Chapter 6: Environmental Considerations

“How long can men thrive between walls of brick, walking on asphalt pavements, breathing the fumes of coal and of oil, growing, working, dying, with hardly a thought of wind, and sky, and fields of grain, seeing only machine-made beauty, the mineral-like quality of life?”
— Charles A. Lindbergh, Reader's Digest, November 1939

6.1 Introduction

This chapter presents screening-level analyses for potential environmental effects of the aircraft operations forecasts and potential master plan projects discussed in Chapters 3 through 5. It is important to note that there may or may not be a correlation between potential master plan projects and the number of aircraft operations. That is, in some cases, potential projects might reduce or at least not increase the number of aircraft operations, or aircraft operations might occur in any event, even if some of the potential master plan projects are not constructed.

This chapter has the following five sections:
• Wetlands (Section 6.2)
• Aircraft Noise (Section 6.3)
• Other Airport Environmental Programs and Policies (Section 6.4)
• Preliminary Environmental Screening Matrix (Section 6.5)
• Community-Requested Environmental Projects (Section 6.6)

The analyses presented in this chapter have been prepared in accordance with FAA AC No. 150/5070-6A. The AC states that the two essential components of environmental analysis in the OAK master plan, the following principle, as outlined in the AC, was used: “The information presented in this AC covers the planning requirements for all ports, regardless of size, complexity or role. However, the scope of study must be tailored to the individual port, with the level of effort limited to its specific needs and problems. Based on an airport’s specific needs, certain master planning elements may be emphasized while others will not be considered at all.”

As a concept-level planning and feasibility study, the OAK master plan focuses on short-term planning strategies and long-term planning principles, not specific airport projects or facilities. If and when any possible development contemplated in the OAK master plan should ripen into a project that the Port may wish to pursue and approve, the Port will follow all environmental regulations and permit requirements required of specific project-level planning, including environmental review in accordance with the National Environmental Policy Act (NEPA) and/or the California Environmental Quality Act (CEQA).

As such, when it considers approval of the OAK master plan, the Board of Port Commissioners will not be deciding to propose or approve any specific project or groups of projects. Rather, any project identified in the OAK master plan would need to undergo more detailed planning, engineering and environmental review before it could proceed, including understanding how much it might cost, how it is going to be funded, and importantly, its environmental effects (through a CEQA and NEPA process). Only then could a project or groups of related projects be approved by the Board and proceed into construction. For additional discussion on environmental considerations in the master plan, see Appendix K.

6.2 Wetlands

Figure 6.1 shows the wetlands and other water bodies on the Airport that are under jurisdiction of the U.S. Army Corps of Engineers. According to the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency, wetlands are areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. As described in Figure 2.2, there are approximately 327 acres of jurisdictional wetlands, the majority of which are located on South Field in the Central Basin and around Runway 11-29.

The list of planning considerations for each of the potential development areas (Chapter 3) and the potential airfield development (Chapter 4) noted if the potential development would likely impact on Airport wetlands. If a potential project that impacts wetlands were to proceed, the Port would need to obtain permits to fill the wetlands and would be required to mitigate the effects by replacing wetlands at another (preferably off-Airport) location. It is important to note that while wetlands are environmentally beneficial and, in some locations on the Airport, serve an important drainage function (e.g., filtering storm water runoff), they also attract birds, which can pose a serious safety hazard to aircraft operations.

6.3 Aircraft Noise

This section presents background on aircraft noise (Sections 6.3.1 through Section 6.3.5), discusses existing aircraft noise control programs at OAK (Section 6.3.6), and presents the results of aircraft noise modeling, which compares existing (2004) aircraft noise contours with anticipated 2010 aircraft noise contours, assuming the aircraft operations forecasts developed in Chapter 3 (Sections 6.3.7 through 6.3.9).
6.3.1 Background

This section presents background information on the characteristics of noise. Noise analyses involve the use of technical terms that are used to describe aviation noise. This section provides an overview of the metrics and methodologies used to assess the effects of noise.

Characteristics of Sound

Sound Level and Frequency — Sound can be technically described in terms of the sound pressure (amplitude) and frequency (similar to pitch). Sound pressure is a direct measure of the magnitude of a sound without consideration for other factors that may influence its perception.

The range of sound pressures that occur in the environment is so large that it is convenient to express these pressures as sound pressure levels on a logarithmic scale that compresses the wide range of sound pressures to a more usable range of numbers. The standard unit of measurement of sound is the Decibel (dB) that describes the pressure of a sound relative to a reference pressure.

The frequency (pitch) of a sound is expressed as Hertz (Hz) or cycles per second. The normal audible frequency for young adults is 20 Hz to 20,000 Hz. Community noise, including aircraft and motor vehicles, typically ranges between 50 Hz and 5,000 Hz. The human ear is not equally sensitive to all frequencies, with some frequencies judged to be louder for a given signal than others. See Figure 6.2. As a result of this, various methods of frequency weighting have been developed. The most common weighting is the A-weighted noise curve (dBA). The A-weighted decibel scale (dBA) performs this compensation by discriminating against frequencies in a manner approximating the sensitivity of the human ear. In the A-weighted decibel, everyday sounds normally range from 30 dBA (very quiet) to 100 dBA (very loud). Most community noise analyses are based upon the A-weighted decibel scale. Figure 6.3 shows the A-weighted scale compared to other scales such as the C-weighted scale, which is more sensitive to low frequency noise and used in assessing hearing loss in occupational or recreational exposures to noise. The C-weighted scale has also been used to quantify low frequency noise in the environment, but such use is crude and can be misleading. Changes in C-weighted scale noise do not mean changes in low frequency noise. The C-weighted scale also measures higher frequency sounds, and therefore a change in the C-weighted scale measurement could be due to low or high frequency sounds. If low frequency noise impacts are to be identified, measurements in frequency bands are the best method of defining low frequency noise.

Sources of Aircraft Noise — The noise generated by an aircraft flight is quite complex. The sound sources can be described in four broad categories: jet noise (the mixing of high velocity exhaust gases with ambient air), combustor noise (the noise associated with the rapid oxidation of jet fuel and the associated release of energy), turbomachinery noise (often noticed as an aircraft is coming towards you), and aerodynamic noise (the noise associated with rapid air movement over the airframe and control surfaces). New technologies in modern aircraft have achieved significant reductions in jet noise and combustor noise. Turbomachinery noise has also been reduced in newer aircraft. Aerodynamic noise is a current area of acoustic research to reduce aircraft noise. As jet noise, combustor noise and turbomachinery noise are reduced, aerodynamic noise may remain as the major noise source on aircraft of the future.

Propagation of Noise — Outdoor sound levels decrease as the distance from the source increases, and as a result of wave divergence, atmospheric absorption and ground attenuation. Sound radiating from a source in a homogeneous and undisturbed manner travels in spherical waves. As the sound wave travels away from the source, the sound energy is dispersed over a greater area decreasing the sound power of the wave. Spherical spreading of the sound wave reduces the noise level at a rate of 6 dB per doubling of the distance. Atmospheric absorption also influences the levels received by the observer. The greater the distance traveled, the greater the influence of the atmosphere and the resultant fluctuations. Atmospheric absorption becomes important at distances of greater than 1,000 feet. The degree of absorption varies depending on the frequency of the sound as well as the humidity and temperature of the air. For example, atmospheric absorption is lowest (i.e., sound carries farther) at high humidity and high temperatures. Schematic atmospheric effects diagrams are presented in Figure 6.4. Turbulence and gradients of wind, temperature and humidity play a significant role in determining the propagation of sound over a large distance. At short distances between the source and receiver, atmospheric effects are minimal. Certain conditions, such as inversions, can channel or focus the sound waves resulting in higher noise levels than would result from simple spherical spreading. Absorption effects in the atmosphere vary with frequency. The higher frequencies are more readily absorbed than the lower frequencies. Over large distances, the lower frequencies become the dominant sound as the higher frequencies are attenuated.

The effect of sound reflecting across a water surface has an even more profound effect than weather. Sound propagating over water is louder than propagating over land as the result of the reflective characteristics of water. Shielding of noise by a structure also can have significant effects on noise. Structures such as buildings, homes, sound walls, etc., block the straight line propagation of sound. Homes shielded by these structures receive a lower noise level than without the intervening structures.
**Duration of Sound** — annoyance from a noise event increases with increased duration of the noise event (i.e., the longer the noise event, the more annoying it is). The “effective duration” of a sound is the time between when a sound rises above the background sound level until it drops back below the background level. Psycho-acoustic studies have determined the relationship between duration and annoyance and the amount a sound must be reduced to be judged equally annoying for increased duration. Duration is an important factor in describing sound in a community setting.

The relationship between duration and noise level is the basis of the equivalent energy principal of sound exposure. Reducing the acoustic energy of a sound by one half results in a 3 dB reduction. Doubling the duration of the sound increases the total energy of the event by 3 dB. This equivalent energy principal is based upon the premise that the potential for a noise to impact a person is dependent on the total acoustical energy content of the noise. Defined in Section 6.3.2, noise metrics such as CNEL, DNL, Leq and SEL are all based upon the equal energy principle.

**Change in Noise** — the concept of change in ambient sound levels can be understood with an explanation of the hearing mechanism’s reaction to sound. The human ear is a far better detector of relative differences in sound levels than absolute values of levels. Under controlled laboratory conditions, listening to a steady unwavering pure tone sound that can be changed to slightly different sound levels, a person can just barely detect a sound level change of approximately 1 decibel for sounds in the mid-frequency region. When ordinary noises are heard, a young healthy ear can detect changes of two to 3 decibels. A 5 decibel change is readily noticeable while a 10 decibel change is judged by most people as a doubling or a halving of the loudness of the sound. It is typical in environmental documents to consider a 3 dB change as potentially discernable.

**6.3.2 Sound Rating Scales**

The description, analysis, and reporting of community sound levels is made difficult by the complexity of human response to sound and myriad of sound-rating scales and metrics developed to describe acoustic effects. Various rating scales approximate the human subjective assessment to the “loudness” or “noisiness” of a sound. Noise metrics have been developed to account for additional parameters such as duration and cumulative effect of multiple events.

Noise metrics are categorized as single event metrics and cumulative metrics. Single event metrics describe the noise from individual events, such as one aircraft flyover. Cumulative metrics describe the noise in terms of the total noise exposure throughout the day. Noise metrics used in this study are summarized below.

**Single Event Metrics**

**Frequency Weighted Metrics (dBA)** — In order to simplify the measurement and computation of sound loudness levels, frequency weighted networks have obtained wide acceptance. The A-weighting (dBA) scale has become the most prominent of these scales and is widely used in community noise analysis. Its advantages are that it has shown good correlation with community response and is easily measured. The metrics used in this study are all based upon the dBA scale.

**Maximum Noise Level** — The highest noise level reached during a noise event is called the “Maximum Noise Level,” or Lmax. For example, as an aircraft approaches, the sound of the aircraft begins to rise above ambient noise levels. The closer the aircraft gets, the louder it is until the aircraft is at its closest point directly overhead. Then as the aircraft passes, the noise level decreases until the sound level again settles to ambient levels. Such a history of a flyover is plotted at the top of Figure 6.5. It is this metric to which people generally instantaneously respond when an aircraft flyover occurs.

**Single Event Noise Exposure Level (SENEL) or Sound Exposure Level (SEL)** — Another metric that is reported for aircraft flyovers is the Sound Exposure Level (SEL). This metric is essentially equivalent to the metric Single Event Noise Exposure Level (SENEL). It is computed from dBA sound levels. Referring to Figure 6.5, the shaded area, or the area within 10 dB of the maximum noise level, is the area from which the SEL is computed. The SEL value is the integration of all the acoustic energy contained within the event. Speech and sleep interference research can be assessed relative to Sound Exposure Level data.

The SEL metric takes into account the maximum noise level of the event and the duration of the event. For aircraft flyovers, the SEL value is typically about 10 dBA higher than the maximum noise level. Single event metrics are a convenient method for describing noise from individual aircraft events. This metric is useful in that airport noise models contain aircraft noise curve data based upon the SEL metric. In addition, cumulative noise metrics such as Leq, CNEL and DNL can be computed from SEL data.

**Cumulative Metrics**

Cumulative noise metrics assess community response to noise by including the loudness of the noise, the duration of the noise, the total number of noise events, and the time of day these events occur into one single number rating scale.

**Equivalent Noise Level (Leq)** — Leq is the sound level corresponding to a steady-state A-weighted sound level containing the same total energy as several SEL events during a given sample period. Leq is the “energy” average noise level during the time period of the sample. It is based on the observation that the potential for noise annoyance is dependent on the total acoustical energy content of the noise. This is
Community Noise Equivalent Level (CNEL) — CNEL is a 24-hour, time-weighted energy average noise level based on the A-weighted decibel. It is a measure of the overall noise experienced during an entire day. The term “time-weighted” refers to the penalties attached to noise events occurring during certain sensitive time periods. In the CNEL scale, noise occurring between 7 PM and 10 PM is penalized by approximately 3 dB. This penalty accounts for the greater potential for noise to cause communication interference during these hours, as well as typically lower ambient noise levels during these hours. Noise that takes place during the night (10 PM to 7 AM) is penalized by 10 dB. This penalty was selected to attempt to account for the higher sensitivity to noise in the nighttime and the expected further decrease in background noise levels that typically occur in the nighttime.

CNEL is graphically illustrated in the bottom of Figure 6.6. Another way to think of a cumulative noise metric like CNEL is to compare CNEL to a “noise bucket.” Each single event noise event contributes to the overall “noise bucket.” An event during evening hours counts as 3 events and an event at night counts as 10 events. This is shown schematically in Figure 6.7. Examples of various noise environments in terms of CNEL are presented in Figure 6.8. CNEL is specified for use in the California Airport Noise Regulations and is used by local planning agencies in their General Plan Noise Element for land-use compatibility planning.

Day Night Noise Level (DNL) — The DNL index is very similar to CNEL but does not include the evening (7 PM to 10 PM) penalty that is included in CNEL. It does however include the nighttime (10 PM to 7 AM) penalty. Typically DNL is about 1 dB lower than CNEL, although the difference may be greater if there is an abnormal concentration of noise events in the 7 AM to 10 PM time period. DNL is specified by the FAA for airport noise assessment and by the Environmental Protection Agency (EPA) for community noise and airport noise assessment. The FAA guidelines (described later) allow for the use of CNEL as a substitute to DNL.

Factors That Affect Individual Annoyance to Noise

<table>
<thead>
<tr>
<th>Primary Acoustic Factor</th>
<th>Secondary Acoustic Factors</th>
<th>Non-acoustic Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sound Level</td>
<td>Spectral Complexity</td>
<td>Physiology</td>
</tr>
<tr>
<td>Frequency</td>
<td>Fluctuations in Sound Level</td>
<td>Adaptation and Past Experience</td>
</tr>
<tr>
<td>Duration</td>
<td>Fluctuations in Frequency</td>
<td>How the Listener’s Activity Affects Annoyance</td>
</tr>
<tr>
<td>Rise-time of the Noise</td>
<td></td>
<td>Predictability of When a Noise will Occur</td>
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<tr>
<td>Localization of Noise Source</td>
<td></td>
<td>Is the Noise Necessary?</td>
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Source: C. Harris, 1979

Factors Influencing Human Response to Sound

Many factors influence sound perception and annoyance. This includes not only physical characteristics of the sound but also secondary influences such as sociological and external factors. Molino, in the Handbook of Noise Control, describes human response to sound in terms of both acoustic and non-acoustic factors. These factors are summarized in Table 6.1.

Sound rating scales are developed in reaction to the factors affecting human response to sound. Nearly all of these factors are relevant in describing how sounds are perceived in the community. Many non-acoustic parameters play a prominent role in affecting individual response to noise. Fields, in his analysis of the effects of personal and situational variables on noise annoyance, has identified a clear association of reported annoyance and various other perceptions or beliefs. In particular, Fields stated: “There is therefore firm evidence that noise annoyance is associated with: (1) the fear of an aircraft crashing or of danger from nearby surface transportation; (2) the belief that airport noise could be prevented or reduced by designers, pilots or authorities related to airlines; and (3) an expressed sensitivity to noise generally.” Thus, it is important to recognize that non-acoustic factors such as the ones described above as well as acoustic factors contribute to human response to noise.

Effects of Noise on Humans

Noise, often described as unwanted sound, is known to have several adverse effects on humans. From these known adverse effects of noise, criteria have been established to help protect the public health and safety and prevent disruption of certain human activities. These criteria are based on effects of noise on people such as hearing loss (not a factor with typical community noise), communication interference, sleep interference, physiological responses, and annoyance. Each of these potential noise impacts on people are briefly discussed in the following narrative.
Annoyance
Annoyance is the most difficult of all noise responses to describe. Annoyance is a very individual characteristic and can vary widely from person to person. What one person considers tolerable can be quite unbearable to another of equal hearing capability. The level of annoyance, of course, depends on the characteristics of the noise (i.e., loudness, frequency, time, and duration), and how much activity interference (e.g., speech interference and sleep interference) results from the noise. However, the level of annoyance is also a function of the attitude of the receiver. Personal sensitivity to noise varies widely. It has been estimated that 2% to 10% of the population is highly susceptible to annoyance from any noise not of their own making, while approximately 20% are unaffected by noise. Attitudes are affected by the relationship between the person and the noise source (is it our dog barking or the neighbor’s dog?). Whether we believe that someone is trying to abate the noise will also affect our level of annoyance.

Annoyance levels have been correlated to CNEL levels. Figure 6.9 relates CNEL noise levels to community response based on community response surveys. It displays the percent of a population that can be expected to be annoyed by CNEL noise exposure levels in airport related studies.

Sleep Interference
Sleep interference is a major noise concern in noise assessment and, of course, is most critical during nighttime hours. Sleep disturbance is one of the major causes of annoyance due to community noise. Noise can make it difficult to fall asleep, create momentary disturbances of natural sleep patterns by causing shifts from deep to lighter stages and cause awakening. Noise may even cause awakening that a person may or may not be able to recall.

Extensive research has been conducted on the effect of noise on sleep disturbance. Recommended values for desired sound levels in residential bedroom space range from 25 to 45 dBA, with 35 to 40 dBA being the norm. In 1981, the National Association of Noise Control Officials published data on the probability of sleep disturbance with various single event noise levels. Based on laboratory experiments conducted in the 1970s, this data indicated noise exposure at 75 dBA interior noise level event will cause noise induced awakening in 30% of the cases.

However, recent research from England has shown that the probability for sleep disturbance is less than what had been reported in earlier research. These recent field studies conducted during the 1990s and using new sophisticated techniques indicate that awakenings can be expected at a much lower rate than had been expected based on earlier laboratory studies. This research showed that once a person was asleep, it is much more unlikely that they will be awakened by a noise. The significant difference in the recent English study is the use of actual in-home sleep disturbance patterns as opposed to laboratory data that had been the historic basis for predicting sleep disturbance. Some of this research has been criticized because it was conducted in areas where subjects had become habituated to aircraft noise. On the other hand, some of the earlier laboratory sleep studies had been criticized because of the extremely small sample sizes of most laboratory studies and because the laboratory was not necessarily a representative sleep environment.

The Federal Interagency Committee on Noise (FICON) in 1992 in a document entitled Federal Interagency Review of Selected Airport Noise Analysis Issues recommended an interim dose-response curve for sleep disturbance based on laboratory studies of sleep disturbance. In June of 1997, the Federal Interagency Committee on Aviation Noise (FICAN) updated the FICON recommendation with an updated curve based on the more recent in-home sleep disturbance studies that show lower rates of awakening compared to the laboratory studies. The FICAN recommended a curve based on the upper limit of the data presented and therefore considers the curve to represent the “maximum percent of the exposed population expected to be behaviorally awakened,” or the “maximum awakened.” The FICAN recommendation is shown on Figure 6.10. This is a very conservative approach. A more common statistical curve for the data points reflected in Figure 6.10, for example, would indicate a 10% awakening rate at a level of approximately 100 dB SEL, while the “maximum awakened” curve reflected in Figure 6.10 shows the 10% awakening rate being reached at 80 dB SEL. (The full FICAN report can be found on the internet at www.ficdn.org.)

Hearing Loss
Hearing loss is generally not a concern in community noise problems, even very near a major airport or a major freeway. The potential for noise induced hearing loss is more commonly associated with occupational noise exposures in heavy industry, very noisy work environments with long term exposure, or certain very loud recreational activities such as target shooting, motor cycle or car racing, etc. The Occupational Safety and Health Administration (OSHA) identifies a noise expo-
sure limit of 90 dBA for 8 hours per day to protect from hearing loss (higher limits are allowed for shorter duration exposures). Noise levels in neighborhoods, even in very noisy neighborhoods, are not sufficiently loud to cause hearing loss.

Communication Interference
Communication interference is one of the primary concerns in environmental noise problems. Communication interference includes speech interference and interference with activities such as watching television. Normal conversational speech is in the range of 60 to 65 dBA and any noise in this range or louder may interfere with speech. There are specific methods of describing speech interference as a function of distance between speaker and listener and voice level.

Physiological Responses
Physiological responses are those measurable effects of noise on people that are realized as changes in pulse rate, blood pressure, etc. While such effects can be induced and observed, the extent is not known to which these physiological responses cause harm or are a sign of harm. Generally, physiological responses are a reaction to a loud short-term noise such as a rifle shot or a very loud jet overflight. Health effects from noise have been studied around the world for nearly 30 years. Scientists have attempted to determine whether high noise levels can adversely affect human health, apart from auditory damage that is amply understood. These research efforts have covered a broad range of potential impacts from cardiovascular response to fetal weight and mortality. Yet while a relationship between noise and health effects seems plausible, it has yet to be convincingly demonstrated (i.e., shown in a manner that can be repeated by other researchers while yielding similar results).

While annoyance and sleep / speech interference have been acknowledged, health effects, if they exist, are associated with a wide variety of other environmental stressors. Isolating the effects of aircraft noise alone as a source of long-term physiological change has proved to be almost impossible. In a review of 30 studies conducted worldwide between 1993 and 1998, a team of international researchers concluded that, while some findings suggest that noise can affect health, improved research concepts and methods are needed to verify or discredit such a relationship. They called for more study of the numerous environmental and behavioral factors than can confound, mediate, or moderate survey findings. Until science refines the research process, a direct link between aircraft noise exposure and non-auditory health effects remains to be demonstrated. The World Health Organization (WHO) has made quite specific findings on the potential of environmental noise to cause health impacts.

“The overall conclusion is that cardiovascular effects are associated with long-term exposure to LAeq, 24h values in the range of 65–70 dB or more, for both air- and road-traffic noise. However, the associations are weak and the effect is somewhat stronger for ischemic heart disease than for hypertension. Other observed psychophysiological effects, such as changes in stress hormones, magnesium levels, immunological indicators, and gastrointestinal disturbances are too inconsistent for conclusions to be drawn about the influence of noise pollution.” (Source: WHO Guidelines, Section 3.5, Cardiovascular and Physiological Effects).

In other words, the World Health Organization believes that health effects do not occur at noise levels less than 65 CNEL.

School Room Effects
Interference with classroom activities and learning from aircraft noise is an important consideration and the subject of much recent research. Studies from around the world indicate that vehicle traffic, railroad, and aircraft noise can have adverse effects on reading ability, concentration, motivation, and long term learning retention. A complicating factor in this research is the extent of background noise from within the classroom itself. The studies indicating the most adverse effects examine cumulative noise levels equivalent to 65 CNEL or higher and single event maximum noise levels ranging from 85 to 95 dBA. In other studies, the level of noise is unstated or ambiguous. According to these studies, a variety of adverse school room effects can be expected from interior noise levels equal to or exceeding 65 CNEL and/or 85 dBA SEL.

Some interference with classroom activities can be expected with noise events that interfere with speech. As discussed above, speech interference begins at 65 dBA, which is the level of normal conversation. Typical construction attenuates outdoor noise by 20 dBA with windows closed and 12 dBA with windows open. Thus some interference of classroom activities can be expected at outdoor levels of 77 to 85 dBA.

6.3.5 Noise / Land-Use Compatibility Guidelines

Noise metrics are used to quantify community response to various noise exposure levels. The public reaction to different noise levels has been estimated from extensive research on human responses to exposure of different levels of aircraft noise. Noise standards generally are expressed in terms of the DNL 24-hour average scale (CNEL in California) based on the A-weighted decibel. Utilizing these metrics and surveys, agencies have developed standards for assessing the compatibility of various land uses with the noise environment. There are no single event noise based land-use compatibility criteria that have been adopted by the federal government or State of California.

A summary of some of the more pertinent regulations and guidelines are presented in the following paragraphs.
Federal Aviation Administration
Federal Aviation Regulations (FAR), Part 36, "Noise Standards: Aircraft Type and Airworthiness Certification" — Originally adopted in 1960, FAR Part 36 prescribes noise standards for issuance of new aircraft type certificates. Part 36 prescribes limiting noise levels for certification of new types of propeller-driven, small airplanes as well as for transport-category, large airplanes. Subsequent amendments extended the standards to certain newly produced aircraft of older type designs. Other amendments have at various times extended the required compliance dates. Aircraft may be certificated as Stage 1, Stage 2, or Stage 3 aircraft based on their noise level, weight, number of engines and in some cases number of passengers. Stage 1 aircraft are no longer permitted to operate in the U.S. Stage 2 aircraft are being phased out of the U.S. fleet as discussed below on the Airport Noise and Capacity Act of 1990. Although aircraft meeting Part 36 standards are noticeably quieter than many of the older aircraft, the regulations make no determination that such aircraft are acceptably quiet for operation at any given airport. Stage 4 noise limits are in the process of being adopted.

Aviation Safety and Noise Abatement Act of 1979 — Further weight was given to the FAA’s supporting role in noise compatibility planning by Congressional adoption of this legislation. Among the stated purposes of this act is “To provide assistance to airport operators to prepare and carry out noise compatibility programs.” The law establishes funding for noise compatibility planning and sets the requirements by which airport operators may apply for funding. This is also the law by which Congress mandated that FAA develop an airport community noise metric that would be used by all federal agencies assessing or regulating aircraft noise. The result was DNL. Because California already had a well-established airport community noise metric in CNEL, and because CNEL and DNL are so similar, FAA expressly allows CNEL to be used in lieu of DNL in noise assessments performed for California airports. The law does not require any airport to develop a noise compatibility program.

Federal Aviation Regulations (FAR), Part 150, “Airport Noise Compatibility Planning” — As a means of implementing the Aviation Safety and Noise Abatement Act, the FAA adopted regulations on Airport Noise Compatibility Planning programs. These regulations are contained in FAR Part 150. As part of the FAR Part 150 Noise Control Program, the FAA published noise and land-use compatibility charts to be used for land-use planning with respect to aircraft noise. An expanded version of this chart appears in FAA AC No. 150/5020-1 (dated August 5, 1983) and is provided in summary form in Figure 6.11. These guidelines represent recommendations to local authorities for determining acceptability and permissibility of land uses. The guidelines recommend a maximum amount of noise exposure (in terms of the cumulative noise metric DNL) that might be considered acceptable or compatible to people in living and working areas. These noise levels are derived from case histories involving aircraft noise problems at civilian and military airports and the resultant community response. Note that residential land use is deemed acceptable for noise exposures up to 65 dB DNL. Recreational areas are also considered acceptable for noise levels above 65 dB DNL (with certain exceptions for amphitheaters). However the FAA guidelines indicate that ultimately “the responsibility for determining the acceptability and permissible land uses remains with the local authorities.”

Airport Noise and Capacity Act of 1990 — The Airport Noise and Capacity Act of 1990 (PL 101-508, 104 Stat. 1388), also known as ANCA or the Noise Act, established two broad directives to the FAA: (1) establish a method to review aircraft noise, airport use or airport access restrictions, imposed by airport proprietors; and (2) institute a program to phase-out Stage 2 aircraft over 75,000 pounds by December 31, 1999. Stage 2 aircraft are older, noisier aircraft (Boeing 737-200, Boeing 727, and Boeing / McDonnell Douglas DC-9); Stage 3 aircraft are newer, quieter aircraft (Boeing 737-300, Boeing 757, Boeing / McDonnell Douglas MD80/90). To implement ANCA, FAA amended Part 91 and issued a new Part 161 of the Federal Aviation Regulations. Part 91 addresses the phase-out of Stage 2 aircraft and the phase-in of Stage 3 aircraft. Part 161 establishes a stringent review and approval process for implementing use or access restrictions by airport proprietors.

Part 91 generally required that all Stage 2 aircraft over 75,000 pounds be out of the domestic fleet by December 31, 1999. The State of Hawaii and Alaska are not affected by this regulation. The agency may, for individual cases, grant waivers through 2002. But for the most part, only Stage 3 aircraft greater than 75,000 pounds are in the domestic fleet as of that date.

Part 161 sets out the requirements and procedures for implementing new airport use and access restrictions by airport proprietors. Proprietors must use the DNL metric to measure noise effects and the Part 150 land-use guideline table, including 65 dB DNL, as the threshold contour to determine compatibility, unless there is a locally adopted standard that is more stringent. CNEL is an acceptable surrogate for DNL.

The regulation identifies three types of use restrictions and treats each one differently: (1) negotiated restrictions; (2) Stage 2 aircraft restrictions, and (3) Stage 3 aircraft restrictions. Generally speaking, any use restriction affecting the number or times of aircraft operations will be considered an access restriction. Even though the Part 91 phase-out does not apply to aircraft under 75,000 pounds, FAA has determined that Part 161 limitations on proprietors’ authority applies as well to the smaller aircraft.
Negotiated restrictions are more favorable from the FAA’s standpoint, but still require unwieldy procedures for approval and implementation. In order to be effective, the agreements normally must be agreed to by all airlines using the airport.

Stage 2 restrictions are more difficult because one of the major reasons for ANCA was to discourage local restrictions more stringent than 1999 phase-out already contained in ANCA. To comply with the regulation and institute a new Stage 2 restriction, the proprietor must generally do two things: (1) prepare a cost/benefit analysis of the proposed restriction and (2) give proper notice. The cost/benefit analysis is extensive and entails considerable evaluation. Stage 2 restrictions do not require approval by the FAA.

Stage 3 restrictions are even more difficult to implement. A Stage 3 restriction involves considerable additional analysis, justification, evaluation, and financial discussion. In addition, a Stage 3 restriction must result in a decrease in noise exposure of the 65 dB DNL to noise sensitive land uses (residences, schools, churches, parks). The regulation requires both public notice and FAA approval.

ANCA applies to all new local noise restrictions and amendments to existing restrictions proposed after October 1990.

State of California

California Airport Noise Regulations — The Aeronautics Division of the California Department of Transportation (Caltrans) enforces the California Airport Noise Regulations. These regulations establish 65 CNEL as a noise impact boundary within which there shall be no incompatible land uses. This requirement is based, in part, upon the determination in the Caltrans regulations that 65 CNEL is the level of noise which should be acceptable to “a reasonable man residing in the vicinity of an airport.” Airports are responsible for achieving compliance with these regulations. Compliance can be achieved through noise abatement alternatives, land acquisition, land-use conversion, land-use restrictions, or sound insulation of structures. Airports not in compliance can operate under variance procedures established within the regulations.

California Noise Insulation Standards — California Noise Insulation Standards apply to all multi-family dwellings built in the State. Single-family residences are exempt from these regulations. With respect to community noise sources, the regulations require that all multi-family dwellings with exterior noise exposures greater than 60 CNEL be sound insulated such that the interior noise level will not exceed 45 CNEL. These requirements apply to all roadway, rail, and airport noise sources.

General Plan Requirements — The State of California requires that all municipal General Plans contain a Noise Element. The requirements for the Noise Element of the General Plan include describing the noise environment quantitatively using a cumulative noise metric such as CNEL or DNL, establishing noise/land-use compatibility criteria, and establishing programs for achieving and/or maintaining compatibility. Noise elements shall address all major noise sources in the community including mobile and stationary sources.

Airport Land Use Commissions — Airport Land Use Commissions were created by State Law for the purpose of establishing a regional level of land-use compatibility between airports and their surrounding environs. The Alameda County Airport Land Use Commission has adopted an Airport Environments Land Use Plan (AELUP) for Alameda airports including OAK. The AELUP establishes noise/land-use acceptability criteria for sensitive land uses at up to 70 CNEL for outdoor areas and 45 CNEL for indoor areas of residential land uses. The Alameda standard is considerably more permissive than the standard set by the State of California or the guidelines established by the FAA.

6.3.6 Noise Analysis Methodology

The methods used for describing existing noise and forecasting the future noise environment rely heavily on computer noise modeling. The noise environment is commonly depicted in terms of lines of equal noise levels, or noise contours. The computer noise models used for master plan aircraft noise analyses are described below.

Noise contour modeling is a key element of the aircraft noise analyses performed for this master plan. Generating accurate noise contours is largely dependent on the use of a reliable, validated, and updated noise model. The computer model can then be used to predict the changes to the noise environment as a result of any alternatives under consideration.

For the master plan, the FAA’s Integrated Noise Model (INM) Version 6.01c was used to model aircraft operations at OAK. The INM has an extensive database of civilian and military aircraft noise characteristics, and this most recent version of INM incorporates advanced plotting features. Noise contour files from the INM were loaded into Arcview Geographic Information System (GIS) software for plotting and land-use analysis. All of the noise contours presented in this master plan were developed by Brown-Buntin Associates as a subcontractor to Mestre Greve Associates.
6.3.7 Existing Noise Control Program

The Port has adopted a comprehensive noise control program to minimize and mitigate the effects of aircraft noise. This program affects various modeling assumptions. For example, it is assumed that all elements of the Port’s existing noise control program would remain in effect through the 2010 to 2012 timeframe. This program can be described in terms of the following broad categories:

- Noise Management Measures
- Noise Abatement Procedures
- Community Outreach and Public Participation
- Community Land-Use Measures
- Noise Reduction Programs, Studies and Other Commitments

These elements of the program are described in outline form in Figure 6.12, and a detailed explanation of each program is contained in a program description from the Port’s Aviation Noise / Environmental Management Office.

6.3.8 Aircraft Single Event Noise Contours

Single event noise levels, reported here in terms of Sound Exposure Level (SEL), vary by aircraft type. Even for a given aircraft type, airlines operate at different weights depending on destination and load factor. SEL contours are presented to compare the difference in noise level that different aircraft make. Figure 6.13 and Figure 6.14 show the SEL contours for arrivals and departures to Runway 29 for a variety of the major aircraft that use this runway. In Figure 6.13, single event contours are shown for the Boeing 727 Hushkit aircraft and the narrow-body twin-engine jet aircraft, such as the Boeing 737 and Airbus A320 family. The Boeing 727 Hushkit is one of the noisiest aircraft that operates at OAK, and the scale of the map used for the Boeing 727 contour set is much smaller than the scale used for the other contour sets. The Boeing 737 and Airbus A320 families are the main workhorses for air carrier operations at OAK. Figure 6.14 shows single event contour sets for the wide-body twin-engine aircraft such as the Boeing 767 and Airbus A300 family and contour sets for the 3-engine wide-body aircraft such as the Boeing / McDonnell Douglas MD-11 and older Boeing / McDonnell Douglas DC-10. The Boeing 767 and Airbus A300 contours are important because these are the aircraft that will likely replace the noisier aging Boeing 727 Hushkit aircraft. Figure 6.13 and Figure 6.14 include tables comparing the existing number of average daily operations in 2004 and the forecast number in 2010 for these types of aircraft. Data are provided for the day, evening, and night hours (corresponding to the CNEL time periods) for departures and arrivals. These data show a decrease in the number of operations forecast for the B727 Hushkit aircraft, and an increase in the number of operations for the newer types of aircraft.

6.3.9 Existing CNEL Noise Contours

CNEL contours for 2004 are presented in Figure 6.15. These contours were developed by Brown-Burtn Associates for the Oakland Annual Noise Report for 2004 and are reproduced here on an aerial photograph. The 65 CNEL contour, shown as a dashed blue line, encroaches on the southern edge of Bay Farm Island and the southern end of San Lorenzo near San Francisco Bay.

6.3.10 Future (2010) CNEL Noise Contours

CNEL contours for the forecast number of operations in 2010 (as developed in Chapter 3) are shown in Figure 6.16. The 2010 CNEL contours are compared with existing (2004) CNEL contours in Figure 6.17. Existing 2004 CNEL contours are shown as dashed lines, and forecast 2010 CNEL contours are shown as solid lines. The forecast 2010 CNEL contours are slightly smaller than the current (2004) contours. Because of the forecast change in the aircraft fleet mix, the contours are smaller even though the operations increase. In particular, the number of B727 Hushkit operations decrease (but are not eliminated) in 2010. It is important to note that all of the new technology aircraft being built today are quieter than the aircraft they replace. This is true for the newest members of the Boeing 737 family and particularly true for aircraft like the Boeing 777 and new Boeing 787. The transition to the newer, quieter technology aircraft is being enhanced by the lower fuel consumption of these aircraft, which provides a strong incentive for airlines to modernize their aircraft fleet.

6.4 Other Airport Environmental Programs and Policies

The Port attempts to promote a sustainable operating environment at OAK, whether looking at current day-to-day operations or forecasting future needs and requirements.

In November 2000, the Board of Port Commissioners adopted a policy directing Port staff to "implement a sustainable development strategy as an overarching principle guiding the Port of Oakland's operations and development programs, with the goal of making the Port a sustainable public agency and business enterprise." The November 2000 Port Sustainability Policy seeks to support all of the "Three Es": environmental responsibility, economic vitality, and social equity. The Airport supports this policy through a variety of programs and policies that are coordinated through the Port’s Aviation Noise / Environmental Management Office and Environment and Safety Department in the Engineering Division. Environmental responsibility and stewardship is incorporated into many different aspects of Airport projects, including engineering / design, project development, environmental review, construction (contracts / plans and specifications), and monitoring (health and safety compliance).
In addition, the Airport has several ongoing environmental programs at the Airport, including:

- Air Quality and Alternative Fuels
- Construction Mitigation
- Green Building and LEED Certification
- Recycling / Waste Reduction
- Water Quality
- Water and Wetlands
- Wildlife Management

Each of these environmental programs is described in more detail in the following sections, and are summarized in Figure 6.18.

The Port has received several awards for its efforts in environmental stewardship through the programs described in the following sections. For example, the Port was recognized as one of the best examples of urban sustainability at the 2005 United Nations World Environment Day conference in San Francisco. Below is a partial list of accomplishments and awards.

Alternative Fuel Program
- Over $1 million in grant funding was awarded for the purchase of cleaner burning fueled vehicles and supporting infrastructure at the Airport.
- Over 600,000 gasoline gallon equivalents (gge) were pumped at the OAK compressed natural gas (CNG) refueling station for the first five months of 2005.
- Awards include Natural Gas Vehicle Coalition, 2004 National Natural Gas Vehicle Achievement Award; Department of Energy, 2004 Finalist in the National Partner Award for Advancing Alternative Fuels; American Lung Association, 2003 Clean Air Award for Outstanding Leadership in increasing use of alternative fuels in the East Bay; and Bay Area Air Quality Management District, 2003 Clean Air Champion Award for outstanding leadership in advancing clean air vehicles.

Airport Recycling Program
- Over 450 tons of Airport-related material was recycled in 2004.
- Awards include Alameda County Stop Waste for recycling efforts, 2003; and Port Sustainability Award for the Airport’s recycling efforts, 2003.

Design
- Assisted FedEx in design of the 904-kilowatt photovoltaic system atop the roof of its leased facility (installed in 2005), which is expected to fuel 80% of the 81,000 square-foot facility’s energy needs.
- Awards include the Port 2003 Sustainability Awards for lighting retrofit in the terminal buildings, incorporating Green Design into the Terminal 2 renovation / extension project, and starting the “Dark Skies” program aimed at decreasing the impact of exterior lighting on the surrounding community and to conserve energy.

Public Access and Wetlands / Habitat
- Martin Luther King Jr. Regional Shoreline, located on Port property adjacent to the Airport, is a 1,220-acre regional shoreline offering picnicking, fishing, hiking, bicycling, boating, and bird-watching opportunities for the public.
- A bike trail on Ron Cowan Parkway has been completed, providing bike access between the Airport and Alameda.
- Oro Loma is approximately 16 acres of tidal and seasonal wetland that was created as mitigation for the Airport Development Program (ADP). It has achieved all the performance criteria established during the review and permitting process.

6.4.1 Air Quality and Alternative Fuels

Engine emissions from gasoline- or diesel-powered vehicles such as automobiles, trucks or aircraft service equipment, are some of the contributors of air pollution in the San Francisco Bay Area. OAK is actively working to reduce these emissions through its alternative fuels program, focusing on vehicles using CNG and biodiesel fuel, and rechargeable batteries; solar-power program; aircraft ground power and pre-conditioned air program; an employee trip-reduction program; and a multi-modal public transportation program with the Bay Area Rapid Transit (BART).

Compressed Natural Gas

OAK began incorporating alternative fuel vehicles into its fleet in 1999 because it recognized that it would contribute locally to cleaner air in the surrounding communities. OAK directed its energies towards vehicles using CNG, which are up to 95% cleaner than gas- or diesel-powered vehicles. Currently, OAK has 40 CNG vehicles in its fleet, including 11 buses that transport workers from the employee parking lot to the terminals.

In 2002, OAK and its partner, Clean Energy (formerly Pickens), opened a public access, self-service CNG station at North Field. The CNG station is always open and provides fuel to Port-owned vehicles; private ground transportation operators such as taxis, shuttle vans and limos making frequent trips to OAK; other public agencies; and the general public. The fuel station has four dispensers. As of June 2005, approximately 600,000 gallons (more accurately, gge) of fuel has been pumped compared to 430,000 gallons the previous year. With the growing popularity of this station, Clean Energy will open a second CNG station located at an off-Airport site on San Leandro Street in early 2006.

The Port’s Board of Port Commissioners passed two ordinances requiring taxis and ground transportation providers, such as door-to-door and hotel shuttles, that have two or more permits to have 50% of their fleet be powered by alternative fuel. And, through the use of incentives and grants, OAK’s alternative fuel vehicle program has been greatly expanded. To date, approxi-
mately 70% of taxis serving OAK are alternative fuel vehicles. Other ground transportation providers have converted 50% of their fleets to alternative fuel vehicles. The Port has secured two more grants to help offset the cost of purchasing 15 additional off-airport parking shuttles and five CNG AirBART shuttle buses. DHL also owns and operates four CNG delivery vans at OAK.

**Biodiesel**

Shuttles buses transporting passengers between the terminals and the rental car center at North Field are now using B20 Biodiesel, a cleaner-burning diesel fuel. The B20 Biodiesel fuel, a blend of 20% soybean-based Biodiesel and 80% diesel, is now powering the Airport’s fleet of 21 shuttle buses that serve the rental car center at North Field. The fleet averages a total of 304 trips daily between the terminal at South Field and the rental car center. Each bus has a 100-gallon fuel capacity.

B20 Biodiesel reduces the amount of harmful emissions from diesel engine vehicles into the air and is recognized as an alternative fuel by the Department of Energy and the U.S. Environmental Protection Agency. One of its major advantages is that it can be used in existing diesel engines and fuel injection equipment with little impact to operating performance.

**Rechargeable Batteries**

As the number and types of alternative fuel vehicles increase in popularity in the San Francisco Bay Area, OAK has installed a free battery charging program for travelers using the on-Airport parking lots. OAK’s electric vehicle charging stations are located in the Daily Parking, Lots A and B, and in the valet parking lot. The four charging stations have both conductive and inductive hook-ups. Additionally, OAK has introduced a fleet of 15 electric vehicles that are used by staff to monitor parking lots and roadways in an effort to reduce vehicle emissions.

**Ground Service Equipment (GSE) Alternative Fuel Program**

Most current GSE run on gasoline or diesel fuel. OAK is committed to working toward converting the entire GSE fleet to alternative fuel to mitigate for the potential increase in air emissions. The conversion of these vehicles is expected to reduce emissions at OAK. Currently, the Port is conducting an inventory of the equipment used at the Airport, as well as exploring grant opportunities to help airlines offset the cost of purchasing alternative fuel GSE.

**Solar Energy**

FedEx has implemented a solar-power energy program at the Metroplex. In 2005, FedEx installed a 904-kilowatt photovoltaic system atop the roof of its 81,000 square-foot facility that is expected to fuel 80% of the facility’s energy needs. At peak output, the system can produce the equivalent of power used by more than 900 homes during the daytime. In addition to generating electricity, the solar panels will help insulate the buildings, further reducing heating and cooling costs.

Over its expected 30-year lifespan, the system’s clean solar electricity will replace most of the fossil fuel-generated electricity that would have been purchased on the open market for the facility. Additionally, by avoiding the purchase of fossil-fuel generated electricity and implementing energy efficiency measures, this project will reduce carbon dioxide emissions by 10,800 tons over 30 years, equivalent to planting 3,000 acres of trees or removing almost 2,100 cars from California roadways.

The system will reduce demand on the utility grid and will serve as an additional source of power capacity to benefit businesses and residents of California. During periods when the energy generated by the system is greater than is needed to power the facility, the surplus energy will be transferred into the utility grid for general use.

**Trip Reduction Program**

The Port coordinates and provides commuter information such as shuttle schedules and timing, frequency, and stopping points of public transportation providers to serve the transportation needs of Airport employees and the various tenants. The Port conducted an employee commute survey of Airport tenants and staff in April 2004.

While 87% of respondents indicated they drive to work alone, a significant number of them indicated they would, if given some incentive, consider using alternative transportation. The Port is analyzing the data and will develop a trip reduction program that will identify on-site amenities, provide travel demand recommendations, develop communication material and work with the airlines and other major tenants to provide ongoing commute program support.
AirBART

AirBART is a bus system operated by the Port that links the Coliseum BART station with Terminals 1 and 2 (BART and the Port jointly share operating revenues and costs). In fiscal year 2005, AirBART carried over 1,171,000 riders. For the past several years, AirBART has experienced a 12.5% annual increase in ridership. OAK employees receive a discount for riding AirBART and approximately 3% of the ridership is attributed to employees. As ridership grows, the Port can add additional buses to the system to increase capacity, as is done today during peak periods (e.g., the Wednesday before Thanksgiving).

Aircraft Emissions

The Port is continuing its leadership role in aviation environmental issues through its participation in a recent study on aircraft-related emissions. Currently there is little data on emissions from commercial aircraft engines in the U.S. As a result, Port staff have been involved with recent efforts to collect important aircraft emissions information. The Port agreed to host a new study that involved collecting emissions data from aircraft engines. Southwest Airlines also joined this project by volunteering its aircraft for the experiment. The FAA and the University of Missouri-Rolla are working with scientists from National Aeronautics and Space Administration (NASA) and the California Air Resources Board to conduct the study.

6.4.2 Construction Mitigation

Construction associated with maintaining and upgrading existing facilities and pavement, or building new facilities at OAK generates construction debris. The Port has implemented several programs to address this issue.

Materials Management

The Terminal 2 extension / renovation project is currently underway. Because most of the construction is taking place on already developed land, tons of recyclable construction materials are being generated. Established in 2004, the airport’s Materials Management Program (MMP) diverts from public landfills recyclable construction materials such as concrete, asphalt and rebar from this and other Port projects, and converts it into reusable material for new airport construction and maintenance projects. The MMP has designated three on-airport sites for material stockpiling and recycling, allowing for the reduction of disposal and material purchasing costs and reduction of truck emissions associated with landfill disposal of waste.

It is estimated that over the next 5 years, the MMP will recycle and reuse over 200,000 cubic yards of construction materials and will save $5 million.

Construction Mitigation

A major component of project-level environmental mitigation measures are those related to construction projects. As such, the Airport has developed a construction site inspection checklist and field-monitoring follow-up to ensure contractor compliance with those measures identified in final plans and specifications. The field visits and checklists assist the Airport staff in:

- Monitoring and tracking compliance with mitigation measures identified in the EIR,
- Enforcing compliance,
- Assessing and tracking the effectiveness of applicable measures,
- Identifying mitigation measures that may require revision,
- Making recommendations for corrective action, and
- Maintaining clear communications among all responsible parties.

6.4.3 Green Building and LEED Certification

In accordance with the Port Sustainability Policy, the Airport has incorporated green building measures into the Terminal 2 renovation / extension project that is currently under construction. Green building strives to improve design and construction practices to protect natural resources and produce buildings that last longer, cost less to operate, and provide better environments for workers or residents. The Port is using the Leadership in Energy and Environmental Design (LEED) Green Building Rating System as a framework and will apply for LEED certification upon completion of the project. LEED is a voluntary, consensus-based national standard for developing high-performance, sustainable buildings. It emphasizes state-of-the-art strategies for sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality. Examples of green building measures in the project include:

- Water-efficient plumbing fixtures,
- Energy-efficient building design, lighting, heating, and cooling systems,
- Substantial recycling and salvaging of construction and demolition debris,
- Use of recycled-content and renewable building materials where feasible, and
- Use of low volatile organic compound (VOC)-emitting carpet, composite wood panels, glues, and paints.

OAK is one of the first airports in the nation to seek LEED certification.
6.4.4 Recycling / Waste Reduction

In-Terminal Recycling
With more than 8,000 Airport employees and 14 MAP traveling through OAK, there is a lot of trash generated, much of it recyclable material. On Earth Day 2002, the Port launched its recycling program to divert discarded newspapers and magazines, office paper, and aluminum and plastic beverage cans and bottles from landfills. The Port has recently enhanced it further by installing 35 new recycling stations in the terminals.

These additional recycling stations are conveniently located adjacent to trash receptacles and will encourage greater recycling by identifying the types of acceptable material through visuals on the top and sides of each station. The Port is well on its way to achieving its goal of diverting over 50% of post-consumer trash from landfills through this enhancement. In 2004, the program diverted over 298 tons of material (368 tons of cardboard/fiber and 38 tons of bottles/cans) from landfills.

Food Waste Recycling
In 2004, the Port added food waste to its recycling efforts. The food waste program collects pre-consumer waste such as vegetable trimmings, coffee grounds and filters, milk cartons, cheesy pizza boxes and used paper towels from airport concessionaires for use as high-nutrient fertilizer in the production of organic food and fiber. Over 51 tons of food waste was diverted from the landfill in 2004.

Airline Consolidated Waste and Recycling Program
Prior to 2003, each airline contracted separately with a waste company, resulting in inefficient garbage disposal and inconsistent recycling. In 2003, the Port worked with the airlines to consolidate their waste and recycling into one coordinated program. The airlines now recycle magazines, newspapers, cardboard and bottles, diverting over 101 tons of recycling from landfills in 2004, resulting in less waste going to the landfills and about $14,000 in cost savings monthly.

Airline Pillow Recycling
OAK is one of the first airports in the nation to participate in a pillow recycling program. Normally, airline pillows are immediately disposed of following the completion of a flight. This waste goes directly into landfills. The pillow recycling program collects these pillows for use as insulation or as material in making furniture.

6.4.5 Water Quality

Storm Water Program
The Port has developed a monitoring program for Port facilities, industrial tenants, and construction contractors to raise awareness of water quality issues and assist in compliance with the State Water Resources Control Board’s industrial permit. The Port organizes workshops, conducts pollution prevention training, collects and analyzes storm water samples, and inspects approximately 40 Port and tenant facilities annually. The Port also reviews storm water regulations with contractors and assists them in the development of storm water pollution prevention plans.

6.4.6 Water and Wetlands

Oro Loma
In 1999, the Port purchased a 16-acre site adjacent to the existing Oro Loma Marsh that had been diked and filled by the Oro Loma Sanitary District. Known as the Sonoma Baylands project, restoration of the 320-acre tidal wetland began in 1996 and was completed in September 2000, using clean dredge materials excavated from the Port of Oakland’s minus 42-foot harbor deepening project. Monitoring and maintenance of the project will continue through 2005, whereupon the property likely will be transferred to a resource agency.

Damon Slough
In the fall of 2004, the Port completed the enhancement and expansion of a 9-acre seasonal wetland along Damon Slough and adjacent to the existing Martin Luther King Jr. Regional Shoreline. Also, as part of this project, a ¼-mile connection has been constructed to fill in a gap in the San Francisco Bay Trail, a planned recreational corridor that, when complete, will encircle San Francisco and San Pablo Bays with a continuous 400-mile network of bicycling and hiking trails. To date, approximately 240 miles of the alignment—over half the Bay Trail’s ultimate length—have been completed.

6.4.7 Wildlife Management

Burrowing Owl Mitigation Program
Burrowing owls are one of the many species recognized by the State of California as a “species of concern.” As such, special measures have been developed and implemented to insure that the impacts to this species are minimized. The Port has developed a plan to mitigate construction impacts to burrowing owls and their burrows, and to provide long-term maintenance of a stable burrowing owl population.

A 70-acre property in eastern Alameda County was purchased to establish an off-Airport Burrowing Owl Management Area to preserve burrowing owl habitat in perpetuity. Ownership of this property was transferred to the California Department of Fish and Game for use as burrowing owl habitat and additional money was provided by the Airport to undertake initial protection, enhancement measures, and long-term management of the property.
6.5 Preliminary Environmental Screening Matrix

A preliminary environmental screening matrix was prepared to screen the potential development areas and the aircraft operations forecasts against several environmental planning considerations. Environmental planning considerations include site planning (or footprint) considerations and operational planning considerations. The distinction between site and operational planning is important. Site planning considerations, such as aesthetics, wetlands / wildlife, and geology and soils, are used to screen the potential development of certain areas on the Airport, and operational planning considerations, such as aircraft noise and air quality, are used to screen the aircraft operations forecasts. It is important to note that the development of facilities in any particular area may or may not generate new aircraft operations, and thus may or may not have any operational planning considerations. Also, an increase in the number of aircraft operations (as forecast in Chapter 3) may or may not require additional facilities, and thus may or may not result in any site planning considerations.

Table 6.2 shows the preliminary environmental screening matrix. In all cases, the evaluation is relative to existing conditions at OAK. Each potential development area is referenced to a figure shown in Chapters 4 and 5 and is evaluated against the environmental planning criteria using the following symbols:
• Red dot (•) means that there is a potential opportunity for environmental benefit,
• Gold dot (•) means that there is a potential environmental constraint,
• Green dot (•) means that there is no potential environmental benefit or constraint, and
• Black dot (•) means that it is unknown (without further study) if there is an environmental benefit or constraint.

It should be noted that the preliminary environmental screening matrix presents a high-level environmental screening of potential development areas and aircraft operational forecasts, and is subject to change upon further study and environmental review (see Note on bottom of Table 6.2). This high-level environmental screening was prepared by Port staff. Also, several of the site planning considerations have already been discussed in the general planning considerations for each area (as presented on the various graphics). In fact, some of the areas have already been recommended for discontinuation from further consideration based on potential environmental constraints (e.g., potential terminal development Areas 1 and 3).

6.5.1 Site Planning Considerations

This section summarizes the site planning considerations for each potential development area.

Aesthetics
In most cases, potential development areas are not anticipated to have an aesthetic benefit or constraint. However, in the case of potential terminal development Area 3, potential remain overnight (RON) aircraft parking Area 4, potential airline support facility Areas 2 and 7, and potential roadway Area 11, it is unclear whether there would be any aesthetics constraint due to potential effects on views from the City of San Leandro (additional study would be required).

Wetlands / Wildlife
If potential development in an area is anticipated to disturb or take wetlands that are under jurisdiction of the U.S. Army Corps of Engineers, it is noted as a potential environmental constraint. It should be noted that it is, of course, possible to disturb or fill wetlands, but appropriate environmental review and permits are required, in addition to providing appropriate mitigation (e.g., restoring or creating wetlands off-Airport). If potential development in an area might disturb wildlife, it is noted as an unknown benefit or constraint because appropriate wildlife surveys would need to be conducted. However, the Port is aware that potential development areas at North Field are potential habitat for burrowing owls (recognized by the State of California as a “species of concern”) and would require surveys and treatment before development in these areas could proceed (along with appropriate environmental reviews, engineering, etc.). In the case of potential airline support facility Areas 4 and 6 and potential parking Area 7, it is unknown at this time whether there would be an environmental benefit or constraint because the environmental benefit or constraint would depend the exact location of the potential development within the areas.

Historic Values
In most cases, potential development areas are not anticipated to have a benefit or constraint due to historic values of the community. However, in the case of potential general aviation development Area 4 and potential airline support facility Area 5, there may be potential effects due to some portions of North Field potentially being eligible for historic designation.

Geology and Soils
Almost all of the geology and soils at the Airport is challenging from an engineering and construction perspective. At North Field, the soil is mostly unconsolidated clays (bay mud) on top of older, consolidated clays. These soil conditions mean that significant structures (i.e., buildings) must be constructed on piles and that drainage conditions are often challenging (e.g., ground water does not percolate into the soil). Conditions at South Field are similar, except that there is usually a layer of sand over the bay mud. Significant structures (e.g., buildings) must be constructed on piles,
### Master Plan Preliminary Environmental Screening Matrix (Compared to Existing Conditions)

#### Table 6.2

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<thead>
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<th>Site Planning Considerations</th>
<th>Terminal (Fig. 4.1)</th>
<th>Air Cargo (Fig. 4.15)</th>
<th>General Aviation (Fig. 4.18)</th>
<th>Airfield (Taxiway)</th>
<th>Remain Overnight (RON)</th>
<th>Airline Support Facility (Fig. 4.19)</th>
<th>Airline Parking (Fig. 4.20)</th>
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</tr>
</tbody>
</table>

#### Footnotes

- **Operational Planning Considerations**
  - Airline Passengers: 14 MAP** increasing to 18 MAP and 156,000 aircraft operations increasing to 197,830 aircraft operations
  - Air Cargo: 0.7 MAT** increasing to 0.9 MAT and 56,940 aircraft operations increasing to 59,860 aircraft operations
  - General Aviation: 126,642 aircraft operations increasing to 158,504 aircraft operations

#### Notes

- This is a preliminary screening-level evaluation matrix for master planning purposes only and subject to change. Preliminary evaluations at this matrix may change as projects are defined in these areas and upon further environmental reviews. In all cases, evaluations are compared to existing conditions if and when a project or group of related projects are proposed. The Port will complete more detailed environmental reviews at that time in accordance with the California Environmental Quality Act (CEQA).

- This table was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This table must be interpreted in the context of the entire master plan document.

#### Legend

- Potential Opportunity for Environmental Benefit
- Potential Environmental Constraint
- No Potential Environmental Benefit or Constraint
- Unknown Benefit/Constraint

---

**Operational Planning Considerations**

- **Aircraft Noise – CHNL**
- **Aircraft Noise – SEL/SENEL**
- **Air Quality**
- **Transportation/Traffic**
- **Safety**

**2010 Activity Forecast**

- Same as Potential Terminal Development Area 2
- Same as Potential Terminal Development Area 2
- Runway 29 Improvements (because this potential improvement reduces taxi times, it may also improve air quality) — Fig. 5.3
- Runway 29 Improvements (because this potential improvement reduces taxi times, it may also improve air quality) — Fig. 5.2
- Million Annual Passengers (MAP)
- Million Annual Tons (MAT)
- CHNL = Community Noise Equivalent Level (a time-weighted cumulative noise metric)
- SEL/SENEL = Sound Exposure Level/Single Event Noise Exposure Level (a single aircraft overflight noise metric)
Hazards and Hazardous Materials
The most likely hazard or hazardous material encountered at the Airport is contaminated soils (e.g., hydrocarbons from aircraft operations and maintenance found in the soil). As with geology and soils, appropriate clean-up and engineering solutions can usually overcome any potential hazard or hazardous materials constraint. In general, currently or previously developed sites might have a constraint due to hazards and hazardous materials, while largely undeveloped sites, such as the central basin might have fewer hazards or hazardous materials constraints (because aircraft have never been operated or maintained there). However, even these could contain some contaminants due to runoff from adjacent developed areas. Localized hazards or hazardous materials could always be a challenge and must be cleaned up or engineered during the appropriate phase of project development.

In the case of potential general aviation development Area 3, this would normally be shown with no potential constraint, except that this area has historically been used for aircraft operations (e.g., blimp launching / recovery area) that might have caused some limited soil contamination. Therefore, this area is marked with an unknown benefit or constraint from a hazards and hazardous materials perspective. Also, any areas adjacent to the existing fuel farms might contain contaminated soil.

Hydrology and Water Quality
For the purposes of environmental screening, it was assumed that any newly created impervious surfaces (e.g., pavement in a parking lot or aircraft apron, buildings, etc.) might create a potential environmental constraint. Pervious surfaces allow rainfall to percolate into the soils and/or traverse the surface through dirt, grass, and other vegetation, improving water quality. As with geology / soils and hazards / hazardous materials, hydrology and water quality constraints created by new impervious surfaces can be addressed through appropriate engineering solutions, such as the construction of bio-swales and detention basins. In the case of potential airline support facility development Areas 6 and 7, the potential hydrology and/or water quality constraints are unknown because any potential benefit or constraint depends on the exact location of any development within the area.

Land Use and Planning
There are no potential land-use benefits or constraints associated with any of the development areas, with the possible exception of terminal development Area 3, which might be partially located within the City of San Leandro.

Public Access
There are no potential public access benefits or constraints associated with any of the development areas. As with the other site planning considerations, this preliminary assessment could change as projects in these areas are more fully developed and undergo detailed environmental review, engineering, etc.

Utilities and Service Systems
There are no potential utilities and service systems benefits or constraints associated with any of the development areas. As with the other site planning considerations, this preliminary assessment could change as projects in these areas are more fully developed and undergo detailed environmental review, engineering, etc.

6.5.2 Operational Planning Considerations
This section summarizes the operational planning considerations for the master plan forecasts developed in Chapter 3. As shown on Table 6.2, airline passengers and passenger airline operations, air cargo weight and cargo airline operations, and general aviation operations are all anticipated to increase (at varying rates described in Chapter 3). This increase in aviation activity is evaluated against the following five operational planning criteria:

Aircraft Noise — CNEL
Although CNEL noise contours are developed assuming all aircraft operations (airline, cargo, and general aviation), the evaluations here attempt to show how each type of operation contributes to the overall CNEL contours. As described in Section 6.3.9, the overall CNEL noise contours in 2010 (assuming the master plan aircraft operations forecasts) are smaller (less noise footprint)
than the existing (2004) noise contours. In general, the modest increase in the number of passenger airline and general aviation operations do slightly increase the CNEL noise contours. However, anticipated changes in the air cargo fleet have a significant effect in reducing the CNEL contours in the future (2010 timeframe). That is, when the cargo airlines retire their older and noisier Boeing 727 aircraft and replace them with larger (to accommodate the increase in air cargo weight), quieter aircraft, the CNEL contours are anticipated to get smaller (less noise footprint).

**Aircraft Noise — SEL / SENEL**

Generally, this evaluation criteria represents a potential constraint as the number of operations increases because there will be more noise events (one with each operation, which is anticipated to increase as shown on Table 6.2). However, in the case of the cargo airlines, the increase in the number of operations is quite small (in fact, there are no anticipated new cargo airline flights at South Field in 2010 compared to 2004) and the cargo aircraft in 2010 are anticipated to be quieter than the existing air cargo fleet, as described above.

**Air Quality**

The increase in aircraft operations has an unknown benefit or constraint on air quality, and additional environmental review would be required to determine the relationship between the increase in the number of operations and air quality. Also, assumptions would need to be made regarding future facilities, such as the airfield improvements shown in Figure S.2 and S.3, because they could provide air quality benefits, which might offset any constraint associated with the anticipated increase in operations.

**Transportation / Traffic**

It is anticipated that the increase in the number of airline passengers and air cargo weight would generate additional traffic and transportation requirements to and from the Airport. As with other planning considerations, it is anticipated most constraints could be overcome with appropriate traffic and transportation engineering solutions. Additional study would be required to determine how increases in traffic associated with increased aviation activity would affect the surrounding communities. For example, it is not known how much of the traffic accessing OAK uses local streets in the cities of Alameda and San Leandro. General aviation is not a significant generator of traffic and transportation demand, and thus it is assumed that it has no potential environmental benefit or constraint, even with the anticipated increase in activity.

**Safety**

There are no potential safety benefits or constraints associated with the anticipated increase in aircraft operations at OAK.

### 6.5.3 Environmental Constraints / Benefits of Recommended Development Areas

For each development area discussed in Chapters 4 and 5, the preliminary environmental screening matrix (Table 6.2) highlights potential environmental benefits or constraints (vertically, in each column under the development area). For example, potential terminal development in Area 2 is not anticipated to have any major environmental constraints, with the exception of hazards and hazardous materials, such as contaminated soils, that might need to be cleaned up or engineered, as appropriate, before development occurs (or as otherwise required by regulatory agencies).

### 6.6 Community-Requested Environmental Projects

Port staff asked members of the Stakeholder Advisory Committee to consider any environmentally beneficial projects that they may wish to request be included in the master plan (in addition to all of the environmental programs and policies the Port already has underway). The City of San Leandro representatives requested that the Port consider constructing a noise barrier to block aircraft ground noise in the Neptune Drive neighborhood. The City of Alameda representatives requested that Port and City of Alameda jointly undertake a ground traffic study to determine how much traffic going to or from the Airport uses local streets in the City of Alameda. The City of San Leandro representatives requested that the study be expanded to include local streets in the City of San Leandro. It is recommended that the Port undertake an Airport traffic study, with assistance from the cities of Alameda, San Leandro, and Oakland. Finally, the City of Alameda representatives requested that the Port and City of Alameda jointly conduct a study to investigate why some corporate jets (less than 2%) choose not to comply with the Port’s voluntary noise abatement procedures, which requests that they taxi to and depart from South Field instead of North Field (during west plan, except those that can depart on Runway 33). It is recommended that the Port undertake this study, with assistance from the City of Alameda.

The following sections summarize the Port’s investigation into a San Leandro noise barrier.

#### 6.6.1 Noise Barrier Background

The noise from jet aircraft operating on Runway 29 has been a concern to residents living along Neptune Drive in the City of San Leandro. In particular, the issue of jet echo boost noise at the beginning of takeoff roll has been raised as an issue that might be addressed by some kind of noise barrier located adjacent to the runway. In the following sections the feasibility of such a barrier located near the runway or near the residences is examined.
6.6.2 The Noise Barrier Effect

A noise barrier is effective at reducing noise when the barrier is located between the noise source and the receiver and is high enough to block the direct line of sight between the source and the receiver. The barrier must be long enough to prevent flanking around the sides of the barrier, have no holes or cracks, and have sufficient density so that sound does not pass through the barrier. Barriers are most effective when placed very near the source or the receiver and is least effective when placed halfway between the source and the receiver. Figure 6.19 shows schematically the direct line of sight and the path over the top of a barrier for a barrier located near the source and for a barrier located near the receiver.

Noise barriers are commonly used to mitigate roadway noise, particularly adjacent to freeways. Barriers are not typically used for airport noise with the exception of barriers around locations where aircraft engine maintenance runups are performed (such as the ground runup enclosure, GRE, located on the South Field at OAK). It is rare to use a barrier to mitigate pre-takeoff engine runup noise.

Noise barriers are very good at mitigating high frequency noise and very poor at mitigating low frequency noise. The amount of noise reduction that a barrier will achieve is dependent on the height of the barrier and frequency of the noise. A noise barrier will not effectively reduce the low frequency rumble associated with some of the louder, older technology jets that operate at Oakland, such as the Boeing 727. A noise barrier has no effect unless the barrier is high enough to block line of sight between the source and the receiver. For a typical noise source such as a diesel truck or an aircraft without major low frequency rumble, a noise barrier that is just high enough to break line of sight will result in a 5 dBA noise reduction, provided that the barrier is long enough to prevent flanking around the ends (i.e., sound leaks around the ends). The higher the barrier, the greater the noise reduction (there is a practical limit of about 20 dBA noise reduction for very tall barriers).

A noise barrier to reduce high frequency taxi and Runway 29 take-off roll noise in the Neptune Drive neighborhood could be constructed either on-Airport (near the end of Runway 29 along San Francisco Bay) or in the rear yards of the homes along the west side of Neptune Drive (along San Francisco Bay). It is important to note that only the homes along the west side of Neptune Drive would benefit from a potential noise barrier, whether constructed on-Airport or along the rear yards of the homes along the west side of Neptune Drive. This limited benefit is because the homes along the west side of Neptune Drive already serve as a noise barrier and block much of the high frequency taxi and Runway 29 take-off roll noise from the rest of the neighborhood.

6.6.3 Barrier Near the End of Runway 29

The potential to locate a noise barrier near the end of Runway 29 is severely constrained by the mandatory Object Free Area associated with a runway of this type. The Object Free Area is designed to minimize aircraft damage and loss of life in the event of an aircraft excursion from the runway. Object Free Areas have fixed dimensions and are mandated by the FAA. Figure 6.20 shows the potential location of the noise barrier at the departure end of Runway 29. The Object Free Area sets a southern limit to the barrier (shown in yellow). This barrier would just barely block line of sight for an aircraft located at the start of Runway 29 relative to the homes on Neptune Drive. The barrier would need to extend farther south (into San Francisco Bay) to prevent sound flanking around the southern end of the barrier. In order to examine the potential effectiveness of such a noise barrier, a detailed analysis of the effectiveness of a barrier was completed for aircraft in various positions as shown in Figure 6.20.

Aircraft in positions A, B, C, D and E were considered in the analysis. Aircraft at positions A and B would be taxiing and therefore at a low engine thrust level. For position C an aircraft may be stopped at the hold position and use a higher thrust level to get the aircraft moving (break-away thrust). Aircraft at positions D and E would be at a very high thrust setting for takeoff.

In order to examine the effect of a barrier near the end of Runway 29 an example case was calculated for a Boeing 727 Hushkit aircraft. This is one of the types of aircraft that FedEx uses at night and of which the community has expressed concern. This aircraft has 3 engines, one of which is a centerline engine that is located 15 feet above the pavement (to engine centerline). This analysis was done for an observer located in the rear yard of the southern most home on the Bay side of Neptune Drive.

The barrier assumed for this analysis was a 25 foot high barrier located on top of the dike (levee) that separates the Airport from San Francisco Bay. This dike has a top elevation of about 10.5 feet, thus the top of barrier elevation assumed for this analysis was about 35.5 feet above mean sea level (MSL). The runway and taxiway elevation used was 5.5 feet MSL. The elevation of the rear yard of the home on Neptune Drive is about 6 feet MSL.

The noise barrier reduction was calculated for a case of no wind and no vertical temperature gradient, in other words a very calm condition where the ambient noise levels along Neptune Drive would be very low. The noise barrier noise reduction is about 6 dBA (the actual calculation vary from 5.6 to 6.3 dBA for the 5 aircraft positions shown in Figure 6.20), except when the aircraft is located at the runway threshold (position D). At position D there will be flanking around the south end of the barrier, and the barrier noise reduction will be closer to 3 dBA instead of 6 dBA, unless the barrier could be extended into San Francisco Bay.
Francisco Bay, as shown in Figure 6.20, in which case a 6 dBA noise reduction would be possible. Extending the barrier into San Francisco Bay prevents the flanking of noise around the end of the barrier at the start of the take-off roll. It should also be noted that the noise levels at the observer on Neptune Drive are heavily influenced by the thrust setting on the engines. The table on Figure 6.20 summarizes the maximum noise level and effectiveness of the noise barrier.

A 6 dBA noise reduction is noticeable but not dramatic. A 10 dBA reduction would sound half as loud. A 3 dBA reduction would be barely perceptible. These results show that a barrier is of marginal value and may not be worth pursuing. At these levels of noise reduction, one would not expect residents to express great relief from existing noise levels as a result of installing this barrier. If this barrier is pursued it is important to emphasize to neighbors the limited benefit of the barrier and be careful not to raise expectations. Further, if the barrier is pursued, it need not extend as far north as is shown in Figure 6.20.

6.6.4 Barrier Adjacent to the Homes on Neptune Drive

An alternative to building the barrier near the runway is to build the barrier along the rear yards of homes on Neptune Drive. Figure 6.20 shows an aerial photograph of this alternative. Of course, one of the main disadvantages of such a barrier is that a tall barrier would block views of San Francisco Bay, a highly undesirable side effect of a barrier. This barrier would be effective only for first row of homes on the Bay.

An alternative to a solid opaque barrier such as that used adjacent to the Interstate Highway 880 in San Leandro is to use a transparent barrier. To be effective for the 2-story homes that are located along Neptune Drive, the barrier would have to be at least 15 feet high to get the minimum 5 dBA noise reduction for a second story observer. A 15-foot barrier would provide 12 dBA noise reduction for an observer in the rear yard of these homes, as shown in the table on Figure 6.20. In this concept, the barrier would consist of a low 4-foot solid wall, probably cement block, with 11 feet of transparent panel located above. The 11-foot panel would be installed in two 5 1/2-foot sections in either a metal or wood frame. Block or cement pilasters would have to be spaced such that the wall would meet seismic and wind loading requirements. The footings for the pilasters for such a tall wall would have to be engineered for the type of soil, water content, and design wind loads for the area.

A transparent barrier will have a much greater maintenance requirement than an opaque barrier in order to keep the barrier clear and maintain views of the Bay. The moist salt air will be the biggest problem keeping the barrier clear. Glass would be easiest material to maintain, with maintenance being similar to cleaning the windows on a home. However, glass would be subject breakage either by vandals or objects blown into the glass by the wind. Plastic materials such as Plexiglass or Lexan are much more resistant to breakage, but will tend to pit, yellow, or fog with time. To maintain clear views, a plastic barrier will require occasional polishing and waxing. In either case, glass or plastic, the surface density of the material used shall be at 4 pounds per square foot to maintain the desired sound reduction (surface density is the density of the material divided by the thickness of the material).

Finally, the construction of such a barrier either on Airport or in the rear yards of the homes along the west side of Neptune Drive would be subject to the approval and permitting from the San Francisco Bay Conservation and Development Commission (BCDC) because these locations are within their jurisdiction. A barrier extending into San Francisco Bay would also require bay fill.

6.6.5 Comparing a Barrier at the Airport with a Barrier near the Shore of Neptune Drive

The top of Figure 6.21 shows a comparison of noise levels when a Boeing 727 departs on Runway 29, beginning at the time the aircraft reaches the runway threshold (Position D on Figure 6.20). The top graph (blue line) shows the noise level in the rear yards of the homes on Neptune Drive as the aircraft progresses down the runway and there is no barrier. The next graph down (red line) shows the noise level at Neptune Drive if a 25-foot barrier is constructed at the Airport on top of the perimeter levee (outside of the Object Free Area). The lower graph (green line) shows the noise level in the rear yard of the Neptune Drive homes if a 15-foot barrier is constructed along the rear of these homes (along the Bay).

For an on-Airport barrier, there is only a 3 dBA noise reduction for the first 10 seconds of the event (assuming no extension of the barrier into San Francisco Bay), then the noise reduction increases as the aircraft proceeds down the runway and the barrier flanking is reduced. By about 18 seconds into the event, a 6 dBA noise reduction is realized. As the aircraft proceeds farther down the runway, the barrier effectiveness is reduced to about 5 dBA, and finally has no effect when the aircraft rotates and climbs. If the barrier could be extended into San Francisco Bay, there would be a 6 dBA noise reduction until the barrier effectiveness is reduced to about 5 dBA, and finally has no effect when the aircraft rotates and climbs. When the aircraft rises above the noise barrier, the noise increase will be sudden. However, since the noise barrier reduction at this point is about 5 dBA, the increase would not be considered dramatic. The bottom graph (green line) shows that a barrier along Neptune Drive provides a constant 12 dBA noise reduction until the aircraft rotates and climbs high enough to be seen above the barrier. When the aircraft rises above the noise barrier, the noise increase will be sudden and very noticeable.
Similar data are shown in the middle and bottom of Figure 6.21 for the Boeing / McDonnell Douglas MD-11 / DC-10 aircraft types and the Boeing 737 (-600, -700, -800, and -900 models) and Airbus A319 / A320 families of aircraft respectively. The scales of the figures are identical, and it shows that the Boeing 727 is much louder than the MD-11 / DC-10 types of aircraft and the much more frequently operated Boeing 737 / Airbus A319 / A320 family of aircraft.

In the case of the MD-11 / DC-10 aircraft, there is no noise barrier reduction for an on-Airport barrier while the aircraft is at the end of the runway at the start of takeoff roll. This is because the tail-mounted third engine is located over 32 feet above the ground and is not shielded by the barrier until the aircraft rolls down the runway some distance.

In the case of the Boeing 737 / Airbus A319 / A320 families of aircraft, the noise reduction of an on-Airport barrier is greater than for the other aircraft because the engines are located much closer to the ground (under 5 feet from the surface to the engine centerline), making the barrier more effective at reducing noise. However, these aircraft are much quieter and probably only audible along Neptune Drive during the calmest and quietest times.

The noise level calculations for with and without barrier conditions were computed for an observer standing in the backyard of a home along the Bay side of Neptune Drive. The computations assume no wind whatsoever (less than 1 knot). Under these conditions, the aircraft application of power at the start of takeoff roll would be audible at the homes on Neptune Drive. For conditions where the wind is not calm, the presence of wind noise and noise caused by the wind (such as the water lapping on the rocks on the shore) would mask the aircraft noise, and affect the propagation sound in such a way that the noise barrier computations made here would not be realized. This is due either to wind noise masking the aircraft noise or wind gradients affecting the propagation of sound over a long distance. The potential benefit of a noise barrier is greatest when the wind is calm and diminishes rapidly as the wind speed increases.

As described earlier, it is important to note that only the homes along the west side of Neptune Drive would benefit from a potential noise barrier, whether constructed on-Airport or along the rear yards of the homes along the west side of Neptune Drive. This limited benefit is because the homes along the west side of Neptune Drive already serve as a noise barrier and block much of the high-frequency noise taxi and Runway 29 take-off roll noise from the rest of the neighborhood.

In January 2006, the City of San Leandro hosted a meeting with the Neptune Drive neighborhood so that the Port could present the above analyses on a potential noise barrier either on-Airport or along the rear yard of the homes on the west side of Neptune Drive. All homeowners along the west side of Neptune Drive that expressed an opinion indicated that they did not want a noise barrier constructed in their rear yards despite the potential noise reduction benefit (up to 12 dBA during certain conditions, as described in Section 6.6.4). Instead, they requested that the Port continue to study the costs and benefits of constructing on-Airport noise barriers. Further, the community requested that the City of San Leandro and Port continue to pursue sound insulation as one of the most effective methods of reducing the effects of aircraft noise.
Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and the planning process only it does not propose any particular course of action (it might represent an idea or concept that was discarded) and must be interpreted in the context of the entire master plan document.
Sound and Noise — What We Hear

**Acronyms**
- dB: Decibels
- Hz: Hertz
- SPL: Sound Pressure Level

**Legend**
- March 2006
- Oakland International Airport Master Plan
- Figure 6.2

**Sound and Noise — What We Hear**

- **Audible Range**
- **Music**
- **Speech**

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Sound and Noise — Frequency Weighting

Typical Frequency Range for Community Noise

Frequency, Hz

Relative Response, dB

-80 -60 -40 -20 0 20

10 100 1,000 10,000 100,000

-80 -60 -40 -20 0 20

A Weighted
C Weighted

Frequency Weighting

is an effort to approximate the sensitivity of the human ear. The human ear is not equally sensitive to all frequencies.

Weighted Decibel Scales

The A-weighted decibel scale (dBA) discriminates against frequencies in a manner approximating the sensitivity of the human ear. In the A-weighted scale, everyday sounds normally range from 30-dBA (very quiet) to 100-dBA (very loud). Most community noise analyses are based upon the A-weighted decibel scale.

The C-weighted scale is used in assessing hearing loss in comparison to occupational exposure to noise and is more influenced by low frequency noise than the A-weighted scale.

Acronyms

dB Decibels
Hz Hertz

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Sound Exposure Level (SEL), Maximum Noise Level (Lmax) and Duration

- Maximum Noise Level (Lmax) 90 dBA
- SEL ~ 100 dBA
- Ambient Noise
- Rise Time
- Duration

Legend:
- dB: Decibels
- dBA: A-Weighted Decibels
- Lmax: Maximum Noise Level
- SEL: Sound Exposure Level

Note: This graphic was prepared by the Port as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not propose any particular course of action (it might represent an idea or concept that was discarded), and must be interpreted in the context of the entire master plan document.
Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible noise and planning concepts. This graphic is conceptual in nature and does not propose any particular course of action. It might represent an idea or concept that was discarded, and must be interpreted in the context of the entire master plan document.

LEGEND
- Hourly Leq's (No Penalty)
- 5 dB Evening Penalty
- 10 dB Nighttime Penalty

Time Periods
- Day: 7 am - 7 pm
- Evening: 7 pm - 10 pm
- Night: 10 pm - 7 am

* Time axis not drawn to scale. Aircraft events are much shorter than shown here.

Acronyms
- CNEL: Community Noise Equivalent Level
- dBA: Decibels
- Leq: Equivalent Noise Level

**Figure 6.6**

**Noise Metrics**

![Graph of Noise Metrics](image-url)
Single Event Noise to Cumulative Noise (CNEL)

\[ SEL + 10 \log (1 \times Ops_{\text{day}} + 3 \times Ops_{\text{evening}} + 10 \times Ops_{\text{night}}) - 49.4 = \text{CNEL} \]
Examples of Community Noise Equivalent Levels (CNEL)

Typical Outdoor Locations

- Apartment Next to Freeway
- 3/4 Mile From Touchdown at Major Airport
- Downtown With Some Construction Activity
- Urban High Density Apartment
- Urban Row Housing on Major Avenue
- Old Urban Residential Area
- Wooded Residential
- Agricultural Crop Land
- Rural Residential
- Wilderness Ambient

CNEL in dB

Acronyms
- CNEL: Community Noise Equivalent Levels
- dB: Decibels

Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan assessed many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not propose any particular course of action (it might represent an idea or concept that was discarded), and must be interpreted in the context of the entire master plan document.
Annoyance and Community Noise Equivalent Level (CNEL)

Percentage of People Highly Annoyed

CNEL in dB

Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examines many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only (it does not propose any particular course of action). It might represent an idea or concept that was discarded, and must be interpreted in the context of the entire master plan document.
This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not propose any particular course of action (it might represent an idea or concept that was discarded), and must be interpreted in the context of the entire master plan document.

Acronyms:
- dB: Decibels
- FICAN: Federal Interagency Committee on Aircraft Noise
- FICON: Federal Interagency Committee on Noise
- SEL: Sound Exposure Level

Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not propose any particular course of action (it might represent an idea or concept that was discarded), and must be interpreted in the context of the entire master plan document.
Summary of FAA Part 150 Noise and Land Use Guidelines for New Development

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</table>

Yearly CN EL, dB

Note: This graphic was prepared by the Port of Oakland as part of a master plan for Oakland International Airport. The master plan examined many possible ideas and planning concepts. This graphic is conceptual in nature and for planning purposes only. It does not propose any particular course of action (it might represent an idea or concept that was discarded), and must be interpreted in the context of the entire master plan document.
Aircraft Noise Abatement Procedures for North Field Program

General Policy
Safety permitting, aircraft flying by visual flight rules are to avoid flying over nearby residential areas when arriving or departing the Airport.

Day and Night
Aircraft Restrictions
The following aircraft shall not depart Runways 27L/R, nor land on Runways 29L/R, except during emergencies. These aircraft must use Runway 11/29:
- Turbojet and turbofan powered aircraft
- Turboprop aircraft over 17,000 pounds
- Four-engine reciprocating powered aircraft
- Surplus military aircraft over 12,500 pounds
- Regularly scheduled passenger and cargo airlines or regional jet commercial passenger aircraft operations shall not land on Runways 27L/R at the North Field, except for emergencies or when Runway 11/29 is closed for maintenance or repair.

Helicopter Restrictions
- Helicopters should fly over freeways and water as much as possible to avoid hotels and residential areas.
- Local training flight patterns (touch-and-go operations, etc.) should be restricted to Airport boundaries or adjacent commercial and industrial areas to the maximum extent possible.

Daytime (6:00 a.m. to 10:00 p.m.)
Aircraft Restrictions —
Single and Twin Piston-engine Aircraft
VFR Departures
- Aircraft departing Runways 27L/R, turn over San Leandro Bay, continue to the 1880 Freeway.
- Straight-out departures should not be approved.
- Aircraft departing Runway 33 turn right and fly over San Leandro Bay, continue to the 1880 Freeway.
- Straight-out or left crosswind/downwind departures should not be approved.
VFR Arrivals
- Aircraft should avoid flying over residential areas as much as possible on arrival to any North Field runway.
- Straight-in arrivals to Runway 15 are not allowed unless required by wind or safety.

Touch-and-Go Operations
- Runway 27L is the preferred runway for these procedures.
- Aircraft should follow the standard traffic pattern whereby avoiding flying over residential areas.

Nighttime Quiet Hours (10:00 p.m. to 6:00 a.m.)
Aircraft Departures
- Aircraft should use Runway 9R (not 9L) as the preferred departure runway.
- Aircraft should use Runway 27R (not 27L) as the preferred departure runway.
- Aircraft should not turn left from Runways 9R/L on departure.
- Aircraft should not depart straight-out from Runway 9L.
- All aircraft over 75,000 pounds are directed to use Runway 11/29.
- Aircraft should use only full-length departures on the elected runway.
- Stage 2 corporate turbojet aircraft are directed to use Runway 11/29.

Pilots may choose between the following noise abatement departure procedures, wind and weather permitting:
- FAA and SALAD VFR departures from Runway 27L/R
  - VFR departures use right crosswind or additional downwind segment avoiding Alameda residences.
  - The SALAD Standard Instrument Departure Procedure allows pilots not to use the OAK 313 radial or 310 heading.

VFR and IFR Departures from Runway 9R/L
- For Runway 9R departures, use 140-180 degree departure headings.
- For Runways 9R/L departures, use right turn over the Airport for north/northeast departures.

Aircraft Arrivals
- Aircraft should use Runway 27L, as the preferred arrival runway.

Oakland International Airport Departure Routes

Aircraft Noise Abatement Procedures for South Field Program

Day and Night
Runway 11/29 is preferred for departures and arrivals of all turbojet and heavy aircraft.

Runway 29 Departures
- Turboprop aircraft shall not be turned north over Oakland Hills until leaving 3,000 feet.
- VFR aircraft that depart Runway 29 and request a right turn shall be instructed to proceed at least 2 miles west or climb to at least 1,500 feet before starting right turn.

Runway 29 Arrivals
- Air traffic controllers require turbojet aircraft on a visual or VFR approach northeast of OAK to cross the Oakland 100 radial at or above 3,000 feet.
  - Between the hours of 10:00 p.m. to 6:00 a.m., and at other times when traffic permits, air traffic controllers keep turbojet aircraft over the Bay when approaching from the west, south, of OAK.

Daytime (6:00 a.m. to 10:00 p.m.)

Touch-and-Go Operations
- Turbojet aircraft practicing instrument approaches south of OAK are to remain over the Bay when using Runway 29.

Nighttime (10:00 p.m. and 7:00 a.m.)
Runway 29 Silent 7 Departure Procedure
- Reduces noise on Alameda and other East Bay communities.
- Turns turbojet aircraft to the west and further out over the Bay when departing from Runway 29.

Runway 11 Quiet Departure Procedure
- Reduces noise on San Leandro and other East Bay communities.
- Turns turbojet aircraft to the right and further out over the Bay when departing from Runway 11.

Rolling Take-off Departure Procedure
- Used for takeoffs in which engine power is applied and the takeoff roll commenced immediately as an aircraft is lased onto the runway.
- Reduces “back blast” noise.
- Applied to turbojet departures between 10:00 a.m. and 5:00 a.m.

Acronyms and Definitions

Aircraft Noise Abatement Procedures Compliance Reports
Quarterly reports on compliance with aircraft noise abatement are provided to the Cities of Alameda and San Leandro, CLASS and KOB, and are posted on the Airport’s website. These reports detail if planes are flying in the preferred flight paths, include information on aircraft noise levels, and describe performance compliance with the following various procedures:
- Quiet Hours Program
- VFR aircraft departures
- North Field turbojet restrictions
- Silent 7 SID
- Runway 29 eight turn departure restrictions
- Engine maintenance run-up restrictions

California Airport Noise Regulations Reports
Quarterly reports evaluating aircraft noise levels are provided to meet the requirements of the California Airport Noise Regulation (California Code of Regulations, Title 21, Section 1030). They are posted on the Airport’s website.
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Note

Brown Buntin Associates
Jim Buntin
Mestre Greve Associates
Vincent Mestre, P.E.

Sources

Visual Flight Rules
VFR

United States Postal Service
USPS

Sound Insulation Program
SIP

SALAD

Over the Bay Committee
Berkeley Keep Jets
KJOB

Oakland International Noise Abatement Procedures

• Educational materials such as ad-hoc reports, an airport
Airport Noise and Operations
ANOMS
Program
ADP

• All routine noise abatement reports
City of Alameda General Plan

• Basic information on Airport and aircraft noise programs
City of San Leandro General Plan

• Preferential Runway Use Agreement for San Leandro

• All routine noise abatement reports

Zoning/Land-Use Controls
Alameda County Airport Land Use Policy Plan (1986) establishes noise land use compatibility standards for noise sensitive uses. The Plan encourages no residential development up to 65 CNEL, but residential uses are permitted up to 70 CNEL if sound insulation is provided.

City of Alameda General Plan

The City of Alameda’s General Plan includes land-use requirements that are compatible with policies regarding development within the Airport enclaves.

City of Alameda General Plan

The City of Alameda’s General Plan includes stipulations for Bay Farm Island residential and business park development that are in accordance with the 1976 and 1980 Settlement Agreements with the Port of Oakland.

Noise Reduction Programs, Studies and Other Commitments

City of Alameda — Residential
Sound Insulation Program

To date, approximately 500 homes have been insulated on Bay Farm Island. The final one will be completed in 2006.

City of San Leandro — Residential
Sound Insulation Program

The Port will fund insulation expenses for 200 homes in San Leandro that are located south of I-880, and will also fund up to $100,000 for city administration costs.

City of San Leandro — School
Sound Insulation Program

The Port will fund insulation for the following schools in San Leandro.

City of San Leandro Unified School District.

The studies showed that existing conditions were sufficient to meet state law standards and that additional sound insulation was not required for the library and three schools identified in the Settlement Agreement.

Crosswind Runway Alignment Study

The Port, City of Alameda, and CLASS jointly undertook a noise study of single event and low frequency noise impacts associated with the cross wind runway alignments previously proposed by CLASS. The results showed that benefits were offset by noise increases in other communities east and south of the Airport.

Airport Tenant Orientation Program

The Port agreed to provide its existing and future tenants with information about the Airport’s noise abatement procedures and to gain their commitment to follow the procedures. Statements are attached to lease agreements.

General Aviation VFR Aircraft Study

The Port, Alameda, and CLASS agreed to jointly undertake an evaluation of general aviation aircraft departures from Runways 27L/R and 33 under visual flight rules. The project was completed in 2002.

Preferential Runway Use Agreement for San Leandro

The Port and San Leandro will work together to prepare and coordinate with FAA a preferential runway use agreement for North Field that addresses the mutual noise mitigation concerns relative to North Field nighttime operations and touch-and-go operations.

Ongoing Noise Abatement Work with the FAA

The Port agreed to continue to work with the FAA to gain their cooperation in implementing the Airport’s noise abatement procedures on the behalf of the City of Alameda, CLASS, and KJOB.

Master Plan

The Port agreed to prepare a 20-year Master Plan for the Airport in accordance with FAA Advisory Circular 150/5070-6A. Members of the Master Plan Stakeholder Committee include representatives from the cities of Alameda, San Leandro and Oakland, CLASS, and the San Leandro Unified School District. KJOB also was invited to participate.

Runway 11/29 Length Agreement

The Port agreed not to propose, approve, or construct any extension of Runway 11/29 that would give Runway 11/29 a total effective length in excess of 11,600 feet.

Meet and Confer Agreement

The petitioners agree to meet and confer in good faith with Port on any future efforts by Port to secure assurances for and construct an outboard runway at the Airport.

USPS Facilities Agreement

The Port agreed not to construct or enter into new leases that authorize construction of or modifications to the USPS facilities identified in the ADP as Project D.2 at any location on the Airport for at least 20 years.

Additional Noise Monitors Agreement

The Port agreed to install, operate, and maintain two remote monitoring terminals at the locations identified by KJOB when KJOB provides Port with written notice of the location for the noise monitoring sites and submits easements for the sites.

No New Runway Construction on North Field

The Port agreed not to construct any new runways on any portion of the North Field.

No Runway Expansion on North Field

The Port agreed that existing North Field runways may not be realigned or lengthened, or widened, etc., if the purpose of doing so is to increase the runway weight and load capacities to accommodate operations beyond alternate use by air carriers.

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### Acronyms

- **dB**: Decibels
- **SEL**: Sound Exposure Level, also known as SENEL

### Night Single Event Noise Contours

#### Boeing 727 HK Departure
- **Average Daily Departures**
  - **Day**: 3
  - **Evening**: 1
  - **Night**: 4
- **Year 2004**: 116
- **Year 2010**: 185

#### Boeing 727 HK Arrival
- **Average Daily Arrivals**
  - **Day**: 3
  - **Evening**: 2
  - **Night**: 3
- **Year 2004**: 104
- **Year 2010**: 179

#### Boeing 737 & A319/320* Departure
- **Average Daily Departures**
  - **Day**: 116
  - **Evening**: 37
  - **Night**: 22
- **Year 2004**: 156
- **Year 2010**: 185

#### Boeing 737 & A319/320* Arrival
- **Average Daily Arrivals**
  - **Day**: 104
  - **Evening**: 48
  - **Night**: 23
- **Year 2004**: 104
- **Year 2010**: 179

*These aircraft do not have identical noise contour footprints, but are very similar and are grouped here for display purposes.

**Most night operations of B737 aircraft occur between the hours of 10pm and 11pm and between 6am and 7am.**

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### Boeing 767 & A300/310 Departure

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### Boeing 767 & A300/310 Arrival

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### Boeing MD11/DC10 Departure

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### Boeing MD11/DC10 Arrival

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<th>Day</th>
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<tr>
<td>Year 2010</td>
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<td>1</td>
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</tbody>
</table>

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Figure 6.15
Community Noise Equivalent Level (CNEL) Contours 2004

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Figure 6.17
Community Noise Equivalent Level (CNEL) Contours 2004 and 2010

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Legend
- 60 dB CNEL Year 2004
- 65 dB CNEL Year 2004
- 70 dB CNEL Year 2004
- 60 dB CNEL Year 2010
- 65 dB CNEL Year 2010
- 70 dB CNEL Year 2010

Acronyms
CNEL: Community Noise Equivalent Level
dB: Decibel
Air Quality Programs

Alternative Fuel Programs
- Ground transportation providers are required to have 50% of their fleet in alternative fuel vehicles (taxis, door-to-door shuttles, off-airport parking shuttles, hotel shuttles, etc.).
- Airport light duty fleet, where practical, is alternative fuel vehicles.
- Airport heavy duty fleet uses ultra low sulfur diesel.

Port of Oakland
- Facility opened in July 2002
- Open 24 hours
- Serves Port vehicles, private operators and general public

CNG Refueling Station Fueling Volumes, 2002–2005

Ground Service Equipment (GSE) Alternative Fuel Program
- GSE includes: conveyer belt baggage loaders, forklifts, food service vehicles, bags, baggage carts, etc.
- GSE typically runs on either diesel or gasoline.
- Airport staff is working with airlines on local and national level to address ways to replace GSE fleet with alternative fuels.
- Airport staff is currently conducting an inventory of equipment and exploring grant opportunities to help offset costs.

BART-OAK Connector (BART Connector)
- Airport supports development of BART Connector
- For the last 12 months ending April 30, 2005, AirBART carried over 1,154,000 riders.
- Employees receive discount tickets for riding AirBART, resulting in 3% of the ridership.


diagram
diagram

Recycling Programs

Recycling in the Passenger Terminals
- Port launched first passenger recycling program on Earth Day 2002.
- The program has since expanded to collect newspapers, magazines, office paper, cars and bottles.
- In 2004, the program diverted over 298 tons of material from the landfill.

Food Waste Program
- Food waste recovery was added in 2004.
- Program collects pre-consumer waste such as vegetable trimmings, coffee grounds and filters, milk cartons, cheesy pizza boxes and used paper towel from Airport food concessions.
- Material is then used as high nutrient fertilizer in the production of organic food.
- 51 tons were diverted from the landfill in 2004.

Airport Consolidated Waste and Recycling Program
- Open 24 hours
- Facility opened in July 2002
- Serves Port vehicles, private operators and general public


diagram
diagram

Air Quality Programs

Airport Ground Power and Pre-Conditioned Air Loading Bridges
- Newly constructed loading bridges provide pre-conditioned air and reduce air emissions. Without pre-conditioned air and ground power, aircraft generate electricity by running on the aircraft's jet fuel.
- Trip Reduction Program
  - Airport coordinates and provides shuttle schedule information to Airport tenants.
  - Discount AirBART tickets are available to employees.
  - Vanpool parking is available.
  - Employee commute survey was completed in April 2004. 87% of respondents indicated they drive to work alone but would consider alternative transportation, if given incentives. Airport is analyzing data and will develop a trip reduction program including travel demand recommendations, communication materials for use by tenants and provide on-going commute program support.

Stormwater Programs
- Port has a monitoring program to raise awareness of water quality issues and assist in compliance with State Water Resources Control Board's industrial permit.
- Port holds workshops, training, collects and analyzes stormwater samples, and inspects facilities.
- Port provides assistance to contractors on developing storm water pollution prevention plans.

Wetlands Management Program

Oro Loma
- The program restored a 16-acre diked and filled area of former bylands on Oro Loma Sanitary District land. Restoration was completed in September 2000 and monitoring of the project continues through 2005.

Damon Slough
- The program expanded and expanded a 9-acre seasonal wetland adjacent to Martin Luther King Jr. Regional Shoreline.

Burrowing Owl Mitigation Program

Burrowing Owls are a California "Species of Concern." To provide long-term maintenance of a stable Burrowing Owl population, construction impacts on their habitat are mitigated on an ongoing basis. Accordingly, the Port purchased 70 acres in eastern Alameda County to establish off-Airport mitigation. Ownership of 70 acres was transferred to California Department of Fish and Game.

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Graphics are not to scale.

LEGEND

- Sound Source
- Sound Direction
- Line of Sight Between Source and Receiver

Figure 6.19
Oakland International Airport Master Plan
March 2006
Potential Takeoff Noise Barrier Near Source or Receiver
Figure 6.20

Potential Takeoff Noise Barriers

Legend
- Potential Barriers
- Potential Barrier Extension
- Object Free Setback

Acronyms
- dBA: Decibels Adjusted
- Lmax: Maximum Sound Level

Notes
- Aircraft are not to scale.
- Noise estimates are for a very calm wind.
- Noise barrier calculations include only one barrier, either at the airport or at Neptune Dr.
- Noise barriers will have little effect on low frequency noise.

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Potential Effect of Barrier on Departure Noise
No Wind, Outdoor Noise Level, Neptune Drive Backyard

Boeing 727

Boeing MD-11/DC-10

Boeing 737–700

Average Daily Departures
Year 2004
Year 2010
Day
Evening
Night
Day
Evening
Night
Day
Evening
Night
Year 2004
3
1
4
Year 2004
5
1
6
Year 2010
1
0
2
Year 2010
5
1
8

* includes all B737 and A318, A319 and A320 models
** Most night operations of B737 aircraft occur between the hours of 10pm and 11pm and between 6am and 7am

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