3.5 NOISE AND VIBRATION

This section evaluates the potential impacts of the proposed project resulting from noise and vibration. The evaluation is based on the Noise Technical Report prepared by URS (2006), which is included as Appendix D to this EIR.

3.5.1 Existing Conditions

Noise

Noise is generally defined as loud, unpleasant, unexpected, or undesired sound that is typically associated with human activity and that interferes with or disrupts normal activities. Although exposure to high noise levels has been demonstrated to cause hearing loss, the principal human response to environmental noise is annoyance. The response of individuals to similar noise events is diverse and influenced by the type of noise, the perceived importance of the noise and its appropriateness in the setting, the time of day and the type of activity during which the noise occurs, and the sensitivity of the individual.

The project site is located within undeveloped parkland, and is adjacent to residential land uses in some areas. Noise levels at the three primary construction areas, the FRS II site and the North and South Portals, are low for an urban area and reflect a rural environment. This is primarily the result of the size of MTRP and the lack of developed areas within the park. An exception is the North Portal area, where traffic noise from SR-52 can overwhelm the natural noise level.

Construction access is through primarily residential neighborhoods along arterial roadways. Existing sources of noise within the park and along the construction routes consist of traffic on SR-52 to the north, military aircraft from MCAS Miramar to the north, civilian aircraft from Montgomery Field to the west, and traffic, construction, maintenance, and landscaping activities within adjacent residential neighborhoods.

Land uses that are considered sensitive to noise are typically associated with indoor and outdoor activities that may be subject to stress or significant interference from noise. They often include residential dwellings, mobile homes, hotels, motels, hospitals, nursing homes, educational facilities, and libraries. In the case of this project, single- and multi-family residences are located approximately 50 feet from the Pipeline Interconnect Reconfiguration site, approximately 250 feet from the North Portal, approximately 800 feet from the FRS II site, and over 2,000 feet from the South Portal. Single- and multi-family homes, schools, parks, community centers, churches, and commercial areas, and open space are all found along the proposed construction access routes through Tierrasanta. The zoning in the project area is RM-1-1 (Residential-Multiple Unit), which replaced the R-2 designation.

The intensity of sound describes the sound's loudness and is measured in decibels (dB). A sound level of 0 dB is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. The minimum change in the sound level of individual events that an average human ear can detect is about 3 dB. A change in sound level of about 10 dB is usually perceived by the average person as a doubling (or halving) of the sound's loudness.

Sound from a tuning fork (a pure tone) contains a single frequency, but most sounds consist of a broad band of frequencies. The method commonly used to quantify sounds in the general environment is called "A" weighting, which corrects for the fact that human hearing is less sensitive at low frequencies and extremely high frequencies than at the mid-range frequencies. The decibel level measured is called the A-weighted sound level (dBA).

Noise measurements for construction projects are expressed in term of Community Noise Equivalent Level (CNEL), which is defined as the A-weighted average sound level for a 24-hour day. It is calculated by adding a 5-dB penalty to sound levels in the evening (7:00 p.m. to 10:00 p.m.) and a 10-dB penalty to sound levels in the night (10:00 p.m. to 7:00 a.m.) to compensate for the increased sensitivity to noise during the quieter evening and nighttime hours. The CNEL is used by the State of California and the City of San Diego to define acceptable land use compatibility with respect to vehicular traffic noise.

The existing noise levels were measured at several locations along the MTRP boundary and the haul routes. The purpose of the measurements was to quantify the existing noise environment near the proposed project. Two types of sound level measurements were conducted: short-term (1-hour duration) and long-term (24-hour duration). Because measured sound levels typically vary within a wide range, all measurements are expressed as Leq or "equivalent sound level." The Leq is the equivalent constant sound level that would have to be produced by a given source to equal the fluctuating level measured.

Sound measurements were taken at the following locations, which represent residential uses near various construction locations of the proposed project:

- Along Corte Playa Catalina, approximately 800 feet southwest of the proposed FRS II structure (short-term measurement) (**ST 1**)
- At the intersection of Seda Drive and Renovo Way, approximately 2,300 feet from the South Portal (short-term measurement) (**ST 2**)
- Along Portobelo Drive in the Belsera condominium complex, overlooking the proposed Portobelo Drive access route near the North Portal and the Pipeline Interconnect Reconfiguration site (long-term measurement) (**LT 1**)
- Along Portobelo Drive in the Belsera condominium complex, overlooking the North Portal (long-term measurement) (**LT 2**)

Daytime noise sources at each site consisted of vehicular traffic on SR-52; heating, ventilation and air conditioning (HVAC) units on residences, jets from MCAS Miramar, small aircraft overflights, birds vocalizing, dogs barking, and people talking. Nightime noise sources at each site were dominated by HVAC units and crickets.

Table 3.5-1 provides the results of the short-term sound measurements taken along Corte Playa Catalina and Seda Drive and Table 3.5-2 provides the range and average results of the two long-term (24-hour) sound measurements taken in Belsera.

Table 3.5-1
Short-Term Sound Level Measurements (dBA)

Measurement Identification	Location Description	Time	L_{eq}
ST1	5190 Corte Playa Catalina	12:55-13:55	42.2
		23:05-00:05	38.9
ST2	Seda Drive	11:45-12:45	43.0
		22:00-23:00	44.4

September 1, 2005

Table 3.5-2
Long-Term (24-Hour) Sound Level Measurements (dBA)

Measurement Identification*	Location Description	Range in 24 hours, L_{eq}	Average L_{eq}
LT1	Belsera 11390 Portobelo Drive	39.5 – 68.9	48.9
LT2	Belsera 11360 Portobelo Drive	42.9 – 72.0	53.0

*LT1 taken between 10:30 a.m. on September 1 and 11:30 a.m. on September 2.
LT2 taken between 11:00 a.m. on September 1 and 12:00 p.m. on September 2

Vibration

Mechanical or structural vibrations are generally unwanted and, depending on their magnitude, can produce physical discomfort, misalignment of equipment, and damage to structures. The peak ground velocity produced by sources such as trucks, trains, pile driving, blasting, or earthquakes can range from less than 0.01 inches per second (in/sec), which would be barely perceptible to humans, to more than 10 in/sec, which would be sensed as very unpleasant to intolerable by humans.

Regulatory Framework

The City of San Diego's Noise Ordinance has established maximum noise levels for construction-related noise (Chapter 5, Article 9.5, §59.5.0404). The Noise Ordinance states:

(a) It shall be unlawful for any person, between the hours of 7:00 p.m. of any day and 7:00 a.m. of the following day, or on legal holidays as specified in Section 21.04 of the San Diego Municipal Code, with exception of Columbus Day and Washington's Birthday, or on Sundays, to erect, construct, demolish, excavate for, alter or repair any building or

structure in such a manner as to create disturbing, excessive or offensive noise unless a permit has been applied for and granted beforehand by the Noise Abatement and Control Administrator.

(b) It shall be unlawful for any person, including The City of San Diego, to conduct any construction activity so as to cause, at or beyond the property lines of any property zoned residential, an average sound level greater than 75 decibels during the 12–hour period from 7:00 a.m. to 7:00 p.m.

3.5.2 Thresholds of Significance

Thresholds used to evaluate potential noise and/or vibration impacts are based on applicable criteria in the State CEQA Guidelines (CCR §§15000-15387), Appendix G; and the City of San Diego's Significance Determination Thresholds for CEQA. A significant noise and/or vibration impact would occur if the project would:

- Expose sensitive land uses to construction noise, which exceeds 75 dBA L_{eq} between the hours of 7:00 a.m. and 7:00 p.m. If the project vicinity ambient level is currently at or exceeds 75 dBA L_{eq}, noise level increases greater than 3 dB would be considered significant.
- Expose sensitive land uses to construction noise between the hours of 7:00 p.m. and 7:00 a.m.
- Exceed the significance thresholds in Table 3.5-3 for interior and exterior noise impacts from traffic generated noise.
- Result in a permanent increase in ambient noise levels in the project vicinity, which exceed the significance thresholds in Table 3.5-4.
- Expose persons to or generate excessive vibration that:
  - Results in peak particle velocities in excess of 2 in/sec at the nearest structure.
  - Results in a daily average particle velocity in excess of 0.5 in/sec at the nearest sensitive receptor.

3.5.3 Impact Analysis

Would the project expose sensitive land uses to construction noise, which exceeds 75 dBA L_{eq} between the hours of 7:00 a.m. and 7:00 p.m.? If the project vicinity ambient level is currently at or exceeds 75 dBA L_{eq}, noise level increases greater than 3 dB would be considered significant.

The proposed project would require approximately 2 years to construct, with varying levels of intensity and numbers and types of construction equipment. The analysis of noise impacts assumed the peak level of construction during which the FRS II site would be excavated, the tunnel portals would be excavated, and excess spoils would be hauled from MTRP. This peak level of activity and noise would take place for several months although construction noise would occur at the North Portal, FRS II, and South Portal for up to 2 years.

Table 3.5-3
Thresholds for Interior and Exterior Noise Impacts

Structure of Proposed Use that would be impacted by Traffic Noise	Interior Space	Exterior Usable Space[a]	General Indication of Potential Significance
Single-family detached	45 dB CNEL	65 dB CNEL	Structure or outdoor useable area[b] is < 50 feet from the center of the closest (outside) lane on a street with existing or future ADTs > 7,500[c]
Multi-family, schools, libraries, hospitals, day care, hotels, motels, parks, convalescent homes.	45 dB CNEL pursuant to Title 24	65 dB CNEL	
Offices, Churches, Businesses, Professional Uses	n/a	70 dB CNEL	Structure or outdoor usable area is < 50 feet from the center of the closest lane on a street with existing or future ADTs $\geq$ 20,000
Commercial, Retail, Industrial, Outdoor Spectator Sport Uses	n/a	75 dB CNEL	Structure or outdoor usable area is < 50 feet from the center of the closest lane on a street with existing or future ADTs $\geq$ 40,000

Source: City of San Diego Acoustical Report Guidelines (December 2003) and 2) City of San Diego Progress Guide and General Plan (Transportation Element)

a. If a project is currently at or exceeds the significance thresholds for traffic noise described above and noise levels would result in less than a 3 dB increase, then the impact is not considered significant.
b. Exterior usable areas do not include residential front yards or balconies, unless the areas such as balconies are part of the required usable open space calculation for multi-family units.
c. Traffic counts are available from:
   - San Diego Regional Association of Governments (SANDAG) Regional Economic Development Information System (REDI): http://cart.sandag.cog.ca.us/REDI/
   - SANDAG Traffic Forecast Information Center: http://pele.sandag.org/trfic.html

Table 3.5-4
Land Use Noise Thresholds

Land Use Zone	Time of Day	Threshold[a,b] One-hour dBA Leq
Residential: All R-1	7 a.m. to 7 p.m. 7 p.m. to 10 p.m. 10 p.m. to 7 a.m.	50 45 40
All R-2	7 a.m. to 7 p.m. 7 p.m. to 10 p.m. 10 p.m. to 7 a.m.	55 50 45
R-3, R-4 and all other Residential	7 a.m. to 7 p.m. 7 p.m. to 10 p.m. 10 p.m. to 7 a.m.	60 55 50
All Commercial	7 a.m. to 7 p.m. 7 p.m. to 10 p.m. 10 p.m. to 7 a.m.	65 60 60
Manufacturing all other industrial including Agricultural and Extractive Industry	any time	75

Source: City of San Diego, SDCWA

a. Measured at or beyond six feet from the boundary of the easement upon which the equipment is located.
b. If the project vicinity ambient level is currently at or exceeds the significance thresholds described above, noise level increases greater than 3 dB would be considered significant

Sound levels of typical noise sources and environments are provided in Table 3.5-5 to provide a frame of reference.

Table 3.5-5
Sound Levels of Typical Noise Sources and Noise Environments
(A-Weighted Sound Levels)

Noise Source (at a Given Distance)	Scale of A-Weighted Sound Level in Decibels	Noise Environment	Human Judgment of Noise Loudness (Relative to a Reference Loudness of 70 Decibels*)
Military Jet Take-off with After-burner (50 ft) Civil Defense Siren (100 ft)	140 130	Aircraft Carrier Flight Deck	
Commercial Jet Take-off (200 ft)	120		Threshold of Pain *32 times as loud
Pile Driver (50 ft)	110	Rock Music Concert	*16 times as loud
Ambulance Siren (100 ft) Newspaper Press (5 ft) Power Lawn Mower (3 ft)	100		Very Loud *8 times as loud
Motorcycle (25 ft) Propeller Plane Flyover (1,000 ft) Diesel Truck, 40 mph (50 ft)	90	Boiler Room Printing Press Plant	*4 times as loud
Garbage Disposal (3 ft)	80	High Urban Ambient Sound	*2 times as loud
Passenger Car, 65 mph (25 ft) Vacuum Cleaner (10 ft)	70		Moderately Loud *70 decibels (Reference Loudness)
Normal Conversation (5 ft) Air Conditioning Unit (100 ft)	60	Data Processing Center Department Store	*1/2 as loud
Light Traffic (100 ft)	50	Private Business Office	*1/4 as loud
Bird Calls (distant)	40	Lower Limit of Urban Ambient Sound	Quiet *1/8 as loud
Soft Whisper (5 ft)	30	Quiet Bedroom	
	20	Recording Studio	Very Quiet
	10		
	0		Threshold of Hearing

Construction activities at the proposed site would result in a short-term, temporary increase in the ambient noise level from the operation of construction equipment. The increase in noise level would be primarily experienced by receptors close to the noise source. The magnitude of the impact would depend on the type of construction activity, noise level generated by various pieces

of construction equipment, duration of the construction phase, and distance between the noise source and receiver. As discussed in Appendix D (URS 2006), acoustical calculations were performed to estimate noise from construction/demolition activities for each of the project components. Sound levels of typical construction equipment range from approximately 65 dBA to 95 dBA at 50 feet from the source (U.S. EPA 1971).

Construction activities for the project would include earthwork, building structures, tunneling, trenching, pipe installation, and landscaping. Tunneling noise would be concentrated at the portals, where equipment such as ventilation fans, diesel generators, and materials transport vehicles would be operating. All mobile construction equipment would be required to have properly operating mufflers. The worst-case number of equipment operating at any one time would be during the grading and excavation and building construction phases. Worst-case sound levels at the closest residential uses are summarized in Table 3.5-6 for each of the project components.

Table 3.5-6
Calculated Sound Levels from Construction/Demolition (dBA)

Description of Activity	Distance to Closest Residences (ft)	Calculated Sound Level (dBA)
FRS II construction	700	42 – 72
North Portal construction	250	51 – 81
Pipeline Interconnect Reconfiguration	40	67 - 97
South Portal construction	1,900	33 - 63
Elliot Vent #1 demolition	200	53 – 83
Elliot Vent #2 demolition	850	40 – 70
Elliot Vent #3 demolition	1,900	33 – 63
Elliot Vent #4 demolition and replacement	1,900	33 – 63
River crossing construction	500	45 - 75

Noise levels would range from 67 to 97 dBA at the residences closest to the Pipeline Interconnect Reconfiguration site, located approximately 40 feet to the south; 42 to 72 dBA at the residences closest to the FRS II site, located approximately 700 feet west; 51 to 81 dBA at the closest residences to the North Portal construction area, approximately 250 feet to the southwest; and 33 to 63 dBA at the residences closest to the South Portal, approximately 1,900 feet to the west. Noise levels may range from 33 to 83 dBA at the closest residential uses to the vent demolition sites, approximately 200 to 1,900 feet to the south and west. Sound levels would range from 45 to 75 dBA at the closest residences to the stabilized river crossing, approximately 500 feet to the south.

In addition to noise from construction equipment, the sudden and intense airborne noise potential created by a blast could create adverse reactions for nearby sensitive receptors. While the noise level of a blast is typically not very loud, it is sudden and can therefore startle persons not expecting it. For that reason, and to maintain site safety, an audible pre-blast warning is sounded prior to blasting.

Because of the intermittent nature of construction work, the average sound level for an 8-hour workday would be less than predicted in Table 3.5-6. The majority of the construction activity would be limited to the hours of 7:00 a.m. and 7:00 p.m., Monday through Saturday. During this time, the construction noise generally would comply with the thresholds criteria. This is because the calculated sound levels stated in Table 3.5-6, when averaged over an 8-hour day, would likely be less than 75 dBA. An exception to this conclusion would be at the North Portal and adjacent to the Pipeline Interconnect Reconfiguration, where the proximity of sensitive receptors to the proposed work site and the estimated sound levels from construction equipment may cause average daily sound levels to exceed 75 dBA, resulting in a significant noise impact **(Impact N 1)**.

Would the project expose sensitive land uses to construction noise between the hours of 7:00 p.m. and 7:00 a.m?

Nighttime construction would occur at the North Portal for 10 consecutive days during the connection of the new pipeline, and for the same duration at the Pipeline Interconnect Reconfiguration site. Nighttime construction would occur at the South Portal for approximately 1 year. Construction during nighttime hours (7:00 p.m. through 7:00 a.m.) would not be in conformance with the nighttime hourly average threshold of 45 dBA in residential zones (shown in Table 3.5-4). Noise impacts between 7:00 p.m. and 7:00 a.m., Monday through Saturday, and all day Sunday, would be significant **(Impact N 2)**.

Would the project exceed the significance thresholds in Table 3.5-3 for interior and exterior noise impacts from traffic generated noise?

The California Department of Transportation (Caltrans) Sound32 Traffic Noise Prediction Model (based on FHWA RD-77-108) with California Reference Energy Mean Emissions Levels was used to calculate existing and existing plus project noise levels at 50 feet from the centerline of Calle de Vida, Rueda Drive, Via Valarta, Portobelo Drive, and Clairemont Mesa Boulevard for the purpose of estimating the change in sound level resulting from project construction traffic at off-site receptors.

Data from the traffic analysis prepared by Linscott, Law & Greenspan (Appendix A) was used in the noise analysis. The worst-case scenario for traffic was used in the traffic analysis; therefore, the highest potential traffic numbers associated with any project alternative were used for the noise calculations. The actual sound level at any receptor location is dependent on such factors as the source to receptor distance and the presence of intervening structures, barriers, and topography. The modeling effort considered estimated average vehicle speed and the ADT. It was assumed that the peak hour traffic volume is 10 percent of the ADT. A vehicle mix of 98 percent autos, 1.5 percent medium trucks, and 0.5 percent heavy trucks for all roadways was assumed for the existing conditions. Of the traffic generated by the project, it was assumed that approximately 65 percent of the ADT was heavy trucks and that the trucks would operate between 7:00 a.m. and 7:00 p.m., Monday through Saturday. The remaining 35 percent of the ADT would be light trucks and the personal vehicles used by construction workers to commute to and from the jobsite. The following vehicle speeds were used: 25 miles per hour (mph) for Rueda Drive, 30

mph for Calle de Vida, 35 mph for Portobelo Drive, 40 mph for Via Valarta and for Clairemont Mesa Boulevard between Rueda Drive and Via Valarta, 45 mph for Clairemont Mesa Boulevard between Via Valarta and Santo Road, and 50 mph for Clairemont Mesa Boulevard between Santo Road and I-15.

Table 3.5-7 summarizes the results of the acoustical calculations. A review of the table shows that worst-case sound levels along all roadways would increase by approximately 1.1 dBA CNEL along Via Valarta, 1.5 dBA CNEL along Clairemont Mesa Boulevard, 1.7 dBA CNEL along Portobelo Drive, 3.2 dBA CNEL along Calle de Vida, and 3.3 dBA CNEL along Rueda Drive for the duration of the worst-case traffic condition. The worst-case condition for traffic is anticipated to last for approximately 2 months, when traffic associated with the export of excavated materials from the North Portal, FRS II, and South Portal would be at its peak.

Table 3.5-7 shows that calculated sound levels along all roadways, except Clairemont Mesa Boulevard, would remain below the 65 dBA CNEL threshold at residential land uses. Therefore, there would be no significant impact to residences along Calle de Vida, Rueda Drive, Via Valarta, and Portobelo Drive as a result of the project, as long as the trucks are not utilized during the nighttime period. Calculated sound levels along Clairemont Mesa Boulevard already exceed the 65 dBA CNEL under the existing conditions and the project would increase sound levels by approximately 1.5 dBA CNEL. However, the residences along Clairemont Mesa Boulevard are at a greater distance than 50 feet from the centerline and most residences have an existing noise barrier along the property line. In addition, the typical human ear cannot perceive changes in sound level by less than 3 dBA. Therefore, the noise impact to residences along Clairemont Mesa Boulevard as a result of truck traffic would be less than significant.

Table 3.5-7
Calculated Traffic Sound Levels at 50 feet from Roadways (dBA CNEL)

Roadway	Speed Limit	Existing		With Project		Delta[1]
		ADT	Calculated Level (dBA CNEL)	ADT	Calculated Level (dBA CNEL)	
Clairemont Mesa Blvd						
Rueda to Via Valarta	40 mph	4,700	63.4	6,130	64.9	1.5
Via Valarta to Santo Road	45 mph	11,600	68.8	13,530	69.2	0.4
Santo Road to I-15	50 mph	13,200	70.5	15,130	71.1	0.6
Calle de Vida	30 mph	1,000	54.9	1,715	58.2	3.3
Rueda Drive	25 mph	2,100	55.3	2,815	58.5	3.2
Portobelo Drive	35 mph	1,200	56.5	1,700	58.2	1.7
Via Valarta	40 mph	2,700	61.0	3,200	62.1	1.1

[1]Difference between existing and with project. Calculated Level is 50 ft from centerline of roadway

Calculations were also performed to estimate the sound levels resulting from the proposed project at off-site receptors near the North Portal ingress/egress route on the Portobelo Drive access road. There are residences on either side of the access road. The multi-family residences to the north are approximately 10 feet above the road and approximately 160 feet from the road. The single-family residences to the south are approximately 25 feet above the road and

approximately 165 feet from the road. The worst-case scenario for traffic impacts at the North Portal was used for the noise calculations. The actual sound level at any receptor location is dependent on such factors as the source to receptor distance and the presence of intervening structures, barriers, and topography. The modeling effort considered estimated average vehicle speed and the ADT (172 haul trucks and 72 worker vehicles). It was assumed that the peak hour traffic volume is 10 percent of the ADT, the trucks would only operate between 7:00 a.m. and 7:00 p.m. Monday through Saturday, and the speed of the trucks would be 10 mph. Based on these assumptions, the residences to the north and south would experience sound levels of approximately 40 dBA CNEL. Therefore, sound levels do not exceed the 65 dBA CNEL guideline for traffic noise or the 75 dBA CNEL City guideline for construction noise. In addition, calculated sound levels would be below the measured average sound level of 49 dBA at the monitoring location along the Portobelo Access Road. The impact of noise from construction traffic to and from the North Portal and the Pipeline Interconnect Reconfiguration site would be less than significant.

Would the project result in a permanent increase in ambient noise levels in the project vicinity, which exceed the significance thresholds in Table 3.5-4?

The primary noise impacts associated with the operation of project facilities would be from employee vehicles traveling to the FRS II structure and the Water Authority's right-of-way to ensure proper operation of project facilities. These noise impacts would be periodic and minor, and would not result in a significant impact to the ambient noise levels. Water Authority employees currently patrol the right-of-way and inspect the FRS I on a daily basis and would add the FRS II to their route. There would not be a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project. This impact would be less than significant.

Would the project expose persons to or generate excessive vibration that:

- *Results in peak particle velocities in excess of 2 in/sec at the nearest structure?*
- *Results in a daily average particle velocity in excess of 0.5 in/sec at the nearest sensitive receptor?*

Construction activity can result in varying degrees of ground-borne vibration, depending on the equipment and methods. Operation of construction equipment causes ground vibrations that propagate through the ground and diminish in strength with distance. Ground vibrations from construction activities very rarely reach the levels that can damage structures, but can be audible/perceptible in buildings very close to the site. The construction activities that typically generate the most severe vibrations are blasting and pile driving. Blasting would be required for the proposed project; pile driving is not anticipated.

Various types of construction equipment have been measured under a variety of activities with an average of source levels reported in terms of velocity levels (FTA 1995). These measurements converted to peak particle velocities (in/sec) are shown in Table 3.5-8. Based on these measurements, large dozers generate a peak particle velocity (PPV) of approximately 0.089 in/sec at 25 feet. At the closest home to the North Portal (approximately 250 feet from the construction activities), the equipment would generate a PPV of less than 0.01 in/sec. At the

closest home to the Pipeline Interconnect Reconfiguration site (40 feet), vibration would still be less than the threshold of 0.5 in/sec. The vibration level is considered acceptable for both humans and structures. Therefore, ground-bourne noise impacts would be less than significant.

Blasting is planned for the tunnel and North Portal excavations in hard rock within the Santiago Peak Volcanics where excavation by roadheader would result in excessively slow progress rates and excessive wear. Blasting may also be required at the FRS II site or other areas where the hardness of the rock encountered during excavation may require its use. Blasting would create local ground-borne vibrations. The character of the blast and ground vibrations would be dependent on such factors as type of soil/rock, type of explosive, amount of explosive used, depth of explosion and meteorological conditions. Drill-and-blast methods would generally consist of the following steps: 1) drilling a pattern of holes in a rock face and loading the holes with explosives, 2) blasting the round and ventilating the blasting gasses, 3) mucking the blasted rock, and 4) installing initial ground support as needed.

Table 3.5-8
Vibration Source Levels for Construction Equipment

Equipment		Peak particle Velocity (PPV) at 25 ft (in/sec)
Pile Driver (impact)	Upper range	1.518
	Typical	0.644
Pile Driver (sonic)	Upper range	0.734
	Typical	0.170
Large bulldozer		0.089
Caisson drilling		0.089
Loaded trucks		0.076
Jackhammer		0.035
Small bulldozer		0.003

There are approximately 12 homes within approximately 250 and 500 feet of the North Portal. Half of these residences have a direct line-of-sight of the North Portal and the remaining are on the tunnel side of the North Portal. There is insufficient information available at this time regarding the locations and sizes of blasts to perform calculations of the airblast or ground-borne vibration from the blasting; however, due to the close proximity of the residences near the North Portal site, it is assumed that this impact would be significant **(Impact N 3)**.

3.5.4 Mitigation Measures

To mitigate significant construction noise impacts associated with substantial increases of noise levels above ambient that may exceed 75 dBA, the Water Authority shall implement the following mitigation measures:

N 1-1 No motor driven semi-stationary equipment shall be operated continuously under load within 500 feet of any residences at night (7:00 pm – 7:00 a.m.) unless a temporary noise propagation barrier is erected, and/or enhanced mufflers are used to reduce noise exposure at any adjacent building facade to 45 dB L_{eq}.

N 1-2 The contractor shall use portable noise screens or enclosures to provide shielding for high noise activities or equipment as necessary. The effectiveness of a barrier depends upon factors such as the relative height of the barrier relative to the line-of-sight from the source to the receiver, the distance from the barrier to the source and to the receiver and the reflections of sound. To be effective, a barrier must block the line-of-sight from the source to the receiver. A properly designed noise barrier can reduce noise as much as 20 dBA.

N 1-3 The Water Authority shall monitor noise levels during construction to ensure compliance with the noise thresholds.

To mitigate significant noise impacts during night construction at the North Portal and Pipeline Interconnect Reconfiguration, the Water Authority shall implement the following mitigation measure:

N 2-1 The Water Authority shall construct a temporary sound wall along the western boundary of the North Portal staging area and the Pipeline Interconnect Reconfiguration site to reduce construction noise levels at the Belsera property line. A properly designed noise barrier can reduce noise as much as 20 dBA.

N2-2 The Water Authority shall monitor noise levels during construction to ensure compliance with the noise thresholds.

To mitigate the potential vibration impacts associated with blasting, the Water Authority shall implement the following mitigation measures:

N 3-1 The Water Authority shall monitor all blasting activities to confirm that they are consistent with the Water Authority's General Conditions and Standard Specifications, Section 02229, including:

- Blasting shall only be conducted during construction when other practicable excavation methods are not available.
- Advanced written notification of the date and time of any blasting activities shall be provided to all residents and businesses within 400 feet of the blast area.
- A Blast Plan will be developed and approved by the local regulatory authority in the event that blasting is necessary.

N 3-2 Blast monitoring shall be required for all blasting operations within the City, including monitoring of ground motions, peak particle velocity, and air blast levels.

N 3-3 The hours of blasting shall be determined by site specific requirements and blasting shall be limited to daytime hours between 7:00 a.m. and 7:00 p.m., Monday through Saturday.

N 3-4 If the blasting results in vibration or blast levels with a PPV in excess of 2.0 inches/second, modifications to the procedures shall be implemented, such as using different delay patterns, reduction in size of the individual blasts, shorter and/or smaller diameter blast holes, closer spacing of blast holes, reduction of explosives, blast mats, sound walls, or a combination. A properly designed noise barrier can reduce noise as much as 20 dBA.

N 3-5 A public outreach program shall be implemented to alert the public to the potential for vibrations and noise associated with blasting.

3.5.5 Residual Impacts after Mitigation

Implementation of the mitigation measures recommended above would reduce short-term impacts due to construction noise by 20 dBA, but these impacts would not be expected to be reduced to below a level of significance by the above measures. Therefore, the impacts due to construction noise would remain significant during the construction period. A Statement of Overriding Considerations would be necessary for project approval. This significant noise impact would be temporary because it would cease upon the completion of construction.

No residual impacts would remain after implementation of the proposed mitigation measures for potential vibration impacts associated with blasting.

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