4.0 ENVIRONMENTAL IMPACT ANALYSIS G. NOISE

INTRODUCTION

The following analysis defines the existing noise environment within the project area and estimates future noise levels at surrounding land uses resulting from project construction and operation. Potential short-term and long-term noise levels associated with the proposed project are assessed with respect to the City of Pasadena's Noise Element and City Code – Title 9, Article IV, Chapter 9, Section 36 "Noise Restrictions Ordinance" as well as other industry recognized noise and vibration criteria. This section is based in part on information provided in the *Repowering Project Noise Assessment Study* prepared by Emery Tuttle in December 2011. This document is provided in **Appendix E** to this Draft EIR.

1. ENVIRONMENTAL SETTING

a. Regulatory Framework

Many government agencies have established noise regulations and policies to protect citizens from potential hearing damage and various other adverse physiological and social effects associated with noise and groundborne vibration. The City of Pasadena has adopted a number of policies, which are based in part on federal and State regulations and are intended to control, minimize or mitigate environmental noise effects. There are no City-adopted policies or standards that relate to ground-borne vibration, but the Federal Transit Administration (FTA) and the California Department of Transportation (Caltrans) do have such standards and/or policies. The regulations and policies that are relevant to project construction and operation noise levels are discussed below.

(1) Pasadena Noise Restrictions Ordinance

The Pasadena noise ordinance is contained in Title 9, Article IV, Chapter 9, Section 36 and is titled, "Noise Restrictions Ordinance." The ordinance restricts new mechanical noise sources such as those which are being considered as part of the proposed project by limiting those sources to not more than five decibels above the existing background or "ambient" noise level. According to the ordinance, the ambient noise levels are to be based on an average of noise sources both near and far, excluding: (1) unusual or unrepresentative noise; and (2) the noise source being evaluated for compliance. The ambient noise, measured in decibels, represents the baseline noise level for the existing environment. The ambient noise level plus five dB (decibels) is the maximum limit for noise sources being evaluated for compliance. Refer to section 4.1 for a description of applicable noise metrics used to quantify environmental noise levels.

The City's Noise Ordinance prohibits construction noise within a residential district or within a radius of 500 feet therefrom between the hours of 7:00 P.M. and 7:00 A.M. Monday through Friday and on Saturday before 8:00 A.M. and after 5:00 P.M., and does not allow construction noise on Sunday or on a holiday.¹

¹ Ldn is the term used in the City's Noise Element of the General Plan, but is often referred to as DNL in discussions.

The City's Noise Ordinance also limits noise from powered construction equipment if the operation of such equipment emits noise at a level in excess of 85 dBA when measured within a radius of 100 feet from such equipment.²

(2) Pasadena Noise Element of the General Plan

The Noise Element of the General Plan is primarily used by the Planning Department as a permitting guideline to prevent noise sensitive land use developments from encroaching upon existing preemptive noise sources unless adequate noise abatement is incorporated into the encroaching development. The City of Pasadena Noise Element contains a noise compatibility matrix that shows acceptable and unacceptable ranges of noise for various land uses. The noise compatibility matrix is shown in **Table 4.G-1**, *City of Pasadena Guidelines for Noise Compatible Land Use*, (appears as Figure 1 in the City's Noise Element). A 2004 Environmental Impact Report³ for the City of Pasadena states the following with respect to noise sensitive land uses:

"The City has determined maximum acceptable noise levels for each land use, which range from "clearly acceptable" to "normally acceptable." As indicated in [Figure 3], the City has classified residential land uses as the most sensitive land use category, with 70 dB(A) as the highest "normally acceptable" noise level, and 75 dB(A) the highest "conditionally acceptable" level. Schools, libraries, churches, hospitals, and nursing homes are assigned a maximum "normally acceptable" dB(A) of 70 and a maximum "conditionally acceptable" dB(A) of 70 and a maximum "conditionally acceptable" dB(A) of 80. Industrial land uses have a "clearly acceptable" dB(A) up to 75 dB(A). Any project to be constructed within the "conditionally acceptable" category is subject to a noise analysis to identify reduction requirements, including, if necessary, incorporation of insulation features into project design."

In addition to land use planning considerations for new land uses, the Noise Element contains implementation measures to help carry out its objectives and policies. Two of the measures pertain to projects such as the Glenarm Power Plant Repowering Project and state the following:

"Measure 8 -As feasible and practical, new equipment purchased by the City will meet noise performance standards consistent with the best available noise reduction technology." ⁴

"Measure 21 -The City will encourage new developments to site outdoor ... mechanical equipment, and other noisier components away from residential zones and other sensitive uses as defined in [Figure 3], to the extent feasible, unless the siting of such components near to noise-sensitive uses provides transportation or other benefits." ⁵

² City of Pasadena Municipal Code, Section 9.36.080.

³ Environmental Impact Report for The 2004 Land Use and Mobility Elements, Zoning Code Revisions, and Central District Specific Plan prepared for the City of Pasadena, CA.

⁴ City of Pasadena. Revised Noise Element of the General Plan. Figure 1, Guidelines for Noise Compatible Land Use; Implementation Measures; Measure 8 on p. 10.; December.

⁵ City of Pasadena. Revised Noise Element of the General Plan. Figure 1, Guidelines for Noise Compatible Land Use; Implementation Measures; Measure 21 on p. 11.; December.

Land Use Category	Community Noise Exposure L _{dn} or CNEL, dBA										
	5	5	60	65	70	75	80	85			
Residential – Low Density Single Family, Duplex, Mobile Homes											
Residential – Multi- Family and Mixed Commercial/Residential Use											
Transient Lodging – Motels, Hotels											
Schools, Libraries, Churches, Hospitals, Nursing Homes											
Auditoriums, Concert Halls, Amphitheaters											
Sports Arena, Outdoor Spectator Sports											
Playgrounds, Neighborhood Parks											
Golf Courses, Riding Stables, Water Recreation, Cemeteries											
Office Buildings, Business Commercial and Professional											
Industrial, Manufacturing, Utilities, Agriculture											
CLEARLY ACCEPTABLE: Specified land use is satisfact involved are of normal conventional construction, without	ory, bas t any spe	ed up ecial	oon the noise i	assum nsulati	ption ti on requ	hat any iiremen	buildin nts.	ıgs			
NORMALLY ACCEPTABLE: New construction or develo the noise reduction requirements is made and needed nois Conventional construction, but with closed windows and f normally suffice.	opment s se insula fresh air	houl tion supj	d be un feature oly syste	dertak s inclu ems or	en after ded in 1 air cor	r an an the des ıdition	alysis c ign. ing will	pf			
CONDITIONALLY ACCEPTABLE: If new construction or development proceeds, an analysis of the nois reduction requirement should be made and needed noise insulation features included in the design.											
NORMALLY UNACCEPTABLE: New construction or dev it can be demonstrated than an interior level of 45 dBA ca	elopmen in be acl	t sha hieve	ould ger d.	ierally	not be	underta	aken, ur	ıless			
* Please note that these guidelines are general and may not apply to	specific	sites									
Source: California, General Plan Guidelines, 1998, as modified by the	e City of	Pasa	idena, 2	2002							

City of Pasadena Guidelines for Noise Compatible Land Use

(3) South Pasadena Noise Regulation

The South Pasadena noise ordinance is contained in Chapter 19A, and is titled, "Noise Regulation." The section of 19A.12 restrict new mechanical noise sources such as those which are being considered for as part of the proposed project by limiting those sources to not more than five decibels above the existing ambient noise level. The section 19A.13 of the noise regulation prohibits construction noise within a residential

district or within a radius of 500 feet therefrom between the hours of 7:00 P.M. and 8:00 A.M. Monday through Saturday and on Sunday before 10:00 A.M. and after 7:00 P.M., and does not allow construction noise on Sunday or on a holiday.

(4) Ground-Borne Vibration Standards

The City of Pasadena has not adopted policies or guidelines relative to ground-borne vibration. As such, the following is a summary of FTA and Caltrans' ground-borne vibration policies and guidelines. With respect to ground-borne vibration from construction activities, the Caltrans has adopted guidelines/recommendations to limit ground-borne vibration based on the age and/or condition of the structures that are located in close proximity to construction activity.

A technical discussion of construction activity-related vibration is provided in Section 12.2 of FTA publication titled "Transit Noise and Vibration Impacts Assessments," May 2006. As described therein, a ground-borne vibration level of 0.2 inch-per-second peak particle velocity (PPV) should be considered as damage threshold criterion for structures deemed "fragile". With respect to residential and commercial structures, Caltrans' technical publication *Transportation- and Construction-Induced Vibration Guidance Manual* June 2004, provides a vibration damage potential threshold criterion of 0.5 inches per second (PPV) for older residential structures, 1.0 inches per second (PPV) for newer residential structures, and 2.0 inches per second (PPV) for modern industrial/commercial buildings.

b. Existing Conditions

(1) Baseline Noise Model Results

Baseline noise model methods were discussed in the section 4.2, *Noise Sources: Descriptions, Measurements, and Modeling,* of the noise study. As shown in **Figure 4.G-1**, *Noise Sensitive Impact Evaluation Locations,* seventeen noise sensitive locations were chosen for specific evaluation of potential noise impacts for the Repowering Project by Emery Tuttle. The noise model results are summarized in **Table 4.G-2**, *Summary of Existing Noise Levels at Sensitive Receptor Locations,* and the noise sensitive locations are shown in Figure 4.G-1. The existing LEQ(d) ⁶ and LEQ(n) ⁷ at each of the seventeen receptor locations is shown in the middle section of Table 4.G-2 along with the noise limit allowed by the City's Noise Restrictions Ordinance. The Noise Restrictions Ordinance allows a five-decibel increase above the existing levels shown in Table 4.G-2, under the column heading, "Limit." Several of the receptors show a nighttime level that is greater than the daytime level in Table 4.G-2.

The baseline DNL levels for the existing setting are also shown on the right side of Table 4.G-2. The table shows that twelve of the seventeen sensitive receptor locations are currently below the "Normally Acceptable" noise compatibility criteria according to the City's Noise Element of the General Plan (refer to Figure 3 of the noise study). Four receptors are currently near or above the "Normally Acceptable" noise compatibility criteria. These include a single-family residence (R-07) located at the southwest corner of Fair Oaks Avenue and State Street, the multi-family land uses in South Pasadena on State Street near the Pasadena Freeway (R-10 and R-11), and a multi-family land use (R-15) located on the east side of Marengo

⁶ *LEQ(d)* is the average noise level occurring during daytime hours (6 am to 11 pm) in units of dBA.

⁷ LEQ(n) is the average noise level occurring during nighttime hours (11 pm to 6 am) in units of dBA.





Evaluation Location



0 400 Feet

Noise Sensitive Impact Evaluation Locations

FIGURE **4.G-1**

Glenarm Power Plant Repowering Project Source: Repowering Project Noise Assessment Study, Emery W. Tuttle, December 2011. This page is intentionally blank.

Summary of Existing Noise Levels at Sensitive Receptor Locations

Receptor	Proximity to		Existing Ambien Lev	Daytime t Noise els	Existing N Ambien Lev	lighttime t Noise els	Existing	Baseline Noise Compatibility Criteria, DNL, dBA ^b		
Locations No.	Power Plant (feet)	Land Use Description	LEQ(d), dBA	Limit, dBA ^c	LEQ(n), dBA	Limit, dBA ^c	Baseline DNL, dBA	Normally Acceptable	Conditionally Acceptable	
R-01	935 NW	R1 – single-family residential, south side of Glenarm Street	61.8	66.8	55.6	60.6	64.7	70	75	
R-02	285 NW	R1 – multi-family residential, north side of Glenarm Street	66.1	71.1	65.8	70.8	67.8	70	75	
R-03	470 W	R1 – single-family residential, Grace Hill community	53.0	58.0	50.9	55.9	57.5	70	75	
R-04	380 W	R1 – single-family residential, south side of Glenarm Street	60.5	65.5	62.5	67.5	60.7	70	75	
R-05	365 W	R1 – single-family residential, south side of Glenarm Street	63.2	68.2	65.6	70.6	61.4	70	75	
R-06	210 W	R1 - single-family residential, behind Fair Oaks commercial strip	64.8	69.8	66.6	71.6	63.6	70	75	
R-06a	210 W	R1 – single-family residential, behind Fair Oaks commercial strip	70.2	75.2	72.2	77.2	68.2	70	75	
R-07	320 SW	R1 – single-family residential, south side of State Street	69.4	74.4	68.9	73.9	71.3 ^d	70	75	
R-08	425 S	R3 - multi-family residential, Raymond Hill community	66.8	71.8	67.9	72.9	63.6	70	75	
R-09	750 S	R3 – multi-family residential, Raymond Hill community	65.7	70.7	66.7	71.7	63.2	70	75	
R-10	1,140 S	R3A – single-family residential, west side of State Street	67.2	72.2	66.9	71.9	69.3	70	75	
R-11	1,750 S	R3A - single-family residential, west side of State Street	66.8	71.8	61.4	66.4	70.5 ^d	70	75	
R-12	845 E	M – Blair High School, near amphitheater	67.5	72.5	67.0	72.0	67.7	70	80	
R-13	1,070 E	R3 – west side of Allendale Branch Library	65.8	70.8	66.2	71.2	67.4	70	80	

Table 4.G-2 (Continued)

Summary of Existing Noise Levels at Sensitive Receptor Locations

Receptor	Proximity to		Existing Ambien Lev	Daytime It Noise rels	Existing N Ambien Lev	lighttime It Noise rels	Existing	Baseline Noise Compatibility Criteria, DNL, dBA ^b		
Locations No.	Power Plant (feet)	Land Use Description	LEQ(d), dBA	Limit, dBA ^c	LEQ(n), dBA	Limit, dBA ^c	Baseline DNL, dBA	Normally Acceptable	Conditionally Acceptable	
R-14	1,270 EE	R3 – Playground on Wallis Street	61.8	66.8	63.6	68.6	62.8		75	
R-15	1,300 SE	R3 – multi-family residential, east side of Marengo Street	66.7	71.7	63.9	68.9	69.9	70	75	
R-16	1,900 E	R3 – mixed residential / commercial	55.3	60.3	57.8	62.8	56.5	70	75	

^{*a*} *Refer to Figure 4.G-1 for a map showing the location of noise sensitive impact evaluation receptors.*

^b DNL noise compatibility level (also referred to as Ldn) established according to the City of Pasadena Noise Element guidelines shown in Table 4.G-1

^c LEQ noise limit established according to the City of Pasadena Noise Restrictions Ordinance.

^d Existing baseline DNL level at this location is above the, "Normally Acceptable" noise compatibility criteria.

Source: Repowering Project Noise Assessment Study, Emery W. Tuttle, December 2011.

Avenue, south of Blair High School. All of these receptors are predominantly affected by roadway noise. However, receptor R-07 is nearest to the Glenarm Plant site. Therefore, careful consideration will need to be exercised in the design of the proposed project to avoid potential noise impacts at receptor R-07.⁸ None of the existing levels exceed the "conditionally acceptable" compatibility criterion.

(2) Vibration Sensitive Receptor Locations

With respect to structures, vibration-sensitive receptors generally include historic buildings, buildings in poor condition, and uses that require precision instruments (e.g., operating rooms or scientific laboratories). The Glenarm Power Plant and adjacent electric fountain, and the Pacific Electric Railway Company (PERC) Substation No. 2 are located within the area of potential perceptible vibration (within 50 feet) and could be affected by vibration caused by short-term construction and long-term project operation.

c. Noise and Vibration Basics

(1) Noise

Noise is usually defined as sound that is undesirable because it interferes with speech/communication and hearing, or is otherwise annoying (unwanted sound). The decibel (dB) is a conventional unit for measuring the amplitude of sound because it accounts for the large variations in sound pressure amplitude and reflects the way people perceive changes in sound amplitude.⁹ The human hearing system is not equally sensitive to sound at all frequencies. Therefore, to approximate this human frequency-dependent response, the A-weighted system is used to adjust measured sound levels (dBA). The term "A-weighted" refers to a filtering of the noise signal in a manner corresponding to the way the human ear perceives sound.

Community noise levels usually change continuously during the day. The equivalent sound level (L_{eq}) is normally used to describe community noise. The L_{eq} is the equivalent steady-state A-weighted sound level that would contain the same acoustical energy as the time-varying A-weighted sound level during the same time interval. For intermittent noise sources, such as a vehicle alarm, the maximum noise level (L_{max}) is normally used to represent the maximum noise level measured.

The City's Noise Restrictions Ordinance is based on the community background noise, referred to as, ambient noise level. The ordinance provides the following definition for ambient noise:

"Ambient noise" means the all-encompassing noise associated with a given environment, being usually a composite of many sources near and far. ... ambient noise level is the level obtained when the noise level is averaged over a period of 15 minutes without inclusion of noise from isolated identifiable sources ..."

The average noise level refers to a logarithmic energy average rather than a straight numeric average of the sound level over time. The abbreviation for the energy average noise level is LEQ, in units of A-weighted decibels (dBA)¹⁰. LEQ can be used to describe short periods of time such as an hour or less LEQ(h), and can

⁸ Repowering Project Noise Assessment Study, Emery W. Tuttle, December 2011.

⁹ All sound levels, measured in decibel (dB), in this study are relative to $2x10^{-5}$ N/m².

¹⁰ Decibels, abbreviated dB, are a unit of measure for sound pressure level with a standard pressure reference quantity of 20 micro-Pascals. The A-weighted decibel, dBA, is used to approximate human hearing characteristics.

also be used to describe the daytime and nighttime portions of a 24-hour day, LEQ(d) and LEQ(n), respectively. LEQ is often used to describe continuous noise such as noise from power plants. Community noise is typically higher during daytime periods than it is at night since humans are typically more active during the day, more commercial businesses are open, and street traffic is higher. For this reason, the ambient noise level is categorized chronologically into two time periods so that it corresponds with the higher daytime and lower nighttime noise environments that are typical in a community:

LEQ(d) representing average daytime levels, in dBA (6 am to 11 pm); and LEQ(n) representing average nighttime levels, in dBA (11 pm to 6 am).

LEQ(d) and LEQ(n) were selected to assess the background noise levels in the community. This allows the daytime and nighttime community noise assessment to be distinctly separate from each other since nighttime periods are significantly quieter than the daytime. In addition, the Noise Restrictions Ordinance can easily be applied to the LEQ(d) and LEQ(n) noise metrics. For noise sources that are not continuous but periodically occur as noise events such as train operations or power plant start-up noise, another noise metric called the sound exposure level, or SEL is often used. SEL can also be used for the computation of other noise descriptors such as LEQ(d), LEQ(n), or DNL. The following provides a description of DNL.

The City's Noise Element of the General Plan utilizes a noise descriptor, which is related to the LEQ, called the Day-Night average Level, is mathematically symbolized as Ldn¹¹ and abbreviated as DNL in discussions. DNL is a 24-hour logarithmic energy average of the noise level, with one additional factor incorporated into the computation: a ten decibel adjustment is added to all nighttime noise levels occurring between 10 pm and 7 am prior to the final 24-hour averaging computation. This adjustment serves as a penalty to nighttime noise since this is a more sensitive time period for residential receptors. Alternatively, the Noise Element allows the use of CNEL which is approximately equal to DNL. DNL has been selected as an additional noise metric to assess the noise environs around the proposed project site.

(2) Ground-Borne Vibration

Vibration is an oscillatory motion through a solid medium, such as the ground, in which the motion's amplitude can be described in terms of displacement, velocity, or acceleration. The response of humans, buildings, and equipment to vibration is more accurately described using velocity or acceleration.¹² Vibration amplitudes are usually described as "peak particle velocity" (PPV). The peak level represents the maximum instantaneous peak of the vibration. PPV is typically used for evaluating potential building damage. In addition, vibrations can be measured in the vertical, horizontal longitudinal, or horizontal transverse directions. A peak vertical particle velocity descriptor is usually used for vibration impact analysis, because vibration levels propagated along the ground surface are typically greater in the vertical direction than horizontal longitudinal and horizontal transverse directions.¹³ Therefore, the analysis of ground-borne vibration associated with the project is addressed in the vertical direction.

¹¹ Decibels, abbreviated dB, are a unit of measure for sound pressure level with a standard pressure reference quantity of 20 micro-Pascals. The A-weighted decibel, dBA, is used to approximate human hearing characteristics.

¹² Federal Transit Authority, Transit Noise and Vibration Impact Assessment, Final Report, page 7-3, April 1995.

¹³ California Department of Transportation (Caltrans), <u>Transportation Related Earthborne Vibrations</u>, page 4, February 2002.

2. ENVIRONMENTAL IMPACTS

a. Thresholds of Significance

The City of Pasadena has not adopted its own significance thresholds for the evaluation of noise impacts. Based on the Initial Study Environmental Checklist form contained in Appendix G of the State *CEQA Guidelines*, a project would normally have a significant noise impact on nearby noise sensitive uses if it would result in one or more of the following:

- Expose persons to or generate noise levels in excess of standards established in the local general plan; or
- Expose persons to or generate excessive groundborne vibration or groundborne noise levels established in the Caltrans' standards;

The following significance thresholds evaluate potential noise and vibration impacts of the project based on the regulatory framework described earlier in this section.

NOISE-1	Construction-related noise levels exceed 85 dBA when measured within a radius of 100 feet from such equipment;
NOISE-2	Construction activities would occur outside the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday day, from 8:00 a.m. 5:00 p.m. on Saturday, or anytime on Sunday or holidays (City-observed);
NOISE-3	Would project construction activities cause ground-borne vibration levels to exceed 0.2 inches per second (PPV) at the nearest historic building?
NOISE-4	Would project construction activities cause ground-borne vibration levels to exceed 0.5 inches per second (PPV) at the nearest residential building?
NOISE-5	Would project-related operational activities cause ambient noise levels to increase by 5 dBA or more at noise sensitive receptor locations?

b. Methodology

(1) Construction Noise

Noise impacts from construction, truck staging, and hauling are evaluated by determining the noise levels generated by the different types of construction activity, calculating the construction-related noise level at nearby sensitive receptor locations, and comparing these construction-related noise levels to the significance thresholds. More specifically, the following steps were undertaken to calculate construction-period noise impacts:

1. Typical noise levels for each construction equipment were obtained from the Federal Highway Administration (FHWA) roadway construction noise model (RCNM);

- 2. Distances between construction site locations (noise source) and surrounding sensitive receptors were measured using project architectural drawings, Google Earth, and site plans;
- 3. The construction noise level was then calculated, in terms of hourly L_{eq} , for sensitive receptor locations based on the standard point source noise-distance attenuation factor of 6.0 dBA for each doubling of distance; and
- 4. Construction noise levels were then compared to the construction noise significance thresholds identified below.

(2) Ground-Borne Vibration During Construction

Ground-borne vibration impacts were evaluated by identifying potential vibration sources, measuring the distance between vibration sources and surrounding structure locations, and making a significance determination.

c. Project Features

d. Analysis of Project Impacts

(1) Construction Noise

(a) On-Site Construction Activities

NOISE-1 Would construction-related noise levels exceed 85 dBA when measured within a radius of 100 feet from such equipment?

Noise impacts from construction activities are generally a function of the noise generated by construction equipment, the equipment location, the sensitivity of nearby land uses, and the timing and duration of the noise-generating activities. It is anticipated that construction would take up to 23 months following project approval, and would include approximately five months of demolition, asbestos abatement, site clearing, grading, and excavation, and approximately 18 months of construction of the power generation unit and auxiliary facilities.

Project construction would require the use of mobile heavy equipment with high noise level characteristics. Individual pieces of construction equipment that would be used for project construction produce maximum noise levels of 75 dBA to 90 dBA at a reference distance of 50 feet from the noise source, as shown in **Table 4.G-3**, *Construction Equipment Noise Levels*. These maximum noise levels would occur when equipment is operating under full power conditions. However, equipment used on construction sites often operate under less than full power conditions, or part power as shown in the second column in Table 4.G-3. As shown in Table 4.G-3, the part power percentage (%) of construction equipment is based on the Construction Noise Control Specification developed for the Central Artery/Tunnel project in Boston.¹⁴ To more accurately characterize construction-period noise levels, the average (Hourly L_{eq}) noise level associated with each construction stage is calculated based on the quantity, type, and usage factors for each type of equipment that would be used during each construction stage and are typically attributable to multiple pieces of equipment operating simultaneously.

¹⁴ Federal Highway Administration, Roadway Construction Noise Model User's Guide, 2006.

Construction Equipment Noise Levels

Equipment	Estimated Usage Factor, %	Typical Noise Level at 50 feet from Equipment, dBA (L _{max})	Typical Noise Level at 100 feet from Equipment, dBA (L _{max})
Aerial Lift	20	75	69
Concrete Mixer Truck	40	79	73
Concrete Saw/Blade	20	90	84
Crane	16	81	75
Forklift	10	75	69
Grader	40	85	79
Excavator	40	81	75
Other Equipment	50	85	79
Pavement Scarifier	20	90	84
Paver	50	77	71
Pump	50	81	75
Tractors/Loaders/Backhoes	50	80	74
Source: FHWA Roadway Construct	ion Noise Model User's Guide, 2	006; PCR Services Corporation, 201	12

Construction noise levels were estimated based on an industry standard sound attenuation rate of 6 dB per doubling of distance for point sources (e.g., construction equipment).¹⁵ Within the analysis, construction equipment was assumed to operate simultaneously at the construction area nearest to potentially affected residential receptors. These assumptions represent a worst-case noise scenario as construction activities would routinely be spread throughout the construction site further away from noise sensitive receptors. In addition, noise from different construction phases, which have the potential to occur simultaneously were added together to provide a composite construction noise level. As shown in Table 4.G-3, the equipment proposed to be used produce noise at or below 84 dBA at a distance of 100 feet from the equipment, which would not exceed the City's significance threshold of 85 dBA.

A summary of the construction noise impacts at the nearby sensitive receptors is provided in **Table 4.G-4**, *Estimate of Construction Noise Levels* (L_{eq}) at Off-Site Sensitive Receiver Locations. Detailed noise calculations for construction activities are provided in **Appendix E** of this EIR. As shown in Table 4.G-4, construction noise levels are estimated to reach a maximum of 69 dBA at the nearest off-site receptor location, 210 feet from the construction site. Construction noise levels would not exceed the significance threshold of 85 dBA. In addition, construction activities would not occur outside the hours of 7:00 A.M. to 7:00 P.M. Monday through Friday, 8:00 A.M. to 5:00 P.M. on Saturday, or anytime on Sunday or a holiday. As such, impacts would be less than significant.

¹⁵ The CalTrans' Technical Noise Supplement (November 2009) defines hard sites as sites with a reflective surface between the source and the receiver such as parking lots or smooth bodies of water. No excess ground attenuation is assumed for these sites and the changes in noise with distance (drop-off rate) are simply the geometric spreading of the line source (traffic on roadway) or 3 dBA per doubling distance. The technical study also states 6 dBA attenuation per doubling distance for a point source (stationary noise source).

Noise Sensitive Receptor	Construction Phases	Nearest Distance between Receptor and Construction Site, feet	Estimated Construction Noise Levels at the Noise Sensitive Receptor by Construction Phase, ^a Hourly L _{eq} (dBA)
	Demolition	285	66
D 02 h	Site Grading	285	65
K-02 ⁶	Building Construction	285	66
	Paving	285	64
	Demolition	210	68
R-06 b	Site Grading	210	68
	Paving	210 210	69
	Demolition	425	62
B_08 b	Site Grading	425	62
K-08 ^D	Building Construction	425	62
	Paving	425	60

Estimate of Construction Noise Levels (Leg) at Off-Site Sensitive Receiver Locations

^a Estimated construction noise levels represent the worst-case condition when noise generators are located closest to the receptors and are expected to last the entire construction duration.

^b Partially shielded from the construction site by existing buildings.

Source: PCR Services Corporation, 2012

(b) Off-Site Construction Activities

NOISE-2

Would construction activities occur outside the hours of 7:00 a.m. to 7:00 p.m. Monday through Friday day, 8:00 a.m. to 5:00 p.m. Saturday, or anytime on Sunday or holidays (City-observed)?

Construction ingress for haul and delivery trucks would be provided at the existing State Street access gate on the southern boundary of the Glenarm site, with separate egress directly to Fair Oaks Avenue south of the Glenarm Building. Staging of equipment and materials would be accommodated on the Glenarm site, and construction personnel parking would be provided on the Glenarm and Broadway sites.

It was estimated that a maximum of 20 haul trucks trips per day would be expected during site grading and excavation, over a period of up to five months. These haul trips are assumed to be the noisiest truck trips related to construction. Noise levels from haul and delivery trucks would be approximately 51 dBA L_{eq} along Fair Oaks Avenue. The estimated noise level due to truck movements would not exceed the significance threshold of 85 dBA within 100 feet from residential uses. Therefore, impacts would be less than significant.

(c) Ground-Borne Vibration during Construction

NOISE-3

Would project construction activities cause ground-borne vibration levels to exceed 0.2 inches per second (PPV) at the nearest historic building?

NOISE-4 Would project construction activities cause ground-borne vibration levels to exceed 0.5 inches per second (PPV) at the nearest residential building?

Construction activities can generate varying degrees of ground vibration, depending on the construction procedures and the construction equipment used. The operation of construction equipment generates vibrations that spread through the ground and diminish in amplitude with distance from the source. The effect on buildings located in the vicinity of the construction site often varies depending on soil type, ground strata, and construction characteristics of the receptor buildings. The results from vibration can range from no perceptible effects at the lowest vibration levels, to low rumbling sounds and perceptible vibration at moderate levels, to slight damage at the highest levels. Ground-borne vibration from construction activities rarely reach levels that damage structures. The FTA has published standard vibration velocities for construction equipment operations. The PPV for construction equipment pieces anticipated to be used during project construction are listed in Table 4.G-5, Typical Vibration Velocities for Potential Project Construction Equipment.

Table 4.G-5

Equipment	inch/second
	PPV ^{a,b}
Large bulldozer	0.089
Loaded trucks	0.076
Jackhammer	0.035
Small bulldozer	0.003

Typical Vibration Velocities for Potential Project Construction Equipment

Source: USDOT Federal Transit Administration, 2005

The proposed project would generate ground-borne construction vibration during demolition and grading activities such as large bulldozer operation. Based on the vibration data provided in Table 4.G-3, vibration velocities from operation of construction equipment would range from approximately 0.003 to 0.089 inches per second (PPV) at 25 feet from the source of activity. As previously indicated, the nearest vibration sensitive receptors are the Glenarm Power Plant and the PERC Substation No. 2, which are located approximately 20 feet and 25 feet from the proposed site, respectively. These two locations would be exposed to vibration velocities that range from approximately 0.004 to 0.124 inches per second (PPV) at the Glenarm Power Plant and from approximately 0.003 to 0.089 inches per second (PPV) at the PERC Substation No. 2. Vibration at these locations would be below the 0.2 inches per second (PPV) significance threshold (potential building damage for historical building). As shown in Table 4.G-2, the nearest off-site residential structures are located across South Fair Oaks Avenue approximately 210 feet west of the project site and would be exposed to vibration velocities ranging approximately from 0.0001 to 0.0037 inches per second (PPV). This value is would not exceed the 0.5 inches per second (PPV) significance threshold (potential building damage for older residential structures). Therefore, vibration impacts during construction would be less than significant.

(2) Operational Noise

NOISE-5

Would project-related operational activities cause ambient noise levels to increase by 5 dBA or more at noise sensitive receptor locations?

According to the noise study by Emery Tuttle, 2011, the proposed GT-5 combined cycle system would produce an equivalent power generation compared to the B-3 steam plant (approximately 67 megawatts), which would be decommissioned when the installation of GT-5 is completed in the year 2015, which is the assumed buildout year. The B-3 steam plant is intended to be left standing on the Broadway plant site after decommissioning. All noise emissions associated with the B-3 steam plant were removed from the noise model, but the B-3 structures were left in place so that their effects on noise propagation from other sources would be considered. Two gas turbine manufactures are being considered for the proposed project power generation equipment configuration: General Electric and Rolls Royce. Both produce similar power, which would replace the power generation of Unit B-3. However, the location for Unit GT-5 would be on the Glenarm Plant as shown on Figure 4.G-1. The following sections provide noise assessments for the two gas turbine alternatives: ¹⁶

(a) Noise Projections for the General Electric LM 6000 Gas Turbine Configuration

According to the noise study, project noise levels at buildout at each of the seventeen receptors shown on Figure 4.G-1 were calculated using the noise model. Detailed description of the noise model is described in the *Noise Assessment Study* prepared for the project by Emery W. Tuttle and provided in **Appendix E** of this Draft EIR. The noise model results for the General Electric alternative are shown in **Table 4.G-6**, *Project Noise Levels at Buildout – General Electric LM 6000 PG Sprint Alternative*. According to the requirements of the noise ordinance, the predicted noise levels for the General Electric LM 6000 configuration would be in compliance at all seventeen receptor locations. The daytime levels range from 0.9 to 9.4 decibels below the daytime limits. The nighttime levels range from 0.0 to 13.3 decibels below the nighttime limits. Several locations, R-08 through R-16, would experience no significant increase or a decrease in noise due to the decommissioning of the B-3 steam plant. According to the requirements of the noise elevels for the General Electric LM 6000 configuration would be below the "Normally Acceptable" criteria at fifteen of the seventeen receptor locations. The remaining two locations, R-07 and R-11, have existing noise levels which are already above the "Normally Acceptable" criteria. The project would increase the noise level at R-07 by 0.6 decibel, which is considered imperceptible and insignificant. The project noise would not increase the noise level at R-11.¹⁷ Therefore, impacts would be less than significant.

(b) Noise Projections for the Rolls-Royce Energy Systems Trent 60 Turbine Configuration

The model was configured to predict the same noise metrics at each receptor location as the previous alternative, allowing a similar evaluation. Project noise levels at buildout were calculated using the noise model at each of the seventeen receptors shown on Figure 4.G-1. Detailed description of the noise model is described in the noise study. The noise model results for the Rolls-Royce Trent 60 configuration are shown in **Table** 4.G-7, *Project Noise Levels at Buildout – Rolls-Royce Trent 60 WLE Alternative*. The noise levels in Table 4.G-7 include all necessary noise control features that would be required to achieve the levels as shown (please see the noise mitigation discussed in Section 6.0 of the *Noise Assessment Study* prepared for

¹⁶ Repowering Project Noise Assessment Study, Emery W. Tuttle, December 2011.

¹⁷ Ibid.

			Impact Assessment Using the Pasadena Noise Restriction Ordinance											Impact Assessment Using the Pasadena Noise Element of the General Plan							
	Proximi		Average Daytime Noise Levels (LEQ(d), dBA Average Nighttime Noise Levels (LEQ(d), dBA Day-								Day-Night	Night Average Noise Levels, DNL, dBA									
Receptor Location No. ^a	ty to Power Plant	Land Use Description	Existing w/B-3	GT-5 Project Only	Existing + Project w/o B-3	Limit ^b	Over (+) Under (-) Limit	Existing w/B-3	GT-5 Project Only	Existing + Project w/o B-3	Limit ^b	Over (+) Under (-) Limit	Receptor Location No. ^a	Existing w/B-3	GT-5 Project Only	Existing + Project w/o B-3	Normally Acceptable Criteria ^c	Over (+) Under (-) Criteria	Conditionally Acceptable Criteria ^c	Over (+) Under (-) Criteria	
R-01	NW	R1 – single-family residential, south side of Glenarm Street	61.8	35.8	61.8	66.8	-5.0	55.6	39.5	55.7	60.6	-4.9	R-01	64.7	31.7	+64.7	70	-5.3	75	-10.3	
R-02	NW	R1 – multi-family residential, north side of Glenarm Street	66.1	67.3	69.6	71.1	-1.5	65.8	69.7	70.8	70.8	+0.0	R-02	67.8	62.5	+68.9	70	-1.1	75	-6.1	
R-03	W	R1 – single-family residential, Grace Hill community	53.0	45.9	53.6	58.0	-4.4	50.9	47.7	52.0	55.9	-3.9	R-03	57.5	40.9	+57.6	70	-12.4	75	-17.4	
R-04	W	R1 – single-family residential, Grace Hill community	60.5	60.3	63.1	65.5	-2.4	62.5	62.2	64.9	67.5	-2.6	R-04	60.7	55.3	+61.7	70	-8.3	75	-13.3	
R-05	W	R1 – single-family residential, Grace Hill community	63.2	63.0	65.9	68.2	-2.3	65.6	65.2	68.2	70.6	-2.4	R-05	61.4	58.1	+63.0	70	-7.0	75	-12.0	
R-06	W	R1 – single-family residential, behind Fair Oaks commercial strip	64.8	67.3	68.9	69.8	-0.9	66.6	69.4	70.8	71.6	-0.8	R-06	63.6	62.4	+65.9	70	-4.1	75	-9.1	
R-06a	W	R1 – single-family residential, behind Fair Oaks commercial strip	70.2	69.2	72.5	75.2	-2.7	72.2	70.5	74.1	77.2	-3.1	R-06a	68.2	63.9	+69.5	70	-0.5	75	-5.5	
R-07	SW	R1 – single-family residential, south side of State Street	69.4	67.3	71.3	74.4	-3.1	68.9	70.1	72.2	73.9	-1.7	R-07	71.3 d	62.7	71.9 d	70	+1.9 d	75	-3.1	
R-08	S	R3 – single-family residential, Raymond Hill community	66.8	56.9	66.5	71.8	-5.3	67.9	59.5	67.8	72.9	-5.1	R-08	63.6	52.2	+63.7	70	-6.3	75	-11.3	
R-09	S	R3 – single-family residential, Raymond Hill community	65.7	52.0	61.3	70.7	-9.4	66.7	55.1	63.2	71.7	-8.5	R-09	63.2	47.5	+60.8	70	-9.2	75	-14.2	
R-10	S	R3A – multi-family residential, west side of State Street	67.2	49.2	65.7	72.2	-6.5	66.9	52.7	64.0	71.9	-7.9	R-10	69.3	44.9	+68.6	70	-1.4	75	-6.4	
R-11	S	R3A – multi-family residential, west side of State Street	66.8	8.7	66.8	71.8	-5.0	61.4	12.1	61.4	66.4	-5.0	R-11	70.5 d	4.4	70.5 d	70	+0.5 d	75	-4.5	
R-12	Е	M – Blair High School, near amphitheater	67.5	41.0	63.6	72.5	-8.9	67.0	44.3	58.7	72.0	-13.3	R-12	67.7	36.6	+67.1	70	-2.9	80	-12.9	
R-13	Е	R3 – west side of Allendale Branch Library	65.8	40.2	62.5	70.8	-8.3	66.2	43.7	58.1	71.2	-13.1	R-13	67.4	36.0	+66.6	70	-3.4	80	-13.4	
R-14	Е	R3 – Playground on Wallis Street	61.8	47.6	57.6	66.8	-9.2	63.6	51.4	56.8	68.6	-11.8	R-14	62.8	43.5	+61.6			75	-13.4	
R-15	SE	R3 – multi-family residential, east side of Marengo Street	66.7	38.3	66.2	71.7	-5.5	63.9	42.0	61.8	68.9	-7.1	R-15	69.9	34.1	+69.9	70	-0.1	75	-5.1	
R-16	Е	R3 – mixed residential / commercial	55.3	38.7	51.1	60.3	-9.2	57.8	42.8	51.0	62.8	-11.8	R-16	56.5	34.7	+55.4	70	-14.6	75	-19.6	
a Refer	to Figure	7 for a man showing the location of noise sensitive impact evaluation r	ecentors																		

Project Noise Levels at Buildout – General Electric LM 6000 PG Sprint Configuration

Refer to Figure 7 for a map showing the location of noise sensitive impact evaluation receptors. b

LEQ noise limit established according to the City of Pasadena Noise Restriction Ordinance.

с DNL noise compatibility criteria (also referred to as Ldn) established according to the City of Pasadena Noise Element compatibility guidelines shown in Figure 3. d

Existing baseline DNL level at this location is above the, "Normally Acceptable" noise compatibility criteria.

Source: Power Engineers, Inc., 2011

Project Noise Levels at Buildout – Rolls-Royce Trent 60 WLE Configuration

			Impact Assessment Using the Pasadena Noise Restriction Ordinance											Impact Assessment Using the Pasadena Noise Element of the General Plan							
	Proximi		Average Daytime Noise Levels (LEQ(d), dBA				Average Nighttime Noise Levels (LEQ(d), dBA						Day-Night Average Noise Levels, DNL, dBA								
Receptor Location No. ^a	ty to Power Plant	Land Use Description	Existing w/B-3	GT-5 Project Only	Existing + Project w/o B-3	Limit ^b	Over (+) Under (-) Limit	Existing w/B-3	GT-5 Project Only	Existing + Project w/o B-3	Limit ^b	Over (+) Under (-) Limit	Receptor Location No. ^a	Existing w/B-3	GT-5 Project Only	Existing + Project w/o B-3	Normally Acceptable Criteria ^c	Over (+) Under (-) Criteria	Conditionally Acceptable Criteria ^c	Over (+) Under (-) Criteria	
R-01	NW	R1 – single-family residential, south side of Glenarm Street	61.8	32.1	61.8	66.8	-5.0	55.6	35.8	55.6	60.6	-5.0	R-01	64.7	28.0	64.7	70	-5.3	75	-10.3	
R-02	NW	R1 – multi-family residential, north side of Glenarm Street	66.1	63.6	67.7	71.1	-3.4	65.8	66.0	68.3	70.8	-2.5	R-02	67.8	58.8	68.3	70	-1.7	75	-6.7	
R-03	W	R1 – single-family residential, Grace Hill community	53.0	42.2	53.1	58.0	-4.9	50.9	44.0	51.0	55.9	-4.9	R-03	57.5	37.2	57.6	70	-12.4	75	-17.4	
R-04	W	R1 – single-family residential, Grace Hill community	60.5	56.6	61.6	65.5	-3.9	62.5	58.5	63.3	67.5	-4.2	R-04	60.7	51.6	61.1	70	-8.9	75	-13.9	
R-05	W	R1 – single-family residential, Grace Hill community	63.2	59.3	64.4	68.2	-3.8	65.6	61.5	66.7	70.6	-3.9	R-05	61.4	54.4	62.1	70	-7.9	75	-12.9	
R-06	W	R1 – single-family residential, behind Fair Oaks commercial strip	64.8	63.6	66.7	69.8	-3.1	66.6	65.7	68.4	71.6	-3.2	R-06	63.6	58.7	64.6	70	-5.4	75	-10.4	
R-06a	W	R1 – single-family residential, behind Fair Oaks commercial strip	70.2	65.5	71.1	75.2	-4.1	72.2	66.8	72.8	77.2	-4.4	R-06a	68.2	60.2	68.8	70	-1.2	75	-6.2	
R-07	SW	R1 – single-family residential, south side of State Street	69.4	63.6	70.2	74.4	-4.2	68.9	66.4	70.3	73.9	-3.6	R-07	71.3 ^d	59.0	71.5 ^d	70	+1.5 ^d	75	-3.5	
R-08	S	R3 – single-family residential, Raymond Hill community	66.8	53.2	66.2	71.8	-5.6	67.9	55.8	67.4	72.9	-5.5	R-08	63.6	48.5	63.5	70	-6.5	75	-11.5	
R-09	S	R3 – single-family residential, Raymond Hill community	65.7	48.3	61.1	70.7	-9.6	66.7	51.4	62.8	71.7	-8.9	R-09	63.2	43.8	60.7	70	-9.3	75	-14.3	
R-10	S	R3A – multi-family residential, west side of State Street	67.2	45.5	65.7	72.2	-6.5	66.9	49.0	63.8	71.9	-8.1	R-10	69.3	41.2	68.6	70	-1.4	75	-6.4	
R-11	S	R3A – multi-family residential, west side of State Street	66.8	5.0	66.8	71.8	-5.0	61.4	8.4	61.4	66.4	-5.0	R-11	70.5 d	0.7	70.5 d	70	+0.5 d	75	-4.5	
R-12	E	M – Blair High School, near amphitheater	67.5	37.3	63.6	72.5	-8.9	67.0	40.6	58.6	72.0	-13.4	R-12	67.7	32.9	67.1	70	-2.9	80	-12.9	
R-13	E	R3 – west side of Allendale Branch Library	65.8	36.5	62.5	70.8	-8.3	66.2	40.0	58.0	71.2	-13.2	R-13	67.4	32.3	66.6	70	-3.4	80	-13.4	
R-14	Е	R3 – Playground on Wallis Street	61.8	43.9	57.3	66.8	-9.5	63.6	47.7	56.0	68.6	-12.6	R-14	62.8	39.8	61.6			75	-13.4	
R-15	SE	R3 – multi-family residential, east side of Marengo Street	66.7	34.6	66.2	71.7	-5.5	63.9	38.3	61.7	68.9	-7.2	R-15	69.9	30.4	69.9	70	-0.1	75	-5.1	
R-16	Е	R3 – mixed residential / commercial	55.3	35.0	51.0	60.3	-9.3	57.8	39.1	50.6	62.8	-12.2	R-16	56.5	31.0	55.4	70	-14.6	75	-19.6	

а Refer to Figure 7 for a map showing the location of noise sensitive impact evaluation receptors.

b LEQ noise limit established according to the City of Pasadena Noise Restriction Ordinance.

с DNL noise compatibility criteria (also referred to as Ldn) established according to the City of Pasadena Noise Element compatibility guidelines shown in Figure 3. d

Existing baseline DNL level at this location is above the, "Normally Acceptable" noise compatibility criteria.

Source: Power Engineers, Inc., 2011

the project by Emery W. Tuttle and provided in **Appendix E** of this Draft EIR). According to the requirements of the noise ordinance, the predicted noise levels for the Rolls-Royce Trent 60 configuration would be in compliance at all seventeen receptor locations. The daytime levels range from 3.1 to 9.6 decibels below the daytime limits. The nighttime levels range from 2.5 to 13.4 decibels below the nighttime limits. Several locations, R-08 through R-16, would experience no increase or a decrease in noise due to the decommissioning of the B-3 steam plant. According to the requirements of the noise element, the predicted noise levels for the Rolls-Royce Trent 60 configuration would be below the "Normally Acceptable" criteria at fifteen of the seventeen receptor locations. The remaining two locations, R-07 and R-11, have existing noise levels, which are already above the "Normally Acceptable" criteria. The project would increase the noise level at R-07 by 0.2 decibel, which is considered insignificant. The project noise would not increase the noise level at R-11. ¹⁸ Therefore, impacts would be less than significant.

3. MITIGATION MEASURES

No mitigation measures are recommended because impacts would be less than significant. Lists of noise control features that are being included and considered by the manufacturers in the design of the proposed project as part of the vendor guarantee to meet project noise level requirements are recommended by the noise study. The noise study recommended that the noise control features be reviewed and evaluated for their effectiveness prior to awarding the purchase contract for the equipment. ¹⁹

4. CUMULATIVE IMPACTS

As discussed previously, construction and operation of the proposed project would result in less than significant project-level impacts. With regular maintenance in accordance with manufacturer specifications, any increase in operating noise levels due to the aging and degradation of equipment would be minimal and gradual over the lifetime of the equipment, such that it would not cause a noticeable change in community noise levels. In addition, the project would not result in a substantial change in vehicle trips or truck trips that would cause a noticeable change in average daytime (Leq(d)) or average nighttime (Leq(n)) roadway noise levels. Furthermore, the project site is not located in the vicinity of any related projects. As shown in **Figure 3-1**, *Related Projects Location Map*, of this Draft EIR, the nearest related project and the only other project within the South Fair Oaks Specific Plan area, the Huntington Memorial Hospital Master Plan Project, is approximately .30 miles from the project site. The related projects are located sufficiently far from the project site such that the project's incremental impacts, considered together with any on-site stationary noise from the related projects, would not be cumulatively considerable.

This conclusion is also supported and evidenced by technical study, *Repowering Project Noise Assessment Study*, prepared by Emery Tuttle in December 2011. The technical study concluded that future year cumulative noise levels with project buildout would change by less than 1 dBA at most modeled receptor locations and by much less than 3 dBA at all modeled receptor locations compared to existing conditions. The technical study is provided in **Appendix E** of this Draft EIR.

5. LEVEL OF SIGNIFICANCE AFTER MITIGATION

Project noise impacts were determined to be less than significant, and no mitigation is necessary.

¹⁸ ibid.

¹⁹ Repowering Project Noise Assessment Study, Section 6, Noise Mitigation, Emery W. Tuttle, December 2011.