3.12 NOISE

This section describes the existing physical and regulatory setting related to noise and vibration and discusses the potential effects of the EA Alternatives related to noise and vibration.

3.12.1 Acoustic Terminology and Definitions

Noise is generally defined as unwanted or objectionable sound. Many factors influence how a sound is perceived and whether it is considered harmful or disruptive to an individual or a community. These factors include primary physical characteristics of a sound (e.g., amplitude, frequency, duration, etc.), but also secondary acoustic and non-acoustic factors that can influence perception regarding the degree to which noise is intrusive and disruptive. The effects of noise on people can include general annoyance, interference with speech communication, sleep disturbance, and in the extreme, hearing impairment. Noise effects can be caused by its pitch or loudness. Pitch is the height of a tone; higher pitched sounds are louder to humans than lower pitched sounds. Loudness is intensity or amplitude of sound.

Noise levels are measured as decibels (dB) on a logarithmic scale that quantifies sound intensity in a manner similar to the Richter scale used for earthquake magnitudes. Thus, a doubling of the energy of a noise source, such as doubling of traffic volume, would increase the noise level by 3 dB; a halving of the energy would result in a 3-dB decrease. The human ear is not equally sensitive to all frequencies within the sound spectrum. Therefore, sound can be characterized by several methods. The most common method is the “A-weighted” sound level (dBA), which gives greater weight to the frequencies audible to the human ear by filtering out noise frequencies not audible to the human ear. Human judgments of the relative loudness or annoyance of a sound correlate well with the dBA levels of those sounds. Therefore, the dBA scale is used for measurements and standards involving the human perception of noise.

Human perception of noise has no simple correlation with acoustical energy. The perception of noise is not linear in terms of dBA or acoustical energy. Two noise sources do not sound twice as loud as one source. It is widely accepted that the average healthy person can barely perceive an increase or decrease of 3 dBA; that a change of 5 dBA is readily perceptible; and that an increase of 10 dBA sounds twice as loud (Caltrans, 2009). Table 3.12-1 lists common indoor and outdoor activities and the corresponding sound levels to demonstrate human perception of the correlation of noise with acoustical energy.

In addition to instantaneous noise levels, the duration or magnitude of noise over time is important to the assessment of potential noise disturbance. Average noise levels over a period of time are usually expressed as dBA energy-equivalent noise level (L_{eq}), or the equivalent noise level for that period. For example, $L_{eq(3)}$ would be a 3-hour average; when no period is specified, a 1-hour average is assumed. The time of day is also an important factor for noise assessment, because noise levels that may be acceptable during the day may interfere with the ability to sleep during evening or nighttime hours. Therefore, there are 24-hour noise-level descriptors that incorporate noise penalties (in decibels) for evening and night periods. The community noise equivalent level (CNEL) is the cumulative noise exposure in a community during a 24-hour period, with a 5-dBA penalty added to evening sound levels (between 7 P.M. and 10 P.M.), and a 10-dBA penalty added to the night sound levels (between 10 P.M. and 7 A.M.). The day/night average sound level (L_{dn}) is similar to CNEL, except that the 3-hour evening period is considered with the daytime period and does not include the penalty that is applied with the CNEL.

Table 3.12-1: Representative Environmental Noise Levels

Common Outdoor Noise Sources	Noise Level (dBA)	Common Indoor Noise Sources
Power Saw	—110—	Rock Band
Jet Fly-over at 100 feet		Crying Baby
Subway	—100—	
Gas Lawn Mower at 3 feet		
Tractor	—90—	
		Food Blender at 3 feet
Diesel Truck Moving at 50 mph at 50 feet	—80—	Garbage Disposal at 3 feet
Noisy Urban Area during Daytime		
Gas Lawn Mower at 100 feet	—70—	Vacuum Cleaner at 10 feet
Commercial Area		Normal Speech at 3 feet
Heavy Traffic at 300 feet	—60—	Sewing Machine
Air Conditioner		Large Business Office
Quiet Urban Area during Daytime	—50—	Dishwasher in Next Room
		Refrigerator
Quiet Urban Area during Nighttime	—40—	Theater, Large Conference Room (background)
Quiet Suburban Area during Nighttime		
	—30—	Library
Quiet Rural Area during Nighttime		Bedroom at Night, Concert Hall (background)
	—20—	
		Broadcast/Recording Studio
	—10—	
Lowest Threshold of Human Hearing	—0—	Lowest Threshold of Human Hearing

Notes: dBA = A-weighted decibels
Source: American Association of State Highway and Transportation Officials. *Guide on Evaluation and Attenuation of Traffic Noise*. 1974

Noise levels from a source decline as distance to the receptor increases. Other factors, such as the weather and reflecting or shielding structures, also may intensify or reduce the noise level at a location. Sound waves reflect off of hard surfaces, but are partially absorbed by softer or irregular surfaces. A commonly used rule of thumb for roadway noise is that for every doubling of distance from the source, the noise level is reduced by about 3 dBA at acoustically “hard” locations (i.e., where the area between the noise source and the receptor is nearly complete asphalt, concrete, hard-packed soil, or other solid materials) and 4.5 dBA at acoustically “soft” locations (i.e., where the area between the source and receptor is unpacked earth or has vegetation, including grass). Noise from stationary or point sources (such as construction equipment) is reduced by about 6 to 7.5 dBA for every doubling of distance at acoustically hard and soft locations, respectively. Generally, if a noise source is completely enclosed or completely shielded with a solid barrier located close to the source, an 8 dBA noise reduction can be expected; if the enclosure or barrier is interrupted, noise would be reduced by only 5 dBA. The exterior-to-interior reduction of newer residential units and office buildings is generally 30 dBA or more.

3.12.2 Fundamentals of Environmental Ground-borne Vibration

Vibration is the periodic oscillation of a medium or object. The rumbling sound caused by the vibration of room surfaces is called groundborne noise. Both natural phenomena (e.g., earthquakes, volcanic eruptions, sea waves, landslides) and human-made causes (e.g., explosions, machinery, traffic, trains, construction equipment) can result in groundborne vibration. Some vibration sources, such as factory machinery, are continuous; others, such as explosions, are transient. Vibration amplitude is typically expressed in peak particle velocity (PPV) or root mean square (RMS), as in RMS vibration velocity. The PPV and RMS velocity are normally described in inches per second (in/sec). PPV is defined as the maximum instantaneous positive or negative peak of a vibration signal. PPV is the metric often used to describe blasting vibration and other vibration sources that result in structural stresses in buildings (FTA, 2006).

Although PPV is appropriate for evaluating the potential for building damage, it is not always suitable for evaluating human response. It takes some time for the human body to respond to vibration signals. In a sense, the human body responds to average vibration amplitude. The RMS of a signal is the average of the squared amplitude of the signal, typically calculated over a period of 1 second. As with airborne sound, the RMS velocity is often expressed in decibel notation as vibration decibels (VdB), which serves to compress the range of numbers required to describe vibration (FTA, 2006). This vibration decibel scale is based on a reference value of 1 microinch per second (µin/sec). The background vibration-velocity level typical of residential areas is approximately 50 VdB.

Groundborne vibration is normally perceptible to humans at approximately 65 VdB. For most people, a vibration-velocity level of 75 VdB is the approximate dividing line between barely perceptible and distinctly perceptible levels. Table 3.12-2 summarizes the general human response to different levels of groundborne vibration.

Table 3.12-2: Human Response to Different Levels of Groundborne Vibration

Vibration-Velocity Level (VdB)	Human Reaction
65	Approximate threshold of perception.
75	Approximate dividing line between barely perceptible and distinctly perceptible. Many people find that transportation-related vibration at this level is unacceptable.
85	Vibration acceptable only if there is an infrequent number of events per day.

Note:
VdB = vibration decibels referenced to 1 microinch per second and based on the root mean square vibration velocity.
Source: FTA, 2006

Sensitive Receptors

People typically experience annoyance when they are exposed to vibration that exceeds certain thresholds. These thresholds are generally lower than threshold levels for vibration-related building damage. Buildings that are normally occupied by people are considered sensitive to groundborne vibration. Historical or lightweight buildings are considered most vulnerable to vibration damage; thus, more stringent vibration-damage thresholds are recommended for these building types. Buildings used for research, manufacturing, or healthcare operations that are sensitive to very low thresholds of vibration to function effectively (e.g., magnetic resonance imaging [MRI] or

microelectronics manufacturing facilities) are also considered vibration sensitive; groundborne vibration can result in structural damage and/or interfere with the intended functions of such buildings (FTA, 2006).

3.12.3 Regulatory Framework

Noise Control Act

The USEPA Office of Noise Abatement and Control was established to coordinate federal noise control activities. After its inception, the Office of Noise Abatement and Control established programs and guidelines under the federal Noise Control Act of 1972 to identify and address the effects of noise on public health and welfare and the environment. A summary of recommended guidelines for noise levels considered safe for community exposure without the risk of adverse effects on health or welfare are presented in Table 3.12-3 (EPA, 1974). To prevent hearing loss over the lifetime of a receptor, the yearly average L_{eq} should not exceed 70 dBA; to prevent activity interference and annoyance, the L_{dn} should not exceed 55 dBA in outdoor activity areas or 45 dBA indoors.

Table 3.12-3: Summary of Noise-Level Standards Recommended by the U.S. Environmental Protection Agency

Effect	Level	Area
Hearing loss	$L_{eq(24)} \leq 70$ dB	All areas
Outdoor activity interference and annoyance	$L_{dn} \leq 55$ dB	Outdoor in residential areas and farms and other outdoor areas where people spend widely varying amounts of time and other places in which quiet is a basis for use
	$L_{eq(24)} \leq 55$ dB	Outdoor areas where people spend limited amounts of time, such as school yards and playgrounds
Indoor activity interference and annoyance	$L_{dn} \leq 45$ dB	Indoor residential areas
	$L_{eq(24)} \leq 45$ dB	Other indoor areas with human activities, such as schools

Notes:
dB = decibels; EPA = U.S. Environmental Protection Agency; L_{dn} = day-night noise level (L_{eq} with a 10-dB nighttime weighting); $L_{eq(24)}$ = equivalent noise level (the sound energy averaged over a 24-hour period)
Source: EPA, 1974

The Noise Control Act is applicable to the EA Alternatives insofar as it establishes general guidelines related to what would be considered acceptable noise levels generated by a project alternative and perceived by adjacent or on-site receptors.

Federal Transit Administration Groundborne Vibration Guidelines

To address the human response to groundborne vibration, the Federal Transit Administration (FTA) has guidelines for maximum-acceptable vibration criteria for different types of land uses. Maximum-acceptable vibration criteria based on the frequency of an event are applied to different types of land uses to address the human response to groundborne vibration (FTA, 2006). These guidelines recommend 65 VdB, referenced to 1 microinch per second (µin/sec) and based on the velocity amplitude for land uses where low ambient vibration is essential for interior operations (e.g., hospitals, high-tech manufacturing, laboratory facilities); 80 VdB for residential uses and buildings where people normally sleep; and 83 VdB for institutional land uses with primarily

daytime operations (e.g., schools, churches, clinics, offices) (FTA, 2006). Table 3.12-4 shows the allowable project-generated noise level increases determined to be acceptable.

Table 3.12-4: Summary of Groundborne-Vibration Impact Criteria Recommended by the Federal Transit Administration

Land Use Category	Impact Levels (VdB; relative to 1 µin/sec)		
	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]
Category 1: Buildings where vibration would interfere with interior operations	65[4]	65[4]	65[4]
Category 2: Residences and buildings where people normally sleep	72	75	80
Category 3: Institutional land uses with primarily daytime uses	75	78	83

Notes:
FTA = Federal Transit Administration; VdB = vibration decibels; µin/sec = microinch per second
[1] Defined as more than 70 vibration events of the same source per day. Most rapid transit projects fall into this category.
[2] Defined as 30–70 vibration events of the same source per day. Most commuter trunk lines have this many operations.
[3] Defined as fewer than 30 vibration events of the same kind per day. This category includes most commuter rail branch lines.
[4] This criterion limit is based on levels that are acceptable for most moderately sensitive equipment, such as optical microscopes. Vibration-sensitive manufacturing or research will require detailed evaluation to define the acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the heating, ventilation, and air conditioning systems and stiffened floors.
Source: FTA, 2006

Standards also have been established to address the potential for construction-caused vibration annoyance or interference. The primary concern related to construction vibration is the potential for the operation of heavy-duty construction equipment to cause structural damage to buildings. Varying criteria have been developed to address the appropriate level of vibration considered acceptable before it may result in damage to structures or varying building types (FTA, 2006). Table 3.12-5 shows the allowable project-generated vibration-level thresholds determined to be acceptable for different building types.

Table 3.12-5: Summary of Vibration-Damage Criteria Recommended by the Federal Transit Administration

Building Category	PPV (in/sec)	Approximate VdB
Reinforced concrete, steel, or timber (no plaster)	0.5	102
Engineered concrete and masonry (no plaster)	0.3	98
Nonengineered timber and masonry buildings	0.2	94
Buildings extremely susceptible to vibration damage	0.12	90

Notes:
FTA = Federal Transit Administration; in/sec = inches per second; PPV = peak particle velocity; VdB = vibration decibels
Source: FTA, 2006

The criteria established by FTA and noted above are applicable to the Proposed Action because they are widely used and provide a sound basis for determining how the vibration levels generated by the EA Alternatives would be perceived by adjacent or on-site receptors.

3.12.4 Affected Environment

Existing Noise and Vibration Sources

VA Transfer Parcel

Very few noise sources currently exist within the VA Transfer Parcel. No public roadways currently traverse this area and public access is restricted. Noise sources that contribute to the overall ambient noise level in the area include occasional maintenance vehicles and marine activities along the Oakland Estuary and San Francisco Bay. Management activities for the CLT colony that occur before and during nesting/breeding season also contribute to the noise sources during those times.

Surrounding Area

The predominant noise sources in the surrounding area are mobile sources, such as personal-occupancy and delivery vehicles, and stationary equipment, such as heating, ventilation, and air conditioning (HVAC) systems. Vehicle traffic consists primarily of personal-occupancy vehicles, because there is limited public-transit traffic in the Alameda Point area. Most of the perceivable noise from stationary-source equipment is located in the eastern portion of Alameda Point, where there are existing structures. Other stationary-source noise in the area is generated largely on the rooftops of existing structures and shielded from view by the existing structures.

Noise Measurements

To identify representative noise levels in the Alameda Point area, existing daytime noise levels were monitored on March 11, 2009, from 7 A.M. to 7 P.M. at one location on the VA Transfer Parcel (i.e., northwest corner of the California Least Tern colony). Noise levels were measured using a Larson-Davis Model 820 precision sound level meter, which satisfies the requirements of the American National Standards Institute for general environmental noise measurement instrumentation. The maximum, minimum, and average noise levels measured at the VA Transfer Parcel are identified in Table 3.12-6.

Table 3.12-6: Existing Ambient Noise Levels in the Study Area

Location	Average Noise Level	Maximum Noise Level	Minimum Noise Level
Northwest Corner of CLT colony	52 dBA L_{eq}	100 dBA L_{max}	38 dBA L_{min}

Notes: dBA = A-weighted decibels; L_{eq} = energy-equivalent noise level; L_{max} = maximum noise level (the maximum instantaneous noise level during a specific period); L_{min} = minimum noise level (the minimum instantaneous noise level during a specific period)

Source: Data compiled by AECOM in 2009

Noise-sensitive Receptors

VA Transfer Parcel

There are no sensitive human noise-sensitive receptors within the existing VA Transfer Parcel. However, the VA Transfer Parcel does include wildlife noise-sensitive receptors, the CLT colony. See Section 3.1 (Biological Resources) for a discussion of noise as it relates to the existing CLT colony.

Surrounding Area

The nearest sensitive human receptors to the VA Transfer Parcel are located in the surrounding area. These receptors include residential homes located near the northeast corner of Alameda Point, south of Main Street, approximately 3,700 feet east of the eastern edge of the VA Transfer Parcel. Receptors near roadways that would be used by project traffic include residential areas and schools adjacent to Atlantic Avenue (Ralph Appezzato Memorial Parkway) east of Main Street. It should also be noted that existing noise levels at the project site are considered acceptable for sensitive receptors. As noted above, EPA generally establishes a noise standard of 55 dBA L_{eq} for outdoor areas where people spend limited amounts of time. Existing ambient noise levels do not exceed these standards, and, as a result, are considered acceptable.

3.12.5 Environmental Consequences

Assessment Methods

To assess potential noise impacts from implementation of the EA Alternatives, the effects of construction-related and operational activities on sensitive receptors were identified and assessed. The noise (and vibration) levels of equipment expected to be used in various construction and operational projects were determined and resultant noise levels at sensitive receptors were calculated, assuming documented rates of noise (vibration) attenuation.

Alternative 1

Construction

Noise

Initial construction under Alternative 1 would take approximately 18 months to complete and would entail development of the VHA OPC, VBA Outreach Office, Conservation Management Office, NCA Cemetery, and associated infrastructure within the VA Development Area and an off-site access utility/road corridor. It is anticipated that approximately 441,000 cubic yards of fill would be trucked to the VA Development Area for the initial construction. All construction staging areas would be located within the VA Development Area.

Equipment required for all construction activities under Alternative 1 would include scrapers, graders, loaders, backhoes, vibratory rollers, on-site dump trucks, welders, rollers, pavers, cement/mortar mixers, and water trucks. Additional equipment required only during the initial construction would include tracked dozers and cranes. In addition to general construction equipment, pile driving or deep-compaction techniques would be required for structural foundations.

Construction noise is generated by the operation of construction equipment and vehicles and by the transport of material and workers to and from the site. Construction noise levels are a function of the type of equipment used and the timing and duration of the noise-generating activities. Noise levels vary for individual pieces of equipment, because equipment comes in different sizes and with different engines. Construction equipment noise levels also vary as a function of the activity level or duty cycle. Typical construction projects, with equipment moving from one point to another, work breaks, and idle time, have lower long-term average noise levels than louder short-term noise events. Additionally, noise levels are calculated from the center of the activity because of

the dynamic nature of a construction site. Table 3.12-7 lists noise generation levels for various types of equipment that could be used to construct site facilities.

Table 3.12-7: Noise Levels of Typical Construction Equipment

Equipment Type	Typical Noise Level (dBA) @ 50 feet	Usage Factor (%)
Air compressor	80	40
Backhoe	80	40
Concrete pump truck	82	20
Crane, mobile	85	16
Dozer	85	40
Excavator	85	40
Front-end loader	80	40
Generator	82	50
Pneumatic tools	85	50
Pumps	77	50
Roller	85	20
Welder	73	40
Trucks	74–81	

Notes:
dBA = A-weighted decibels; usage factor = the percent per hour equipment is in use.
All equipment is fitted with a properly maintained and operational noise control device, per manufacturer specifications. Noise levels listed are manufacturer-specified noise levels for each piece of heavy construction equipment.
Source: FTA, 2006

Maximum noise levels from construction equipment typically range from approximately 70 dBA to 90 dBA at 50 feet from the equipment (Table 3.12-7). In a typical construction project, the generators of the loudest short-term noise tend to be earth-moving equipment under full load at approximately 85–90 dBA at a distance of 50 feet from the source. In addition to these maximum instantaneous noise levels, the magnitude of construction noise can be defined by the type of construction activity, the various pieces of equipment operating, and the duration of the activity. Typically, construction noise is averaged over time and expressed as dBA L_{eq}.

Noise levels from construction activities are typically considered “point” sources and attenuate with distance at a rate of 6 dBA per doubling of distance over hard site surfaces, such as streets and parking lots, and a rate of 7.5 dBA per doubling of distance for soft site surfaces, such as grass fields and open terrain with vegetation (FTA, 2006). Operational noise from constructed facilities includes equipment operation (e.g., pumps, generators, fans), vehicle trips to and from the facilities for operation and maintenance, and facility worker trips.

During initial construction under Alternative 1 a maximum noise level of 85 dBA L_{max} and hourly noise level of 77 dBA L_{eq} is projected to occur at a distance of 50 feet from the center of typical construction activity. Pile-driving activities are projected to generate maximum noise levels of 95 dBA L_{max} at 50 feet each time the hammer head strikes the pile. It is estimated that the actual strike of an impact pile driver accounts for 20% of each hour that the equipment is operating on site, thus resulting in an average hourly noise level of 88 dBA L_{eq} at 50 feet from the pile being driven. See Appendix G for complete construction noise modeling results.

The nearest human noise-sensitive receptor (residential area located east of the VA Transfer Parcel on Pan Am Way) is located approximately 3,700 feet (approximately 0.7 mile) from the edge of the VA Development Area. The intervening ground is a mix of developed buildings, green space, and concrete and would be considered acoustically soft because of surface variability and intervening structures. For the purposes of this impact analysis, construction activities are conservatively considered to potentially occur anywhere within the VA Development Area identified for improvements (e.g., the VHA OPC, parking lot, NCA Cemetery improvements).

Construction noise attributable to Alternative 1 was estimated using the FTA's noise methodology for predicting noise from heavy equipment (FTA, 2006). Construction noise levels at the nearest off-site receptor were modeled based on these parameters. The modeling generated a maximum noise level of 36 dBA L_{max} and 28 dBA L_{eq} at the nearest off-site receptor during the initial construction which would be the most intense phase of construction. Pile-driving noise levels at the nearest off-site receptor were also modeled; the modeling generated a maximum noise level of 46 dBA L_{max} and 38 dBA $L_{eq.}$ These modeled noise levels at the nearest off-site receptor would be considered inaudible relative to existing background noise levels. No new receptors would be affected during the subsequent phases of cemetery construction.

Construction during Alternative 1 would require haul trips on area roads as trucks transport fill materials from local commercial quarries to the VA Development Area. Estimates of noise levels are based on the amount of material to be hauled, the number of days of construction, and the hours per day when hauling would occur. Construction-related traffic would be distributed over the roadway network identified in the traffic impact study prepared for this EA (AECOM, 2012). Based on estimates of fill needed for Alternative 1, a maximum of 372 haul trucks per day would be needed at the peak of construction activities. Noticeable increases of 3 dBA (L_{dn}) typically do not occur without a doubling in roadway traffic volumes (Caltrans, 2009:N-96). Existing intersection peak-hour traffic volumes range from 191 to 232 trips per hour; Alternative 1–related haul trucks would generate approximately 16 additional trips per hour at the two main intersections accessing the VA Development Area (Willie Stargell Avenue and Atlantic Avenue). Because Alternative 1 would add less than double the traffic volume to the existing roadways, noise increases from construction traffic under this alternative is projected to be less than 3 dBA.

In summary, noise levels during initial construction under Alternative 1 is projected to be less than 55 dBA at the nearest sensitive human receptors, and off-site construction traffic would not result in a substantial increase in area traffic; thus, temporary noise generated by Alternative 1 construction activities would not result in a substantial increase in the ambient noise environment. As a result, construction-related noise impacts of Alternative 1 would be short term and would not be significant. A discussion of potential effects to biological resources is included in Section 3.1 (Biological Resources).

It is assumed subsequent phased expansion of the cemetery as part of construction under Alternative 1 would include periodic development of 6 acres of land over a period of approximately 12 months beginning in 2026. In addition, it is anticipated that approximately 62,400 cubic yards of fill would be delivered by truck to the VA Development Area for the cemetery under the subsequent phases of cemetery construction under Alternative 1. Noise levels during the first phase of construction is projected to be less than 55 dBA at the nearest sensitive receptor and construction would be substantially less during subsequent phases of cemetery construction. Under subsequent phases of cemetery construction under Alternative 1, noise impacts would be similar to or less than the impact identified for initial construction, because construction during these later phases generally would

involve activities that would occur farther from existing off-site receptors and would be less intense. Because future phases of development (i.e., NCA National Cemetery) under Alternative 1 would result in noise less than 55 dBA at the nearest sensitive receptors, temporary noise generated by construction activities during these future phases would not result in a substantial increase in the ambient noise environment. As a result, construction-related noise impacts associated with subsequent cemetery construction under Alternative 1 would be short term and would not be significant.

Vibration

Construction activities would result in varying degrees of temporary groundborne vibration, depending on the specific construction equipment used and the activities involved. Vibration generated by construction equipment that would be used during initial construction of Alternative 1 spreads through the ground and diminishes in magnitude with increases in distance. Using FTA's recommended procedure (FTA, 2006) to apply a propagation adjustment to these reference levels, construction activities would need to occur within 40 feet of vibration-sensitive receptors to exceed 80 VdB, FTA's maximum-acceptable vibration standard with respect to human annoyance for sensitive uses. Activities would need to occur within 15 feet to exceed 0.2 PPV in/sec, FTA's maximum-acceptable vibration standard with respect to structural damage. See Appendix G for complete construction vibration modeling results.

Because there are no existing on-site human sensitive receptors (i.e., residences and inpatient facilities), and because off-site human sensitive receptors would be a minimum of 3,700 feet from the proposed development, construction of Alternative 1 would occur well beyond the threshold distances identified above and would not expose any sensitive human receptors to excessive levels of vibration. As a result, construction-related vibration impacts of Alternative 1 would be short-term and would not be significant.

On-site vibration levels during subsequent construction of the NCA Cemetery (approximately 6 acres over a period of 12 months as needed from 2026 through 2116) would be less than the aforementioned FTA standards at the nearest sensitive receptors. Construction of the subsequent cemetery phases would be substantially less than under the initial facility construction. Therefore, temporary vibration generated by Alternative 1 subsequent cemetery construction activities would not result in a substantial increase in vibration. Construction-related vibration impacts of Alternative 1 subsequent cemetery construction would be short term and would not be significant.

Operation

Mobile-Source Noise

Operation of the proposed VA facilities under Alternative 1 would result in an increase in traffic volumes on the local roadway network, and consequently, in an increase in noise levels from traffic sources along affected roadway segments. Traffic noise levels associated with Alternative 1 were calculated for roadway segments that would receive the greatest contribution of project-generated traffic in the vicinity of the VA Development Area, using the FHA's Highway Noise Prediction Model (FHWA-RD-77-108).

Traffic noise levels were modeled under existing conditions. Traffic volumes were derived from 2017 P.M. peak-hour intersection volumes as presented in the traffic impact study prepared for this project (AECOM, 2012). Table 3.12-8 summarizes the modeled traffic noise levels of Alternative 1 (year 2017) at 100 feet from the centerline

Table 3.12-8: Predicted Traffic Noise Levels at Full Buildout of Alternative 1 (Year 2017)

Roadway	Segment		L_{dn} at 100 Feet, dB				
	From	To	Existing	Existing Plus Project	Net Change	Significance Threshold	Significant Impact?
Atlantic Avenue	Webster Street	Main Street	64.8	65.6	0.8	1.5	No
Willie Stargell Avenue	Webster Street	Main Street	63.1	64.8	1.8	3	No
Main Street	Atlantic Avenue	Willie Stargell Avenue	60.5	62.8	2.3	3	No
Webster Street	Atlantic Avenue	Willie Stargell Avenue	67.9	68.6	0.7	1.5	No
Webster Street	Willie Stargell Avenue	North	69.2	70.1	0.9	1.5	No

Notes: dB = (A-weighted) decibels; L_{dn} = day-night average noise level
Traffic noise levels are predicted at a standard distance of 100 feet from the roadway centerline and do not account for shielding from existing noise barriers or intervening structures. Traffic noise levels may vary depending on actual setback distances and localized shielding.
Source: Data compiled by AECOM in 2012

of affected roadway segments in the project area. Additional input data included day/night percentages of automobiles, medium and heavy trucks, vehicle speeds, ground attenuation factors, and roadway widths. See Appendix G (insert name) for complete traffic noise modeling results.

The modeling conducted shows that implementation of Alternative 1 in 2017 in addition to then-existing conditions would result in traffic noise-level increases up to 2.3 dB L_{dn} compared to existing noise levels. Therefore, noise levels from traffic generated by Alternative 1 would not result in a substantial permanent increase in ambient noise levels. Accordingly, the operational noise impacts of Alternative 1 from mobile sources would not be significant.

Stationary-Source Noise

Implementing Alternative 1 would result in an increase in on-site stationary-source noise associated with operation of HVAC units as part of the use of proposed buildings, loading docks, landscaping, maintenance, and parking areas. The VHA OPC and NCA Cemetery would be day-use-only facilities, and no overnight sensitive receptors (i.e., residences or inpatient facilities) would be located on site. Because of the distance (3,700 feet) and intervening structures between Alternative 1 development and the nearest human sensitive receptors, noise levels from stationary sources located on site would have to exceed 102 dBA—equivalent to a jet flyover (Table 3.12-1)—to exceed 55 dBA at the nearest sensitive receptor. No stationary noise sources proposed by Alternative 1

would generate noise exceeding 102 dBA. (Typical HVAC noise ranges from 45 dBA to 70 dBA L_{eq} at a distance of 50 feet [EPA, 1971].) In addition to this stationary-source noise, periodic firearm salutes would take place during ceremonies and events on cemetery property. These salutes would be short in duration (less than 10 minutes) and would occur infrequently. As a result, operation of stationary noise sources under Alternative 1 would not cause ambient noise levels at nearby sensitive receptors to increase substantially. Thus, the operational noise impacts of Alternative 1 from stationary sources would not be significant. See Section 3.1 (Biological Resources) for a discussion of potential effects to biological resources.

Vibration

Long-term project operation under Alternative 1 would not include any major sources of vibration. In addition, there are no on-site human sensitive receptors, and off-site human receptors would be a minimum of 3,700 feet from the proposed development. Therefore, operations under Alternative 1 would not expose any sensitive human receptors to excessive levels of vibration and would have no permanent effect on groundborne vibration. Thus, vibration impacts of Alternative 1 would not be significant.

Alternative 2 (Preferred Alternative)

Construction

Noise

Alternative 2 would involve construction activities similar to those of Alternative 1. Alternative 2 construction activities would occur in different locations on the VA Transfer Parcel than activities for Alternative 1; however, as under Alternative 1, the nearest sensitive human receptors are 3,700 feet from the construction activities proposed for Alternative 2. Therefore, modeling of construction noise levels for Alternative 2 generated a maximum noise level of 36 dBA L_{max} and 28 dBA L_{eq} at the nearest off-site receptor during the most intense phase of construction (Phase 1). Pile-driving noise levels at the nearest off-site human receptor would generate a maximum noise level of 46 dBA L_{max} and 38 dBA L_{eq} at the nearest off-site receptor. These maximum construction noise levels are identical to the maximum noise levels modeled for Alternative 1. As noted above (Table 3.12-6), ambient noise levels in the area average approximately 52 dBA L_{eq}. Thus, on-site construction equipment would be considered inaudible relative to existing background noise levels.

Construction traffic associated with Alternative 2 also would be similar to construction traffic for Alternative 1, with approximately 16 trips per hour per intersection. As noted above, noticeable increases of 3 dBA (L_{dn}) typically do not occur without a substantial (i.e., doubling) increase in roadway traffic volumes (Caltrans, 2009:N-96). As under Alternative 1, construction trips associated with Alternative 2 would not double existing traffic volumes, and therefore would not substantially increase the area's traffic noise levels. Construction under Alternative 2 would not result in a substantial temporary increase in ambient noise levels, nor would it generate noise exceeding applicable standards. As a result, Alternative 2 construction activities would not result in a substantial increase in the ambient noise environment. Construction-related noise impacts of Alternative 2 would be short-term and would not be significant.

Vibration

Alternative 2 would involve construction activities similar to those of Alternative 1. Alternative 2 construction activities would occur in different locations on the VA Transfer Parcel than activities for Alternative 1; however, as under Alternative 1, the nearest sensitive human receptors to any initial construction activity are 3,700 feet away (i.e., residential development located near northeast corner of Alameda Point). Using FTA's recommended procedure (FTA, 2006) to apply a propagation adjustment to these reference levels, construction activities would need to occur within 40 feet of vibration-sensitive human receptors to exceed 80 VdB, FTA's maximum-acceptable vibration standard with respect to human annoyance for sensitive uses. Activities would need to occur within 15 feet to exceed 0.2 PPV in/sec, FTA's maximum-acceptable vibration standard with respect to structural damage.

Because there are no on-site human sensitive receptors (i.e., residences and in-patient facilities), and because off-site receptors would be a minimum of 3,700 feet from the proposed development, construction of Alternative 2 facilities would not expose any sensitive human receptors to excessive levels of vibration. As a result, construction-related vibration impacts of Alternative 2 initial construction would be short-term and would not be significant.

It is assumed that as part of subsequent cemetery phase construction under Alternative 2 additional areas of the proposed NCA Cemetery would be developed over a period of approximately 12 months beginning in 2026. On-site vibration levels during initial construction would be less than FTA standards at the nearest sensitive human receptors and construction would be substantially less under subsequent cemetery phase construction than under initial construction. Therefore, temporary vibration generated by Alternative 2, subsequent cemetery phase construction activities would not result in a substantial increase in vibration. Construction-related impacts of Alternative 2 subsequent cemetery phases would be short-term and would not be significant.

Operation

Mobile-Source Noise

Alternative 2 would generate the same levels of traffic as Alternative 1. Like Alternative 1, Alternative 2 would result in a maximum increase of 2.3 dBA L_{dn} over existing conditions (Table 3.12-8). Therefore, implementing this alternative would not result in a substantial permanent increase in ambient noise levels, nor would it cause existing noise to exceed applicable standards. Noise levels from traffic generated by Alternative 2 would not result in a substantial increase in the ambient traffic noise environment. Accordingly, the operational noise impacts of Alternative 2 from mobile sources would not be significant.

Stationary-Source Noise

Implementing Alternative 2 would involve the operation of stationary sources of the same type and on the same scale as implementing Alternative 1. Alternative 2 sources would be located in different locations on the VA Transfer Parcel; however, as under Alternative 1, the nearest sensitive human receptors are 3,700 feet away. Therefore, like Alternative 1, Alternative 2 would not include stationary sources that could generate noise levels sufficient to cause annoyance to these receptors or cause existing noise to exceed applicable standards. Alternative 2 would not result in a substantial increase in the ambient noise environment. The operational noise impacts of Alternative 2 from stationary sources would not be significant.

Vibration

As under Alternative 1, long-term project operation under Alternative 2 would not include any major sources of vibration. In addition, there are no on-site sensitive human receptors, and off-site human receptors would be a minimum of 3,700 feet from the proposed development. Therefore, operations under Alternative 2 would not expose any sensitive receptors to excessive levels of vibration and would have no permanent effect on groundborne vibration and noise. Thus, vibration impacts of Alternative 2 would not be significant.

No Action Alternative

Construction

Under the No Action Alternative, the fed-to-fed transfer would not take place and the proposed development (e.g., VHA OPC, VBA Outreach Office, NCA Cemetery, etc.) would not be built. Therefore, no significant construction impacts on noise or vibration would occur.

Operation

Under the No Action Alternative, the fed-to-fed transfer would not take place and the proposed development and operations (e.g., VHA OPC, VBA Outreach Office, NCA Cemetery, etc.) would not occur. Therefore, no significant operational impacts on noise or vibration would occur.

3.12.6 References

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3.13 PUBLIC SERVICES

This section describes the existing physical and regulatory setting related to fire protection/emergency medical services, law enforcement services, and parks and recreation and discusses the potential effects of the EA Alternatives related to these resources.

3.13.1 Regulatory Framework

National Fire Protection Association Fire Code

The National Fire Protection Association (NFPA) Fire Code provides the requirements to establish a reasonable level of fire safety and property protection in new and existing buildings. Any new development would meet the requirements of the NFPA Fire Code.

Alameda Fire Code

The Alameda Fire Code is based on the 2010 California Fire Code and includes portions of the 2009 International Fire Code, together with Alameda amendments. The Alameda Fire Code is enforced by the Alameda Fire Department's (AFD's) Fire Marshal, who operates under the supervision of the Chief of the Fire Department.

The AFD currently serves the VA Transfer Parcel. Because the VA Transfer Parcel is a federal property that receives fire and Emergency Medical Service (EMS) protection services from the AFD, any new development would meet the requirements of the of the Alameda Fire Code to satisfy the AFD's needs to service the site.

3.13.2 Affected Environment

This section describes conditions related to fire protection, law enforcement, and parks and recreation in the immediate vicinity of the VA Transfer Parcel. Other public services, including solid waste disposal, are discussed in Section 3.11 (Utilities).

Fire and Emergency Medical Services

The AFD provides emergency fire and medical response, emergency planning, and preventive services for the City of Alameda, including Alameda Point and the VA Transfer Parcel. The AFD is an all-risk public safety agency, meaning that it responds to all emergencies and hazards (not including law enforcement) that occur within the City of Alameda. The AFD operates four fire stations[1] situated throughout Alameda, staffed with a total of approximately 25 personnel each day (AFD, 2011). The fire station closest to the VA Transfer Parcel is Alameda Fire Station 2, located at 635 Pacific Avenue, approximately 2.5 miles from the VA Transfer Parcel. The VA Transfer Parcel is located within Fire District 5. Services provided by AFD include fire suppression on land and water; advanced life support (ALS), including ambulance transport services; fire prevention, consulting, and investigative services; community disaster preparedness, including Community Emergency Response Teams; hazardous materials response and mitigation; confined-space rescue services; and water rescue (AFD, 2011).

[1] AFD's Station 5, located on 950 W. Ranger Road, is closed until further notice (Alameda, City of, 2011).

In 2011, AFD responded to a total of 335 calls for service in District 5; of these calls, eight were fire-related, 242 were EMS-related, and 85 were considered "other" calls for service. In the event of an emergency, Alameda Fire Station 2 would provide the primary response to the VA Transfer Parcel (Olson, pers. comm., 2012). Table 3.13-1 displays the average response times per vehicle deployed out of Fire Station 2 in 2011.

Table 3.13-1: Alameda Fire Department Station 2: Average Response Times for All Emergency Calls, per Emergency Vehicle

Emergency Vehicle	Destination	Average Response Time (minutes)
Engine 2	Citywide	5:02
Truck 2	Citywide	5:54
Ambulance 2	Citywide	5:35

Source: Olson, pers. comm., 2012

The AFD indicates that since the closure of Fire Station 5 in 2009, located on West Ranger Road 0.5 mile from the VA Transfer Parcel, the average response times of Fire Station 2 and other stations have increased (Olson, pers. comm., 2012). At this time there is no plan to reopen Station 5 and the facility is being used for vehicle storage (Ott, pers. comm., 2012).

The primary entrance for fire and emergency medical vehicles is on the north side of Alameda Point at the Main Street Gate. Public access to the VA Transfer Parcel is restricted by an existing chain-link fence. However, in the event of a fire or other emergency, AFD can access the property through the locked gate, which is secured with a key box (Alameda, 2012).

Water for fire suppression is provided by East Bay Municipal Utility District (EBMUD), which operates and maintains the existing water systems at Alameda Point through an agreement with the City of Alameda. Two distinct water systems serve Alameda Point; one provides potable and non-potable water to fire hydrants, while the other serves fire protection sprinkler systems inside industrial buildings (ARRA, 2005). Alameda Point historically received water from EBMUD via three existing metering stations located on Main Street. The existing potable-water system remains functional; however, there are service concerns in some places, and most of the existing system is not built to City of Alameda or EBMUD standards (Alameda, n.d.), see Section 3.11 (Utilities).

Police Services

The Alameda Police Department (APD) provides law enforcement services within the City of Alameda, including the VA Transfer Parcel. The majority of the VA Transfer Parcel is located in Alameda County and a smaller portion of the parcel (southwest corner) is located within San Francisco County. Concurrent jurisdiction has been established between the San Francisco Police Department and APD to provide a legal basis for law enforcement (Alameda, 1998). The APD divides Alameda into a five-sector system that is patrolled by one to four officers 24 hours a day. The sectors are further divided into 25 beats, each assigned to individual officers (Alameda, 2011). The APD currently serves federal property at Alameda Point. Alameda Point is patrolled exclusively by one uniformed APD rotating officer, 24 hours a day, 7 days a week (APD, 2011).

Parks and Recreation

The Alameda Recreation and Park Department administers an extensive system of local parks, athletic fields, dog parks, skate parks, historical museums, gymnasiums, a model airplane field, a community center, and a senior center. The city has 150 acres of municipal parkland and an overall park acreage ratio of about 2 acres of parkland per 1,000 residents. Given the distribution of Alameda's parks and flat topography, most of the city's population is within easy walking distance of a park or open space facility (Gates and Associates, 2011). Recreational resources within 0.5 mile of the VA Transfer Parcel are shown in Table 3.13-2.

Table 3.13-2 Existing Alameda Recreation and Park Department Facilities within 0.5 Mile of the VA Transfer Parcel

Facility	Acres
Alameda Point Gym	0.20
City View Skatepark	0.55
Alameda Point Multi-Purpose Field	4.80
Main Street Dog Park	1.30
Albert H. DeWitt Officers Club	3.40

Sources: ARPD, 2010; ARPD, 2012

3.13.3 Environmental Consequences

Assessment Methods

Evaluation of potential public service impacts was based on a review of documents pertaining to the Proposed Action; coordination with appropriate agencies and City of Alameda staff members; and review of the VA Development Area and surroundings. The Proposed Action does not involve proposals for new residential structures. As it would not directly generate new residents in Alameda, the Proposed Action would not substantially increase citywide demand on public services. However, localized impacts resulting from increases in daily population (staff, patients, visitors) may occur and are analyzed below.

Alternative 1

Construction

Fire and Emergency Medical Services

During construction, access by fire trucks and emergency vehicles to the VA Transfer Parcel would be maintained at the current level. Given that construction-related traffic would not substantially affect the traffic flows in the area, it is unlikely that emergency vehicles traveling through the area would be delayed as a result. Construction-related traffic impacts would be temporary and any temporary traffic lane closures would be coordinated with the City of Alameda to minimize potential impacts on traffic and would be subject to NFPA and Alameda Fire Code emergency-access standards and requirements. Construction activities would not be expected to generate demand for additional AFD fire and emergency services that would exceed the capacity of existing services or result in an

adverse impact to current service levels. Construction activities, including construction related traffic, would not have a significant adverse impact on fire and EMS services, including response times and site access. See Section 3.3 (Transportation, Traffic, Circulation, and Parking) for more information traffic.

Police Services

The APD currently serves federal property at Alameda Point, including the VA Transfer Parcel. Upon transfer of the VA Transfer Parcel from the Navy to VA, VA would augment the local police coverage of the site with VA Police and other law enforcement entities. During construction, staffing for police services would be provided by VA to properly secure the site. Although the VA Transfer Parcel is considered federal property, it is anticipated that there would be a mutual-aid agreement with APD, in which each party helps one another when needed. This arrangement is standard procedure at other VA campus locations. Construction activities would not be expected to generate demand for additional APD police services that would exceed the capacity of existing services or result in an adverse impact to current service levels. Therefore, construction activities would not have a significant impact on police services.

Parks and Recreation

There are approximately five City of Alameda–owned parks and recreational facilities within 0.5 mile of the VA Transfer Parcel. Access to these facilities would not be disrupted during construction because construction activities would occur entirely within the VA Development Area. Construction under Alternative 1 would be performed by a temporary workforce consisting of approximately 20 to 56 persons derived from the local labor pool. As stated in Section 3.9 (Socioeconomics and Environmental Justice) the addition of 20 to 56 construction jobs that could be filled by Bay Area and/or Alameda residents is not anticipated to result in an adverse growth-inducement impact. Although construction workers would be within walking distance (0.5 mile) of nearby park and recreational facilities the increase in park usage would be minimal. For these reasons, construction-related impacts on parks and recreational amenities would not be significant.

Operation

Fire and Emergency Medical Services

Operation of Alternative 1 would result in approximately 250 employees, 540 patients, and numerous visitors utilizing the proposed facilities within the VA Development Area on an average weekday (smaller number expected during weekends). However, based on similar VA facilities, the development and use of the property would not be expected to generate demand for additional AFD fire and emergency services that would exceed the capacity of existing services or result in an adverse impact to current service levels or require the need for an expansion of services.

Access to the VA Transfer Parcel, including emergency access, would be improved with the construction of a new primary access point (i.e., on- and off-site improvements) and a secondary emergency access point. As identified by AFD, the current emergency route to the VA Transfer Parcel is not the most direct route to the site. A shorter route that accesses the VA Transfer Parcel from the east would improve response times. As part of Alternative 1, secondary emergency access (from West Redline Avenue) would be provided along the east boundary of the VA Transfer Parcel (Figure 2-2 in Chapter 2.0 [Alternatives]). Adding a secondary emergency entrance would

alleviate AFD's concerns about current access to the VA Transfer Parcel.

Water system improvements would involve installing new water mains that provide potable water and fire suppression water to new buildings and irrigated areas. Because the Proposed Action would be required to meet standard fire code requirements for fire hydrant systems administered in accordance with the NFPA, water capacity and service that may be needed for fire suppression actions would be improved.

Operational activities, including daily occupation of the property by employees, patients, and visitors would not have a significant impact on fire and EMS services, including response times, site access, water supplies for fire suppression, or require an expansion of existing services.

Police Services

As mentioned above, operation of Alternative 1 would result in approximately 250 employees, 540 patients, and numerous visitors utilizing the proposed facilities within the VA Development Area on an average weekday (smaller number expected during weekends). The VA Transfer Parcel would continue being served by the local APD together with augmented law enforcement support from VA. Although property owned by VA is considered federal property, it is anticipated that there would be a mutual-aid agreement with APD, in which each party helps one another when needed. Because primary police and security services will be provided by VA, the development and use of the property would not be expected to generate demand for additional APD police services that would exceed the capacity of existing services or result in an adverse impact to current service levels or require the need for an expansion of services. Therefore, operational activities would not have a significant impact on police services.

Parks and Recreation

Although the Proposed Action would not contribute to the City of Alameda's designated public parklands, Alternative 1 includes an access road and sidewalk along the northern VA Development Area allowing bicyclists and pedestrians to travel to a location approximately 100 feet from the western shoreline of the VA Development Area. The publically accessible road and sidewalk would allow limited access to additional open space and the shoreline. Further, the remaining 438 acres of the VA Transfer Parcel, including the existing CLT colony, would remain undeveloped. The undeveloped portion of the VA Transfer Parcel would be managed for the long-term persistence and sustainability of the CLT colony and access would be restricted during the CLT breeding/nesting season (April 1 through August 15). The undeveloped area would add to the cumulative open space within the City of Alameda, a beneficial impact.

Some of the employees, patients, and visitors who would utilize the proposed facilities within the VA Development Area may also use City of Alameda park and recreational facilities (e.g., personnel visiting a local park on their lunch break), but this additional usage is not expected to result in a substantial increase in demand for nearby park and recreational facilities. The additional usage of nearby park and recreational facilities would not be such that substantial physical deterioration of the facility would occur or be accelerated, nor would the construction or expansion of park and recreational facilities be required. For the reasons stated above, operational impacts of Alternative 1 on park and recreational usage would not be significant.

Alternative 2 (Preferred Alternative)

Construction

The construction of VA facilities under Alternative 2 would be similar to that under Alternative 1. Therefore, impacts of construction under Alternative 2 on fire protection/emergency medical services, law enforcement services, and parks and recreation would be the same as those described for Alternative 1. Construction-related impacts of Alternative 2 would not be significant.

Operation

The operation of VA facilities under Alternative 2 would be similar to that under Alternative 1. Therefore, impacts of facility operation under Alternative 2 on fire protection/emergency medical services, law enforcement services, and parks and recreation would be the same as those described for Alternative 1. Operation-related impacts of Alternative 2 would not be significant.

No Action Alternative

Construction

Under the No Action Alternative, construction of new buildings and the cemetery would not take place. Therefore, no significant construction-related impacts on fire protection/emergency medical services, law enforcement services, or parks and recreation would occur.

Operation

Under the No Action Alternative, no VA facilities would be implemented on the VA Transfer Parcel. The property would be retained by the Navy in caretaker status until another action on the property is taken. Therefore, no significant impacts on fire protection/emergency medical services, law enforcement, or parks and recreation would occur.

3.13.4 References

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3.14 GEOLOGY AND SOILS

This section describes the geology and soils setting and regulatory setting and discusses the potential effects of the EA Alternatives on geology and soils.

3.14.1 Regulatory Framework

Clean Water Act

The Clean Water Act (CWA) (33 U.S. Code [USC] 1251 et seq.) includes provisions for reducing soil erosion for the protection of water quality. The CWA prohibits the discharge of pollutants from a point source to navigable waters, unless a permit was obtained under the CWA's provisions. Regulation of discharges under the CWA also pertains to construction sites where soil erosion and stormwater runoff and other pollutant discharges could affect downstream water quality. The CWA is described in greater detail in Section 3.2 (Water Resources).

Executive Order 12699

Executive Order 12699, "Seismic Safety of Federal and Federally Assisted or Regulated New Building Construction," was signed by President George H. W. Bush on January 5, 1990, to further the goals of Public Law 95-124, the Earthquake Hazards Reduction Act of 1977, as amended. The executive order applies to new construction of buildings owned, leased, constructed, assisted, or regulated by the federal government. Guidelines and procedures for implementing the order were prepared in 1992 by the federal Interagency Committee on Seismic Safety in Construction. The guidelines establish minimum acceptable seismic safety standards, provide evaluation procedures for determining the adequacy of local building codes, and recommend implementation procedures. Each federal agency is independently responsible for ensuring that appropriate seismic design and construction standards are applied to new construction under its jurisdiction.

Under Executive Order 12699, the original model code for the West Coast was the Uniform Building Code, developed by the International Conference of Building Officials. In 1994, the International Conference of Building Officials joined with other similar organizations in the Southeast and on the East Coast to form the International Code Council (ICC). In 2000, the ICC published the first International Building Code (IBC) based on the reassessment of earlier codes and the combined updated experience of ICC member organizations. The current (2006) IBC is the result of nearly 100 years of building code improvement.

International Building Code

The IBC, which encompasses the former Uniform Building Code, is published by the ICC to provide standard specifications for engineering and construction activities, including measures to address geologic and soil concerns (ICC, 2009). Specifically, these measures encompass issues such as seismic loading (e.g., classifying seismic zones and faults), ground motion, and engineered fill specifications (e.g., compaction and moisture content). The referenced guidelines, though not formal regulatory requirements per se, are widely accepted by regulatory authorities and are routinely included in related standards such as grading codes. The IBC guidelines are updated regularly to reflect current industry standards and practices, including criteria from sources such as

the American Society of Civil Engineers and ASTM International (ASTM, formerly known as the American Society for Testing and Materials).

Earthquake Hazards Reduction Act

In October 1977, the U.S. Congress passed the Earthquake Hazards Reduction Act (42 USC 7701 et seq.) to "reduce the risks to life and property from future earthquakes in the United States [U.S.] through the establishment and maintenance of an effective earthquake hazards and reduction program" (42 USC 7702). To accomplish this, the act established the National Earthquake Hazards Reduction Program. The National Earthquake Hazards Reduction Program Act (NEHRPA) substantially amended this program in November 1990 by refining the description of agency responsibilities, program goals, and objectives. The NEHRPA designates the Federal Emergency Management Agency (FEMA) as the lead agency of the program and assigns FEMA several planning, coordinating, and reporting responsibilities. Other NEHRPA agencies include the National Institute of Standards and Technology, the National Science Foundation, and U.S. Geological Survey (USGS).

Veterans Health Administration Directive 2005-019

The purpose of Veterans Health Administration (VHA) Directive 2005-019 is to establish a policy regarding the seismic safety of VHA buildings. Because facilities identified as essential must remain in operation after a seismic event, VHA Directive 2005-019 assists VA in providing adequate life-safety protection to veterans, employees, and other building occupants. Under VHA Directive 2005-019, all new buildings must be structurally designed and constructed in compliance with VA Seismic Design Requirements H-18-8 and the IBC. A major update of the VA Seismic Design Requirements H-18-8 (formerly known as H-08-8) was implemented in 1995. The current VA Seismic Design Requirements H-18-8 closely aligns with the IBC, and the VA Seismic Design Requirements are applicable to the Proposed Action.

Alquist-Priolo Earthquake Fault Zoning Act

The California Alquist-Priolo Earthquake Fault Zoning Act (Alquist-Priolo Act) was passed in December 1972 to mitigate the hazard of surface faulting to structures for human occupancy. Surface rupture is the most easily avoided seismic hazard. The main purpose of the Alquist-Priolo Act is to prevent the construction of buildings used for human occupancy on the surface trace of active faults.

The Alquist-Priolo Act addresses only the hazard of surface fault rupture and is not directed toward other earthquake hazards. The California Seismic Hazards Mapping Act, passed in 1990, addresses earthquake hazards caused by non-surface fault rupture, including liquefaction and seismically induced landslides. The law requires the State Geologist to establish regulatory zones, known as earthquake fault zones, around the surface traces of active faults and to issue appropriate maps. The maps are distributed to all affected cities, counties, and state agencies for their use in planning and controlling new or renewed construction. Local agencies regulate most development projects within the zones. Projects include all land divisions and most structures for human occupancy. Before a project can be permitted, cities and counties must require a geologic investigation to demonstrate that proposed buildings will not be constructed across active faults. An evaluation and written report of a specific site must be prepared by a licensed geologist. If an active fault is found, a structure for human occupancy cannot be placed over the trace of the fault and must be set back 50 feet from the fault trace.

Because no active fault zones are known to exist in the City of Alameda, no earthquake fault zones are mapped on the VA Transfer Parcel under the Alquist-Priolo Act.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act of 1990 addresses non-surface fault rupture earthquake hazards, including liquefaction and seismically induced landslides, and its purpose is to protect public safety from the effects of strong ground shaking, liquefaction, landslides, or other ground failure, and other hazards caused by earthquakes. This law requires the State Geologist to delineate various seismic hazard zones and requires cities, counties, and other local permitting agencies to regulate certain development projects with these zones. Before a development permit is granted for a site within a seismic hazard zone, a geotechnical investigation of the site has to be conducted and appropriate mitigation measures incorporated into the project design. Seismic Hazard maps have been completed for much of the San Francisco Bay Area.

3.14.2 Affected Environment

Regional Geologic Setting

The VA Transfer Parcel is located in the City of Alameda on the east side of San Francisco Bay in the Coast Ranges geomorphic province, a relatively young geologically and seismically active region on the western margin of the North American Plate. The Coast Ranges are characterized by discontinuous northwest to southeast–trending mountains and valleys, and is dominated by northwest-trending faults, folds, and geologic structures (California Geological Survey [CGS], 2002). The VA Development Area is bordered on the west by San Francisco Bay, a northwest-trending structural depression. The Bay and much of its margins are underlain by the Late Mesozoic Age rocks of the Franciscan Complex. The Franciscan Complex rocks commonly consist of sheared shale and interbedded sandstone, with serpentinite and other metamorphic rocks. Tertiary and Quaternary formations occur locally in unconformity on the Franciscan Complex, while other Mesozoic formations occur in fault contact with the Franciscan Complex (CGS, 2002).

Beneath San Francisco Bay and its margins, the Franciscan bedrock is overlain by a young, geologically unconsolidated sedimentary sequence, which in places exceeds 400 feet in thickness. The sequence is divided into three units, older Bay sediments of the Yerba Buena Formation, Merritt sands of the San Antonio Formation, and younger Bay Mud. Artificial fill of variable thickness, quality, and density has been placed along the margins of San Francisco Bay to reclaim marshland and land once covered by shallow water.

Faulting and Seismicity

VA Transfer Parcel

The major regional active faults considered likely to produce damaging earthquakes at the VA Transfer Parcel are the San Andreas, San Gregorio, Hayward, and Calaveras Faults (Figure 3.14-1). Table 3.14-1 lists the proximity of the closest of the active faults to the VA Transfer Parcel and the estimated maximum moment magnitude[1] for

[1] Seismologists now use a moment magnitude (MN) scale, since it provides a more accurate measurement of the size of major and great earthquakes given that earthquake magnitudes readings greater than MN 7.0 on the moment magnitude scale are slightly greater than a corresponding Richter magnitude. Maximum moment magnitude is the most severe earthquake that could occur on a particular fault.

each fault. Alameda Point is not located within an "earthquake fault zone" as delineated by the CGS, and as shown in Figure 3.14-1, no active faults exist on the VA Transfer Parcel (see "Alquist-Priolo Earthquake Fault Zoning Act," above).

Table 3.14-1: Regional Faults and Seismicity

Fault Name	Distance (km) from VA Transfer Parcel	Direction from Site	Maximum Moment Magnitude
Hayward—Total	10	Northeast	7.1
San Andreas—1906 Rupture	19.5	Southwest	7.9
San Andreas—Peninsula	19.5	Southwest	7.2
San Andreas—North Coast South	24	West	7.5
San Gregorio North	25	West	7.3
Mount Diablo Thrust	26	East	6.7
Northern Calaveras	27.5	East	7.0
Concord	32	Northeast	6.5
Rodgers Creek	33	North	7.1
Southern Green Valley	36	Northeast	6.5
Northern Greenville	39	Northeast	6.6
Monte Vista	40	South	6.8
West Napa	42	North	6.5
Great Valley—6	45	Northeast	6.7
Central Greenville	45.5	East	6.7
Point Reyes	47.5	West	6.8
Great Valley—5	50	Northeast	6.5

Notes: km = kilometers; VA = U.S. Department of Veterans Affairs
Source: WGCEP, 1999

Surrounding Area

The Bay Area is located in a seismically active region near the boundary between two major tectonic plates, the Pacific Plate to the southwest and the North American Plate to the northeast. These two plates move relative to each other in a predominantly lateral manner, with the San Andreas Fault Zone at the junction. The Pacific Plate, on the west side of the fault zone, is moving north relative to the North American Plate on the east. Since approximately 23 million years ago, about 200 miles of right-lateral slip has occurred along the San Andreas Fault Zone to accommodate the relative movement between these two plates (USGS, 2002). The relative movement between the Pacific and North American Plates generally occurs across a 50-mile zone extending from the San Gregorio Fault in the southwest to the Great Valley Thrust Belt to the northeast. In addition to the right-lateral slip movement between tectonic plates, a compressional component of relative movement has developed between the Pacific Plate and a smaller segment of the North American Plate at the latitude of San Francisco Bay during the last 3.5 million years. Strain produced by the relative motions of these plates is relieved by right-lateral

Source: Data compiled by AECOM in 2012

Figure 3.14-1: Major Faults and Earthquake Epicenters in the San Francisco Bay Area

strike-slip faulting on the San Andreas Fault and related faults, and by vertical reverse-slip displacement on the Great Valley Fault and other thrust faults in the central California area.

The region's seismic faults can be classified as historically active, active, sufficiently active and well-defined, or inactive, as defined below (CGS, 2007):

- *Historically active* faults are faults that have generated earthquakes accompanied by surface rupture during historic time (approximately the last 200 years) or that exhibit a seismic fault creep (slow incremental movement along a fault that does not entail earthquake activity).
- *Active* faults show geologic evidence of movement within Holocene time (approximately the last 11,000 years).
- *Sufficiently active and well-defined* faults show geologic evidence of movement during the Holocene along one or more of their segments or branches, and their trace may be identified by direct or indirect methods.
- *Inactive* faults show direct geologic evidence of inactivity (that is, no displacement) during all of Quaternary time or longer.

Although it is difficult to quantify the probability that an earthquake will occur on a specific fault, the preceding classification is based on the assumption that if a fault has moved during the last 11,000 years, it is likely to produce earthquakes in the future.

Ground Shaking

VA Transfer Parcel

Earthquakes occurring on faults closest to the VA Transfer Parcel would have the potential to generate the largest ground motions at the site.

Surrounding Area

The USGS has predicted that there is a 63% chance of a moment magnitude 6.7 earthquake or greater occurring in the Bay Area over a period of 30 years, between 2003 and 2032 (USGS, 2007). The intensity of the seismic shaking during an earthquake depends on the distance and direction to the earthquake's epicenter, the magnitude of the earthquake, and the area's geologic conditions.

Topography and Soils

VA Transfer Parcel

The VA Transfer Parcel is located on Alameda Point, which is located on the western portion of Alameda Island. The existing VA Transfer Parcel ranges from 0 msl to approximately 10 feet above msl (CH2M Hill, 2011).

The VA Transfer Parcel is underlain by approximately 15–30 feet of artificial fill consisting of loose to medium dense sands, overlying a range of 30–65 feet of very soft, compressible younger Bay Mud deposits. The younger Bay Mud is underlain by about 30 feet of dense to very dense sands of the San Antonio Formation, including Merritt and Posey sands. These sands are overly stiff to very stiff, older Bay Mud (clay) deposits with a similar

origin as the younger Bay Mud (AECOM, 2009). The VA Development Area for both Alternative 1 and Alternative 2 is located within an area that is mapped as a liquefaction hazard zone (CGS, 2003).

Surrounding Area

Alameda Island is characterized by a low topographic profile with surface elevations from mean sea level (msl) to approximately 30 feet above msl.

Like other areas around San Francisco Bay, Alameda Point was created with artificial fill to create developable land (Figure 3.14-2). Historical records indicate that Alameda Point was formerly a shallow mudflat consisting of young Bay Mud with depths generally ranging from 20-feet to more than 100-feet thick. Over an extended period of time, from 1906 to about 1956, the area was filled to create land. The artificial fill sequence consisted of periodic placement of sandy fills in several phases, using hydraulic dredging methods.

The westerly fill at Alameda Point consists of heterogeneous landfill materials consisting of a wide variety of waste materials and construction debris. As part of the fill sequence, a series of scuttled hulls of small warships were used as a breakwater for a yacht harbor in the mid to late 1930s. Present information suggests that these hulls are still present beneath the ground surface, but may have drifted during past storms, and therefore, their exact locations are not known (AECOM, 2009). In the eastern portion of Alameda Point, a Marsh Crust Horizon, approximately 2–6 inches thick, exists just under the artificial fill. The Marsh Crust was not encountered during soil borings near the VA Transfer Parcel (CH2M Hill, 2011).

3.14.3 Environmental Consequences

Assessment Methods

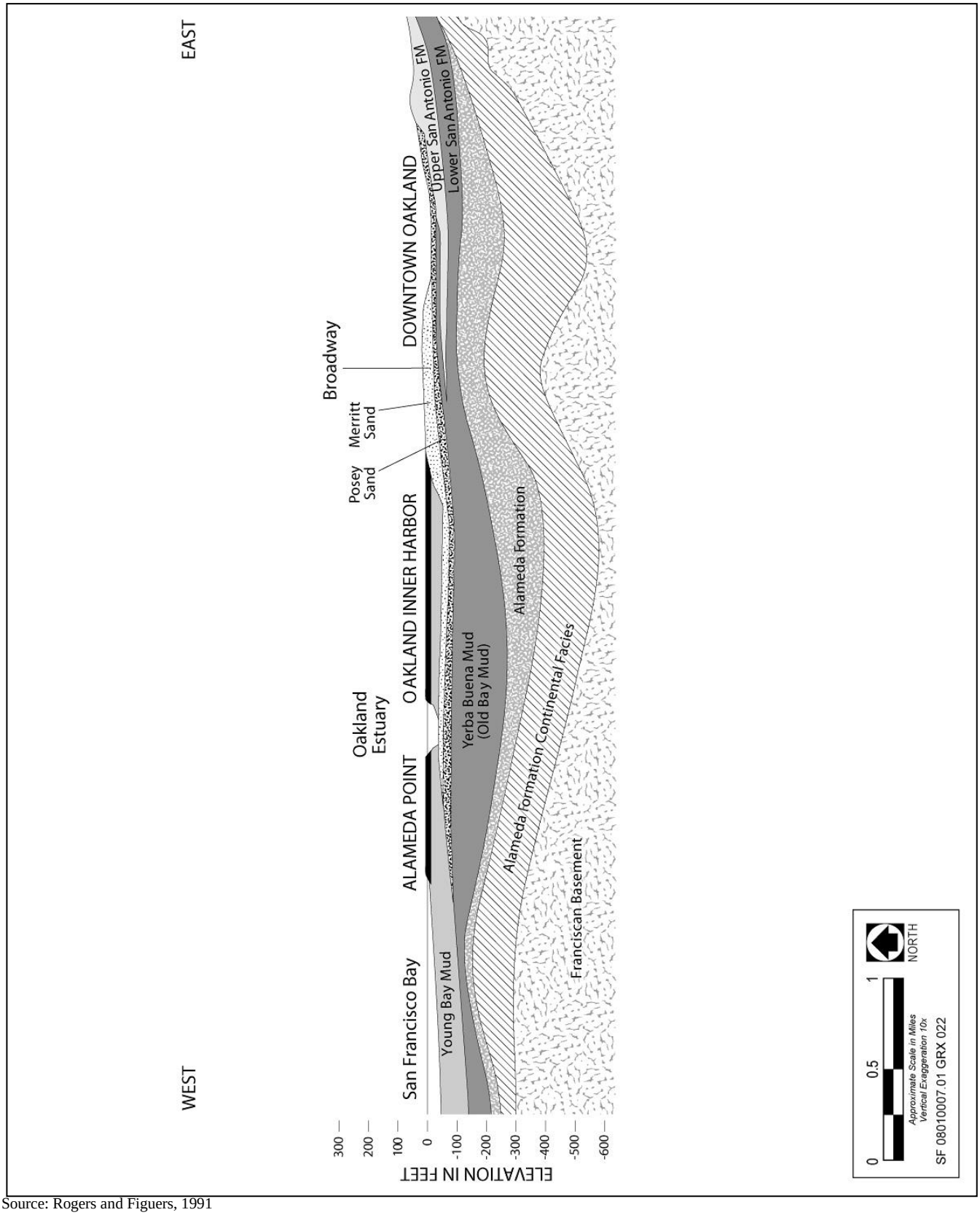
The significance of impacts associated with faulting, ground acceleration, and ground shaking was evaluated based on distance to known fault zones and the seismic characteristics of fault zones. Adverse impacts could occur on soils possessing moderate to severe potential for erosion and liquefaction. Soil erosion impacts are also discussed in Section 3.2 (Water Resources). As noted above, the City of Alameda is not located within an earthquake fault zone, as delineated by CGS, and no active faults exist on Alameda Point; thus, exposure of people or structures to surface fault rupture is not evaluated below. The analysis below is based on site-specific geotechnical reports that are provided in Appendix H of this Draft EA.

Alternative 1

Construction

Erosion and Loss of Topsoil

Construction of the proposed VHA OPC, the Conservation Management Office, and the first phase of the NCA Cemetery during initial construction of Alternative 1 would involve site grading and preparation that would disturb exposed artificial fill. Despite previous development on the former NAS Alameda, erosion and loss of topsoil could occur as a result of construction activities. Excavation, grading, import of fill, and facility construction in the VA Development Area would require temporary disturbance of surface soils and removal of



Source: Rogers and Figuers, 1991

Figure 3.14-2: Geologic Cross Section

existing on-site pavements, five existing bunkers, and existing subsurface infrastructure. Exposed fill materials would be susceptible to erosion during construction-related excavation. Stormwater runoff could cause erosion during project construction, although most loosened and eroded soil would remain within the excavation pits.

VA would be required to obtain a National Pollutant Discharge Elimination System (NPDES) general permit for stormwater discharges associated with construction activities (Construction General Permit; State Water Resources Control Board Order No. 99-08-DWQ) before construction could proceed. To complete construction activities that would disturb 1 acre or more where drainage would flow to the separate sewer system, VA must comply with the Construction General Permit and must prepare and implement a storm water pollution prevention plan (SWPPP) that meets the permit's conditions. See the discussion of a SWPPP in Section 3.2 (Water Resources) which evaluates erosion in further detail. With implementation of a SWPPP, the construction-related impact of initial construction related to erosion and loss of topsoil would not be significant.

Under subsequent construction of the cemetery phases of Alternative 1 through the year 2116, potential erosion impacts would be similar to those identified for initial construction. Therefore, the construction-related impact of Alternative 1, for the subsequent cemetery phase construction related to erosion and loss of topsoil would not be significant.

Alteration of Topography

Construction of Alternative 1 would not involve any below-grade development or substantial change in the current topography of the VA Development Area. However, as part of the construction of proposed VA facilities and through the import of 440,000 cubic yards of fill, the ground elevation would be raised to 12.5 feet above msl for the proposed roadways and to 13.5 feet above msl for the proposed VHA OPC, Conservation Management Office, and NCA National Cemetery. As noted previously, the VA Transfer Parcel is primarily flat. The topography in the VA Development Area would be altered to include areas raised above the current topography to 12.5 to 13.5 feet above msl, but these changes in topography would be contoured gradually over the approximately 111-acre, on-site development area. Thus, the construction-related impact of Alternative 1 related to alteration of topography would not be significant.

Operation

Seismically Induced Ground Shaking and Associated Ground Failure

Liquefaction typically occurs when saturated, clean, fine-grained loose sands near the surface (usually in the upper 50 feet) are subject to intense ground shaking and the groundwater table is shallow. One of the major types of liquefaction-induced ground failures is lateral spreading of mildly sloping ground. Lateral spreading is a failure within a nearly horizontal soil zone (possibly from liquefaction) that causes the overlying soil mass to move toward a free face or down a gentle slope.

As noted above, the VA Development Area is located within an area that is mapped as a liquefaction hazard zone (CGS, 2003). As required by VA, a report to identify engineering geologic hazards (geotechnical investigation) and site-specific ground responses was prepared by the Allegiance Group, LLC in April 2012 for the project area (Allegiance Group, 2012). The liquefaction analysis performed by the Allegiance Group indicated high liquefaction potential in the VA Development Area from the surface to 40 feet below ground surface. Borings

during the geotechnical site investigation encountered groundwater between 1.0 and 4.5 feet below ground surface (Allegiance Group, 2012). Because the VA Development Area is located between two major active faults (the Hayward and San Andreas Faults) and the top 25–40 feet of soil consists of loose to very loose saturated sand, the potential for liquefaction and lateral spreading during a seismic event is high (Allegiance Group, 2012).

Two options for engineering and design of the proposed facilities—stone columns and deep dynamic compaction—were recommended to address the potential for seismically induced ground shaking and associated ground failure at the VA Development Area. The VA would design and construct the facilities proposed by Alternative 1 utilizing the engineering and design specifications identified in either option, as well as VA Seismic Design Requirements H-18-8 and the IBC.

Stone columns would only prevent lateral spreading; thus, piles for protection from liquefaction also would be required. The deep dynamic compaction option would address both lateral spreading and liquefaction. Before construction, a geotechnical contractor would review the project plans and specifications to confirm that they follow the recommendations of the geotechnical report and that they use either the stone columns option or the deep dynamic compaction option.

Subsidence, the sinking or settling of land, is caused by compaction of unconsolidated soils during a seismic event, soil compaction by heavy structures, erosion of peat soils, or groundwater depletion. Subsidence usually occurs over a broad area, and therefore is not detectable at the ground surface. Placing additional fill or constructing buildings with shallow foundations in the VA Development Area would place additional weight on the Bay Mud. This additional weight would cause consolidation of the Bay Mud layer, resulting in settlement at the ground surface. Consolidation would occur relatively slowly as excess pore pressures dissipate. The amount of consolidation settlement would depend on the thickness of the existing fill, thickness of the soft Bay Mud, and the imposed loads from the new fill and buildings (AECOM, 2009).

The VA Development Area is not mapped in a subsidence zone (Allegiance Group, 2012). However, with the addition of approximately 440,000 cubic yards of fill for Alternative 1, Phase 1, which would include construction of the VHA OPC, the Conservation Management Office, the access road, and the initial phase of the cemetery, potential settlement effects may occur.

As described above, the project design would be required to include seismic safety–related features to mitigate the potential for seismically induced ground failure. Therefore, operational impacts of Alternative 1 related to seismically induced ground shaking and ground failure would not be significant.

Seismically Induced Landslides or Slope Failures

Landslides and other slope failures are common occurrences during or soon after earthquakes. The VA Development Area is not located within a designated landslide hazard zone (CGS, 2003), and no potential exists for landslides because the area is flat. No operational impact related to seismically induced landslides or slope failures would occur under Alternative 1.

Expansive or Corrosive Soils

Expansive soils generally result when specific clay minerals in the soil expand when saturated and shrink in volume when dry. Expansive soils can occur in any climate; however, arid and semiarid regions are subject to more extreme cycles of expansion and contraction than more consistently moist areas. As noted previously and shown in Figure 3.14-2, the VA Development Area is underlain by both young and old Bay Mud. The site-specific geotechnical investigation states that using one of the two options for seismic mitigation (stone columns or deep dynamic compaction) and subsurface engineering, and following standard VA seismic design recommendations for the proposed facilities, would help accommodate any potential expansion of Bay Mud (clay). Therefore, the operational impact of Alternative 1 related to expansive or corrosive soils would not be significant.

Alternative 2 (Preferred Alternative)

Construction

Alternative 2 would involve the same project components as Alternative 1; however, under Alternative 2, the VA Development Area would be located farther north and would extend into an area referred to as the Northwest Territories (Figure 2-3 in Chapter 2.0 [Alternatives]). Under VHA Directive 2005-019, all new buildings would be structurally designed and constructed in compliance with VA Seismic Design Requirements H-18-8 and the IBC.

Erosion and Loss of Topsoil

The effects of constructing buildings, parking lots, and a cemetery as proposed under Alternative 2 would be similar to those of Alternative 1. As under Alternative 1, VA would be required to obtain a NPDES general permit for stormwater discharges associated with construction activities (Construction General Permit; State Water Resources Control Board Order No. 99-08-DWQ) and to implement a SWPPP that meets the conditions of the Construction General Permit. With implementation of a SWPPP, the construction-related impact of Alternative 2 related to erosion and loss of topsoil would not be significant.

Alteration of Topography

Like Alternative 1, Alternative 2 would not result in any below-grade development or any substantial change in the current topography of the VA Development Area. The area's topography would not be substantially altered, and the proposed buildings would be constructed following applicable VA Seismic Design Requirements H-18-8 and the IBC. Therefore, the construction-related impact of Alternative 2 related to alteration of topography would not be significant.

Operation

Seismically Induced Ground Shaking and Ground Failure

Alternative 2 would involve the same project components as Alternative 1; however, under Alternative 2, the VA Development Area would be located farther north. Thus, the effects related to seismically induced ground failure discussed above for Alternative 1 also would apply to Alternative 2. The two options for seismic mitigation (stone

columns and deep dynamic compaction) would apply to Alternative 2, and VA would design and construct facilities under this alternative utilizing the engineering and design specifications for either option, the VA Seismic Design Requirements H-18-8, and the IBC. Therefore, the operational impact of Alternative 2 related to seismically induced ground shaking and ground failure would not be significant.

Seismically Induced Landslides or Slope Failures

Alternative 2 would involve the same project components as Alternative 1; however, under Alternative 2, the VA Development Area would be located farther north, which is also flat, like the rest of Alameda Point. Therefore, no operational impact related to seismically induced landslides or slope failures would occur under any phase of Alternative 2.

Expansive or Corrosive Soils

Alternative 2 would involve the same project components as Alternative 1; however, under Alternative 2, the VA Development Area would be located farther north. The site-specific geotechnical investigation states that using one of the two options for seismic mitigation (stone columns or deep dynamic compaction) and subsurface engineering, and following standard VA seismic design recommendations for the proposed facilities, would help accommodate any potential expansion of Bay Mud (clay). Therefore, the operational impact of Alternative 2 related to expansive or corrosive soils would not be significant.

No Action Alternative

Construction

Under the No Action Alternative, the fed-to-fed transfer would not take place, and no VA facilities would be constructed. Therefore, no significant construction-related geology and soil impacts would occur.

Operation

Under the No Action Alternative, the fed-to-fed transfer would not take place, and no VA facilities would be operated on the property. The property would be retained by Navy in caretaker status until another action on the property is taken. Therefore, no significant operational-related geology and soil impacts would occur.

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