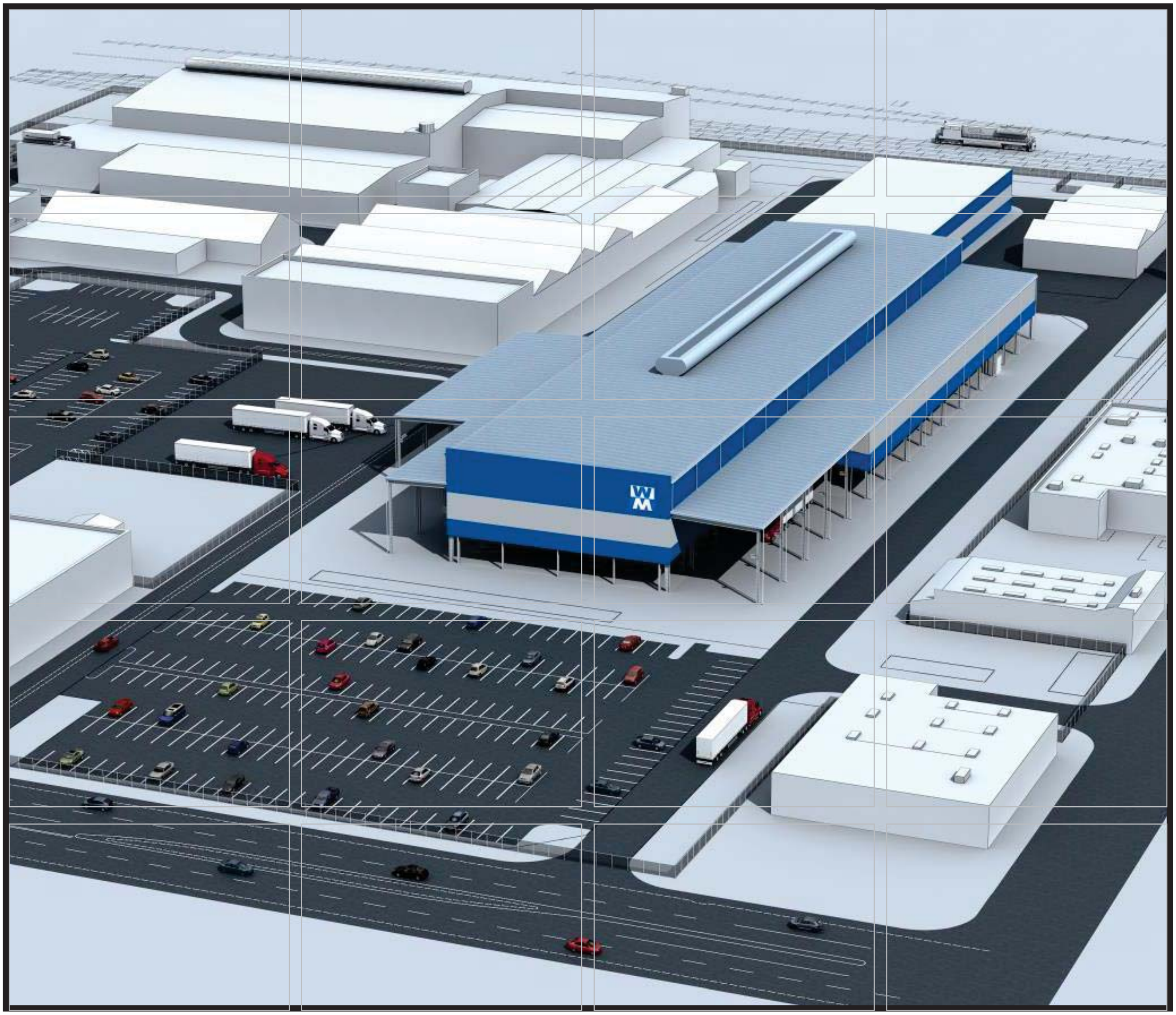
Appendix F

Noise Study



Noise Technical Supplement
Large Press Expansion Project

Prepared for:
City of Long Beach
Planning Department

Weber Metals Facility
Long Beach and Paramount, California

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WEBER METALS, INC.

ERM

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CNEL	Community noise equivalent level
dB	Decibel
dBA	Decibels on the A-weighted sound level
FTA	Federal Transit Administration
Ldn	Day-night average noise level
Leq	Equivalent A-weighted noise level
PPV	Peak particle velocity
Project	Large Press Expansion Project
RMS	Root mean square
VdB	vibration decibel

1.0 INTRODUCTION

This report serves as a technical supplement to the Site Plan Review application submitted to the City of Long Beach for the proposed Large Press Expansion Project (Project) at the Weber Metals facility located in the cities of Long Beach and Paramount, California. This technical report:

- Provides an overview of the principles of noise and vibration (Section 2);
- Identifies key applicable noise requirements and guidance and summarizes existing conditions at the Weber facility as they relate to noise and vibration (Section 3); and
- Discusses the anticipated Project-related noise impacts from construction and operation (Section 4).

2.0 NOISE AND VIBRATION CONCEPTS

This document assesses the potential noise and vibration impacts associated with the proposed Project on the surrounding population. Noise is undesirable sound that either disrupts daily life or minimizes the comfort, repose, or health of a recipient. Vibration is perceived as movement of the ground or surrounding structures. The following section provides more details on the concepts of noise and vibration.

2.1 NOISE

Sound is composed of a pressure wave passing through a medium, usually air. The magnitude of sound is measured in decibels (dB). Since the range of sound levels detected by the human ear is quite large, sound is measured on a logarithmic scale. With humans being less sensitive to very low and very high frequencies, sound measurements are typically adjusted such that more weight is assigned to the mid-range frequencies. The conventional weighting scale required by local, state, and federal agencies is the A-weighted sound level (dBA), and is thus used in this report. An increase in noise levels is generally perceptible when that increase is 3 dBA or more.

Because environmental noise fluctuates over time, most descriptors average the sound level over the time of exposure, and some add "penalties" during the times of day when intrusive sounds would be more disruptive to listeners. The most commonly used descriptors are:

- Equivalent A-weighted noise level (Leq). The Leq is an average or constant sound level over a given period that would have the same sound energy as the time-varying, A-weighted sound over the same period.
- Day-night average noise level (Ldn). The Ldn is a 24-hour average sound level; however, for the night hours between 10:00 p.m. and 7:00 a.m., a penalty of 10 dBA is added to the average. This additional 10 dBA accounts for the tendency of people to perceive noise to be louder at night.

- Community noise equivalent level (CNEL). The CNEL is similar to the Ldn, except that, in addition to the 10:00 p.m. to 7:00 a.m. 10 dBA penalties, a 5 dBA penalty is applied to noise levels occurring from 7:00 p.m. to 10:00 p.m. Typically, day-night average noise levels are within 1 dBA of the CNEL.

Typical sound levels for common sources of noise are shown in Table 1.

Table 1 Typical Sound Levels for Common Noise Sources

Source	Distance (feet)	Sound Level (dBA)
Soft Whisper	5	30
Quiet Office	--	40
Light Traffic	100	50
Average Speech	3 – 5	60
Automobiles	50	70
Concrete Mixer	50	85
Inside Subway Train	--	90
Freight Train	25	100

2.2 *VIBRATION*

Vibration is the rapid periodic or oscillating motion of an object where the average displacement of the object is zero. This oscillating motion is caused by waves of energy originating from a vibration source and transmitted from particle to particle through a propagating material, either an object or the earth. As the wave passes from particle to particle, energy is dissipated and the oscillating motion gradually decreases as the distance from the vibration source increases. Vibration is rarely annoying to people who are outdoors. When there is an adverse human reaction to vibration, it tends to be indoors when people can also perceive the shaking of a building.

The magnitude of vibration is measured in peak particle velocity (PPV), which represents the maximum displacement (either positive or negative) within the vibration wave and is in terms of inches per second. The PPV is typically used to evaluate the potential of damage to buildings. Vibration level can also be described in units of vibration decibels (VdB), which is generally used to characterize the potential level of human annoyance.

The perceptibility threshold for vibration by humans is approximately 65 VdB, with residential neighborhoods having a typical vibration background of 50 VdB. The human response to vibration is typically not significant below 70 VdB (Federal Transit Administration [FTA], 2006).

Examples of typical vibration levels are provided in Table 2.

Table 2 Typical Vibration Levels for Common Sources

Source	Distance (feet)	Vibration Level (VdB)
Bus/truck	50	65
Rapid Transit	50	70
Bulldozers	50	70-80
Blasting	50	100

3.0 SITE BACKGROUND

As is typical for industrial facilities, operations at the Weber Metals facility generate noise and vibration. Weber Metals currently works three shifts, twenty-four hours a day, five days a week and overtime as needed. At full capacity, the plant could be staffed to work twenty-four/seven. The following operational activities represent the main sources of noise/vibration at the facility:

- Forging of aluminum and titanium parts (hand forging and die forging);
- Trimming of forged parts;
- Grinding of forged parts;
- Transportation of parts to various treatment areas; and
- Loading and transportation of raw materials and forged parts to on-site storage areas or trucks for off-site transport.

On January 7, 2015, during active operations, Weber Metals staff measured noise levels inside and outside the buildings where the above operations currently occur. These measurements are presented on Figure 1. These measurements were taken using a hand-held meter during a facility walk-through while active production activities were occurring. The duration of each measurement was approximately 30 seconds. As can be seen in the figures, outdoor noise levels are generally less than indoor noise levels due the structures and walls that "block" or reduce noise levels.

Currently, some of the highest operational noise levels are associated with the Pump Room, located in Building A in the northeastern corner of the Weber Metals facility. A given pump operates at a noise level of approximately 110 dBA. The Pump Room is partially enclosed, with open stair wells to the shop floor, and the ceiling structure consists of steel plating in many areas. These features allow for the propagation of noise from the Pump Room to the adjoining areas. During the January 2015 measurement event, a reading of 86 dBA was measured inside Building A at ground level several stories above the Pump Room. Outdoor measurements outside Building A ranged from 68 to 75 dBA.

Figure 1 *Noise Level Measurements*

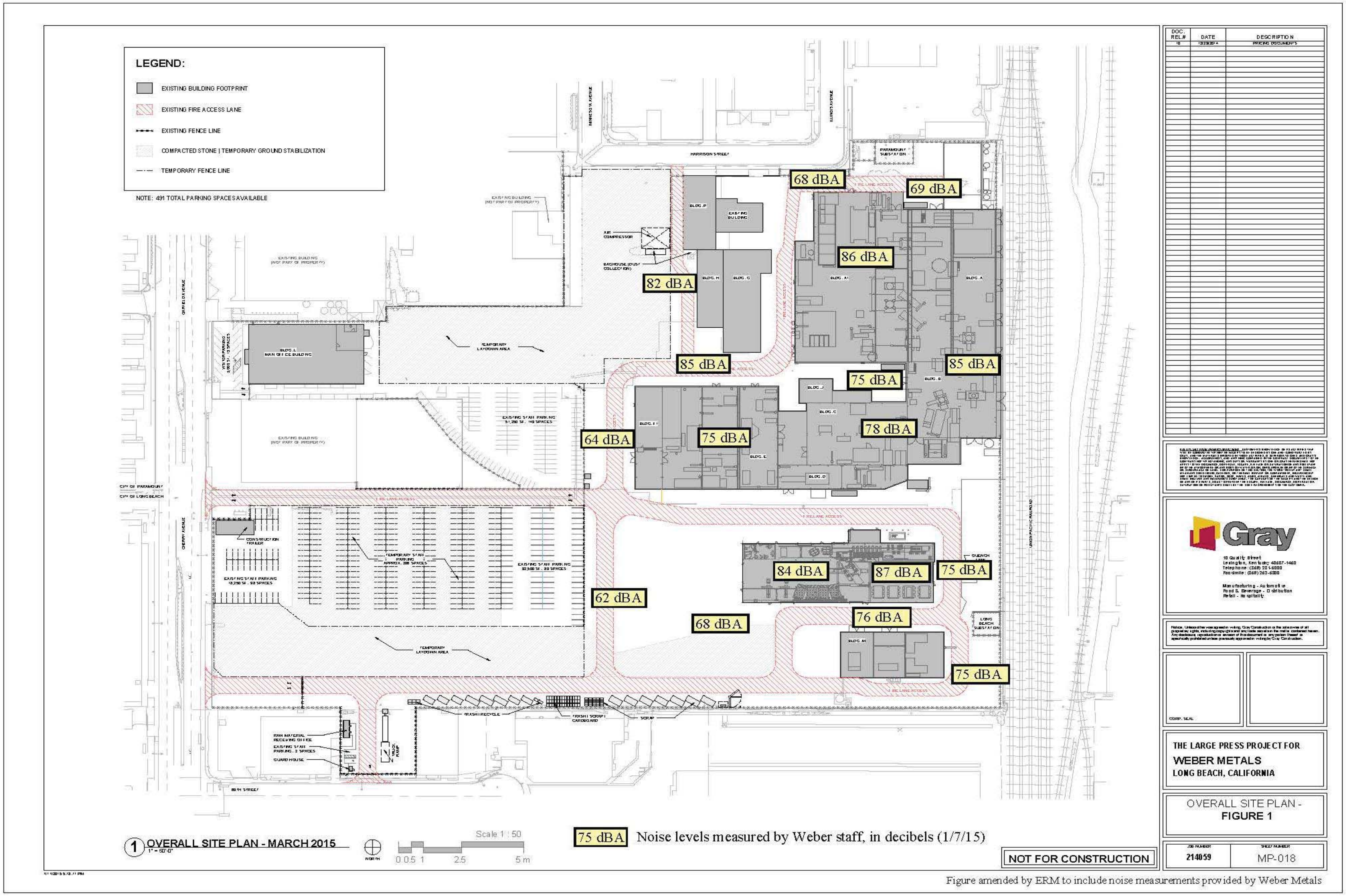

Figure amended by ERM to include noise measurements provided by Weber Metals

Guidance and rules associated with noise and vibration are contained in the City of Long Beach and City of Paramount General Plans and ordinances. The key applicable guidance and rules are summarized below.

3.1 LONG BEACH GENERAL PLAN

The Noise Element from the Long Beach General Plan (City of Long Beach, 1975) identifies recommended criteria for maximum acceptable noise that should be considered in land use planning and regulations. In particular, the General Plan recommends that noise levels above those specified in Table 3 are considered to be significant.

Table 3 Recommended Outdoor Noise Criteria from Long Beach General Plan

Land Use Type	Maximum Hourly Peak (dBA)	Noise Level Exceeded 10% of Time (dBA)	Noise Level Exceeded 50% of Time (dBA)
Resident (7:00 a.m. - 10:00 p.m.)	70	55	45
Resident (10:00 p.m. – 7:00 a.m.)	60	45	35
Commercial	75	65	55
Industrial	85	70	60

3.2. LONG BEACH ORDINANCE

The Long Beach ordinance specifies exterior noise limits depending on the city area or "district" that receives the noise. The area surrounding the proposed Project on the Long Beach side is in Districts 1 and 4, which generally have an exterior noise limit of 45 dBA between 10:00 p.m. and 7:00 a.m., 50 dBA during the rest of the day for the residential receptors, and 70 dBA for industrial receptors (over a period of 30 minutes or more).

The ordinance also does not allow construction activities during the following times:

- 7:00 p.m. to 7:00 a.m. on weekdays;
- Before 9:00 a.m. and after 6:00 p.m. on Saturdays; and

- Sundays (unless a special work permit is obtained).

The ordinance also does not allow the operation of equipment on private property that creates vibration above the perception threshold at which a person is aware of the vibration.

3.3 CITY OF PARAMOUNT GENERAL PLAN

The City of Paramount General Plan (City of Paramount, 2007) contains noise compatibility guidelines, which include guidelines for maximum acceptable noise levels as summarized in Table 4 below.

Table 4 Noise Compatibility Guidelines from City of Paramount General Plan

Land Use	Maximum CNEL (dBA)
Low Density Residential	55
Medium Density Residential	60
High Density Residential	65
Schools	60
Office/Commercial	65
Industrial	70

3.4 CITY OF PARAMOUNT ORDINANCE

The City of Paramount noise ordinance contains the noise limits specified in the table below. The ordinance specifically exempts construction activities that occur between 7:00 a.m. and 8:00 p.m.

Table 5 City of Paramount Noise Ordinance

Noise Zone	Maximum Noise (dBA)	
	Day (6:00 a.m. to 10:00 p.m.)	Night (10:00 p.m. to 6:00 a.m.)
Single-Family Residential (R-1) and Medium-Density Residential (R-2)	62	57
Multi-Family Residential (R-M)	67	62
Industrial/Commercial	82	77

4.0 NOISE AND VIBRATION IMPACTS

This section presents the potential impacts from noise and vibration during construction and operation of the proposed Project.

4.1 NOISE

Construction is expected to last for about 18 months. The range of activities would include site preparation, excavation, and dewatering, press facility construction, equipment installation, utility connections, substation construction, and paving. Construction workers would be traveling to and from the site and would be operating on- and off-road equipment such as excavators, loaders, drill rigs, bulldozers, rollers cranes, lifts, welders, compressors, forklifts, pumps, pavers, concrete trucks, and haul trucks. In addition, operation of the proposed large press would represent a new noise source at the facility.

Potential noise impacts during the construction and operational phases of the Project are discussed below.

4.1.1 Construction Phase

4.1.1.1 Roadway Noise

The number of construction workers would vary, potentially reaching a peak of about 350 during the construction of the press facility. Construction workers would generate noise from on-road vehicles, both from their own passenger vehicle or van pools to get to the site and from pickup trucks (up to 120) and concrete trucks (up to 10) to deliver materials. This would be added to the existing vehicles being used by the 465 employees plus the more significant additional traffic from drivers not associated with the site. Considering that increases in noise levels generally start to become noticeable when the source of noise doubles (e.g., doubling of traffic volume would generally increase noise by 3 dBA), the increased noise levels from these passenger vehicles and trucks over a period of a day are not expected to be appreciable.

4.1.1.2 On-Site Noise

While temporary in nature, noise from the operation of diesel- and gas-powered construction equipment may be noticeable. Construction noise levels would depend on the type of equipment being operated, the number of pieces of equipment that may be operated throughout the day, and the location of the equipment. Based on the locations where construction is proposed, noise equipment could be operated as close as 100 feet to the nearby residences located on Garfield Avenue, which is zoned for multi-family residential use in the City of Paramount. The nearest residential receptors to the proposed Project in the City of Long Beach would be about 200 feet to the southeast. Therefore, the 100-foot distance is assumed to be the closest that heavy equipment would be operated to a residential receptor. These residential receptors at 100 feet from proposed construction are treated as the receptors that may experience the highest level of noise during construction.

Noise levels from the proposed construction were analyzed for various scenarios. Table 6 summarizes potential maximum noise levels from off-road equipment and on-road heavy equipment operated during the three most active phases of construction expected to generate the most noise:

- Site Preparation combined with Excavation and Dewatering;
- Press Facility Construction combined with Substation Construction; and
- Press Facility Construction combined with Utility Connections

For each phase, the table presents noise levels for (1) noise from one piece of equipment that is expected to generate the most noise and (2) noise from all the equipment operating at the same time.

In this table, the noise for one piece of equipment was estimated assuming the equipment would be operated at about 100 feet from the residential area along Garfield Avenue. The western-most portion of the new press facility would be roughly 500 feet from the residential receptors with the eastern-most portion being about 1,000 feet. Since it is unlikely that all the construction equipment would be concurrently operated at the closest location, the combined noise levels for all the equipment are conservatively assumed to occur at an average distance of 500 feet.

The predicted noise levels assume most of the equipment is operating simultaneously for 6 hours during the day. In reality, particularly for the short-term noise levels, noise levels are expected to be less than estimated since operation would likely not always occur simultaneously and for that long. In addition, the noise contribution from the substation work is conservatively high because that work is further than 500 feet from residences and buildings (which would "block" noise) are located between the substation area and residences. More details on the noise calculations are presented in Appendix A.

As shown in Table 6, the expected noise levels, using conservative assumptions about equipment use and location relative to residential receptors, are consistent with the General Plans and local ordinances for both cities for industrial sites and construction.

Table 6 Predicted Noise Levels from Construction Equipment

Phase	Heavy Construction Equipment Assumed to be Used	Potential Noise Level at 100 feet from the Single Loudest Equipment (dBA)	Potential Noise Level at 500 feet from all Equipment (dBA)
Site Preparation+ Excavation and Dewatering	Drill Rig (1) Excavators (4) Dump Trucks (8) Front End Loaders (2) Bulldozer (1) Rolling Compactors (2)	Hourly Max: 82	Hourly Max: 79 CNEL: 73
Press Facility Construction+ Substation Construction	Cranes (3) Concrete Trucks (10) Forklifts (12) Aerial Lifts (7) Portable Welders (4) Air Compressors (2) Scissor Lifts (6) Concrete Pump Trucks (2)	Hourly Max: 79	Hourly Max: 78 CNEL: 72
Press Facility Construction+ Utility Connections	Cranes (2) Concrete Trucks (10) Forklifts (8) Aerial Lifts (5) Portable Welders (6) Air Compressors (4) Scissor Lifts (12) Concrete Pump Trucks (2)	Hourly Max: 79	Hourly Max: 78 CNEL: 72

The Long Beach Municipal Code and Paramount Municipal Code allow construction activities within specified hours. In particular, construction would be conducted between 7:00 a.m. and 7:00 p.m. on weekdays, which is consistent with the municipal codes for both cities. With the construction activities conducted as required by the municipal codes and such activities being of short-term nature, noise impacts are expected to be less than significant. To help further minimize noise levels during construction, the following standard measures would also be implemented:

- All equipment will be properly maintained and equipped with noise control, such as mufflers, according to manufacturers' specifications.
- Construction equipment will be located as far from sensitive receptors (e.g., residences, schools, places of worship, and hospitals) as possible, will be arranged to minimize travel adjacent to noise-sensitive receptors, and will be turned off during prolonged periods of nonuse.
- All reasonable and customary noise reduction measures will be implemented and the name and telephone number of a person for the public to contact to resolve noise-related problems will be posted.

4.1.2 Operational Phase

4.1.2.1 Roadway Noise

Once construction is complete, the facility is expected to increase the number of employees from 465 to 525 (projected for 2018), a 13 percent increase in workforce. These employees would drive passenger vehicles to work, contributing to noise levels on nearby roadways. As mentioned previously, noise increases typically start to be noticeable when traffic levels double. Given the increase from traffic associated with workers from the site would only increase by 13 percent, the anticipated noise levels from nearby roadways would not increase significantly. For example, if the additional 60 workers are assumed to result in 60 more cars on the road per day (i.e., 60 more round trips), and conservatively assuming a third are being driven in the daytime hours and two-thirds are being driven in the nighttime hours, the CNEL from these cars alone would be about 50 dBA at 50 feet. Background levels near roadways are generally 55 to 75 dBA depending on the traffic volumes and road configuration. Combining the 50 dBA noise with an existing 55 dBA would only increase noise levels by about 1 dBA, which would generally not be noticeable.

4.1.2.2 On-Site Equipment Noise

The current facility has existing operations occurring in multiple buildings. The major stationary source of new noise as a result of the proposed Project would be the new press facility. The new press facility will have equipment similar to what is already operated at the facility such as gas-fired furnaces, a hydraulic forging press, cranes, semi-automated manipulators, and fork trucks. According to the manufacturer of the proposed New Press, noise levels at a given pump would be roughly 110 dBA, comparable to existing pump noise levels as noted in Section 3.

Like the existing layout, the new equipment would be housed within a building, which would reduce outdoor noise from the new equipment. In fact, in some cases, instead of forklifts, some tracked manipulators will be used, which are expected to have lower noise levels compared to forklifts. Furthermore, the pump room in the New Press Building would be fully enclosed, with concrete walls and ceiling; therefore noise propagation beyond the new Pump Room would be less than under current conditions at the Building A Pump Room.

Similar to traffic noise (see above), noise sources generally need to double to result in an appreciable increase in noise levels. Weber Metals is expecting that the exterior noise levels for the new press facility would be similar to existing noise levels from one of the existing buildings. In addition, as shown in Table 7, the overall increase in the number of equipment would less than double (though some new equipment may be larger than existing equipment). Overall, the increase in noise-generating activity is expected to be less than double. Therefore, for noise sensitive receptors located no closer to the new press facility than the existing buildings generating noise, the overall increase in noise is expected to be less than 3 dBA and less than appreciable.

Table 7 Key Existing and Proposed Equipment

Current Key Equipment	**Equipment Added for Proposed Project**
• Gas-Fired Furnaces (22) • Quench Tanks (4) • Quench Oven Electric (1) • Hydraulic Presses (12) • Mechanical Press (1) • Cleaning/Etching Dip Tanks (20) • Heat Treating Ovens (2) • Salt Baths (2) • Grinding Work Centers (4) • Boiler (1) • Dryer (1) • Scrubbers (3) • Semi-Automated Manipulators, for Rail (1) • Mobile Manipulators (25)/Fork Trucks (35) • Cooling Systems for Oil Hydraulic System (4) • Freezers (3) • Overhead Cranes (24)	• Gas-Fired Furnaces (9) • Quench Tank (1) • Hydraulic Press (1) • Abrasive Blast Room with Baghouse • Semi-Automated Manipulators, for Rail (2) • Mobile Manipulators (2)/Fork Trucks (6) • Cooling Systems for Oil Hydraulic System (2) • Freezers (3) • Overhead Cranes (5)

The new press facility, however, would introduce new sources of noise that would be closer to the residential receptors located along Garfield Avenue to the west in the City of Paramount. In particular, the existing facilities generating the most noise are located anywhere from roughly 800 to 1,300 feet away from residential receptors in Paramount. In contrast, the western-most portion of the new press facility would be roughly 500 feet from the residential receptors with the eastern-most portion being about 1,000 feet away.

In January 2015, Weber Metals staff measured noise levels of approximately 75 dBA outside of an existing building that they expect generates similar level of noise as the new press facility. Assuming similar noise levels and an effective distance from the measurement point and this existing source of noise of about 50 feet, noise levels from the new press facility can be roughly approximated. Taking the distance from the closest portion of the new press facility to the nearest residential receptor (about 500 feet), the noise level from the new press facility at the nearest residential receptor would be estimated to be about 55 dBA. This does not take into account the presence of obstructions between the new press facility and the residential receptor, such as the existing building to the west. These obstructions would further reduce noise levels. The City of Paramount noise ordinance limits noise in areas of multi-family land use to 67 dBA during the day and 62 dBA during the night. With a predicted noise level from the new press facility of about 55 dBA at the nearby residences, the predicted noise levels from the new press facility alone is below the noise levels allowed by the noise ordinance.

The combined noise from the new press facility and noise sources such as other industrial activities and traffic would vary throughout the day. If the new press facility generates a noise level of about 55 dBA at the nearby residences on Garfield Avenue, noise levels would increase by 3 dBA or more (the threshold at which an increase in noise is generally appreciable) when existing noise levels are 55 dBA or less. This would still result in noise levels below noise ordinance. When existing noise levels go above 55 dBA, the combined noise level from existing and the new press facility would result in an increase of less than 3 dBA, which would generally not be perceptible.

4.2 VIBRATION

4.2.1 Construction Phase

The proposed construction would use equipment that can create temporary sources of vibration. During construction, the following equipment may be used that can generate appreciable vibration near the equipment: haul trucks, loaders, bulldozers, and drill rigs.

Vibration can result in annoyance or interference with vibration-sensitive activities and in some more rare cases, damage to buildings. The Transit Noise and Vibration Impact Assessment (FTA, 2006) contains vibration thresholds for construction activities that consider damage to buildings and the potential for annoyance or interference with vibration-sensitive activities. The FTA document addresses noise and vibration from not only transit sources, but also construction equipment and stationary sources. In addition, the thresholds are based on how the "receiver" of the vibration would react (the "receiver" being humans or buildings). Thus, the FTA thresholds for vibration can be used to assess the impact from a range of noise-generating sources, including those associated with the proposed Project. The thresholds are defined in terms of PPV and root mean square (RMS) velocity, both of which are indicative of the level of vibration.

For evaluating impacts from potential human annoyance, the threshold established in the FTA for residential receptors is 72 VdB. For potential damage, the most conservative threshold is a PPV of 0.12 inch per second and an RMS velocity of 90 VdB. Table 8 summarizes the potential vibration levels for bulldozers, drill rigs, and loaded trucks at 100 feet (the closest construction equipment is expected to be located to a residential receptor).

Table 8 Predicted Vibration Levels from Construction Equipment at 100 Feet

Equipment	Vibration Level (VdB)	PPV (inches per sec)
Bulldozer	69	0.01
Drillers	69	0.01
Loaded Trucks	68	0.01

These predicted vibration levels are less than the FTA criteria. When equipment is operated more than 150 feet away, the vibration levels would be less than 65 dBA, which is generally not perceptible. Thus, the short-term impacts from vibration associated with construction equipment are predicted to be less than significant.

4.2.2 Operation

The new press facility would have equipment such as gas-fired furnaces, a hydraulic forging press, cranes, semi-automated manipulators, and fork trucks that are similar to existing equipment. The new press is precisely controlled with modern hydraulics and electric control circuits, limiting the amount of vibration generated. Specifically, the following design features reduce the amount of vibration that is produced:

- During the forging process, a part is located in an enclosed cavity as the die is closed.

- The press has a 16-cylinder design for controlling and generating the necessary force, which reduces the amount of vibration that is generated. The specific cylinder positions are adjusted to fit the specific geometry of the part that is being forged. Four of those cylinders are used to generate the primary force. Eight other balancing cylinders are designed to lower the press in a controlled process through a combination of hydraulic and electric control. These eight cylinders are arranged such that the press can react very quickly to maintain the set positions without creating unnecessary vibrations. There are also four cylinders that raise the press back to the top position.

The precision control of these cylinders combined with the closed die operations minimizes vibration levels. With the incorporated design and controls, the new equipment is not expected to generate significant levels of vibration.

5.0 REFERENCES

City of Long Beach, 1975. *Noise Element of Long Beach General Plan*. 25 March.

City of Paramount, 2007. *Final Paramount General Plan*. 7 August.

Federal Transit Administration (FTA), 2006. *Transit Noise and Vibration Impact Assessment*. May.

Appendix A
Noise Calculations

Predicted Noise Levels from Construction Equipment

L_{eq} (equipment-soft surfaces) = E.L. + 10 log (U.F.) – 20 log (D/50) – 10G log (D/50) FTA

L_{eq} (equipment-hard surfaces) = E.L. + 10 log (U.F.) – 20 log (D/50)

Leq = Leq at the receptor from the operation of a single piece of equipment
E.L. = Noise Emission Level of construction equipment at reference distance of 50 feet
U.F. = Usage Factor (fraction of time equipment is in use over specified time period)
G = constant that accounts for ground effects
D = distance between the construction equipment and receptor

SOURCE: United States Federal Transit Administration. May 2006. *Transit Noise and Vibration Impact Assessment. Soft surfaces adjustment from California Department of Transportation, October 1998, Technical Noise Supplement.*

$L_{dn} = 10*\log[(15)*10^{(Leq(day)/10)} + (9)*10^{(Leq(night)/10)}] - 13.8$

SOURCE: United States Federal Transit Administration. May 2006. Transit Noise and Vibration Impact Assessment.
Note: Original Equation adds a 10 dB penalty to the Leq(night). However, for construction equipment, the nighttime penalty was assigned by multiplying the nighttime usage factor by 10 per instructions within the document.

$L_{eq}\text{ (total)} = 10\log(\sum 10^{Leq/10})$

$L_{dn}\text{ (total)} = 10\log(\sum 10^{Ldn/10})$

SOURCE: United States Federal Transit Administration. May 2006. Transit Noise and Vibration Impact Assessment.

Scenario # 1 - Site Preparation(1)+Excavation and Dewatering(2) — Distance to Receptor: 500 feet — Baseline: 0 dBA L_{dn}

	Equipment	Time Period	Typical Noise Level (dBA) 50 feet from Source	Hours Used	Usage Factor	Day-Night Average From One Equipment: L_{eq} (daytime) (dBA)	L_{eq} (nighttime) (dBA)	L_{dn}	Hourly Average from One Equipment: Ln
		Day (7 AM to 10 PM)		6	0.40	60			
1	Drill Rig	Night (10 PM to 7 AM)	84	0	0.00		0	58	64
		Day (7 AM to 10 PM)		6	0.40	61			
4	Excavators	Night (10 PM to 7 AM)	85	0	0.00		0	59	65
		Day (7 AM to 10 PM)		6	0.40	64			
8	Dump Trucks	Night (10 PM to 7 AM)	88	0	0.00		0	62	68
		Day (7 AM to 10 PM)		6	0.40	61			
2	Loaders	Night (10 PM to 7 AM)	85	0	0.00		0	59	65
		Day (7 AM to 10 PM)		6	0.40	61			
1	Bulldozer	Night (10 PM to 7 AM)	85	0	0.00		0	59	65
		Day (7 AM to 10 PM)		6	0.40	58			
2	Rolling Compactors	Night (10 PM to 7 AM)	82	0	0.00		0	56	62
	All Equipment					**75**		**73**	**79**

Scenario # 2 - Press Facility Construction(3A)+Substation Construction(6A) — Distance to Receptor: 500 feet — Baseline: dBA L_{dn}

	Equipment	Time Period	Typical Noise Level (dBA) 50 feet from Source	Hours Used	Usage Factor	Day-Night Average From One Equipment: L_{eq} (daytime) (dBA)	L_{eq} (nighttime) (dBA)	L_{dn}	Hourly Average from One Equipment: Ln
		Day (7 AM to 10 PM)		6	0.40	59			
4	Cranes	Night (10 PM to 7 AM)	83	0	0.00		0	57	63
		Day (7 AM to 10 PM)		6	0.40	61			
10	Concrete Trucks	Night (10 PM to 7 AM)	85	0	0.00		0	59	65
		Day (7 AM to 10 PM)		6	0.40	56			
12	Forklifts	Night (10 PM to 7 AM)	80	0	0.00		0	54	60
		Day (7 AM to 10 PM)		6	0.40	56			
7	Aerial Lifts	Night (10 PM to 7 AM)	80	0	0.00		0	54	60
		Day (7 AM to 10 PM)		6	0.40	50			
4	Portable Welders	Night (10 PM to 7 AM)	74	0	0.00		0	48	54
		Day (7 AM to 10 PM)		6	0.40	57			
2	Air Compressors	Night (10 PM to 7 AM)	81	0	0.00		0	55	61
		Day (7 AM to 10 PM)		6	0.40	51			
6	Scissor Lifts	Night (10 PM to 7 AM)	75	0	0.00		0	49	55
		Day (7 AM to 10 PM)		6	0.40	61			
2	Concrete Pump Trucks	Night (10 PM to 7 AM)	85	0	0.00		0	59	65
	All Equipment					**74**		**72**	**78**

Equipment	Typical Noise Level (dBA) [1,2,3] 50 feet from Source
Concrete/Industrial Saw	76
Concrete Pumper	82
Backhoe	80
Fork Lift	80
Air Compressor	81
Generator	81
Rock Drill	98
Crane, Mobile	83
Dozer	85
Grader	85
Loader	85
Truck	88
Rail Saw	90
Pick Up Truck (low speed)	75
Pile-Driver (Impact)	101
Welding	74
Man Lift	75
Light Plant	73
Excavator	85
Concrete Mixing	85
Trencher	88
Compactor	82
Auger Drill Rig	84
Paving	89

1 FTA. May 2006. Transit Noise and Vibration Impact Assessment.
2 Forklifts: Bernard Walsh, ERM
3 Light Plant (assumed powered by small generator), onsite trucks (pickups), welding machine, and man lift based measured Lmax levels at 50 feet presented in :
https://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook09.cfm

	Scenario # 3 - Press Facility Construction(3A)+Utility Connections (6B)		Distance to Receptor:	500	feet	Baseline:		dBA L_{dn}	
						Day-Night Average From One Equipment			Hourly Average from One Equipment
	Equipment	Time Period	Typical Noise Level (dBA) 50 feet from Source	Hours Used	Usage Factor	L_{eq} (daytime) (dBA)	L_{eq} (nighttime) (dBA)	L_{dn}	Ln
		Day (7 AM to 10 PM)		6	0.40	59			
2	Cranes	Night (10 PM to 7 AM)	83	0	0.00		0	57	63
		Day (7 AM to 10 PM)		6	0.40	61			
0	Loaders	Night (10 PM to 7 AM)	85	0	0.00		0	59	65
		Day (7 AM to 10 PM)		6	0.40	61			
0	Bulldozer	Night (10 PM to 7 AM)	85	0	0.00		0	59	65
		Day (7 AM to 10 PM)		6	0.40	61			
10	Concrete Trucks	Night (10 PM to 7 AM)	85	0	0.00		0	59	65
		Day (7 AM to 10 PM)		6	0.40	56			
8	Forklifts	Night (10 PM to 7 AM)	80	0	0.00		0	54	60
		Day (7 AM to 10 PM)		6	0.40	56			
5	Aerial Lifts	Night (10 PM to 7 AM)	80	0	0.00		0	54	60
		Day (7 AM to 10 PM)		6	0.40	50			
6	Portable Welders	Night (10 PM to 7 AM)	74	0	0.00		0	48	54
		Day (7 AM to 10 PM)		6	0.40	57			
4	Air Compressors	Night (10 PM to 7 AM)	81	0	0.00		0	55	61
		Day (7 AM to 10 PM)		6	0.40	51			
12	Scissor Lifts	Night (10 PM to 7 AM)	75	0	0.00		0	49	55
		Day (7 AM to 10 PM)		6	0.40	61			
2	Concrete Pump Trucks	Night (10 PM to 7 AM)	85	0	0.00		0	59	65
	All Equipment					74		72	78

	Scenario # 4 - Paving (3B)+Equipment Installation (4)+Utility Connections (5)+Substation Construction(6A)		Distance to Receptor:	500	feet	Baseline:		dBA L_{dn}	
						Day-Night Average From One Equipment			Hourly Average from One Equipment
	Equipment	Time Period	Typical Noise Level (dBA) 50 feet from Source	Hours Used	Usage Factor	L_{eq} (daytime) (dBA)	L_{eq} (nighttime) (dBA)	L_{dn}	Ln
		Day (7 AM to 10 PM)		6	0.40	59			
	Cranes	Night (10 PM to 7 AM)	83	0	0.00		0	57	63
		Day (7 AM to 10 PM)		6	0.40	61			
	Loaders	Night (10 PM to 7 AM)	85	0	0.00		0	59	65
		Day (7 AM to 10 PM)		6	0.40	61			
	Bulldozer	Night (10 PM to 7 AM)	85	0	0.00		0	59	65
		Day (7 AM to 10 PM)		6	0.40	65			
1	Paving	Night (10 PM to 7 AM)	89	0	0.00		0	63	69
		Day (7 AM to 10 PM)		6	0.40	56			
3	Forklifts	Night (10 PM to 7 AM)	80	0	0.00		0	54	60
		Day (7 AM to 10 PM)		6	0.40	56			
7	Aerial Lifts	Night (10 PM to 7 AM)	80	0	0.00		0	54	60
		Day (7 AM to 10 PM)		6	0.40	50			
4	Portable Welders	Night (10 PM to 7 AM)	74	0	0.00		0	48	54
		Day (7 AM to 10 PM)		6	0.40	57			
2	Air Compressors	Night (10 PM to 7 AM)	81	0	0.00		0	55	61
		Day (7 AM to 10 PM)		6	0.40	51			
8	Scissor Lifts	Night (10 PM to 7 AM)	75	0	0.00		0	49	55
		Day (7 AM to 10 PM)		6	0.40	61			
	Concrete Pump Trucks	Night (10 PM to 7 AM)	85	0	0.00		0	59	65
	All Equipment					70		68	74

	Scenario # 5 - Press Facility Construction(3A)+Utility Connections (5)+Substation Construction(6A)		Distance to Receptor:	500	feet	Baseline:		dBA L_{dn}	Hourly Average from One Equipment
						Day-Night Average From One Equipment			
	Equipment	Time Period	Typical Noise Level (dBA) 50 feet from Source	Hours Used	Usage Factor	L_{eq} (daytime) (dBA)	L_{eq} (nighttime) (dBA)	L_{dn}	Ln
		Day (7 AM to 10 PM)		6	0.40	59			
	Cranes	Night (10 PM to 7 AM)	83	0	0.00		0	57	63
		Day (7 AM to 10 PM)		6	0.40	61			
	Loaders	Night (10 PM to 7 AM)	85	0	0.00		0	59	65
		Day (7 AM to 10 PM)		6	0.40	61			
	Bulldozer	Night (10 PM to 7 AM)	85	0	0.00		0	59	65
		Day (7 AM to 10 PM)		6	0.40	65			
	Paving	Night (10 PM to 7 AM)	89	0	0.00		0	63	69
		Day (7 AM to 10 PM)		6	0.40	56			
5	Forklifts	Night (10 PM to 7 AM)	80	0	0.00		0	54	60
		Day (7 AM to 10 PM)		6	0.40	56			
3	Aerial Lifts	Night (10 PM to 7 AM)	80	0	0.00		0	54	60
		Day (7 AM to 10 PM)		6	0.40	50			
4	Portable Welders	Night (10 PM to 7 AM)	74	0	0.00		0	48	54
		Day (7 AM to 10 PM)		6	0.40	57			
2	Air Compressors	Night (10 PM to 7 AM)	81	0	0.00		0	55	61
		Day (7 AM to 10 PM)		6	0.40	51			
8	Scissor Lifts	Night (10 PM to 7 AM)	75	0	0.00		0	49	55
		Day (7 AM to 10 PM)		6	0.40	61			
	Concrete Pump Trucks	Night (10 PM to 7 AM)	85	0	0.00		0	59	65
	All Equipment					**67**		**65**	**71**

Note: Same as CNEL since noise assumed to occur between 7 am and 7 pm

Predicted Vibration Levels

Lv

	Lv@25ft	Distance (ft)	Lv(D)
Bulldozers	87	100	68.94
Loaded Trucks	86	100	67.94

PPV

	PPV@25 ft (in/s)	Distance (ft)	PPV(D)
Bulldozers	0.089	100	0.01
Loaded Trucks	0.076	100	0.01