQS.

Because of the limited sampling period, small number of samples, and relatively few sampling stations and their locations, the data is of limited use. It certainly should not be used as a baseline, but should be used as part of a long-term monitoring program.

In January, 1994, in response to area resident's concerns, PSAPCA collected three samples of residue (black speckles) for analysis. The results indicated that the residues were not similar to unburned jet aircraft fuel and consisted of fungal materials with associated green algae and minerals.

As a follow to this sampling, the Port of Seattle conducted another study of the black residues at three separate residences in January, 1995. AM Test Labs analyzed the residue samples from the residences and a residue sample from the exhaust outlet of a jet aircraft for polynuclear aromatic (PNAs) hydrocarbons and heavy metals. In addition, a microscopic examination was conducted.

The results of this residue sampling indicated that the residue consisted of a variety of substances including fungus, insect particles, minerals/soil and soot. The soot was identified as more typical of motor vehicles or wood burning. Overall the results indicated that the residues are not due to jet fuel related products.

As indicated previously, the air toxic analysis primarily discussed cancer effects. The results were not related to other potential health problems such as heart and respiratory disease. This should be discussed in more detail for both existing and future conditions. Evidence of some of these other health impacts was discussed in, "A Survey and Critique of Epidemiologic

Evidence of Adverse Health Effects Attributable Airport-Related Exposure" (Levy, September 15, 1995).

3.2.5 Construction Vehicle Air Quality Analysis

The results of the construction vehicle air quality analysis is presented primarily in Chapter IV, Section 23 and Appendix D. The analysis focused on CO and PM_{10} concentrations and concluded:

- the maximum CO concentrations along each of the haul routes is expected to be below the CO AAQS;
- the Alternative 3 concentrations of CO will be equal to or slightly higher that the Do-Nothing condition;
- without mitigation the PM_{10} concentrations along the haul routes discussed in the EIS would exceed both the 24-hour and annual AAQS; and
- the Alternative 3-PM_{10} concentrations would be considerably greater than the Do-Nothing concentrations.

The construction vehicle air quality analysis was based on particulate information from a more arid area than the Puget Sound Region, because of the lack of particulate data from the Region. Thus, the PM_{10} results are probably worst case. The lack of particulate data for the Region points out the need to monitor for this information as part of a long-term monitoring effort in the Airport area and Region.

The CO and PM_{10} construction impact information in the EIS is adequate for the haul routes studied in the immediate vicinity of the Airport. As the Master Plan Update is implemented, source fill areas and haul routes are identified, the construction air quality impacts should be re-evaluated. This evaluation should extend further than the immediate area around the Airport.

3.2.6 Clean Air Act Conformity

Chapter IV Section 9 of the EIS includes a discussion on the need for the Master Plan Update implementation to show that the project will not:

- cause or contribute to any new violations of any of the AAQS in the project or metropolitan area;
- increase the frequency or severity of any existing violations of AAQS; and
- delay timely attainment of the AAQS or any required emission reduction in the project area.

In the EIS a brief conformity analysis was presented. According to the EPA (June 6, 1996), the conformity analysis is only considered a draft and the final analysis should include the following:

"1. Creation of an emissions inventory that includes: (a) all reasonably foreseeable direct and indirect emissions for the pollutants of concern for the year of peak construction emissions prior to 2000[1] and 2020; (b) emissions from sources such as construction and haul vehicles, associated increased congestion; and (c) mobile emissions associated with the use of regular gasoline."

"2. An air quality analysis that compares the "no project" and "with project" air quality impacts for the years stated in item one above."

"3. Appropriate mitigation measures--if the "with project" scenario results in an increase in either the frequency or severity of exceedances above the levels in

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"[1] Because conformity requirements for "worse case analysis" differ from NEPA requirements, analysis of emissions during the year of highest impact is required."

the "no project" scenario, measures should be developed to mitigate these impacts."

"4. Commitments from appropriate governmental entities to conduct adequate, specific and enforceable mitigation measures that will prevent any increase in the severity or frequency of predicted exceedances of the National Ambient Air Quality Standards (NAAQS). Since the increased modeled exceedances occur at intersections outside of airport property, it may be necessary to obtain commitments to conduct these mitigation measures from other agencies or local authorities."

The PSAPCA (June 6, 1996) also commented on the final EIS conformity determination for CO. They indicated that the Port of Seattle should ".... make more certain commitments regarding post-2010 project components before conformity to the SIP can be demonstrated." The PSAPCA then offered two options for SIP conformity as follows:

"1. One option would be for the Port to exclude post-2010 project elements from the conformity determination being made now and to make a clear commitment that post-2010 project elements modeled to create future air quality exceedances would not be pursued until additional field monitoring is conducted by other independent environmental agencies. The following would be recommended elements of such an approach:

- commit to revisit in future, via a full SEPA/NEPA environmental analysis, the CO air quality impacts and conformity-related mitigation needs of those master plan phases identified as causing post-2010 CO intersection exceedances, e.g., the North Passenger Terminal phase;

- develop a protocol to govern the conduct of future Port-funded CO monitoring activities consistent with the normal monitoring protocols used by state, local and federal air quality agencies and agreed to by those agencies (Ecology, PSAPCA and EPA);

- specify the schedule and technical approach to be relied upon for evaluating modeled vs. monitored data in the future in order to refine exceedance mitigation measures, coordinating with other state, local and federal air quality agencies as necessary; and

- institute a memorandum of agreement (MOA) signed by the Port, PSAPCA, Ecology and EPA laying out a funded program for monitoring CO air quality in the SeaTac Airport Master Plan project area, and interpreting the results for purposes of implementing conformity-related mitigation measures, ensuring future NEPA compliance and determining future CO monitoring needs. A specific Port commitment to contribute funding should be included in such an MOA."

"2. A second option would be for the Port to advance their current FEIS as published - and thus a positive conformity finding for all Master Plan elements - but commit now to actions affecting those post-2010 project phases for which CO air quality exceedances have been modeled, as follows:

- specify and commit to implementing a menu of intersection exceedance mitigation measures appropriate to the identified (modeled) CO air quality problems;

- regardless of project phasing, demonstrate quantitatively that the identified modeled air quality problems can be resolved by reliance on all or part of this mitigation menu;

- commit to revisit in future, via a full SEPA/NEPA environmental analysis, the CO air quality impacts and conformity-related mitigation needs of those master plan phases identified as causing post-2010 intersection exceedances, e.g., North Passenger Terminal phase;

- develop a protocol to govern the conduct of future Port-funded CO monitoring activities consistent with the normal monitoring protocols used by state, local and federal air quality agencies and agreed to by those agencies (Ecology; PSAPCA and EPA);

- specify the schedule and technical approach to be relied upon for evaluating modeled vs. monitored data in the future in order to refine exceedance mitigation measures, coordinating with other state, local and federal air quality agencies as necessary; and

- institute a memorandum of agreement (MOA) signed by the Port, PSAPCA, Ecology and EPA laying out a funded program for monitoring CO air quality in the SeaTac Airport Master Plan project area, and interpreting the results for purposes of implementing conformity-related mitigation measures, ensuring future NEPA compliance and determining future CO monitoring needs. A specific Port commitment to contribute funding should be included in such an MOA."

Based on these comments, it is obvious that the EIS Clean Air Act conformity discussion is incomplete. As the Master Plan Update is implemented, the public should be kept abreast of issues and status of the analysis.

3.2.7 Certification of Compliance With Air Quality Standards

The EIS indicates that the Washington State's Governor's Office must issue a certification indicating that implementation of the Master Plan Update will comply with all applicable AAQS. The Governor's Air Quality Certificate is expected to be issued before completion of the Federal Aviation Administration Record of Decision.

3.3 Cumulative Impacts

The EIS did not adequately address air quality cumulative impacts associated with Master Plan Update implementation and other major proposed projects in the area. This also was commented upon by EPA (June 6,1996).

This issue needs to be addressed and would most likely include some revision to several areas of the air quality analysis, in particular, those associated with modeling air emissions and the construction vehicles air quality analysis. The EPA (June 6, 1996) specifically indicated that cumulative impacts discussion should include the extension of State Route 509; South Aviation Support Area aircraft maintenance facilities; Des Moines Creek Business Park; SeaTac Hotel; the proposed Cell Therapeutics Inc. (CTI) campus and 28th/24th Avenue South arterial project.

The EPA also mentioned the new Federal Detention Center immediately south of the Airport and the improvements to 3 miles of International Boulevard near the Airport. Both of these projects are currently ongoing.

Other projects which the EIS briefly describes in Chapter III Affected Environment are: regional transit authority high capacity, light rail system and the aviation business center. The CTI campus development is included as part of a larger program, the Des Moines Creek Technology Campus.

The issue of cumulative impacts also was inadequately addressed for noise, water resources, and aesthetics and visual environmental issues. Thus, cumulative impacts need to be seriously evaluated, not just alluded to in a brief discussion.

3.4 Mitigation Measures

Mitigation for potential air quality impacts from Master Plan Update implementation are addressed for the following general topics:

- construction impacts in particular for fugitive dust emissions;

- mitigation at International Boulevard and South 170th Street and South 160th Street; and

- incentives or other regulatory requirements for reducing emissions.

Construction mitigation measures focus on excavation and wind erosion of soils; vehicle traffic on paved and unpaved roads; and cement and aggregate handling. Potential impacts from construction will be mitigated by implementing a Construction and Earthwork Management Plan which will designate haul routes, dust control techniques, etc.

Mitigation for the International Boulevard intersections of concern in the EIS include primarily construction of additional turn lanes. These improvements would occur by 2010 with other improvements by 2020.

Other proposed mitigation measures include the Port of Seattle's support of air quality initiatives mandated by the Growth Management Act; seasonal use of oxygenated fuels (which will be ended); wood burning stove curtailment initiative; and the vehicle inspection/ maintenance program. The EIS also briefly discusses ongoing Airport activities to reduce emissions and additional actions which could further reduce air emissions.

These ongoing and proposed mitigation measures will be discussed in more detail in the Mitigation Plan. The EIS proposed mitigation measures are generally appropriate. Additional measures and issues which need to be addressed in the Construction and Earthwork Management Plan will be discussed further in the Mitigation Plan.

4.0 WATER RESOURCES

In the EIS water resource issues are evaluated in terms of water quality and hydrology; wetlands; and floodplains. These areas include the Task 5 Environmental Analysis Scope of Services areas of concern which are: floodplains; storm drainage and surface runoff; and wetlands. These areas are incorporated in the discussion which follows:

4.1 Water Quality and Hydrology

Water quality and hydrology issues in the EIS are discussed in Chapter IV, Sections 10 and 23, Chapter V, Appendices F, G, P, Q-A, Q-B and part of Appendix R. These issues focus on potential impacts on surface water and ground water resulting from construction and operation of the proposed Master Plan Update implementation.

4.1.1 Methodology

Surface water and ground water resources were evaluated by reviewing existing information and modeling hydrologic conditions of the Airport, Miller Creek and Des Moines Creek using the HSP-F Version 10 continuous simulation model. Also, average sediment production caused by erosion was estimated using the Revised Universal Soil Loss Equation (RUSLE).

The baseline data used for the hydrological analysis for both the present and Master Plan Update conditions included the following:

- 47 year records of hourly precipitation from the Sea-Tac Airport weather stations;
- 5 year flow records at the Miller Creek and Des Moines Creek stream gauging stations;
- watershed data such as river basin drainage areas, land use status, and area soil types and classifications; and

- limited surface water and ground water quality information.

The key parameters/assumptions used in the HSP-F hydrological modeling analysis appear reasonable and engineering sound. These parameters include the runoff coefficient for different land surfaces, and the permeability and infiltration rates for the various soil formations.

As part of the modeling assumptions, it is stated that, "The Industrial Waste System (IWS) has a hydraulic capacity of between the 10- and 25-year storm events and overflows to the SDS during large storm events." This implies that the Airport SDS could receive untreated runoff from the IWS and requires a better explanation.

The RUSLE is an appropriate method of estimating average sediment production from erosion. The HSP-F model also is an appropriate way to assess the effects of the overall land use changes to derive stormwater detention capacity required to meet offsite discharge limitations. However, since a detailed presentation of proposed stormwater facilities (i.e., catch basins, conveyance pipes, stormwater ponds and pond outlet works, etc.) was not incorporated into the HSP-F model, the effect of these facilities on the determination of detention capacity was excluded. To complete the effort, a separate hydraulic analysis with computer program (WATERWORKS), modeling the proposed airport expansion Storm Drain System (SDS) within the Sea-Tac Airport is being done. This will determine if the SDS would have a significant impact on the results so far obtained from the HSP-F modeling. At the time of the Final EIS only preliminary WATERWORKS model files were available. Therefore, the results of the stormwater system modeling analysis using WATERWORKS needs to be evaluated.

The baseline data used for the limited water quality and hydrology studies is based on available historical information from various agencies and publications. Thus, it is believed to be reliable and of acceptable quality. With the respect to surface water and ground water quality, there is a paucity of data which is typically included in an EIS. The surface water quality information in Table IV.10-3 only addresses fifteen parameters and does not include some routinely monitored parameters such as flow and specific conductance; for some

parameters such as dissolved oxygen and temperature there is limited information. If a baseline is to be established to measure both potential construction and operational changes in surface water quality from the Master Plan Update implementation, additional more detailed surface water quality studies need to be conducted. They should be initiated before construction activities begin; seasonal sampling should be conducted (e.g., February, May, August and November); the parameters sampled should include a number of metals and organics (e.g., aviation fuel constituents, and ethylene and propylene glycol) which are based, in part, on the parameters for which water quality standards have been set; and the parameters should include those for which the Port of Seattle monitors for on the Airport such as in stormwater discharges. A recent study of the latter included information on twenty-three parameters (Port of Seattle, June 30, 1995).

There is essentially no ground water quality information in the EIS. This information should be developed for parameters similar to those sampled for in surface water plus static surface water level. Also, a seasonal sampling regime should be developed.

A number of surface water sampling stations should be established on Miller Creek, Walker Creek and Des Moines Creek, starting at the headwaters. Ground water sampling stations also should be established in the various aquifers. These stations should take advantage of existing water supply wells including those of the Seattle Water Department and the Highline Water District.

According to the South King County Water Advisory Committee, et.al. (April 1991), long-term water level declines of 1 foot/year have been observed in the Des Moines Area. It was speculated that the water level declines may be due to urbanization and associated reductions in recharge. Thus, it was recommended that a comprehensive monitoring program including well water levels and pumpage, stream flows, lake levels and water quality should be implemented. It also was indicated that particular emphasis should be placed on hydrologic monitoring of aquifers in the Des Moines and Federal Way areas.

The South King County Water Advisory Committee, et.al. (April 1991) also made the following observations:

- the Seattle Water District's monitoring well network and the stream gauging on Miller Creek should be adequate for monitoring ground water in this area of the Des Moines Upland;

- activities along Miller Creek need to be closely monitored and evaluated because of its sensitive recharge characteristics;

- in the Federal Way Upland, surface water monitoring sites should be maintained in order to ascertain impacts to the surface water system;

- ground water quality monitoring along International Boulevard should be closely evaluated to ensure that contamination from various activities is not occurring; and

- the Sea-Tac Airport area because of its significant industrial and commercial activities with numerous underground storage tank and fueling operations is a sensitive area and should be closely monitored.

4.1.2 Existing Conditions

The hydrology analysis includes baseline information on the following for Miller Creek and Des Moines Creek Watersheds (Basins):

- flood frequencies;
- average seasonal flow rates; and
- annual runoff volumes.

The descriptions of the existing hydrology conditions for Miller Creek Watershed are deemed adequate and form a good baseline from which to monitor future conditions. The information

on the approximate 75 percent of the Des Moines Creek Watershed which was modeled are also adequate. However, consideration should be given to modeling the entire Des Moines Creek Watershed, not just from the headwaters to South 208th Street. It is not completely clear why all of this watershed was not modeled.

The hydrology description of the Miller Creek and Des Moines Creek Watersheds was based on the following:

Watershed	Total Area (Acres)	Total Impervious Area (Acres)	Airport Impervious Area (Acres)
Miler Creek	5,183	1,224	60
Des Moines Creek	3,585	1,202	369

The primary land uses in the watersheds are residential and commercial with only 4 and 27 percent of the land devoted to Airport use in the Miller Creek and Des Moines Creek Watersheds, respectively. Thus, the urbanized watersheds exhibit stream flow characteristics associated with developed watersheds or basins. This includes rapid flow rate increases before and decreases after precipitation events.

Creek flow rates are typically highest from October through April and lowest between May and September. The existing flood frequencies are described as follows based on three and two locations along Miller Creek and Des Moines Creek, respectively:

	Existing Condition Return Period (Years) / Flow Rate (cfs)			
Watershed	1.11	2	10	100
Miller Creek	47-104	80-173	125-293	171-468
Des Moines	74-76	103-112	154-178	232-280

As one would expect the higher flow rates are experienced at downcreek locations. The probability of the flow rate return periods are: 1.11 year, 90 percent; 2 year, 50 percent; 10 year, 10 percent and 100 year, 1 percent.

Miller Creek and Des Moines Creek and their tributaries are classified as Class AA (extraordinary) waters by the Washington State Department of Ecology. Although the creeks

occasionally violate the Class AA water quality standards for pH, dissolved oxygen and ammonia. These violations are due primarily to pollutants found in urban and Airport stormwater runoff such as nutrients; oil and grease; metals; fecal coliforms; and suspended solids. Information on estimated pollutant loadings from the Airport and other sources for each watershed are presented for total suspended solids; biochemical oxygen demand; total phosphorus, copper, lead and zinc; and oil and grease. Overall water quality for select sampling locations along Miller Creek and Des Moines Creek are presented for only fifteen parameters.

Four zones of ground water are described in the EIS with the following general characteristics:

- perched zone - no known use for drinking water; quality unknown, assumed to be good;

- upper or shallow aquifer (QVA, Vashon Advance Outwash) - not used for domestic water supply; localized contamination from leaking jet fuel and rental car fuel distribution systems at the Airport;

- intermediate or Highline Aquifer (Qc(3), Third Coarse Grained Deposit) - Seattle Water Department has three operating potable water supply wells and Highline Water District has two wells; 80 to 200 feet beneath the ground surface; no indication of ground water contamination; wellhead protection plans to protect wells from pollution within at least the 10 year time of travel zone or about 1/2 mile radius around each well; and

- deep aquifer (Qc(4), Fourth Coarse Grained Deposit) - excellent water quality.

As indicated above, there is inadequate surface water and ground water quality information. Before implementation of the proposed Master Plan Update activities, this data should be developed. It should include both available literature information and seasonal sampling data. In addition, there should be a surface water and ground water sampling plan in case there are spills on Airport property that reach the Miller and Des Moines Creek drainages. The

information developed from this sampling should be compared with applicable standards and remedial actions taken, if necessary. The ground water information is particularly important to help determine potential future impacts on aquifers.

The EIS indicates that the Highline Aquifer is protected from existing contamination by overlying aquitards and various hydrologic characteristics. However, there is evidence that when wells are pumping water from this aquifer, drawdown can be observed in shallower aquifers (Greg Wingard, July 22, 1996, personal communication; Wingard and Smith, June 19, 1995). This is indicative of interconnection between the aquifers and a potential path for contaminated ground water to the Highline Aquifer. Therefore, ground water movement in the Airport area needs to be better defined. According to the EIS, these additional studies are being conducted. When available, the studies should be reviewed for potential ground water contamination impacts on the Highline Aquifer and other area aquifers.

In the EIS it is indicated that the Port of Seattle was to have conducted a monitoring study of Miller and Des Moines Creeks the winter of 1995 to 1996, both upstream and downstream of Airport stormwater discharges. The purpose of this study is to help determine the toxicity of Airport stormwater runoff and surface water quality. The results of this study need to be evaluated.

4.1.3 Future Conditions

It is estimated that implementation of EIS preferred Alternative 3 would result in the following:

	New Impervious Surface Area (Acres)	Drainage From Fill Area (Acres)
Miller Creek	97	264
Des Moines Creek	95	282

This is approximately 7 to 11 percent of the total watershed areas based on 5,183 and 3,585 acres in the Miller Creek and Des Moines Creek Watersheds, respectively. The increases in impervious areas are approximately 8 to 24 percent with existing impervious areas of 1,224 and 1,202 acres in the Miller Creek and Des Moines Creek Watersheds, respectively.

To minimize the potential impacts of the new impervious areas and drainage areas, new stormwater detention facilities are planned. If the preferred alternative is implemented the hydrologic analysis and stormwater management facilities should be re-evaluated to support final design. This is particularly true since the EIS indicates that the stormwater management facilities and discharge locations are conceptual layout. The re-evaluated hydrologic analysis should then be used as part of the baseline to monitor potential Alternative 3 impacts. During large storm events, the effect of possible overflow from the IWS on the receiving waters also should be addressed.

Limited details on both the construction and operation of the wet vaults and biofiltration swales was provided in the EIS. There was a more lengthy explanation of the constructed aquifer, which the EIS indicates has not been used before to manage stormwater. More detailed design and operating information needs to be provided on the wet vaults and biofiltration swales. If additional consideration is given to the constructed aquifer, its potential use must be more strongly justified. The Sea-Tac Airport area may not be the most suitable place to try this technology out; especially considering the controversy over disturbing the headwaters of the two watersheds. The King County Surface Water Management Division has suggested that surface water retention facilities are more innovative and effective. Therefore, they should be considered further before the use of wet vaults and/or the constructed aquifer. The surface water facilities potentially could include modifying the Lake Reba facility for better water storage capacity and water quality treatment.

Future Miller Creek and Des Moines Creek flow rates were described for the same locations as the existing conditions. They can be summarized as follows:

	Future Condition Return Period (Years) / Flow Rate (cfs)			
Watershed	**1.11**	**2**	**10**	**100**
Miller Creek	46-103	76-170	119-285	166-454
Des Moines Creek	68-74	96-108	149-173	232-280

As can be seen from comparing the future condition flow rates with the previously mentioned existing condition flow rates, the flow rates are very similar. However, the EIS indicates that

the annual runoff volumes will increase 6 to 11 percent at various locations in Miller Creek and 1 to 2 percent in Des Moines Creek. Most of the volume increase (97 to 99 percent) would occur at flow rates less than the 2 year return period flow rate.

Construction impacts on Miller Creek and Des Moines Creek hydrology are really not discussed in the EIS; the emphasis is more on construction water quality issues and post-construction hydrology. If the mitigation procedures discussed in Appendix P, Natural Resource Mitigation Plan, are not adequately coordinated with the embankment fill activities, there could be problems with surface water runoff from precipitation events. The Construction Stormwater Pollution Prevention Plan referenced in the EIS should help control surface runoff quantity and quality. However, the details of this plan need to be developed and evaluated.

Construction impacts on burrow source site ground water hydrology would involve altering geology and changing ground water recharge, movement and discharge patterns. In general, glacial till areas may be removed which will expose more permeable areas. This could result in reductions in perched ground water and increases in upper aquifer recharge depending on the geology at the burrow sites and should be monitored.

Construction in the area of the third runway would reduce upper aquifer recharge because of the impervious area. However, depending on the locations of the burrow source sites, this loss could be compensated for by the increased recharge at the burrow sites.

Once the third runway is in operation, aquifer recharge would be expected through the relocated Miller Creek and Des Moines Creek channels and other stormwater management facilities. Although the amount and success of this recharge cannot be accurately predicted and should be monitored.

There also would be potential surface water and ground water quality changes during both construction and operation. However, potential future impacts deal mainly with total suspended solids (TSS) and spills of materials such as fuels, lubricants and other materials. Based on the more detailed surface water and ground water quality information which should be collected, the future conditions discussion should include more than TSS and spilled

materials. Although TSS is probably the most important parameter, in particular during construction and before the fill and burrow areas have adequate vegetation.

In EIS Chapter IV, Section 19 Earth, it is indicated that fill material will be " ... placed in layers using common construction techniques." It is assumed that this includes compacting the fill to obtain appropriate densities, which may require large quantities of water. The source of water will have to be identified to ensure that it is from an acceptable source.

In some areas where fill has been placed, there have been reports of ground water levels rising in the fill. This needs to be evaluated with respect to the proposed Airport fill operations, including verification of this observation.

4.1.4 Cumulative Impacts

In the EIS cumulative impacts of Airport Master Plan Update implementation and the relationship to other projects is discussed generically. A more detailed evaluation should be made. Master Plan Update implementation might have water quality and hydrology impacts which can be mitigated to minimize impacts; but, in combination with other projects, could have significant impacts.

4.1.5 Mitigation

Relatively extensive water quality and management facilities are proposed, primarily to control stormwater. The mitigation measures will be expanded upon in the project's stormwater management plans. Overall the mitigation plans presented in the EIS are appropriate. However, additional comments will be provided in the mitigation plan task of the Scope of Services.

If the proposed stormwater management facilities are built, they should be closely monitored to ensure that they work according to their design. This should include monitoring operation of the underground vaults such as collecting water samples before and after the vaults.

As the Natural Resource Mitigation Plan is implemented, the plan should also be evaluated for conformance with the various City Comprehensive Plan and Stormwater and/or Surface Water Management Plans. For example, in the City of Burien's stormwater plan there are comments concerning the following with respect to the headwaters of Miller Creek:

- there is the possibility of building a major stormwater detention system on the Vacca Farm property which encompasses an area in the City of SeaTac of approximately 25 acres; and

- if this development were to be operated in conjunction with Lake Laura and Lake Reba, stormwater could be better controlled for this area of Miller Creek.

Also, the Greater Des Moines Comprehensive Plan discusses some issues and mitigation measures associated with streams, ground water, water quality, stormwater and wetlands.

As part of mitigating potential impacts on Miller Creek, the upper reaches will be relocated. In the early 1970's there was litigation concerning development activities in the Miller Creek Basin. Under the settlement agreements, King County agreed that it would "... not in the future attempt the channelization of Miller Creek except in limited amounts in connection with retention facilities." The relationship between this stipulation and the proposed relocation of part of Miller Creek will have to be resolved as construction associated with Master Plan Update implementation proceeds.

4.2 Wetlands

The EIS discussion of project area wetlands is included primarily in Chapter IV, Sections 11 and 23, Chapter V and Appendices H-A, H-B, P and part of Appendix R. Raytheon's comments on wetlands follows.

4.2.1 Methodology

The evaluation and identification of wetlands in an area is always a sensitive issue. Wetlands play an important part in an ecosystem and they should be protected.

The wetlands in the area around the Airport were identified by accepted and appropriate methods. This included a review of literature information, discussions with appropriate staffs of various agencies, and ground truthing. This resulted in wetlands being identified based on the soil and vegetation characteristics, and hydrologic regime.

Although accepted methodologies were used, these methodologies were not related enough to the wetland provisions of King County's Sensitive Areas Ordinance (King County Ordinance 9614, Sections 97 through 105). Thus, the EIS should have included a better discussion on at least the following key provisions of King County's wetland provisions:

- wetland rating: unique/outstanding; significant; and low concern;
- buffers/setbacks: establishes buffers by wetland rating; provisions for increasing the buffer width; and minimum building setbacks; and
- mitigation, restoration, enhancement and replacement.

4.2.2 Existing Conditions

Fifty-five individual wetlands, or approximately 144 acres, were identified in the study area. Based on the information available to Raytheon, it appears as if a good job was done at identifying the wetlands. In fact, one person in the State of Washington, Department of Ecology, believes that some wetland areas to the west of the Airport were over delineated. However, the wetland information in the EIS is a good basis for predicting future impacts.

4.2.3 Future Conditions

Of the fifty-five wetlands, thirty-four could be impacted by Master Plan Update implementation of Alternative 3 and construction of the 8,500 feet runway. This would result in approximately 10.4 acres of wetlands being destroyed during construction; there would be no additional disturbance of wetlands during operations unless there is some sort of spill at the Airport which reaches the watersheds or the planned mitigation measures for the hydrologic regime do not work. The latter could result in additional wetlands losses, from areas drying-up.

4.2.4 Cumulative Impacts

The discussion of cumulative impacts to wetlands of Master Plan Update implementation and other proposed projects, was cursory. Cumulative impacts should be re-evaluated based on the other known proposed projects as listed in Chapter III Affected Environment. Although the projects listed are located primarily to the east and south of the Airport.

4.2.5 Mitigation

The Port of Seattle believes that it is not possible to mitigate in the Miller Creek Watershed for wetlands which will be lost as part of the Master Plan Update implementation. Thus, the wetland mitigation site is proposed for the lower Green River Valley (City of Auburn) in another watershed. It is a Washington State policy to mitigate for wetlands in the impacted watershed, if possible. But, projects are dealt with on a case-by-case basis and if necessary wetlands can be mitigated in another watershed.

The Port of Seattle has investigated over 100 parcels in the Airport area. Despite this effort, there are many citizens and some government personnel who believe that the loss of the wetlands in the Miller Creek Watershed should still be mitigated in this watershed. Thus, the Port of Seattle should have to continue to justify its wetlands mitigation plan and should be open about the process it is going through. This is particularly true with permitting with the U.S. Army Corps of Engineers and discussions with the City of Auburn.

4.3 Floodplains

Floodplains were discussed primarily in the EIS in Chapters IV, Section 12 and V, Appendix P and part of Appendix R. An evaluation of these parts of the EIS follows.

4.3.1 Methodology

Proposed Master Plan Update area flooding and 100-year floodplain information was obtained from existing information, in particular the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps. Potential impacts on flooding and floodplains were then determined by evaluating construction impacts and modeling post-construction flows. This methodology is acceptable and routinely used in evaluating at least 100-year floodplains.

The methodology did not include a discussion on the 500-year floodplain, which is relevant because of recent storms. There should be some discussion about the 500-year Floodplain since this information is available in literature such as the FEMA maps.

4.3.2 Existing Conditions

Miller Creek has more extensive 100-year floodplains than does Des Moines Creek. Miller Creek essentially has floodplains along its entire length in depressions and relatively flat areas with little topographic relief. Des Moines Creek only has a 100-year floodplain below South 216th Street. These existing floodplains were adequately described in the EIS.

If the Master Plan Update implementation proceeds, the floodplain information should be updated as new data is available. This particularly includes revision of the FEMA maps. This will then allow a better comparison with future impacts.

4.3.3 Future Conditions

As indicated in the EIS, development requirements prohibit significant floodplain encroachment and reduction of flood storage capacity. As discussed in the EIS, without mitigation the proposed Master Plan Update could result in the following:

- significant floodplain encroachment;
- reduced flood storage capacity; and
- increased flow rates and volumes.

This could result in flooding in downstream areas adjacent to Miller Creek and Des Moines Creek.

For Alternative 3, the 8,500 runway could result in the loss of approximately 7.2 acres of 100-year floodplain in the vicinity of Lake Lora at the headwaters of Miller Creek. This loss of floodplains results in loss of flood storage capacity and possibly increases in flood heights in downstream areas. These impacts would depend on the amount of flood storage lost; stormwater runoff detention facility storage volume and release rates; and the timing of peak release rates with respect to other areas in the watershed or basin.

The amount of new impervious area also will potentially impact the amount of stormwater runoff and resultant flood impacts. The proposed 8,500 feet runway would have approximately 73 acres of impervious area of the approximate 192 acres of total impervious area.

The EIS evaluation of potential future impacts on floodplains was good. It forms a basis to evaluate actual changes as the Master Plan Update is implemented.

4.3.4 Cumulative Impacts

As with the other water resources related cumulative impacts discussions, this aspect of the floodplains evaluation is cursory and inadequate. Proposed new projects should have minimal, if any, potential impacts on the Miller Creek Watershed. However, there could be

negative impacts on the Des Moines Creek Watershed floodplains. Because of these potential impacts in combination with implementation of the Master Plan Update, there should be a more lengthy discussion of cumulative impacts. If enough information is available on these other projects, the evaluation should include incorporation of this information in the hydrology modeling. The resultant data could then be used for the cumulative impacts discussion associated with all water resources.

4.3.5 Mitigation

Floodplain mitigation would include adherence to floodplain development standards and floodway management requirements of the Federal Aviation Administration and the State of Washington, Department of Ecology. The development standards prohibit any reduction in the 100-year floodplain or base flood storage volume. State law requires compensatory mitigation for any proposed filling of 100-year floodplain so that there is no net loss in flood storage capacity. Also, the mitigation is to prevent an increased risk of loss of human life on property damage.

For the Master Plan Update compensatory mitigation primarily involves the following:

- relocating approximately 1,080 feet of the main channel of Miller Creek approximately 200 feet west;
- enhancing the habitat features of the relocated channel;
- replace three intermittent tributaries of Miller Creek that will be in fill by constructing tributary mitigation channels; and
- relocating part of Des Moines Creek, which depends on development of the South Aviation Support Area.

In addition, consideration is being given to modifying the operating procedures at the Lake Reba Regional Detention facility. This is supported by the King County Surface Water

Management Division, in particular if the facility can be modified for additional water storage and water quality treatment.

In order to determine the effectiveness of the creek relocations and tributary replacement, a monitoring plan is proposed. The monitoring includes hydrology and hydraulics inspections and maintenance, and a contingency plan. The latter would involve primarily channel modifications to meet required flow rates and stream hydrology.

The proposed mitigation plan for Miller Creek and Des Moines Creek addresses floodplains, and water quality and hydrology. If implemented correctly, the plan should minimize the potential impacts of Master Plan Update implementation. However, with respect to floodplains, the EIS indicates that, "Implementation of these mitigation requirements would be expected to prevent significant floodplain or flooding impacts from the proposed Master Plan Update alternatives." The plan does not guarantee that the mitigation measures will work. Therefore, monitoring of the mitigation measures construction and operation is extremely important.

5.0 AESTHETICS AND VISUAL

EIS Chapter IV, Section 24 and Appendix N deals with Aesthetics and Urban Design. Review of this section of the EIS is the responsibility of both HOK and Raytheon. The following summarizes Raytheon's comments.

5.1 Methodology

Eighteen view sites around the Airport's perimeter were used to describe the existing visual character of the Airport and to assess impacts of Master Plan Update implementation. Existing conditions were based on black and white photographs from the different viewpoints; three dimensional representations of the Master Plan Update alternatives were overlain on the photographs to show the expected changes or impacts.

The methodology used is routine for visual impact studies. However, the number of viewpoints was inadequate, in particular to the west of the Airport. Additional viewpoints should be included in the study, in particular on high ground. Two examples are in the City of Burien at 153rd and 4th Streets, and 160th between 9th and 10th Streets.

The use of black and white photographs makes it difficult to see existing and Master plan Update conditions. Color photographs should be used to more clearly show the Airport facilities. In addition, different stages of construction such as site clearing, earthwork and final design with/without landscaping should be shown.

5.2 Existing Conditions

The initial black and white photographs were used to show the context in which the Airport is located. However, the majority of view sites are located relatively close to the Airport. There are only a few view sites located further away and these are primarily to the northwest and south of the Airport.

As indicated above, more view sites and color photographs should be used to better describe the existing visual conditions of the Airport. The existing conditions description also should

include a discussion of the ground shadow which is cast on the surrounding area from the existing embankment.

Additional view sites to the west, northwest and southwest of the Airport are particularly important because construction of the third runway will bring the runway activities approximately 1/2 mile closer to these areas. The larger fill area also will be closer and will eliminate some of the view sites shown on Exhibit IV.24-1 in the EIS.

The existing condition view sites to the west, northwest and southwest also should more clearly shown aircraft on the existing runways and possibly landing and taking-off. The view sites now show primarily trees and the embankment area and it would have been helpful to show airplanes, where possible.

5.3 Future Conditions

The treatment of future visual conditions is inadequate because the conditions are mainly described in the immediate area around the Airport. More view sites should be evaluated, in particular on high topographic relief points to the west of the Airport. The ground shadow which will be cast by the new embankment for the third runway also should be discussed in more detail than indicating that it will be about 15 minutes longer than the current shade.

Like the existing conditions, aircraft operations on the proposed third runway on the ground should be more clearly shown. This would be particularly helpful for the additional view sites to the west, northwest and southwest of the Airport.

Construction of the third runway will bring aircraft activities on the ground and in the air approximately 1/2 mile closer to the area west of the airport, in particular during landings and take-offs. Therefore, the impact of aircraft in the air during landings and take-offs should be shown and discussed in comparison to the existing conditions.

5.4 Cumulative Impacts

It is indicated that cumulative visual impacts could vary depending on what other developments are implemented. These potential developments should be described in relation to the proposed Master Plan Update improvements. If the visual impacts of these developments and the Airport improvements are deemed significant, visual representations should be presented.

5.5 Mitigation

Visual impact mitigation alludes to adherence to applicable design and landscape codes. It is assumed that this refers to the City of SeaTac Chapter 15.14 Development Standards: Tree Retention and Landscaping. These standards should be used taking into consideration the use of native vegetation of different age class that will minimize maintenance. Vegetation plantings should be used to minimize visual impacts on the third runways embankment and off-site at sensitive viewpoints such as along 153rd and 4th Streets. Mitigation will be discussed in more detail in the Mitigation Plan.

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APPENDIX A

AGENCIES AND PERSONS CONTACTED

APPENDIX A

AGENCIES AND PERSONS CONTACTED

Citizens

Laura Anderson
Rose Clark
Debbie Des Marias
Al Furney

City of Burien

Pat Dugan
Fred Stouder

King County Ground Water Management Program

Mark Isaacson
Paul Shallow

King County Surface Water Management Division

David Masters

Miller Creek Management Coalition

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Mary Vigilante

Trout Unlimited

Al Miller

U.S. Department of Transportation

John D'Aprile
Gregg Fleming

Waste Action Project

Greg Wingard

Other

Airport Impact Assistance Executive Committee

City of Burien Planning Commission

City Council Members/Staff

Burien
Des Moines
Federal Way
Normandy Park
SeaTac
Tukwila

Highline School District

Regional Council on Airport Affairs

DRAFT

CITY OF BURIEN

SEATTLE-TACOMA AIRPORT MASTER PLAN UPDATE STUDIES

ENVIRONMENTAL ISSUES MITIGATION

1.0 INTRODUCTION

Task 8 Mitigation Plan of the Scope of Services provides information on the mitigation measures for the socioeconomic, traffic and environmental issues. Part of Raytheon's scope includes the mitigation measures for the environmental issues. The following discussion focuses on these environmental issues which are as follows:

- Noise and vibration;
- Air quality;
- Water resources: water quality and hydrology; wetlands; and floodplains; and
- Aesthetics and visual.

A discussion of the methodologies and results for describing the existing and future conditions of each of these environmental areas were presented in a separate technical report.

The discussion of mitigation measures for the aforementioned environmental issues includes construction and operation (post-construction) of the facilities associated with Master Plan Update implementation. The discussion follows the same format of the topics discussed in the Environmental Issues evaluation. Although some topics may not be impacted by construction or operation of the proposed facilities.

The mitigation measures evaluation includes some discussion of the proposed mitigation measures in the Final Environmental Impact Statement (EIS) for the Seattle-Tacoma (Sea-Tac) Airport (Airport) Master Plan Update. These mitigation measures were discussed in the EIS Chapters shown in Table 1-3.

Because of the extent of the mitigation measures discussed, a working group or oversight committee shall be assembled to interact with the Port of Seattle during Master Plan Update implementation. The group shall have permanent staff with technical expertise in airport construction and operation and should be supported by representatives of the various cities around the Airport and citizen groups. The permanent staff positions shall be funded as part of the mitigation agreement and shall be separate from Port of Seattle staff.

The working group or oversight committee shall be provided documentation related to the mitigation measures discussed here. The group will then evaluate this information, provide the Port of Seattle comments and finally approve the proposed mitigation measures. In order to avoid delays with the proposed activities associated with Master Plan Update implementation, the information should be provided for review at least 30 to 60 days before proceeding with the various activities. Work on the proposed activities cannot proceed without the group's approval of the mitigation measures and related information.

As part of the mitigation measures for the EIS environmental disciplines, the Port of Seattle shall provide the working group/oversight committee prior to Master Plan Update implementation, a table of all of the engineering and environmental permits/approvals which are required for construction and operation. In addition, a schedule for obtaining these permits/approvals shall be provided. Then, throughout the construction period and until all operating permits/approvals are obtained, monthly permits/approvals status reports will be provided.

The mitigation measures specified here shall not take the place of the measures discussed in the EIS. They shall be used in conjunction with and shall supplement the mitigation measures discussed in the EIS.

TABLE 1-1

EIS CHAPTERS REVIEWED FOR

ENVIRONMENTAL ISSUES MITIGATION MEASURES

EIS		
CHAPTER	SECTION	TITLE
--	--	Executive Summary
III	--	Affected Environment
IV	1	Noise
IV	2	Land Use
IV	7	Human Health
IV	9	Air Quality
IV	10	Water Quality and Hydrology
IV	11	Wetlands
IV	12	Floodplains
IV	19	Earth
IV	20	Solid Waste
IV	21	Hazardous Substances
IV	23	Construction Impacts
IV	24	Aesthetics and Urban Design
V	--	Probable, Unavoidable, Adverse Environmental Impacts and Mitigation Measures
Appendix C	--	Noise Impacts
Appendix D	--	Air Pollutant Methodology
Appendix N	--	Aesthetic Views and Photos
Appendix P	--	Natural Resource Mitigation Plan
Appendix Q	--	Water Studies
Appendix Q-A	--	Baseline Groundwater Study
Appendix Q-B	--	Preliminary Water Conservation Plan
Appendix Q-C	--	Concepts for Using a Constructed Aquifer to Manage Airport Stormwater
Appendix R	--	Responses to Public Comments

2.0 CONSTRUCTION MITIGATION MEASURES

Construction of any large project such as that associated with Master Plan Update implementation involves potential impacts. The impacts during construction for the environmental issues of concern were discussed in the Technical Memorandum on these issues. The following provides information on the construction mitigation measures.

2.1 Noise and Vibration

2.1.1 Aircraft Noise Effects

As part of the EIS, aircraft noise effects were evaluated for the existing conditions. Master Plan Update implementation during construction will not impact aircraft noise levels which are a part of Airport operations. However, there may be an interaction between aircraft noise and construction activities. This area of concern was not addressed in the EIS. Therefore, as part of the mitigation measures for noise, this evaluation shall be conducted by the Port of Seattle to determine potential impacts on the areas to the northwest, west and the southwest of the Airport during construction. This evaluation shall be done using an appropriate computer model, taking into consideration the models that were used in the EIS.

2.1.2 Surface Transportation Noise Effects

1. The Port of Seattle shall comply with all appropriate federal, state and local noise regulatory requirements for surface transportation of fill and other materials associated with Master Plan Update implementation.

2. All construction operations, including heavy equipment and trucks hauling fill, shall only operate between the hours of 7:00 a.m. and 9:00 p.m. Monday through Friday; 9:00 a.m. to 9:00 p.m. on Saturdays; and no operations are allowed on Sundays or holidays.

3. All construction equipment, including trucks hauling fill, shall be equipped with noise control devices which shall be at least as effective as those devices provided with the original equipment.

4. If noise complaints are received during construction, the Port of Seattle shall at least implement one or more of the following:

   a. Locate stationary construction equipment as far from nearby noise sensitive properties as possible;

   b. Shut off idling equipment;

   c. Re-schedule construction operations to avoid periods of noise annoyance;

   d. Notify nearby residents whenever extremely noisy work will be occurring;

   e. Install temporary or portable acoustic barriers around stationary construction noise sources; and

   f. Place material stockpiles between crushing or screening operations and the affected dwelling(s).

5. Prior to the start of construction of any work associated with Master Plan Update implementation, the Port of Seattle shall identify all burrow source areas and haul routes. Then, the Port of Seattle shall re-evaluate the roadway noise analysis to reflect the actual haul routes.

2.1.3 Vibration

The EIS did not provide information on potential impacts of vibration from construction activities. This may be particularly relevant for residences in the vicinity of the earthwork

activities. This information shall be provided by the Port of Seattle prior to the start of construction of activities associated with Master Plan Update implementation.

2.1.4 Cumulative Impacts

A number of other projects are proposed for the Sea-Tac Airport area. These projects may occur at the same time as Master Plan Update implementation. The EIS had a cursory evaluation of potential construction noise cumulative impacts. A more detailed noise cumulative impacts discussion shall be provided by the Port of Seattle prior to the start of construction associated with Master Plan Update implementation. The discussion shall include all known proposed projects for the Airport area and projects which could interact with the fill haul routes. Also, this shall include appropriate modeling.

2.2. Air Quality

1. Once the sources of fill material are known and the haul routes have been identified and approved, the construction vehicle air quality analysis shall be re-evaluated and the dispersion analysis shall be re-done in order to better predict potential air quality impacts prior to the start of construction. The analysis shall extend from the Airport area to the fill source areas.

2. As part of the re-evaluation of the construction vehicle air quality analysis, the Port of Seattle shall work with appropriate regulatory agencies to obtain PM_{10} data which is more representative of the Puget Sound Region. This shall entail the establishment of additional air quality monitoring stations, in particular in the vicinity of the Airport.

3. As part of construction activities, PM_{10} and CO shall be monitored in the vicinity of the fill sources, along the haul routes and in the Airport construction area.

4. During construction at least the following measures shall be used to reduce fugitive dust emissions:

a. appropriate materials shall be applied at the source fill areas and Airport construction areas to control fugitive dust emissions; if chemicals are used, Material Safety Data Sheets (MSDS) shall be provided which show that the materials have a low adverse risk to humans and the environment;

b. to reduce soil deposits on roads and subsequent fugitive dust, the Port of Seattle shall implement procedures for minimizing tracking of soil on area roads at all construction areas including the source fill areas; and

c. the Port of Seattle shall use gravel, paving and revegetation as appropriate to control fugitive emissions during construction.

5. All construction equipment shall have appropriate emissions control devices and shall comply with the vehicle inspection program.

6. All construction equipment shall be well maintained to reduce emissions.

7. All construction vehicles shall avoid prolonged periods of vehicle idling.

8. If concrete batch plants are used during construction, the Port of Seattle shall provide documentation of their compliance with appropriate regulatory requirements.

9. The Port of Seattle shall ensure that all trucks hauling fill material shall be covered to control fugitive dust emissions.

10. The Port of Seattle shall provide a more detailed evaluation of cumulative impacts on air quality of construction associated with Master Plan Update implementation and other known proposed projects in the Airport area.

2.3 Water Resources

2.3.1 Water Quality and Hydrology

1. The Port of Seattle shall hire for the duration of construction of the third runway a geotechnical engineer to ensure, (1) that fill is placed appropriately including compaction and (2) to help detect and remove seismically unstable soils, such as in fill sources. and the proper excavation of it

2. The Port of Seattle shall provide evidence including appropriate certifications that all fill material is free of harmful levels of toxic and hazardous materials as defined by the then current federal and state regulations.

3. At least 2 months prior to construction, the Port of Seattle shall provide for review and approval the following:

   a. Construction Stormwater Pollution Prevention Plan and Erosion and Sediment Control Plan;

   b. Spill Prevention, Control and Countermeasure (SPCC) Plan;

   c. Construction Management Plan;

   d. Construction Waste Management Plan;

   e. geotechnical report;

   f. reclamation plan for proposed fill sources;

   g. earthwork specifications and drawings, in particular for the third runway; and

h. a copy of the State of Washington Governor's Water Quality Certificate which indicates that there is reasonable assurance that the project will be designed, constructed and operated in compliance with applicable water quality standards.

4. Limited baseline surface and ground water data was provided in the EIS. Therefore, prior to the start of construction the Port of Seattle shall establish permanent, long term surface and ground water monitoring stations in the Airport area. The locations and number of these stations shall be approved by the working group/oversight committee.

Once the stations have been established, quarterly sampling shall be initiated during the months of February, May, August and November. The parameters sampled should include metals and organics such as those associated with Airport operations.

The parameters sampled shall be selected based upon discussions with appropriate State of Washington and King County regulatory agencies and the working group/oversight committee. Potential parameters to be considered for sampling are shown in Tables 2-1 and 2-2 for surface and ground water, respectively.

5. There is evidence that when wells are pumping from the Highline Aquifer, drawdown can be observer in shallower aquifers (Greg Wingard, July 22, 1996, personal communications; Wingard and Smith, June 19, 1995). This is indicative of interconnection between the aquifers and a potential path for contaminated ground water to the Highline Aquifer. Therefore, ground water movement in the Airport area shall be better defined prior to the start of construction by the Port of Seattle. According to the EIS, these additional studies are being conducted. When available, the studies shall be reviewed for potential ground water contamination impacts on the Highline Aquifer and other area aquifers.

TABLE 2-1

POTENTIAL SURFACE WATER SAMPLING PARAMETERS

PARAMETERS

General

Water temperature[a]
Specific conductance[a]
pH[a]
Dissolved oxygen[a]

Flow[a]
Acidity
Alkalinity
Bicarbonate

Carbonate
Calcium
Hardness
Color

Turbidity
Dissolved solids, Total
Suspended solids, Total
Fluoride

Magnesium
Potassium
Silica
Sodium
Sulfate

Nutrients

Ammonia
Kjeldahl nitrogen
Nitrate
Nitrite

Phosphorus, Total
Ortho-phosphorus

PARAMETERS

Indicators of Airport, Industrial and Municipal Contaminants

BOD, 5-day
COD
Chloride
Cyanide

Oil and Grease
Sulfide
Coliforms, Total per 100 ml
Coliforms, Fecal per 100 ml

Aviation Fuel Constituents
Ethylene Glycol
Propylene Glycol

Trace Elements

Aluminum
Arsenic
Cadmium
Chromium, Total

Chromium, Hexavalent
Copper
Iron
Lead

Manganese
Mercury
Silver
Zinc

Footnote: [a] In-situ Field measurements.

TABLE 2-2
POTENTIAL GROUND WATER
SAMPLING PARAMETERS

PARAMETERS

General

Depth to ground water
Water temperature
Specific conductance
pH

Dissolved oxygen
Acidity
Alkalinity
Bicarbonate

Carbonate
Calcium
Hardness
Color

Dissolved solids, Total
Suspended solids, Total
Fluoride
Magnesium

Potassium
Silica
Sodium
Sulfate

Nutrients

Ammonia
Kjeldahl nitrogen
Nitrate
Nitrite

Phosphorus, Total
Ortho-phosphorus

PARAMETERS

Indicators of Airport, Industrial and Municipal Contaminants

Chloride
Oil and Grease
Sulfide
Coliforms, Total per 100 ml

Coliforms, Fecal per 100 ml
Aviation Fuel Contaminants
Ethylene Glycol
Propylene Glycol

Trace Elements

Aluminum
Arsenic
Cadmium
Chromium, Total

Chromium, Hexavalent
Copper
Iron
Lead

Manganese
Mercury
Silver
Zinc

Footnote: [a] In-situ Field measurements.

6. In the EIS it is indicated that the Port of Seattle was to have conducted a monitoring study of Miller and Des Moines Creeks the winter of 1995 to 1996, both upstream and downstream of Airport stormwater discharges. The purpose of this study is to help determine the toxicity of Airport stormwater runoff and surface water quality. The results of this study shall be provided by the Port of Seattle and reviewed by the working group/oversight committee prior to the start of construction.

7. To minimize the potential impacts of the new impervious areas and drainage areas, new stormwater detention facilities are planned. If the preferred alternative is implemented the hydrologic analysis and stormwater management facilities shall be re-evaluated to support final design by the Port of Seattle prior to the start of construction. This is required because the EIS indicates that the stormwater management facilities and discharge locations are conceptual layout. The re-evaluated hydrologic analysis shall then be used as part of the baseline to monitor potential Alternative 3 impacts. During large storm events, the effect of possible overflow from the IWS on the receiving waters also shall be addressed. The hydrologic analysis and stormwater information shall be provided by the Port of Seattle to the working group/oversight committee for review at least 2 months prior to the start of construction.

8. Limited details on both the construction and operation of the wet vaults and biofiltration swales was provided in the EIS. There was a more lengthy explanation of the constructed aquifer, which the EIS indicates has not been used before to manage stormwater. More detailed design and operating information shall be provided on the wet vaults and biofiltration swales by the Port of Seattle at least 2 months prior to the start of construction.

   If additional consideration is given to the constructed aquifer, its potential use must be more strongly justified. The Sea-Tac Airport area may not be the most suitable place to try this technology out; especially considering the controversy

over disturbing the headwaters of the two watersheds. The King County Surface Water Management Division has suggested that surface water retention facilities are more innovative and effective. Therefore, they should be considered further before the use of wet vaults and/or the constructed aquifer. The surface water facilities to be considered for modification shall include the Lake Reba facility.

9. The Port of Seattle must place a construction fence at the outside limits of the construction area.

10. Prior to the start of construction, when the burrow source areas have been identified, the Port of Seattle shall conduct baseline studies of any area surface waters and the ground water. This information shall be used to describe the existing conditions and to help monitor potential changes after the earthwork activities are complete. Parameters which should be considered for evaluation shall be those listed in Tables 2-1 and 2-2.

11. Prior to the start of relocating any part of Miller Creek, the Port of Seattle shall provide information on the potential impact on the relocation of litigation concerning King County agreeing not to channelize the Creek except in limited amounts in connection with retention facilities.

2.3.2 Wetlands

1. At least 2 months before the start of construction the Port of Seattle shall provide additional justification for wetlands mitigation in the Green River Valley and not the Miller Creek Watershed. This shall include, (1) evidence of further discussions concerning mitigation in the Miller Creek Watershed with State of Washington and King County regulatory agencies and (2) an approved wetlands mitigation plan from appropriate regulatory agencies.

2. At least 2 months before the start of construction the Port of Seattle shall provide more detailed information on what wetlands will be destroyed as part of Master Plan Update implementation and how other Airport area wetlands will be protected from construction activities.

2.3.3 Floodplains

1. At least 2 months before the start of construction the Port of Seattle shall provide the following:

   a. information on the relationship between the 100 and 500-year floodplains, recent storms in the Puget Sound region and the Master Plan Update implementation EIS analysis;

   b. a copy of the final monitoring plan for evaluating the effectiveness of the Miller Creek and Des Moines Creek relocations; and

   c. final design information for the Miller Creek and Des Moines Creek relocations including specifications and drawings.

2.3.4 Cumulative Impacts

In the EIS cumulative impacts on water resources during construction associated with Master Plan Update implementation and other projects are not discussed in detail. At least 2 months prior to the start of construction the Port of Seattle shall provide for review/approval a more comprehensive cumulative impacts discussion.

2.4 Aesthetics and Visual

Prior to the start of construction, the Port of Seattle shall provide the following concerning aesthetic and visual resources:

1. Color photographs of pictures taken from the EIS viewpoints and additional viewpoints which show the existing and future conditions. The additional viewpoints shall be selected based on discussions with the working group/oversight committee.

2. Landscape plans for the burrow source areas and the third runway fill area. These plans shall take into consideration the following:

   a. the City of SeaTac and other appropriate landscape requirements;

   b. planting temporary vegetation or a cover crop as construction in various areas is completed or proceeds in order to minimize short term impacts, in particular from erosion and sedimentation; and

   c. the final landscaping should include the use of a variety of native vegetation which require low maintenance; and has a mixture of seedlings and more mature plants in order to avoid a monoculture.

3. A cumulative impacts discussion and color photographs, if appropriate, of facilities associated with Master Plan Update implementation and other known proposed projects in the Airport area.

3.0 OPERATION MITIGATION MEASURES

Once the facilities proposed as part of the Master Plan Update implementation are built, there will continue to be potential impacts which need to be mitigated. These mitigation measures are described in this section for the environmental issues previously discussed.

3.1 Noise and Vibration

3.1.1 Aircraft Noise Effects

3.1.1.1 General

1. Version 5.1 of the INM will be available the fall, 1996. This will be a Windows '95 based version and will have at least the following enhancements: ability to plot noise contours on a street map; and an expanded data base of aircraft including the Boeing 777 and MD90. At the time the EIS was done, noise data for a Boeing 767-200 with JJ-9-D was substituted for the Boeing 777 aircraft.

   Because of at least the greater accuracy of the INM, Version 5.1; the ability to plot noise contours on a street map; and the expanded base of aircraft information, the noise model shall be rerun by the Port of Seattle using this new version. This will allow confirmation of the data from INM, Version 4.11 and the most up-to-date information available on the newer aircraft noise characteristics.

2. The EIS noise study did not have an extensive evaluation of sound exposure level (SEL). The INM was used to show the SEL contours for one approach to Runway 16R and one departure from Runway 16L for five aircraft types which dominate the current and future fleet mixes at the Airport. This information shall be developed by the Port of Seattle prior to Master Plan Update implementation and shall include the SEL contours relationship to health problems, in particular, sleep and speech interference. Thus, this shall be done concurrent with re-evaluating the noise data using INM, Version 5.1.

3. The EIS for the Flight Plan Project (Puget Sound Regional Council and Port of Seattle, October, 1992), included noise assessment information associated with the 55 DNL level and a SEL of 80 dBA. This SEL was selected because it is often used to supplement the DNL analysis and 80 dBA corresponds to the level at which sleep disturbance and speech interference start to occur. Similar information shall be developed prior to Master Plan Update implementation by the Port of Seattle.

4. Currently there are eleven noise monitoring stations. The Port of Seattle is upgrading the noise monitoring system to approximately twenty-five stations. Some of these monitoring stations shall be located along the EIS predicted noise contours and consideration shall be given to the need for additional stations if the twenty-five stations are deemed inadequate.

5. The need for the proposed third runway is based on flight delays during inclement weather for arrivals. Therefore, the third runway shall be used only for landings. This will help control noise levels associated with departures.

6. There shall be no arrivals on the third runway, except for emergencies, between 9:00 p.m. and 7:00 a.m.

7. As part of all FAR Part 150 reviews, the working group or oversight committee shall be allowed to participate with the FAA and other parties. Near-term reviews shall include at least the following:

   a. An evaluation of the actions needed to apply, monitor and enforce the North Flow Daytime Departure Duwamish/Elliott Bay Noise Abatement Procedures specified in the 1990 Noise Mediation Agreement. Investigate, and if possible, implement the use of this corridor during periods of lighter activity such as midmorning and midafternoon.

   b. An evaluation of the feasibility of extending the 'nighttime' hours of use for the North Flow Nighttime Departure Noise Abatement Procedures

from 10 p.m. to 6 a.m. to the evening 'shoulder' of 8 to 10 p.m., and to the early morning 'shoulder' of 6 to 7 a.m.

c. A re-evaluation of the use of 'minimum population exposure' flight tracks, in light of the increase in flight operations and the shift in the overall importance of arrival noise as Stage 2 aircraft are phased out.

d. An evaluation of the potential net benefits of preferential runway use during 'low activity' periods (e.g., would more use of the east runway result in reduced overall population noise exposure?), coupled with an expanded residential insulation and acquisition program, as needed.

e. An evaluation of types of land uses and their compatibility with Airport operations in all areas affected by noise shall be conducted based on noise contours at the 55, 60, 65, 70 and 75 DNL.

8. The EIS also did not provide detailed information about the threshold above (TA) noise metric with respect to sensitive noise receptors such as schools, hospitals, etc. This information shall be developed by the Port of Seattle as part of the re-evaluation of the noise data using the INM, Version 5.1.

9. Hush houses (including portable hush houses) shall be used in conjunction with engine maintenance activities, in particular run-ups.

10. The Port of Seattle shall continue the following aircraft noise reduction/abatement programs including:

a. noise budget program - the Airport will move toward an all Stage 3 aircraft fleet by limiting the amount of noise airlines are allowed to make each year; the goal agreed to in the Noise Mediation Agreement (Port of Seattle and Mestre Greve Associates, March 31, 1990) is to reduce noise by the year 2001;

b. nighttime limitations program - this program involves phasing out Stage 2 aircraft during nighttime hours; effective October 1, 1995, Stage 2 jet aircraft may not operate between 10:00 p.m. and 7:00 a.m. unless granted an exemption or variance (e.g., delays due to weather, air traffic control delays, etc.);

c. ground noise control program - airplanes are not allowed to back away from gates using engine power, instead they must be pushed away by "tugs"; run-ups during the daytime are allowed only at designated locations on the north and south ends of the Airport (aircraft must face into the wind so that jet blast is directed back across the airfield); between 10:00 p.m. and 7:00 a.m. run-ups are allowed only under special circumstances such as for a departure;

d. overflight noise abatement procedures - initial "straight-out" departure corridors are in a narrow flight path; Duwamish/Elliott Bay corridor for arriving and departing flights keep aircraft over water and industrial areas as much as possible; nighttime procedures to keep flights over Puget Sound waters as much as possible.

e. flight path monitoring - the Airport's Noise Abatement Office monitors jet flights in the noise abatement corridors;

f. noise monitoring - eleven station permanent noise monitoring system to record noise exposure levels in the Airport area shall be used until the system has been expanded to at least twenty-five stations; and

g. 24-hour noise information line - provides information on noise issues or accepts noise complaints.

11. In Appendix R of the EIS, it is indicated that the nighttime noise budget and limitations program is designed to address noise issues associated with aircraft categorized as having FAR Part 36 Stage 2 noise levels. Therefore, the

program will expire with the completion of the scheduled phase out of these aircraft between 2000 and 2003. These two components are an integral part of the aircraft noise reduction/abatement programs and the Port of Seattle shall continue the implementation of the nighttime limitations program beyond the Stage 2 phase out schedule. Depending on the status of the nighttime noise budget program in relation to Stage 3 aircraft, this program also shall be continually evaluated and updated based on the different stages of aircraft.

12. INM Version 4.11 has the capability to compute noise levels due to airplane engine run-up operations. This is particularly useful for noise information around airplane maintenance facilities. Because concern has been expressed about noise levels associated with existing run-up and maintenance operations, and the proposed south aviation support area activities, a discussion of this feature and data for the Sea-Tac Airport shall be provided by the Port of Seattle for both the existing and future conditions.

13. A number of assumptions must be made which can affect the outcome of the INM. Sensitivity tests can be used to evaluate how much change in a key input value or assumption might affect the outcome. A similar approach would be useful in evaluating the assumptions used in the future noise modeling and the resultant data in the EIS. Thus, sensitivity tests shall be conducted and evaluated by the Port of Seattle. Also, if possible, information on the range and standard deviations of the DNL and other data in the EIS shall be presented. The range and standard deviations of the data could provide an indication of potential impacts beyond the noise contours shown in the EIS.

14. The noise mediation agreement (Port of Seattle and Mestre Greve Associates, March 31, 1990) indicates that as technology with noise barriers develops, the Port of Seattle will evaluate their use. It is not clear if during the future conditions evaluation the use of noise barriers was included. This may be particularly useful in the vicinity of any new maintenance facilities in addition to the use of "hushing" equipment. Appendix R of the EIS also mentions the use of vegetation to help reduce noise. The EIS indicates in Chapter 1 that as part

of the Master Plan Update objectives, Airport noise is to be attenuated through the use of berms and barriers (Port of Seattle, May, 1994). The Port of Seattle shall provide information on the status of using noise barriers at Sea-Tac Airport and if this was included in the EIS noise modeling.

15. The Port of Seattle shall provide information on amending the FAA Four-Post Plan in order to minimize low-altitude overflights of residential areas as discussed in the Flight Plan Project EIS (Puget Sound Regional Council and Port of Seattle, October 1992).

16. The Port of Seattle shall provide information on the status of implementing new technologies such as Microwave Landing System (MLS) and Global Positioning Satellite System (GPS) as part of potentially reducing noise impacts to areas around the Airport.

17. Appendix C Noise impacts in the EIS indicates that existing aircraft operations were based on average daily operations. It is not completely clear how many operations per hour this equates to. The air quality analysis used an aircraft peak hour activity level of about 88 operations (43.9 arrivals and 43.9 departures). The relationship, if any, between the noise and air quality aircraft operations or activity levels shall be explained better by the Port of Seattle taking into consideration the noise and air quality analyses used the August and June, 1994 Official Airline Guide (OAG), respectively. Also, the discussion shall include comments on the Airport being able to accommodate 60 arrivals per hour which was recently mentioned by the Port of Seattle (March 26, 1996; August 1, 1996).

18. The Port of Seattle shall provide information on the ability to maintain the Airport's reduced noise level goals. This discussion is particularly relevant because of the recent concerns about the Port not sufficiently reducing on-the-ground noise impacts by April 1, 1996 (Puget Sound Regional Council, March 27, 1996).

19. The Port of Seattle shall investigate methods and provide a report for mitigating low frequency noise and vibration.

3.1.1.2 Noise Contour Mitigation

65 DNL Contour and Higher

a. Entire neighborhoods shall be bought out at the 65 DNL contour and higher; buy-outs shall not stop on the contour.

b. Buy-outs shall include schools, residences, businesses, etc., which are not compatible with these higher noise levels.

c. Buy-outs shall be for fair market value and relocation costs.

d. The buy-outs area shall be replanned with compatible uses and appropriate infrastructure.

60 to 64 DNL Contour

Three programs shall be offered to neighborhoods within this contour area:

a. Avigation easement based on 25 percent of fair market value of comparable properties not impacted by the Airport.

b. Sound abatement program consisting of at least windows, attic insulation and air conditioning.

c. Sales assistance where the Port of Seattle acts as a third-party broker to assist in home sales.

Not cold climate homes

3.1.1.3 Run-Up, Departure Roll, Thrust Reverse, Tax, Idle and Auxiliary Power Noise

The Port of Seattle Sea-Tac International Airport's Ground Noise Study Phase II (Mestre Greve Associates, February 20, 1994) provided information on findings concerning noise impacts from aircraft engine run-up, departure roll, thrust reverse, taxi, idle and auxiliary power. In addition, recommendations on these areas were made. However, more information shall be provided by the Port of Seattle on the below listed recommendations in order to evaluate their status and the need for additional studies/measures to help reduce Airport noise impacts.

Run-Up

a. The use of monitoring data to identify aircraft run-up noise including placing monitoring stations near run-up locations and sending the noise data to the noise office for recording.

b. Documentation of the number and type of run-ups and what role they play in the total ground noise impact.

c. Information on technological advances in run-up noise control facilities and their implementation at the Airport.

Departure Roll Noise

a. Information on the status of limiting operations of Stage II aircraft and their complete elimination during nighttime operations.

b. Documentation that the noise insulation program takes into consideration mitigation of noise at lower frequencies to account for the lower frequency of Stage III aircraft.

Thrust Reverser Noise

a. Results of a taxiway use study; the development of a new taxiway system at the Airport; and a nighttime taxiway use plan to help reduce thrust reverser noise.

b. Results of the Port of Seattle working with airlines to implement procedures that take advantage of the additional stopping distance to minimize the use of thrust reversers during the nighttime hours.

Taxi and Idle Noise

a. Measures to minimize the number of aircraft queuing at the runway ends during peak activity time periods (e.g., gate hold procedures and capacity enhancement measures).

b. Use of a location at the north/south ends of the Airport for conducting pre-departure engine run-up so that noise is directed towards the buy-out areas, in particular at night.

c. Study of various runway and taxiway designs on aircraft queuing and the resulting taxi and idle noise.

d. Feasibility of constructing a noise berm at the west boundary of the Airport near the runway ends in order to help mitigate taxi and idle noise at the runway ends.

Auxiliary Power Noise

a. Steps to install fixed power at gates, etc., to minimize the use of auxiliary power, in particular during the nighttime hours.

b. Installation of fixed power systems that include preconditioned air.

c. Identification of the source of long duration steady state noise in the north cargo area and its mitigation.

3.1.1.4 On-The-Ground Reduction of Nighttime Noise Impacts

1. The Port of Seattle and Federal Aviation Administration shall more aggressively enforce compliance with the North Flow Nighttime Departure Noise Abatement Procedures and provide evidence of this enforcement (e.g., copies of notices of violations to airlines).

2. The Port of Seattle shall provide evidence of the continuing effort to minimize flights between 10:00 p.m. and 6:00 a.m.

3. The Port of Seattle shall provide evidence of its efforts to minimize the number of variances issued for the Nighttime Limitations Program.

4. The Port of Seattle shall provide evidence of its efforts to ensure the use of Stage 3 aircraft by airlines, in particular foreign airlines.

5. The Port of Seattle shall provide evidence of its working with owners/operators of Stage 2 aircraft (including those under 75,000 pounds) which are currently exempt from the Nighttime Limitations Program, to obtain their cooperation in minimizing or eliminating the use of these aircraft between 9:00 p.m. and 7:00 a.m.

6. The Port of Seattle shall provide evidence of its continuing to work with airlines to minimize nighttime engine run-up. This should include the use of hush houses.

3.1.2 Surface Transportation Noise Effects

1. Depending on when the Master Plan Update implementation is started, existing surface transportation noise shall be remodeled by the Port of Seattle with the

then current version of STAMINA or the most accepted program. This will allow a comparison with the 1994 existing baseline conditions and the actual conditions at the start of construction. In order to plan for this re-evaluation, the following shall be done:

a. specific roadway noise monitoring sites shall be established at key locations, possibly some of the sites identified as being noise impacted by the Federal Highway Administration noise sensitivity criterion; the locations of these sites shall be coordinated with the establishment of additional aircraft noise monitoring sites; data collection from these noise monitoring sites shall begin as soon as possible in order to provide up-to-date baseline information before Master Plan Update implementation construction starts; and

b. more accurate traffic information shall be obtained for the roads in the Airport area (e.g., vehicle categories and road use); the EIS indicates that relevant data was available only on I-5 and International Boulevard for surveys conducted on August 3, 1987; July 8, 1991; and February 25, 1992.

2. Like the existing conditions analysis, the future analysis shall be evaluated again by the Port of Seattle in order to reflect more accurately the information available prior to the start of construction for Master Plan Update implementation. This, is in part, to reflect actual Sea-Tac area traffic information due to growth, changes in any traffic patterns, etc. The re-evaluation would benefit from the following:

a. more accurate information on construction activities, in particular haul routes, so that construction traffic can be included in the roadway noise re-evaluation;

b. more accurate information on vehicle classification and their use of the various roadways; and

c. the additional monitoring data obtained from the roadway noise monitoring sites.

3. The INM incorporated aircraft ground noise in its analysis. However, it was not clear if this included construction and other surface traffic, in particular traffic associated with hauling fill. This shall be clarified by the Port of Seattle and if necessary the interaction between surface transportation and aircraft noise levels shall be evaluated including the construction traffic.

3.1.3 Vibration

The EIS vibration analysis shall be expanded by the Port of Seattle to include qualitative and quantitative information on at least the below listed items for residences, schools and hospitals in the Airport area:

a. human whole body vibration;

b. annoyance and interference to humans caused by building vibration; and

c. building structural damage.

With respect to humans, the evaluation shall look at impacts on working efficiency, health, safety and comfort. The evaluation shall incorporate the information and methodology discussed by the International Organization for Standardization (ISO; International Organization for Standardization, 1985 a and b; 1989).

3.1.4 Cumulative Impacts

Other area projects which may be in operation concurrent with Master Plan Update implementation were only briefly discussed in the EIS noise analysis. In order to more adequately address the relationship between these projects and the activities associated with Master Plan Update implementation, the cumulative impacts discussion shall be re-evaluated

by the Port of Seattle. This shall include appropriate modeling. The evaluation also shall include all known proposed projects in the Airport area.

3.2 Air Quality

3.2.1 General

1. The Port of Seattle shall provide information on Master Plan Update implementation Clean Air Act Conformity. This shall include at least the following:

   a. copy of draft analysis/plan for review and comment;

   b. copy of draft final analysis/plan for review and comment; and

   c. copies of the EPA, PSAPCA, DOE and any other approvals for the conformity analysis/plan.

2. The Port of Seattle shall provide at least the following information on the State of Washington's Certification of Compliance with Air Quality Standards:

   a. copy for review of documentation submitted to the Governor's Office; and

   b. copy of Governor's Air Quality Certificate.

3.2.2 Existing and Future Conditions

1. The closest DOE/PSAPCA monitoring sites are approximately 5 miles from the Airport; there are no monitoring sites west, northwest and southwest of the Airport; CO and PM_{10}, are the most frequently monitored parameters; in order to make monitoring information such as this more useful; permanent monitoring stations shall be established in and around the Airport area. Parameters

monitored shall include the AAQS parameters as well as toxic pollutants of concern such as 1,3 - butadiene, formaldehyde and benzene; quarterly monitoring reports shall be provided which discusses the monitoring data with respect to AAQS and State of Washington ASILS.

2. Air quality monitoring stations shall be located in areas which have historically had complaints, even though the EIS screening analysis did not show violations of AAQS.

3. After 1 year of baseline data has been collected at the new air quality monitoring sites, the area dispersion analysis shall be re-evaluated by the Port of Seattle for both the existing and future conditions.

4. The Port of Seattle shall re-evaluate the existing and future roadway intersection analysis to confirm the accuracy of the evaluation in the EIS and to correct for the following inconsistencies discussed by EPA (June 6, 1996):

   a. "The modeling results for air quality in the SeaTac final EIS conflict with those from the draft EIS for the SR 509/South Access Road Corridor Project at two intersections (both EISs used the same models). The two EIS's model conflicting results for existing conditions and future action alternatives at South 188th and International Boulevard, and South 200th and International Boulevard for the average CO concentrations indicated on page 4-7 in the SR 509 EIS, as compared with the same analyses on page IV.9-11H in the SeaTac final EIS. Both analyses model CO violations for existing conditions, but for future action alternatives the SeaTac analysis shows modeled CO violations where the SR 509 analysis does not."

   b. "Modeled air quality impacts at South 200th and International Boulevard are shown in the South Aviation Support Area Final EIS (pages 4-106 to 109 and 112), the 28/24th Street Arterial Final EIS (page 3.22) and the

CTI Final EIS (page 4-7, 8). The results vary for each project ranging from 5.0 to 13.3 parts per million CO."

5. All Port of Seattle and vehicles associated with Airport operations shall comply with required vehicle emissions inspections and maintenance programs.

6. The Port of Seattle shall provide information on the following or conduct the indicated studies related to air toxics:

   a. long-term air toxics data shall be collected in the Airport area throughout different months of the year;

   b. the Port of Seattle shall conduct an evaluation of health problems in addition to cancer, in the Airport area; the study shall include schools, hospitals, nursing homes and residences;

   c. the Port of Seattle shall conduct a study to determine the nature and extent of fuel odor problems in the Airport area; the study should include an evaluation of increased odors during inclement weather;

   d. the Port of Seattle shall collect appropriate data in order for a cancer risk assessment to be conducted in the Airport area; and

   e. the Port of Seattle shall provide information on vapor recovery and regulatory compliance for all facilities associated with Airport operations including rental car and airline operations.

7. The Port of Seattle shall conduct a study to determine if it is possible to reduce aircraft emissions by improving Airport operations associated with queuing and taxing.

8. As Master Plan Update implementation proceeds, the air dispersion and roadway traffic analysis shall be re-evaluated by the Port of Seattle in order to accurately monitor potential impacts.

3.2.3 Cumulative Impacts

The EIS contained a brief discussion of cumulative impacts associated with air quality issues. The Port of Seattle shall provide a more detailed evaluation of cumulative impacts on air quality. The evaluation shall include the known projects planned for the Airport area during operation of the Master Plan Update activities.

3.3. Water Resources

3.3.1 Water Quality and Hydrology

1. At the time the EIS was issued, a hydraulic analysis with computer program (WATERWORKS) was modeling the proposed airport expansion storm drain system. The Port of Seattle shall provide a copy of the final report for review and comment.

   ^ public

2. The Port of Seattle shall continue the surface and ground water monitoring which was initiated prior to the start of construction as discussed in Section 2.3.1. The need to sample on a quarterly basis shall be discussed and adjusted if it is deemed appropriate. Other aspects of the monitoring program which shall be discussed shall include:

   a. the parameters being monitored; and

   b. the number and locations of the monitoring stations.

   The discussion of the monitoring program components shall be a continuous process in order to take advantage of the monitoring data and in order to reflect Airport operations/issues.

3. The burrow site hydrology monitoring shall be continued by the Port of Seattle until adequate information is obtained for comparison with the EIS existing or baseline conditions.

4. At least 2 months prior to the completion of construction on the third runway, the Port of Seattle shall provide an operations erosion and sediment control plan, and a stormwater pollution prevention plan.

3.3.2 Wetlands

The Port of Seattle shall initiate a wetlands monitoring program to provide at least yearly reports on the success of the wetlands mitigation plan.

3.3.3 Floodplains

1. The Port of Seattle shall provide prior to the start of construction a floodplain monitoring plan which will be implemented following the completion of construction associated with the third runway. The monitoring plan shall include methods for evaluating at least the following:

   - 100 and 500-year floodplain level encroachment/impacts;
   - changes in flood storage capacity; and
   - changes in flow rates and volumes.

   Yearly reports shall be provided on the floodplain monitoring program until the monitoring is no longer deemed necessary by appropriate regulatory agencies and the working group/oversight committee.

2. The Port of Seattle shall provide evidence that following construction of the third runway there has not been any reduction in the 100-year floodplain or base

flood storage volume/capacity. If there has been, appropriate mitigation measures will be developed and implemented.

3.3.4 Cumulative Impacts

Cumulative impacts on water resources of Master Plan Update implementation and other proposed area projects were only briefly mentioned. The Port of Seattle shall provide a more comprehensive discussion of potential impacts following Master Plan Update implementation prior to the start of construction.

3.4 Aesthetics and Visual

Following construction of the facilities associated with Master Plan Update implementation, the Port of Seattle shall provide a landscape maintenance plan. The plan shall include a description of the proposed uses of any pesticides such as herbicides and insecticides.

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