INDIVIDUAL NOISE ASSESSMENT REPORT

Site Name/Facility:	Upper and Lower Alvarado Creek
Master Program Map No.:	59, 60, & 64
Date:	May 26, 2015
Acoustician Name:	Charles Terry

***Instructions**: This form must be completed in its entirety for each target facility identified in the Annual Maintenance Needs Assessment report when the potential exists for sensitive wildlife to occur within 750 feet of a proposed maintenance activity. If no sensitive species are expected within 750 feet of maintenance, only the first two rows under the Existing Conditions section must be completed. Attach additional sheets as needed.*

EXISTING CONDITIONS

The City of San Diego (City) has developed the Master Storm Water System Maintenance Program (MMP, Master Maintenance Program) (City 2011a) to govern channel operation and maintenance activities in an efficient, economic, environmentally and aesthetically acceptable manner to provide flood control for the protection of life and property. This document provides a summary of a noise assessment conducted for proposed maintenance activities within the Upper and Lower Alvarado (Maps 59, 60 and 64) to comply with the MMP's Programmatic Environmental Impact Report (PEIR) (City 2011b). The map numbers correspond to those contained in the MMP.

INA procedures under the MMP provide the guidelines for a site-specific inspection of the proposed maintenance activity site including access routes, and temporary spoils storage and staging areas. An INA is required whenever a qualified biologist determines that noise from maintenance activities could adversely affect sensitive wildlife in or around the maintenance area.

Project Location and Description

The purpose of the project is to maintain the existing storm water facilities by restoring the original design capacity to provide public safety and protection of property. The City is proposing to maintain the Upper and Lower Alvarado Creek channels through the removal of trash, debris, vegetation and accumulated sediment.

The Upper and Lower Alvarado Creek channels are located along Interstate 8, east of Interstate 15 (Figure 1). The Upper Alvarado Creek channel is located on the south side of Alvarado Road between College Avenue and Reservoir Drive. The Lower Alvarado Creek channel is located north of Interstate 8 on the west and east side of Mission Gorge Road and south of Mission Gorge Place (Figure 2). The channels are located in un-sectioned lands in Township 16 South, Range 2 West on the San Bernardino Base and Meridian U.S. Geological Survey (USGS) 7.5-minute La Mesa quadrangle map (Figure 3). The Upper Alvarado Creek channel is included in Map 64 of the MMP. The Lower Alvarado Creek channel is included in Maps 59 and 60 of the MMP.

To facilitate the Individual Hydrology and Hydraulic Assessment (IHHA) prepared for the maintenance, the Upper and Lower Alvarado Creek channels were subdivided into separate reaches. The IHHA for the Upper Alvarado Creek evaluated a total of three "reaches". Maintenance in Reaches 2 and 3 is the responsibility of the City of San Diego. Maintenance in Reach 1 is the responsibility of the State of California. Although the IHHA determined that maintenance is only required in Reach 2, an evaluation of Reaches 1 and 3 was performed in the IHHA to understand how upstream and downstream conditions affect the proposed maintenance.

The IHHA for Lower Alvarado Creek evaluated a total of four reaches. Maintenance within Reaches 2A, 2B and 4 is the responsibility of the City of San Diego. Maintenance within Reach 1 is the responsibility of a private owner. Maintenance in Reach 3 is the responsibility of the Metropolitan Transit Development Board. Maintenance is only proposed within those reaches which are maintained by the City of San Diego (Reaches 2A, 2B and 4).

To facilitate the discussion of the potential effects of maintenance within the Upper and Lower Alvarado Channels, segments where maintenance is proposed are assigned an alpha-numeric code. The first portion of the code identifies whether the segment is located in the Upper Alvarado Creek (U) or Lower Alvarado Creek (L). The second portion identifies the reach number used in the IHHA.

A more detailed discussion of the channels is provided below.

Upper Alvarado Creek, Reach 2

Reach 2 of Upper Alvarado Creek (UR2) runs west approximately 335 meters to the beginning of an un-channelized reach of Alvarado Creek on the SDSU campus, near the bend in Alvarado Court. The most easterly 30 meters of the channel is fully lined with concrete. The remaining 305 meters is a natural-bottom channel with a concrete apron on the north side and a natural bank on the south side. The bottom is mostly cobbled where it is visible. The channel in UR2 is trapezoidal in shape with dimensions of 5.8 meters wide at the bottom, 11.3 meters wide at the top, 2.7 meters deep, and slopes of 1:1 on both sides. Most of UR2 is densely vegetated with freshwater marsh or southern willow scrub vegetation. UR2 receives storm flows from:

- The upstream reach of Alvarado Creek,
- A concrete-lined storm water channel draining Reservoir Drive, and
- Adjacent developed lands on Alvarado Court and undeveloped lands on the slope north of Cleo Street.

UR2 discharges into an un-channelized reach of Alvarado Creek that is densely vegetated with southern willow scrub and southern arroyo willow riparian forest. The slopes immediately south of UR2 are inside the MHPA.

Lower Alvarado Creek, Reach 4

Reach 4 of Lower Alvarado Creek (LR4) runs west approximately 160 meters from a culvert under a parking lot at 4579 Mission Gorge Place to a point behind an industrial building at 4533 Mission Gorge Place. It is bordered by development on both sides for its entire length. LR4 is a concrete trapezoidal channel with dimensions of 7.6 meters wide at the bottom, 15 meters wide at the top, 2.4 meters deep, and slopes of 1.5:1 on both sides. LR4 is densely vegetated with non-native riparian and southern willow scrub vegetation, which is supported by a large amount of accumulated sediment. LR4 receives storm flows from:

- A multiple concrete box culvert under a parking lot and driveway associated with light industrial buildings, and
- Adjacent developed lands on Mission Gorge Place and Alvarado Canyon Road.

LR4 discharges into an earthen-lined reach of Alvarado Creek that continues southwest to LR2B.

Lower Alvarado Creek, Reach 2B

Reach 2B of Lower Alvarado Creek (LR2B) runs southwest approximately 120 meters west to a culvert under Fairmount Avenue. It is bordered by development on both sides for its entire length. LR2B is a concrete trapezoidal channel with dimensions of 9.1 meters wide at the base, 14 meters wide at the top, 2.4 meters deep, and slopes of 1:1 on both sides. LR2B is vegetated with freshwater marsh and southern willow scrub vegetation. LR2B receives storm flows from:

- The upstream reach of Alvarado Creek, and
- Adjacent developed lands.

LR2B discharges into a triple, 96x144-inch concrete box culvert under Fairmount Avenue.

Lower Alvarado Creek, Reach 2A

Reach 2A of Lower Alvarado Creek (LR2A) runs west for approximately 135 meters from a culvert under Fairmount Avenue to a point approximately 120 meters upstream of the confluence of Alvarado Creek and the San Diego River. It is bordered by development on both sides for its entire length. The eastern 105 meters of LR2A is a concrete trapezoidal channel with dimensions of 9.1 meters wide at the bottom, 14 meters wide at the top, 2.4 meters deep, and slopes of 1:1 on both sides. The western 30 meters of LR2A is an earthen channel with rip rap sides. LR2A is densely vegetated with southern willow scrub, freshwater marsh, and non-native riparian vegetation. LR2A receives storm flows from:

- LR2B by way of a triple 96x144-inch concrete box culvert under Fairmount Avenue, and
- Adjacent developed lands.

LR2A discharges into the final 120 meters of Alvarado Creek, which is an earthen channel that terminates in the San Diego River. Lands downstream of LR2A are densely vegetated with southern willow scrub and southern arroyo willow riparian forest, and the MHPA is approximately 75 meters (250 feet) downstream.

Parcels adjacent to UR2 are zoned RS-1-7 (high-density single-family residential), CO-1-2 (commercial office), and RS-1-1 (low-density single-family residential). Parcels adjacent to LR4 are zoned IL-3-1 (light industrial / commercial), and parcels adjacent to LR2B and LR2A are zoned IL-3-1 and CV-1-1 (commercial visitor). According to the Federal Emergency Management Agency (FEMA), all 4 reaches are inside the 1% Annual Chance Flood area. The channels are within the San Diego River Hydrologic Unit. The City's Multi-Habitat Plan Area (MHPA) designation lies along the south side of UR2 and approximately 2,380 square feet (0.05 acre) of the maintenance at the eastern end of UR2 lies within the MHPA. The maintenance associated with the Lower Alvarado River would not occur within an MHPA designation. The nearest MHPA designation in Lower Alvarado Creek lies approximately 250 feet west of the end maintenance within LR2A.

Proposed Maintenance

Upper Alvarado Creek

Maintenance in UR2 is expected to remove up to 1,000 cubic yards of material in order to restore the original capacity of the channel to convey storm water. Equipment involved in the maintenance will include a dozer, a front-end loader, and a dump truck. A sandbag barrier will be placed at the downstream end of maintenance area.

The dozer will enter and exit the channel at the location designated on the IMP which is an existing concrete ramp leading into the channel. The dozer will push material to the access ramp where the front-end loader will transfer the material to a dump truck for disposal at the Miramar landfill.

Street sweepers will sweep adjacent public rights-of-way and immediate truck loading sites nightly. Upon completion of the maintenance, the sandbags will be removed. The equipment will be transported back to the City yard.

In order to control erosion during the period when the natural plant communities re-establish following maintenance, a check dam will be installed across the channel approximately 200 feet east of the downstream limit of the proposed maintenance area. The check dam will slow the velocity of storm water, allowing suspended sediments to settle before being transported downstream. The check dam will be supported by 18-inch fence posts placed within concrete footings with a diameter of 2 feet and a depth of 3 feet. A total of six fence posts will be installed. Four of the fence posts will be located on the channel bottom. The other two will be located at the top of each side of the channel. An 18-inch-high, galvanized, steel fence will be stretched across the channel and secured to the fence posts. Once the City has determined that the channel vegetation has recovered sufficiently to control erosion, the fence and posts will be removed.

Lower Alvarado Creek

Maintenance in Lower Alvarado Creek will involve removal of sediment and vegetation to restore the original capacity of the channels to convey storm water. Based on channel conditions, maintenance in the segments will require different approaches. In all cases, street sweepers will sweep adjacent public rights-of-way and immediate truck loading sites nightly. Upon completion of the maintenance, the sandbags will be removed. The equipment will be transported back to the City yard.

The proposed maintenance approaches for each segment in the Lower Alvarado Creek are summarized below.

LR4: Up to 600 cubic yards of material is expected to be removed in LR4. Equipment involved in the maintenance will include a Gradall, a front-end loader, and a dump truck. A diversion pump will be placed at the upstream and downstream ends of the maintenance area. Water will be pumped around the maintenance area in a pipe, and discharged downstream of the maintenance area. The front-end loader will be lowered into the channel from an existing paved asphalt parking lot located at the rear of 4561 Mission Gorge Place, as designated on the IMP. The Gradall will be positioned above the channel at the same location. The front-end loader will push material to the Gradall. The Gradall will scoop up the material and transfer it to a dump truck for disposal at the Miramar landfill.

LR2B: Up to 400 cubic yards of material is expected to be removed in LR2B. Equipment involved in the maintenance will include a Gradall, a skid steer, and a dump truck. A diversion pump will be placed at the upstream end of the maintenance area. Water will be pumped around the maintenance area in a pipe, and discharged downstream of the maintenance area. The skid steer will be lowered into the channel behind 5733 Fairmount Avenue. The Gradall will be positioned above channel at the same location. The skid steer or front-end loader will push material to the Gradall. The Gradall or front-loader will scoop up the material and transfer it to a dump truck for disposal at the Miramar landfill.

LR2A: Up to 300 cubic yards of material is expected to be removed in LR2A. Equipment involved in the maintenance will include a Gradall, a front-end loader or a skid steer, and a dump truck. A diversion pump will be placed at the upstream end of the maintenance area. Water will be pumped around the maintenance area in a pipe, and discharged downstream of the maintenance area. Equipment involved in the maintenance will include a Gradall, a skid steer or front-end loader and a dump truck. The skid steer or front-end loader will be lowered into the channel from an existing paved asphalt parking lot behind 5732 Fairmount Avenue. The Gradall will be positioned above channel at the same location. The skid steer or front-end loader will push material to the Gradall. The Gradall will scoop up the material and transfer it to a dump truck for disposal at the Miramar landfill.

Due to the potential for standing water at the downstream end of LR2A, a second pump may be required at the west end to withdraw standing water and allow operation of the skid steer. In this event, an inflatable dam would be placed at the west end of the proposed maintenance to keep water from backing up into the maintenance area. A pump located in parking lot

behind 4242 Camino del Rio North would draw water from the upstream portion of the dam. The water would be carried in a hose around the dam and discharged back into the channel.

Unlike the Upper Alvarado Creek, no check dam is proposed at the downstream end of the proposed maintenance within Lower Alvarado Creek.

Survey Methods and Date:

Based on the results of the analysis of the Individual Biological Assessment (IBA) completed for the Upper and Lower Alvarado Creeks, the focus of the noise assessment was on LR2A. The IBA concluded that maintenance noise in LR2A could have an indirect impact on the breeding behavior of the least Bell's vireo, an endangered bird, which has been observed in the riparian habitat to the west of the LR2A. The IBA did not identify any other areas along the proposed maintenance in either Upper or Lower Alvarado Creek that could be significantly impacted by noise generated by maintenance equipment.

All noise level or sound level values presented herein are expressed in terms of decibels (dB), with A weighting (abbreviated "dBA") used to approximate the hearing sensitivity of humans. Time averaged noise levels are expressed by the symbol "L_{EQ}" unless a different period is specified (with "L_{EQ}" implied to mean a period of one hour).

Ambient noise measurements were taken in the proposed maintenance area to establish baseline conditions. The following equipment was used to measure existing noise levels:

- Larson Davis System 831 Integrating Sound Level Meter
- Larson Davis Model CA250 Calibrator
- Windscreen and tripod for the sound level meter
- Digital camera

The sound level meter was field-calibrated immediately prior to the noise measurements to ensure accuracy. All sound level measurements conducted and presented in this report were made with a sound level meter that conforms to the American National Standards Institute specifications for sound level meters (ANSI SI.4-1983 R2001). All instruments were maintained with National Bureau of Standards traceable calibration per the manufacturers' standards.

Meteorological conditions during the measurement period were warmer and dryer than seasonally typical and conditions were appropriate for conducting ambient outdoor SPL measurements. Air temperature at the measurement locations was approximately 68 °F, with 40 percent relative humidity (RH). Winds ranged from zero miles-per-hour to less than five miles-per-hour from the west.

The ambient noise level was measured at a single location near the northwest end of the parking lot for the shopping and dining area adjacent to Camino Del Rio North, west of Mission Gorge Road, between 1:00 p.m. and 2:00 p.m. This location was immediately adjacent to the western end of the channel as the channel goes into the San Diego River

channel, and location gave an accurate ambient measurement at the edge of the MHPA area. The location of the measurement is illustrated on Figure 4. The results are included in Table 1.

Table 1
AMBIENT NOISE LEVELS

Location	Sound Level (dBA $L_{EQ)}$	Primary Noise Source
1	64.7	Traffic on I-8 freeway with minor contribution from local business.

As noted above, the measured roadway traffic noise level, which took place between 1:00 p.m. and 2:00 p.m., was 64.7 dBA L_{EQ}. However, the peak noise level hour, which occurs at full traffic speed, is expected to be 65.1 dBA L_{EQ}. Thus, an ambient noise level of 65.1 dBA L_{EQ} is used for this analysis.

Are there sensitive wildlife species within 750 feet of proposed maintenance?
Yes ☑ No ☐
If not, no further assessment of noise impacts from maintenance is required.
If yes, the rest of this form must be completed.

Sensitive Wildlife Observed/Detected:
Describe sensitive wildlife anticipated to occur within 750 feet of maintenance that were observed and the closest distance to proposed maintenance.

As discussed below, sensitive or protected bird species may occur within 750 feet of the proposed maintenance activities within LR 2A. No sensitive birds occur within 750 feet of LR2B, LR 4 or UR 2.

Least Bell's Vireo

As indicated earlier, the Least Bell's vireo (*Vireo bellii pusillus*; LBV) has been reported within the MHPA located west of LR 2A (see Figure 4). This species is listed as Endangered under the federal and state Endangered Species Acts, and inhabits mature riparian scrub and forest with a well-developed canopy and stratified understory. While the potential for LBV to reside inside the work area of LR2A is low, due to a poorly-developed understory, there is potential for LBV to nest near LR2A and for individuals to forage inside the work area in LR2A.

Migratory Bird Treaty Act Protected Birds

The potential exists for birds protected by the Migratory Bird Treaty Act (MBTA) to nest in trees in and adjacent to the maintenance area.

MAINTENANCE IMPACTS

List the equipment to be used during maintenance and anticipated noise levels associated with each. Calculate the combined maximum hourly noise level associated with simultaneous operation of equipment during maintenance. Estimate the distance to the 60 dBA L_{EQ} including existing ambient noise sources affecting the maintenance area.

Channel Maintenance Activity

Based on the maintenance methodology included in Appendix A, the noise levels associated with the maintenance equipment within LR2A are estimated in Table 2. For purposes of this analysis, the expected noise levels produced by maintenance equipment are based on data obtained from previous on-site noise measurements taken at other similar operations and construction noise levels estimated by the Federal Highway Administration (Appendix B). This analytical method provides a known basis for determining noise levels associated with channel maintenance. The noise levels are based on dBA, L_{max} at 50 feet. Acoustical usage factors (% of an hour) are based on Federal Highway Administration (FHWA) Road Construction Noise Model (RCNM) User's Guide Table 1 (FHWA, 2006).

Table 2
EQUIPMENT NOISE LEVELS

Equipment	Noise Level at 50 feet (dBA, L_{max})	Percentage Operation During Average Hour (%)
Dump Truck	76	40
Gradall	72.5	40
Front-end Loader	78	40
Skid Steer	68	50
Diversion Pump	77	100

Calculate the combined maximum hourly noise level associated with simultaneous operation of equipment during maintenance. Estimate the distance to the 60 dBA L_{EQ} including existing ambient noise sources affecting the maintenance area.

Channel Maintenance Activity

In order to conservatively estimate the potential impact of maintenance on the LBV, this analysis assumed that a Gradall and dump truck would be operating simultaneously from a single point at the eastern end of the LR2A portion of the channel, approximately 70 feet west of Mission Gorge Road and 270 feet east of the closest habitat area. The skid steer or front loader was assumed to operate at the western boundary of the LR 2A, which is approximately 340 feet west of Mission Gorge Road and adjacent to potential habitat for the least Bell's vireo. The diversion pump would be located in the northwest corner of the carwash parking lot, 335 feet west of Mission Gorge Road and within 10 feet of the closest habitat location.

The noise model calculated the aggregate noise level (i.e., the logarithmic sum of the equipment noise sources) along with the estimated percentage of operation within a one-hour period. The estimate was then adjusted to the actual distance from the 50-foot reference distance to account for geometric divergence of 6 dBA per doubling of distance.

Based on the noise model, the combined noise from all of the equipment operating simultaneously (Gradall, dump truck, skid steer, front-end loader, and one diversion pump) at the western end of the channel (edge of MHPA) would be 60.5 dBA L_{EQ}. Thus, without factoring in ambient noise, the 60 dBA L_{EQ} contour would extend a distance of 670 feet from the location from which the Gradall and dump truck would operate (just west of Mission Gorge Road). Based on this, the 60 dBA L_{EQ} contour would extend approximately 30 feet into the MHPA. The combined noise level including maintenance (60.5 dBA L_{EQ}) and ambient noise level (65.1 dBA L_{EQ}) would be 66.4 dBA L_{EQ}. Although the maintenance noise would temporarily increase the ambient noise levels in the offsite habitat, the increase would be less than 2 dBA. Noise level increases of less than 3 dBA are not considered detectable.

Would sensitive wildlife receptors be affected by maintenance noise in excess of 60 dBA L_{EQ}?
Yes ☑ No ☐
If yes, identify the wildlife species and discuss their sensitivity to maintenance noise.

Least Bell's vireo has been reported from the San Diego River west of LR2A. Suitable habitat for vireo extends eastward into the Alvarado Creek channel up to the western end of the maintenance area. This habitat would receive noise impacts from project activities as described above. Although the 60 dBA L_{EQ} contour associated with maintenance would extend approximately 30 feet into potential habitat for the LBV, the impact would not be significant due to the fact that this area is already experiencing ambient noise levels in excess of 60 dBA $L_{EQ.}$ Although, as discussed above, the additional noise associated with maintenance would increase the ambient noise level by 2 dBA, this increase is not considered significant. Noise level increases of less than 3 dBA are not considered detectable. Therefore, although project noise would affect sensitive wildlife receptors, the potential impact on LBV would be less than significant.

Similarly, the potential for the maintenance to adversely affect any nesting activities of MBTA birds located near the maintenance area would not be significant as the ambient noise levels are already over 60 dBA L_{EQ}, and would not increase the ambient noise level by more than 3 dBA.

MITIGATION

What mitigation measures would be required to avoid adverse impacts to sensitive wildlife (e.g. barriers or limitations on hours of operation)?

Based on the conclusion that the noise from maintenance would not substantially increase noise levels over the current ambient noise levels, no mitigation measures are required.

In addition, the following protocols from the MMP would serve to reduce impacts to sensitive birds near the maintenance activities.

Based on the conclusion that the noise from maintenance would not substantially increase noise levels over the current ambient noise levels, implementation of specific MMP protocols designed to protect sensitive bird species is not necessary.

ADDITIONAL COMMENTS OR RECOMMENDATIONS

Although the focus of the INA is on potential impacts to wildlife, it is noted that noise impacts on human receptors are controlled by the Noise Control Ordinance of the San Diego Municipal Code. Per section 59.5.0404, maintenance activity is limited to between the hours of 7:00 am and 7:00 pm. During this time, maintenance noise may not exceed a level of 75 dBA L_{EQ} when averaged over this 12-hour period. Further, the Code limits construction to Monday through Saturday. Maintenance may occur on Sundays by obtaining a permit from the City's Noise Abatement and Control Administrator.

The proposed maintenance is anticipated to comply with the Noise Control Ordinance. Thus, no noise impacts on sensitive uses (e.g., residential development) would occur from operation of equipment in the course of maintenance.

Figure 1: Regional Location Map
Figure 2: Project Vicinity Map (Aerial Photograph)
Figure 3: Project Vicinity Map (USGS Topography)
Figure 4: Maintenance Noise Relative to Sensitive Bird Habitat

Appendix A: Maintenance Methodology
Appendix B: FHWA Construction Equipment Noise Levels

I:\PROJECTS\SDD\SDD-24.16 Alvarado 1A\Map\INA\Fig1_Regional.mxd SDD-24.16 01/15/15 -CL

Regional Location Map

STORM WATER FACILITY MAPS 59, 60, AND 64
(UPPER/LOWER ALVARADO CREEK CHANNELS)

HELIX Environmental Planning

N 0 8 Miles

Figure 1

I:\PROJECTS\SDD\SDD-24.16_Alvarado_1A\Map\INA\Fig2_Vicinity_Aerial.mxd SDD-24.16 01/15/15 -CL

Project Vicinity Map (Aerial Photograph)

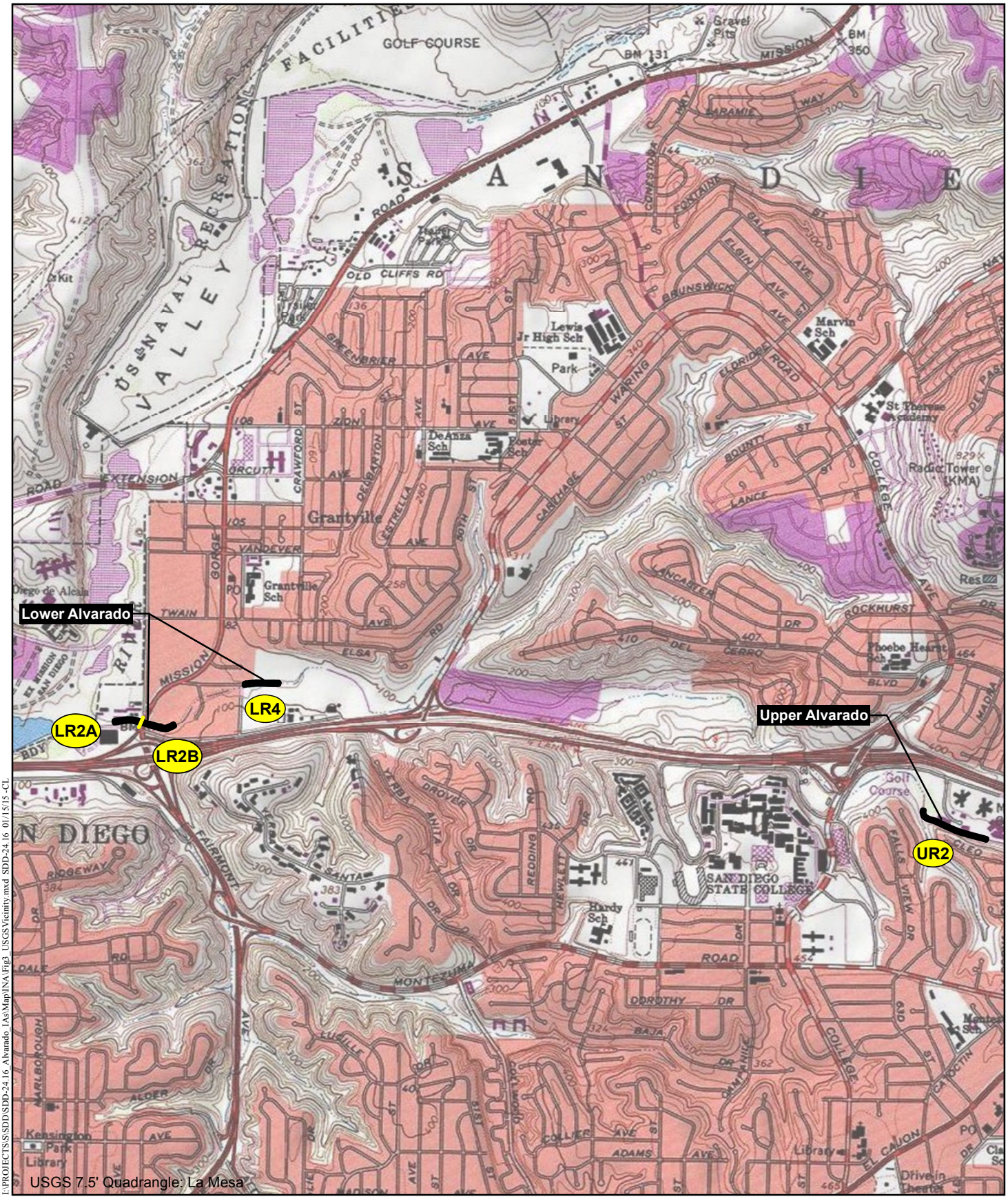
STORM WATER FACILITY MAPS 59, 60, AND 64
(UPPER/LOWER ALVARADO CREEK CHANNELS)

HELIX Environmental Planning

N

0 3,000 Feet

Figure 2



I:\PROJECTS\SDP\SDP-24.16_Alvarado_1A\Map\INA\Fig3_USGSVicinity.mxd SDP-24.16 01/15/15 -CL

Project Vicinity Map (USGS Topography)

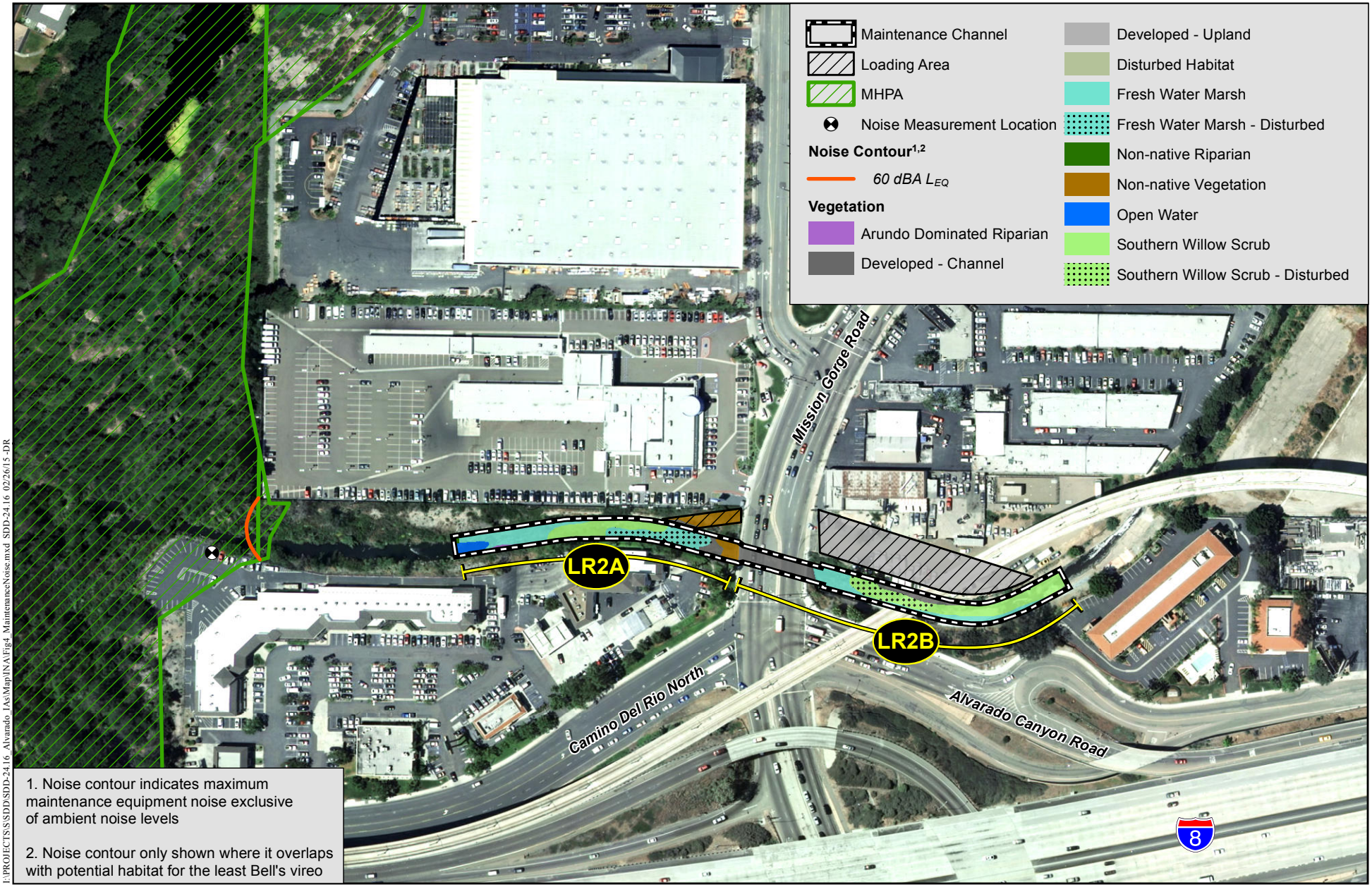
STORM WATER FACILITY MAPS 59, 60, AND 64
(UPPER/LOWER ALVARADO CREEK CHANNELS)

HELIX Environmental Planning

N

0 2,000 Feet

Figure 3



1. Noise contour indicates maximum maintenance equipment noise exclusive of ambient noise levels

2. Noise contour only shown where it overlaps with potential habitat for the least Bell's vireo

I:\PROJECTS\S\SDD\SDD-24.16_Alvarado_IAs\MapINA\Fig4_MaintenanceNoise.mxd SDD-24.16 02/26/15 -DR

Maintenance Noise Relative to Sensitive Bird Habitat

STORM WATER FACILITY MAPS 59, 60, AND 64
(UPPER/LOWER ALVARADO CREEK CHANNELS)

Figure 4

HELIX Environmental Planning

N 0 200 Feet

Appendix A

MAINTENANCE METHODOLOGY

FACILITY/CHANNEL	ALVARADO (LOWER) CHANNEL (LR2A) PHASE 3 (5801 FAIRMOUNT AVENUE)
DIMENSIONS	<u>ALVARADO (LOWER) CHANNEL (PHASE 3)</u> TRAPAZOIDAL, CONCRETE-LINED APPROX. 380' LENGTH APPROX. 60' TOP WIDTH 30' BOTTOM WIDTH 8-12' IN DEPTH 2-12' OF SEDIMENT 100-200 CUBIC YARDS MAXIMUM CUBIC YARDS: 300
MAINTENANCE METHOD	MECHANIZED SEDIMENT & VEGETATION REMOVAL
EQUIPMENT (EQUIPMENT WILL BE EQUIVALENT OR SMALLER IN SIZE/TYPE)	• GRADALL (5100 SERIES) • SKID STEER/BOBCAT (S650) • FRONT-END LOADER (CAT 966) • DUMP TRUCKS (10/12 YD) • 4" OR 6" TRASH PUMPS (WACKER OR GODWIN - FOR DRY WEATHER FLOW DIVERSION)
SCHEDULE	IN CHANNEL WORK WILL TAKE 3 DAYS ; 6:00 AM TO 6:00 PM;
STAFFING	8 TO 10 PEOPLE
MAINTENANCE PROCEDURE	
CHANNEL SEQUENCE	1. <u>ALVARADO (LOWER) PHASE 3</u> (STATION XXXX)
ACCESS & LOADING AREA(S)	<u>ALVARADO (LOWER) CHANNEL (PHASE 3)</u> *ACCESS & LOADING AREA* – (STATION XXXX) - LOADER IS CHAINED TO GRADALL AND LOWERED INTO CHANNEL FROM EXISTING PARKING LOT AT 5801 FAIRMOUNT AVENUE. PRIMARY PLAN – NO LOADING OCCURS IN THIS ACCESS & LOADING AREA. BACKUP PLAN - GRADALL IS POSITIONED ABOVE CHANNEL. GRADALL LOADS TRUCKS STATIONED ON EXISTING PARKING LOT AT 5801 FAIRMOUNT AVE.
STAGING AREA	STAGING OF TRUCKS & EQUIPMENT WILL BE DONE ON PAVED, ASPHALT PARKING LOT AT 5801 FAIRMOUNT AVENUE. ALL MATERIALS WILL BE HAULED IMMEDIATELY TO A LEGAL DISPOSAL SITE (MIRAMAR LANDIFLL).
METHODOLOGY	1. DRY WEATHER FLOW DIVERSION BERM (TIGER DAM, SANDBAGS, AND/OR VISQUEEN), DIVERSION PIPES, & PUMPS WERE PUT IN PLACE DURING PHASE 2 CHANNEL MAINTENANCE. THESE ITEMS ARE LOCATED AT THE EASTERN LIMITS OF MAINTENANCE AREA OF PHASE 3. 2. LOADER IS CHAINED TO GRADALL AND LOWERED INTO CHANNEL AT ACCESS & LOADING AREA. 3. LOADER PUSHES VEGETATION & SEDIMENT TO EAST SIDE OF CULVERT UNDER FAIRMOUNT AVENUE 4. BOBCAT TRAVELS FROM PHASE 2 (LR2B), AND TAKES MATERIAL

	TO PHASE 3 LOADING AREA. 5. MATERIAL IS LOADED INTO DUMP TRUCKS IN THE SAME FASHION AS PHASE 2 WORK. 6. BACKUP PLAN - GRADALL STATIONED OUTSIDE/ABOVE CHANNEL AT 5801 FAIRMOUNT AVENUE . 7. GRADALL SCOOPS MATERIAL & LOADS MATERIAL INTO WAITING DUMP TRUCKS AT 5801 FAIRMOUNT AVENUE. 8. DUMP TRUCKS HAUL MATERIAL TO LEGAL DISPOSAL SITE (MIRAMAR LANDFILL). 9. LOADER IS CHAINED TO GRADALL AND RAISED OUT OF CHANNEL. 10. DRY WEATHER DIVERSION BERM, DIVERSION PIPES, & PUMPS REMOVED.
POST-MAINTENANCE	1. DEMOBILIZE EQUIPMENT. 2. REMOVE TEMPORARY CONSTRUCTION BMPS.
OTHER NOTES	1. SWEEPERS WILL SWEEP ADJACENT PUBLIC RIGHTS-OF-WAY AND IMMEDIATE TRUCK LOADING SITES NIGHTLY. 2. A PUMP MAY BE USED AT VARIOUS LOCATIONS TO REMOVE PONDED WATER PRIOR TO EQUIPMENT ENTERING THE CHANNEL. WATER WILL BE DISCHARGED IN THE VICINITY OF THE DIVERSION DISCHARGE. 3. EQUIPMENT (OTHER THAN PUMPS) FUELED OUTSIDE CHANNEL & LOCATED AT LEAST 150’ FROM WATERS OF US/STATE.

Appendix B

FHWA CONSTRUCTION EQUIPMENT NOISE LEVELS

9.0 CONSTRUCTION EQUIPMENT NOISE LEVELS AND RANGES

9.1 Equipment Type Inventory and Related Emission Levels

Noise levels generated by individual pieces of construction equipment and specific construction operations form the basis for the prediction of construction-related noise levels. A variety of information exists related to sound emissions related to such equipment and operations. This data transcends the period beginning in the 1970s thru 2006. This information exists for both stationary and mobile sources and for steady, intermittent, and impulse type generators of noise.

9.1.1 Stationary Equipment

Stationary equipment consists of equipment that generates noise from one general area and includes items such as pumps, generators, compressors, etc. These types of equipment operate at a constant noise level under normal operation and are classified as non-impact equipment. Other types of stationary equipment such as pile drivers, jackhammers, pavement breakers, blasting operations, etc., produce variable and sporadic noise levels and often produce impact-type noises. Impact equipment is equipment that generates impulsive noise, where impulsive noise is defined as noise of short duration (generally less than one second), high intensity, abrupt onset, rapid decay, and often rapidly changing spectral composition. For impact equipment, the noise is produced by the impact of a mass on a surface, typically repeating over time.

9.1.2 Mobile Equipment

Mobile equipment such as dozers, scrapers, graders, etc., may operate in a cyclic fashion in which a period of full power is followed by a period of reduced power. Other equipment such as compressors, although generally considered to be stationary when operating, can be readily relocated to another location for the next operation.

9.2 Sources of Information

Construction-related equipment and operation noise level data may be provided by numerous sources, including suppliers, manufacturers, agencies, organizations, etc. Some information is included in this document, and many web-based links are given for equipment manufacturers.

9.3 Specifics of Construction Equipment and Operation Noise Inventories

Details included in each specific inventory of construction equipment and operation noise emission levels are often variable in terms of how data is represented. Some inventories include ranges of noise levels while others present single numbers for each equipment type. Others provide levels for specific models of each type of construction equipment. Often, different noise descriptors are used, such as L_{Aeq}, L_{max}, L_{10}, sound power level, etc. As such, the array of data does not readily lend itself to being combined into a single table or easily compared. As such, this Handbook attempts to summarize a variety of such inventories and provide links to each, thereby providing the reader with a variety of sources from which to choose the appropriate levels for use in his or her respective analysis.

9.4 Summaries of Referenced Inventories

Included below are examples of several inventories of construction-related noise emission values. These and additional inventories are included on the companion CD-ROM.

9.4.1 RCNM Inventory

Equipment and operation noise levels in this inventory are expressed in terms of L_{max} noise levels and are accompanied by a usage factor value. They have been recently updated and are based on extensive measurements taken in conjunction with the Central Artery/Tunnel (CA/T) Project. Table 9.1 summarizes the equipment noise emissions database used by the CA/T Project. While these values represent the "default" values for use in the RCNM, user-defined equipment and corresponding noise levels can be added.

Table 9.1 RCNM Default Noise Emission Reference Levels and Usage Factors.

Equipment Description	Impact Device?	Acoustical Usage Factor (%)	Spec. 721.560 L_{max} @ 50 feet (dBA, slow)	Actual Measured L_{max} @ 50 feet (dBA, slow) (Samples Averaged)	Number of Actual Data Samples (Count)
All Other Equipment > 5 HP	No	50	85	N/A	0
Auger Drill Rig	No	20	85	84	36
Backhoe	No	40	80	78	372
Bar Bender	No	20	80	N/A	0
Blasting	Yes	N/A	94	N/A	0
Boring Jack Power Unit	No	50	80	83	1
Chain Saw	No	20	85	84	46
Clam Shovel (dropping)	Yes	20	93	87	4
Compactor (ground)	No	20	80	83	57
Compressor (air)	No	40	80	78	18
Concrete Batch Plant	No	15	83	N/A	0
Concrete Mixer Truck	No	40	85	79	40
Concrete Pump Truck	No	20	82	81	30
Concrete Saw	No	20	90	90	55
Crane	No	16	85	81	405
Dozer	No	40	85	82	55
Drill Rig Truck	No	20	84	79	22
Drum Mixer	No	50	80	80	1
Dump Truck	No	40	84	76	31
Excavator	No	40	85	81	170
Flat Bed Truck	No	40	84	74	4
Front End Loader	No	40	80	79	96
Generator	No	50	82	81	19
Generator (<25KVA, VMS Signs)	No	50	70	73	74
Gradall	No	40	85	83	70

Grader	No	40	85	N/A	0
Grapple (on backhoe)	No	40	85	87	1
Horizontal Boring Hydraulic Jack	No	25	80	82	6
Hydra Break Ram	Yes	10	90	N/A	0
Impact Pile Driver	Yes	20	95	101	11
Jackhammer	Yes	20	85	89	133
Man Lift	No	20	85	75	23
Mounted Impact Hammer (hoe ram)	Yes	20	90	90	212
Pavement Scarifier	No	20	85	90	2
Paver	No	50	85	77	9
Pickup Truck	No	40	55	75	1
Pneumatic Tools	No	50	85	85	90
Pumps	No	50	77	81	17
Refrigerator Unit	No	100	82	73	3
Rivit Buster/Chipping Gun	Yes	20	85	79	19
Rock Drill	No	20	85	81	3
Roller	No	20	85	80	16
Sand Blasting (single nozzle)	No	20	85	96	9
Scraper	No	40	85	84	12
Sheers (on backhoe)	No	40	85	96	5
Slurry Plant	No	100	78	78	1
Slurry Trenching Machine	No	50	82	80	75
Soil Mix Drill Rig	No	50	80	N/A	0
Tractor	No	40	84	N/A	0
Vacuum Excavator (Vac-Truck)	No	40	85	85	149
Vacuum Street Sweeper	No	10	80	82	19
Ventilation Fan	No	100	85	79	13
Vibrating Hopper	No	50	85	87	1
Vibratory Concrete Mixer	No	20	80	80	1
Vibratory Pile Driver	No	20	95	101	44

Warning Horn	No	5	85	83	12
Welder/Torch	No	40	73	74	5

For each generic type of equipment listed in Table 9.1, the following information is provided:

- an indication as to whether or not the equipment is an impact device;
- the acoustical usage factor to assume for modeling purposes;
- the specification "Spec" limit for each piece of equipment expressed as an L_{max} level in dBA "slow" at a reference distance of 50 foot from the loudest side of the equipment;
- the measured "Actual" emission level at 50 feet for each piece of equipment based on hundreds of emission measurements performed on CA/T work sites; and
- the number of samples that were averaged together to compute the "Actual" emission level.

A comparison of the "Spec" emission limits against the "Actual" emission levels reveals that the Spec limits were set, in general, to realistically obtainable noise levels based on the equipment used by contractors on the CA/T Project. When measured in the field, some equipment such as pile drivers, sand blasting, demolition shears, and pumps tended to exceed their applicable emission limit. As such, these noisy devices needed to have some form of noise mitigation in place in order to comply with the Spec emission limits. Other equipment, such as clamshell shovels, concrete mixer trucks, truck-mounted drill rigs, man-lifts, chipping guns, ventilation fans, pavers, dump trucks, and flatbed trucks, easily complied. Therefore, the Spec emission limits for these devices could have been reduced somewhat further. It is recommended that the user review the RCNM User's Guide contained in Appendix A for detailed guidance regarding application of values contained in Table 9.1.

9.4.2 FHWA Special Report Inventories

Appendix A of the 1977 Handbook provides tables of construction equipment noise levels and ranges. The majority of the data were provided by the American Road Builders Association. These data were taken during a 1973 survey in which member contractors were asked to secure readings of noise exposure to operators of various types of equipment. Additionally, the contractors were asked to take readings at 50 feet from the machinery. These 50-foot peak readings are provided in Tables 9.2 through 9.8. Though the data were produced under varying conditions and degrees of expertise, the values are relatively consistent.

Table 9.2 Construction Equipment Noise Levels Based on Limited Data Samples - Cranes.

Manufacturer	Type or Model	Peak Noise Level (dBA)	Remarks
Northwestern	80D	77	Within 15m 1958 mod
Northwestern	8	84	Within 15m 1940 mod
Northwestern	6	72	Within 15m 1965 mod
American	7260	82	Within 15m 1967 mod
American	599	76	Within 15m 1969 mod
American	5299	70	Within 15m 1972 mod
American	4210	82	Within 15m 1968 mod
Buck Eye	45C	79	Within 15m 1972 mod
Buck Eye	308	74	Within 15m 1968 mod
Buck Eye	30B	73	Within 15m 1965 mod
Buck Eye	30B	70	Within 15m 1959 mod
Link Belt	LS98	76	Within 15m 1956 mod
Manitowoc	4000	94	Within 15m 1956 mod

Grove	RF59	82	Within 15m 1973 mod
Koehr	605	76	Within 15m 1967 mod
Koehr	435	86	Within 15m 1969 mod
Koehr	405	84	Within 15m 1969 mod

Table 9.3 Construction Equipment Noise Levels Based on Limited Data Samples - Backhoes.

Manufacturer	Type or Model	Peak Noise Level (dBA)	Remarks
Link Belt	4000	92	Within 15m 1971 mod
John Deere	609A	85	Within 15m 1971 mod
Case	680C	74	Within 15m 1973 mod
Drott	40 yr.	82	Within 15m 1971 mod
Koehr	1066	81 & 84	Within 15m 2 tested

Table 9.4 Construction Equipment Noise Levels Based on Limited Data Samples - Front Loaders.

Manufacturer	Type or Model	Peak Noise Level (dBA)	Remarks
Caterpillar	980	84	Within 15m 1972 mod
Caterpillar	977K	79	Within 15m 1969 mod
Caterpillar	977	87	Within 15m 1971 mod
Caterpillar	977	94	Within 15m 1967 mod
Caterpillar	966C	84	Within 15m 1973 mod
Caterpillar	966C	85	Within 15m 1972 mod
Caterpillar	966	81	Within 15m 1972 mod
Caterpillar	966	77	Within 15m 1972 mod
Caterpillar	966	85	Within 15m 1966 mod
Caterpillar	955L	90	Within 15m ;1973 mod
Caterpillar	955K	79	Within 15m 1969 mod
Caterpillar	955H	94	Within 15m 1963 mod
Caterpillar	950	78 & 80	Within 15m 1972 mod
Caterpillar	950	75	Within 15m 1968 mod
Caterpillar	950	88	Within 15m 1967 mod
Caterpillar	950	86	Within 15m 1965 mod
Caterpillar	944A	80	Within 15m 1965 mod
Caterpillar	850	82	Within 15m 1968 mod
Michigan	75B	90	Within 15m 1969 mod
Michigan	475A	96	Within 15m 1967 mod
Michigan	275	85	Within 15m 1971 mod

Michigan	125	87	Within 15m 1967 mod
Hough	65	82	Within 15m 1971 mod
Hough	60	91	Within 15m 1961 mod
Hough	400B	94	Within 15m 1961 mod
Hough	H90	86	Within 15m 1961 mod
Trojan	3000	85	Within 15m 1956 mod
Trojan	RT	82	Within 15m 1965 mod
Payloader	H50	85	Within 15m 1963 mod

Table 9.5 Construction Equipment Noise Levels Based on Limited Data Samples - Dozers.

Manufacturer	Type or Model	Peak Noise Level (dBA)	Remarks
Caterpillar	D5	83	Within 15m 1967 mod
Caterpillar	D6	85	Within 15m 1967 mod
Caterpillar	D6	86	Within 15m 1964 mod
Caterpillar	D6	81	Within 15m 1967 mod
Caterpillar	D6B	83	Within 15m 1967 mod
Caterpillar	D6C	82	Within 15m 1962 mod
Caterpillar	D7	85	Within 15m 1956 mod
Caterpillar	D7	86	Within 15m 1969 mod
Caterpillar	D7	84	Within 15m 1969 mod
Caterpillar	D7	78	Within 15m 1970 mod
Caterpillar	D7	78	Within 15m 1972 mod
Caterpillar	D7E	86	Within 15m 1965 mod
Caterpillar	D7E	78	Within 15m 1970 mod
Caterpillar	D7E	84	Within 15m 1973 mod
Caterpillar	D7F	80	Within 15m 1972 mod
Caterpillar	D8	92	Within 15m 1954 mod
Caterpillar	D8	95	Within 15m 1968 mod
Caterpillar	D8	86	Within 15m 1972 mod
Caterpillar	D8H	88	Within 15m 1966 mod
Caterpillar	D8H	82	Within 15m 1972 mod
Caterpillar	D9	85	Within 15m 1972 mod
Caterpillar	D9	94	Within 15m 1972 mod
Caterpillar	D9	90	Within 15m 1963 mod
Caterpillar	D9	87	Within 15m 1965 mod
Caterpillar	D9	90	Within 15m 1965 mod

Caterpillar	D9	88	Within 15m 1968 mod
Caterpillar	D9	92	Within 15m 1972 mod
Caterpillar	D9G	85	Within 15m 1965 mod
Allis Chambers	HD41	93	Within 15m 1970 mod
International	TD15	79	Within 15m 1970 mod
International	TD20	87	Within 15m 1970 mod
International	TD25	90	Within 15m 1972 mod
International	TD8	83	Within 15m 1970 mod
Case	1150	82	Within 15m 1972 mod
John Deer	350B	77	Within 15m 1971 mod
John Deer	450B	65	Within 15m 1972 mod
Terex	8230	70	Within 15m 1972 mod
Terex	8240	93	Within 15m 1969 mod
Michigan	280	85	Within 15m 1961 mod
Michigan	280	90	Within 15m 1962 mod
Caterpillar	824	90	Within 15m 1968 mod

Table 9.6 Construction Equipment Noise Levels Based on Limited Data Samples - Graders.

Manufacturer	Type or Model	Peak Noise Level (dBA)	Remarks
Caterpillar	16	91	Within 15m 1969 mod
Caterpillar	16	86	Within 15m 1968 mod
Caterpillar	140	83	Within 15m 1970 mod
Caterpillar	14E	84	Within 15m 1972 mod
Caterpillar	14E	85	Within 15m 1971 mod
Caterpillar	14C	85	Within 15m 1971 mod
Caterpillar	14B	84	Within 15m 1967 mod
Caterpillar	12F	82	Within 15m 1961-72 mod
Caterpillar	12F	72-92	Within 15m 1961-72 mod
Caterpillar	12E	81.3	Within 15m 1959-67 mod
Caterpillar	12E	80-83	Within 15m 1959-67 mod
Caterpillar	12	84.7	Within 15m 1960-67 mod
Caterpillar	12	82-88	Within 15m 1960-67 mod
Gallon	T500	84	Within 15m 1964 mod
Allis Chambers		87	Within 15m 1964 mod

Table 9.7 Construction Equipment Noise Levels Based on Limited Data Samples - Scrapers.

Manufacturer	Type or Model	Peak Noise Level (dBA)	Remarks
Caterpillar	660	92	Within 15m
Caterpillar	641B	85	Within 15m 1972 mod
Caterpillar	641B	86	Within 15m 1972 mod
Caterpillar	641	80 & 84	Within 15m 1972 mod
Caterpillar	641	83 & 89	Within 15m 1965 mod
Caterpillar	637	87	Within 15m 1971 mod
Caterpillar	633	87	Within 15m 1972 mod
Caterpillar	631C	89	Within 15m 1973 mod
Caterpillar	631C	83	Within 15m 1972 mod
Caterpillar	631B	94	Within 15m 1969 mod
Caterpillar	631B	84-87	Within 15m 1968 mod
Caterpillar		85 avg.	Within 15m 1968 mod
Caterpillar	621	90	Within 15m 1970 mod
Caterpillar	621	86	Within 15m 1967 mod
Caterpillar	613	76	Within 15m 1972 mod
Terex	TS24	87	Within 15m 1972 mod
Terex	TS24	84-91	
Terex	TS24	82	Within 15m 1971 mod
Terex	TS24	81-83	Within 15m 1971 mod
Terex	TS24	94	Within 15m 1966 mod
Terex	TS24	92-98	Within 15m 1966 mod
Terex	TS24	94.7	Within 15m 1963 mod
Terex	TS24	94-95	Within 15m 1963 mod
Terex	TS14	82	Within 15m 1969 mod
Terex	S35E	84	Within 15m 1971 mod

Table 9.8 Noise Levels of Standard Compressors.

Manufacturer	Model	Silenced or Standard	Type Eng.	Type Comp.	Test Avg. Cond. (cfm.psi)	Avg. Cond. Noise Lev. (cfm.psi) (dBA) at 7m*
Atlas	ST-48	Standard	Diesel	Reciprocal	160,100	83.6
Atlas	ST-95	Standard	Diesel	Reciprocal	330,105	80.2
Atlas	VSS-170Dd	Silenced	Diesel	Reciprocal	170,850	70.2
Atlas	VT-85M	Standard	Gas	Reciprocal	85,100	81.4
Atlas	VS-85Dd	Silenced	Gas	Reciprocal	85,100	75.5
Atlas	VSS-125Dd	Silenced	Diesel	Reciprocal	125,100	70.1

Atlas	STS-35Dd	Silenced	Diesel	Reciprocal	125,100	73.5
Atlas	VSS-170Dd	Silenced	Diesel	Reciprocal	170,100	
Gardner-Denver	SPWDA/2	Silenced	Diesel	Rotary-Screw	1200,000	73.3
Gardner-Denver	SPQDA/2	Silenced	Diesel	Rotary-Screw	750,000	78.2
Gardner-Denver	SPHGC	Silenced	Gas	Rotary-Screw	185,000	77.1
Ingersoll-Rand	DXL 1200	Standard	Diesel	Rotary-Screw	1200,125	92.6
Ingersoll-Rand	DXL 1200 (doors open)	Standard	Diesel	Rotary-Screw	1200,125	
Ingersoll-Rand	DXL 900S	Silenced	Diesel	Rotary-Screw	900,125	76.0
Ingersoll-Rand	DXL 900S	Silenced	Diesel	Rotary-Screw	900,125	75.1
Ingersoll-Rand	DXLCU1050	Standard	Diesel	Rotary-Screw	1050,125	90.2
Ingersoll-Rand	DXL 900S	Silenced	Diesel	Rotary-Screw	900,125	75.3
Ingersoll-Rand	DXL 900S	Silenced	Diesel	Rotary-Screw	900,125	75.0
Ingersoll-Rand	DXL 900	Standard	Diesel	Rotary-Screw	900,125	89.9
Ingersoll-Rand	DXL 750	Standard	Diesel	Rotary-Screw	750,125	87.7
Jaeger	A	Standard	Gas	Rotary-Screw	175,100	88.2
Jaeger	A(doors open)	Standard	Gas	Rotary-Screw	175,100	
Jaeger	E	Standard	Gas	Vane	85,100	81.5
Jaeger	E(doors open)	Standard	Gas	Vane	85,100	
Worthington	60 G/2Qt	Silenced	Gas	Vane	160,100	74.2
Worthington	750-QTEX	Silenced	Diesel	Rotary-Screw	750,100	74.7

*Data taken from EPA Report - EPA 550/9-76-004.

9.4.3 FTA Noise and Vibration Assessment Procedure

Chapter 12 of the FTA Transit Noise and Vibration Guidance Handbook discusses construction noise evaluation methodology and contains the noise emission levels for construction equipment displayed in Table 9.9.

Table 9.9 FTA Construction Equipment Noise Emission Levels.

Equipment	Typical Noise Level (dBA) 50 ft from Source*
Air Compressor	81
Backhoe	80
Ballast Equalizer	82
Ballast Tamper	83
Compactor	82
Concrete Mixer	85
Concrete Pump	82
Concrete Vibrator	76
Crane Derrick	88
Crane Mobile	83
Dozer	85
Generator	81
Grader	85
Impact Wrench	85
Jack Hammer	88
Loader	85
Paver	89
Pile Driver (Impact)	101
Pile Driver (Sonic)	96
Pneumatic Tool	85
Pump	76
Rail Saw	90
Rock Drill	98
Roller	74
Saw	76
Scarifier	83
Scraper	89
Shovel	82
Spike Driver	77
Tie Cutter	84
Tie Handler	80
Tie Inserter	85
Truck	88

*Table based on EPA Report, measured data from railroad construction equipment taken during Northeast Corridor improvement project and other measured data.

9.5 Links to Equipment Manufacturers

Table 9.10 contains web-based links to manufacturers of construction equipment. While few of these links contain noise-related data associated with the equipment, they provide descriptions and/or specifications related to the equipment, as well as sources for possibly obtaining additional information related to the equipment. Information in this table is by no means all-inclusive and does not represent any type of endorsement of the manufacturers, suppliers, or equipment. Users are hereby advised that the referenced websites may have certain restrictions, copyrights, etc., associated with any use of data contained therein.

Table 9.10 Equipment Manufacturers and Websites.

Equipment	Manufacturer	Website Address
Arrow Boards		
	North Star	http://northstar-traffic.com/index.cfm?SC=14&PT=1
	Trafcom	http://www.trafcon.com
	Allmand	http://www.allmand.com/MB%20AB%20page.htm
Articulated Trucks		
	Case	http://www.casece.com/products/products.asp?RL=NAE&id=196
	Hitachi	http://www.hitachi-c-m.com/global/products/articulate/index.html
	Terex	http://www.terex.com/main.php
	Caterpillar	http://www.cat.com/cda/layout?m=37840&x=7
	Volvo	http://www.volvo.com/constructionequipment/na/en-us/products/articulatedhaulers/
Asphalt Saws		
	Allied	http://www.alliedcp.com/products/rotocut.asp
Augers - See Drills / Augers		
Backhoes - See Loaders/Backhoes		
Boring Equipment - See Pile Drivers/Boring Equipment		
Compaction Equipment		
	Allied	http://www.alliedcp.com/products/compactor.asp
Compressors		
	Sullair	http://www.sullair.com/corp/details/0,10294,CLI1_DIV61_ETI5714,00.html
	Compair	http://www.compair.com/Products/Portable_Compressors.aspx
Concrete and Asphalt Batch/Mixing Plants and Equipment		
	Con-E-Co	http://www.con-e-co.com/products.cfm
	Terex	http://www.terex.com/main.php
	Gunter & Zimmerman	http://www.guntert.com/concrete_mobilebatching.asp
	Rex Con	http://www.rexcon.com
Concrete Breakers/ Hydraulic Hammers/Hydraulic Breakers		
	Drillman	http://www.drillmanindia.com/concrete-breaker.html
	Hydro Khan	http:/www.sangi.co.kr/english/e_product1_2.php
	Stanley	http://www.stanley-hydraulic-tools.com/Hand%20Held/NoAmbreakers.htm
	Lynx	http://www.stanley-hydraulic-tools.com/Lynx/breakers.htm
Concrete Chain Saws		
	Lynx	http://www.stanley-hydraulic-tools.com/Lynx/concrete-saws.htm
Concrete Core Drilling Machines		
	Multiquip	http://www.multiquip.com/multiquip/318_ENU_HTML.htm
Concrete Cutters		

	Vermeer	http://www.vermeermfg.com/vcom/TrenchingEquipment/Line.jsp?PrdlnID=3618
Concrete/Material Pumps		
	Multiquip	http://www.multiquip.com/multiquip/309_ENU_HTML.htm
	Reed	http://www.reedpumps.com/
Concrete Mixer Trucks		
	Oshkosh	http://www.oshkoshtruck.com/concrete/products~overview~home.cfm
	London	http://www.lmi.ca/mixers.cfm
	Terex/Advance	http://www.advancemixer.com
Concrete Saws		
	Multiquip	http://www.multiquip.com/multiquip/315_ENU_HTML.htm
	Diamond Core Cut	http://www.diamondproducts.com/dp_home.htm
Concrete Screeds		
	Multiquip	http://www.multiquip.com/multiquip/317_ENU_HTML.htm
Concrete Vibrators		
	Multiquip	http://www.multiquip.com/multiquip/313_ENU_HTML.htm
	Sullair	http://www.sullair.com/corp/details/0,10294,CLI1_DIV61_ETI5722,00.html
Cranes		
	Malcolm Drilling	www.malcolmdrilling.com
	Link-Belt	http://www.linkbelt.com/lit/products/frameproducthome.htm
	Casagrande	http://www.casagrandegroup.com
	Liebherr	http://www.liebherr.com/em/en/35381.asp
	Terex	http://www.terex.com/main.php
Crawler Tractors - See Dozers/Crawler Tractors		
Crushing and Screening Equipment		
	Cedarapids	http://www.cedarapids.com/crushscr.htm
	Hitachi	http://www.hitachi-c-m.com/
	Komatsu	http://www.komatsu.com/ce/products/mobile_crushers.html
	Terex	http://www.terex.com/main.php
Crushers/Pulverizers		
	Hydro Khan	http://www.sangi.co.kr/english/e_product3.php
Cutoff Saws		
	Multiquip	http://www.multiquip.com/multiquip/309_ENU_HTML.htm
	Lynx	http://www.stanley-hydraulic-tools.com/Lynx/cutoff%20saw.htm
Dozers/CrawlerTractors		
	John Deere	http://www.deere.com/en_US/cfd/construction/deere_const/crawlers/deere_dozer_sele
	Caterpillar	http://www.cat.com/cda/layout?m=37840&x=7
	Case	http://www.casece.com/products/products.asp?RL=NAE&id=2
	Komatsu	http://www.komatsu.com/ce/products/crawler_dozers.html
Dewatering Pumps		
	Multiquip	http://www.multiquip.com/multiquip/371_ENU_HTML.htm
Drills / Augers		
	Malcolm Drilling	www.malcolmdrilling.com
	Casagrande	www.casagrandegroup.com
	Soilmec	http://www.soilmec.com/_vti_g1_techno.aspx?rpstry=4_

	Terex	http://www.terex.com/main.php
Excavators		
	Hitachi	http://www.hitachi-c-m.com/global/products/excavator/index.html
	Caterpiller	http://www.cat.com/cda/layout?m=37840&x=7
	Volvo	http://www.volvo.com/constructionequipment/na/en-us/products/compactexcavators/
		http://www.volvo.com/constructionequipment/na/en-us/products/wheeledexcavators/
		http://www.volvo.com/constructionequipment/na/en-us/products/crawlerexcavators/
	John Deere	http://www.deere.com/en_US/cfd/construction/deere_const/excavators/deere_excavato
	Liebherr	http://www.liebherr.com/em/en/18891.asp
	Soilmec	http://www.soilmec.com/_vti_g1_t02.aspx?rpstry=29_
	Gehl	http://www.gehl.com
	Case	http://www.casece.com/products/products.asp?RL=NAE&id=216
	Komatsu	http://www.komatsu.com/ce/products/crawler_excavators.html
		http://www.komatsu.com/ce/products/wheel_excavators.html
	Terex	http://www.terex.com/main.php
	Link-Belt	http://www.lbxco.com/lx_series.asp
	Gradall	http://www.gradall.com/
	Badger Daylighting	http://www.badgerinc.com/
Fork Lifts - See Lifts / Variable Reach Fork Lifts/ Material Handlers		
Generators		
	Terex	http://www.terex.com/main.php
	Multiquip	http://www.multiquip.com/multiquip/212_ENU_HTML.htm
	Sullair	http://www.sullair.com/corp/details/0,10294,CLI1_DIV61_ETI5714,00.html
	Baldor	http://www.baldor.com/products/generators/ts.asp
Graders		
	Case	http://www.casece.com/products/products.asp?RL=NAE&id=190
	Volvo	http://www.volvo.com/constructionequipment/na/en-us/products/MotorGraders/
	Komatsu	http://www.komatsu.com/ce/products/motor_graders.html
	Terex	http://www.terex.com/main.php
Hand Compaction Equipment		
	Terex	http://www.terex.com/main.php
	Multiquip	http://www.multiquip.com/multiquip/56_ENU_HTML.htm
Hydraulic Hammers/Hydraulic Breakers - See Concrete Breakers/ HydraulicHammers/Hydraulic Breakers		
Jackhammers - See Rock Drilling Equipment/Jackhammers		
Lifts / Variable Reach Fork Lifts/ Material Handlers		
	Genie Lift	www.genielift.com
	Sky Track	www.kirby-smith.com/
	Ingersol-Rand	www.ingersollrand.com
	Terex	http://www.terex.com/main.php
	Roadtec	http://www.roadtec.com/www/docs/102/mtv-material-transfer-vehicle/
LightTowers		
	Baldor	http://www.baldor.com/products/generators/mlt.asp
	Multiquip	http://www.multiquip.com/multiquip/293_ENU_HTML.htm
	Allmand	http://www.allmand.com/Night%20Lite%20Pro%20page.htm
Loaders/Backhoes		
	Case	http://www.casece.com/products/products.asp?RL=NAE&id=54

	Caterpillar	http://www.cat.com/cda/layout?m=37840&x=7
	Volvo	http://www.volvo.com/constructionequipment/na/en-us/products/backhoeloaders/
	John Deere	http://www.deere.com/en_US/cfd/construction/deere_const/backhoes/deere_backhoe_
	Komatsu	http://www.komatsu.com/ce/products/backhoe_loaders.html
Material Handlers - See Lifts / Variable Reach Fork Lifts/ Material Handlers		
Milling Machines		
	Wirtgen	https://www.wirtgenamerica.com/noflash.html
Mining Trucks - See Rigid Dump Trucks/Mining Trucks		
Pans - See Scrapers/Pans		
Pavers/Paving Equipment		
	Caterpillar/ Barber Greene	http://www.cat.com/cda/layout?m=37840&x=7
	Rosco	http://www.leeboy.com/rosco/
	Bomag	http://www.bomag.com/americas/index.aspx?&Lang=478
	Gehl	http://www.gehl.com/const/prodpg_ap.html
	Leeboy	http://www.leeboy.com/leeboy/
	Terex	http://www.terex.com/main.php
	Ingersoll-Rand	http://www.road-development.irco.com/Default.aspx?MenuItemID=12
	Vogele	http://www.vogeleamerica.com/noflash.html
	GOMACO	http://www.gomaco.com/index.html
	Roadtec	http://www.roadtec.com
Pile Drivers/Boring Equipment		
	Soilmec	http://www.soilmec.com/_vti_g1_t09.aspx?rpstry=29_
	Leffer	http://www.leffer.com/hme.html
	Bauer	http://www.bauer.de/en/maschinenbau/produkte/drehbohrgeraete/bg_reihe/usbg15h.ht
Pipelayers/Trenchers		
	Liebherr	http://www.liebherr.com/em/en/18908.asp
	Caterpillar	http://www.cat.com/cda/layout?m=37840&x=7
	Case	http://www.casece.com/products/products.asp?RL=NAE&id=28&archived=1
	Vermeer	http://www.vermeermfg.com/vcom/TrenchingEquipment/trenching-equipment.htm
	Ditchwitch	http://www.ditchwitch.com/dwcom/Product/ProductView/115
	Eagle	http://www.guntert.com/trenchers_home.asp
Profilers - See Roadway Planers/Profilers		
Rammers		
	Multiquip	http://www.multiquip.com/multiquip/56_ENU_HTML.htm
Rebar Benders/Cutters		
	Multiquip	http://www.multiquip.com/multiquip/1316_ENU_HTML.htm
Recyclers - See Stabilizers/Recyclers		
Rigid Dump Trucks/Mining Trucks		
	Hitachi	http://www.hitachi-c-m.com/global/products/rigid/index.html
	Caterpillar	http://www.cat.com/cda/layout?m=37840&x=7
	Liebherr	http://www.liebherr.com/em/en/18898.asp
	Komatsu	http://www.komatsu.com/ce/products/dump_trucks.html
	Terex	http://www.terex.com/main.php
Roadway Planers/Profilers		
	Terex	http://www.terex.com/main.php
	Roadtec	http://www.roadtec.com/products/cold_planers/default.htm

Rock Drilling Equipment/Jackhammers		
	Drillman	http://www.drillmanindia.com/rock-drilling-machine.html
	Whaker	http://www.wackergroup.com/webapp/wcs/stores/servlet/
	Sullair	http://www.sullair.com/corp/details/0,10294,CLI1_DIV61_ETI5721,00.html
	Allied	http://www.alliedcp.com/products/hammers.asp
Rollers - See Tampers/Rollers		
Scrapers/Pans		
	Terex	http://www.terex.com/main.php
Screening Equipment - See Crushing and Screening Equipment		
Slabbuster		
	Allied	http://www.alliedcp.com/products/slabbuster.asp
Slip Form Pavers		
	Huron	http://www.huronmanufacturing.com/
	Guntert & Zimmerman	http://www.guntert.com/concreteSlipformPavers.asp
Stabilizers/Recyclers		
	Bomag	http://www.bomag.com/americas/index.aspx?&Lang=478
	Komatsu	http://www.komatsu.com/ce/products/mobile_crushers.html
	Terex	http://www.terex.com/main.php
	Wirtgen	https://www.wirtgenamerica.com/noflash.html
	Roadtec	http://www.roadtec.com
Sweepers		
	Elgin	http://www.elginsweeper.com
	Johnston	http://www.johnstonsweepers.com/
Tampers/ Rollers		
	Bomag	http://www.bomag.com/americas/index.aspx?&Lang=478
	Komatsu	http://www.komatsu.com/ce/products/vibratory_rollers.html
	Whaker	http://www.wackergroup.com/webapp/wcs/stores/servlet/
	Lynx	http://www.stanley-hydraulic-tools.com/Lynx/tamper.htm
	Multiquip	http://www.multiquip.com/multiquip/181_ENU_HTML.htm
	Ingersoll-Rand	http://www.road-development.irco.com/Default.aspx?MenuItemID=15
Trenchers - See Pipelayers/Trenchers		
Trucks - See Articulated Trucks, Concrete Mixer Trucks, Rigid Dump Trucks/Mining Trucks		
Vacuum Units		
	Advanced Recycling Systems	www.arsrecycling.com/
	Vacmasters	http://www.vacmasters.com/airsystm.htm
	Vector	http://www.vector-vacuums.com/
Variable Message Signs		
	Allmand	http://www.allmand.com/MB%20only%20page.htm
	North Star	http://northstar-traffic.com/index.cfm?SC=13&PT=1
	Trafcom	http://www.trafcon.com
	Daktronics	http://www.daktronics.com/vms_prod/dak_vms_products.cfm
Vibratory Rammers		
	Whaker	http://www.wackergroup.com/webapp/wcs/stores/servlet/
Welders/Welding Equipment		

	Airgas	www.airgas.com
	Multiquip	http://www.multiquip.com/multiquip/408_ENU_HTML.htm
	Miller	http://www.millerwelds.com/products/
	Lincoln	http://www.mylincolnelectric.com/Catalog/equipmentseries.asp?browse=101|400|
Wheel Loaders		
	Hitachi	http://www.hitachi-c-m.com/global/products/loader/index.html
	Case	http://www.casece.com/products/products.asp?RL=NAE&id=30
	Caterpillar	http://www.cat.com/cda/layout?m=37840&x=7
	Volvo	http://www.volvo.com/constructionequipment/na/en-us/products/wheelloaders/
	Terex	http://www.terex.com/main.php
	Komatsu	http://www.komatsu.com/ce/products/wheel_loaders.html
	TCM	http://www.tcmglobal.net/products/main02.html

Page Top | < Previous | Contents | Next >