APPENDIX C

NOISE AND VIBRATION STUDY

Medlin & Associates, Inc.
Acoustical Consultants

RSCI Upper Reach Noise and Vibration Study

Prepared for:

Los Angeles Department of Water and Power

and

Aspen Environmental Group

October 2007

P.O. Box 130941 Carlsbad, CA 92013-0941
760-930-6515
mail@medlin-acoustics.com
www.medlin-acoustics.com

Contents

Summary

Significant impacts to noise-sensitive receivers due to the Upper Reach project are summarized in answering the relevant questions from the CEQA Guidelines, as follows:

Would the project result in exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

Significant and unavoidable. Both the Los Angeles and Burbank ordinances focus on restricted operating hours as a means of regulating construction hours. Construction of the project is planned to occur during daytime, swing and nighttime hours. Section 112.05 of the Los Angeles code further restricts noise emissions from construction equipment to a level of 75 dBA at a distance of 50 feet from any construction equipment, if technically feasible. Provided that all equipment used on this project is fitted with appropriate mufflers, shields, or other available noise-attenuating devices, the technical-feasibility requirement is presumed to be met. Only machinery which inherently creates loud noise (e.g. pavement breakers) would be considered exempt from the technical-feasibility requirement.

Would the project result in exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?

Significant and unmitigatable impact. Sensitive receivers lying within a distance of 150 feet (residential or similar) or 170 feet (film/recording studio) of a tunnel alignment may be subject to ground-vibration or groundborne-noise in excess of the criteria recommended by the Federal Transit Administration. These receivers lie along the northern portion of the project (Phase 1) and along Whitnall Highway in Burbank (Phase 3). Although certain mitigation measures may be applied (discussed below), it is unlikely that impacts can be confidently reduced to below the recommended thresholds due to the nature of ground vibration. All impacts, however, will be temporary and only occur during daytime hours as currently planned.

Would the project result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?

Significant but mitigatable impact. Airborne noise from construction equipment will exceed the significant thresholds defined above for many receivers along the alignment. Of primary concern is exceedance of the 75 dBA threshold. Mitigation of airborne noise to acceptable levels is feasible, however, using a combination of noise barriers and other techniques discussed below.

1 Introduction

The Los Angeles Department of Water and Power proposes to install approximately six miles of pipeline from the Headworks Spreading Grounds to the North Hollywood pump station. This pipeline, referred to as Upper Reach, is part of the larger River Supply Conduit Improvement program. The potential exists that construction of this pipeline could produce unacceptably high levels of noise and vibration at residential and other sensitive locations along the project route.

Medlin & Associates, Inc. was tasked to study the potential noise and vibration impacts from construction of the project, identify significant impacts, and recommend notional mitigation measures. This report documents the findings of that study. This study focused solely on potential impacts due to construction; it did not address operational noise.

2 Project Description

2.1 Project Location

The proposed Upper Reach pipeline would involve the construction of approximately 31,600 linear feet of underground pipeline and appurtenant structures, stretching through portions of the City of Los Angeles and the City of Burbank, as shown in Figure 1 below. The project would be located in the streets, utility corridors, and parks of both cities, with the majority surrounded by urban development including both residential and commercial zones, as well as the existing Whitnall Highway utility corridor. Construction would occur within existing street rights-of-way, existing easements such as Whitnall Highway and Headworks spreading grounds, new easements, and recreation areas.

The project will be divided into three phases, as color-coded in Figure 1. The first phase, shown in orange, begins near the North Hollywood pump station and consists entirely of tunneling. Phase two, shown in blue, is mainly open-trenching with jacking used in certain critical areas. Phase three, shown in green, carries the project to its termination at the Headworks spreading grounds. The stretch across Burbank consists almost entirely of tunneling, with trenching and jacking used on the south side of the Los Angeles River.

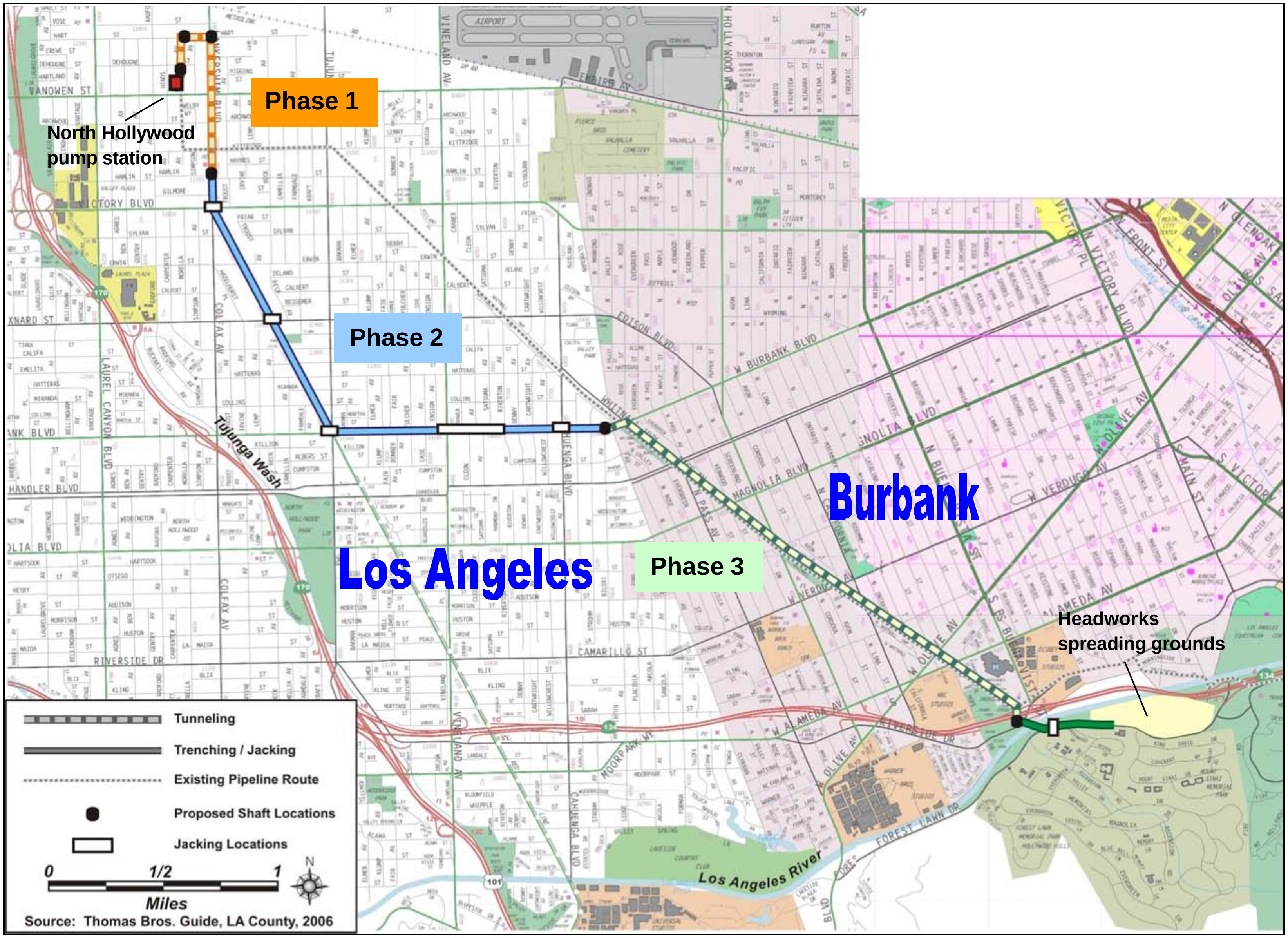


Figure 1: Project map

2.2 Construction Overview

Installation of the pipeline will be accomplished by a combination of open-trench excavations, jacking, and traditional tunneling. Tunneling will occur along those portions shown in Figure 1, with shaft locations noted as black dots. The remainder of the project will comprise open-trenching, with jacking used at certain critical areas. Jacking will likely occur across seven street intersections, including Lankershim Blvd./Burbank Blvd. and Burbank Blvd./Clybourn Ave., under the Los Angeles River from north of Riverside Drive (and south of Highway 134) to Forest Lawn Drive, and beneath existing storm drain on Forest Lawn Drive northeast of Memorial Drive. Other jacking locations may be added during the design phase. Similar to tunneling, pits will be located at both ends of a jacking area. The maximum pit sizes for jacking or tunneling will be about 18 feet wide by 60 feet long.

Potential staging areas identified for the proposed project include the Headworks Spreading Grounds, Buena Vista Park north of Riverside Drive, open right-of way within the Whitnall Highway, or local LADWP facilities, including the North Hollywood Pump Station. Staging area activities may include refueling and maintenance of equipment as well as storage.

Equipment, materials, and waste would be truck-hauled to and from the construction sites over existing roads. Excavated soil may also have to be hauled away from open-trench portions of the project during pipelaying operations.

2.3 Construction Methods

2.3.1 General

The general process for construction consists of site preparation, excavation, pipe (and/or appurtenant structure) installation and backfilling, and site restoration (where applicable). For tunneling and jacking operations, a pit will be located at the entrance and exit of each tunneled or jacked segment. All construction methods will require off-site staging area(s) to temporarily store supplies and materials.

2.3.2 *Open Trench Excavation*

Open trench excavation is a construction method typically utilized to install pipelines and appurtenant structures including maintenance holes, flow meters, valves, and vaults. In general, the process consists of trench excavation, pipe installation, trench backfilling, and site restoration. The existing pavement along the pipeline alignment is cut or broken and removed. A trench is excavated along the pipeline alignment, with the excavated soil either temporarily stored adjacent to the trenches or hauled off-site. The pipe is laid into the trench and welded together, and then the trench is backfilled and the surface restored and repaved.

Equipment used for the above activities comprises common heavy machinery used in construction. A summary of typical equipment is as follows:

- concrete saws and/or pavement breakers to demolish existing pavement, and loaders/backhoes and dump trucks to remove it;
- excavators, loaders, backhoes, and dump trucks to excavate the trench and remove soil;
- excavators and/or cranes to lower pipe into the trench;
- welding trucks to join pipe sections;
- equipment similar to that for excavation to backfill the trench;
- concrete mixers, dump trucks, graders, rollers, and pavers to restore the trench site and replace the pavement;
- ancillary service equipment such as water trucks, pickup trucks, electric generators, air compressors, etc.;
- delivery trucks (tractor-trailers) to bring supplies to the trenching site and remove waste.

For the Upper Reach project, the maximum length of open-trench at any one time would be about 500 feet, with a total construction zone extending about 1,400 feet. Trench widths will be approximately 11 feet, with an overall work-area width of about 30 to 35 feet. This process is expected to move at a rate of 80 feet per day for this project.

2.3.3 Jacking

Pipe-jacking is utilized where open-trenching would cause unreasonable disruption of busy intersections or to avoid other facilities such as flood control channels (e.g., Los Angeles River). Pipe-jacking is an operation in which the soil ahead of the steel casing is excavated and brought out through the steel casing barrel while the casing is pushed forward by a horizontal, hydraulic jack which is placed at the rear of the casing. The jacking equipment utilized for this operation is placed in the jacking pit. Once the casing is placed, the pipe is installed inside the casing. A receiving pit is located on the opposite end of the operation from the jacking pit.

Equipment and operations for pipe-jacking are similar to those for open-trenching, except that operations are essentially stationary from the view of the surface and continue for a much longer duration. The distance between the pits typically ranges from 250 to 500 feet, but may be longer or shorter depending on site conditions. For this project, the size of the jacking and receiving pits would be approximately 20-60 feet long and 12 feet wide.

2.3.4 Tunneling

Traditional tunneling involves the placement of the pipeline in an underground tunnel which is excavated between two or more shafts. As such, it shares characteristics similar to those of pipe-jacking, however the distance between tunnel shafts is typically far greater than those between jacking pits. A tunnel-boring machine (TBM), a device using a large disk mounted with cutters, is typically used to excavate the tunnels.

2.3.5 Dewatering

Excavation in areas with high groundwater may require the use of dewatering pumps. Such pumps may run continuously (including at night) even in the absence of other construction activities, and must therefore be considered separately from the above equipment.

2.4 Project Schedule

Overall project construction is expected to commence in August 2008 and finish in October 2012, for a total of 51 months. Table 1 shows the proposed start and completion dates for the individual phases.

Table 1: Proposed construction schedule

Phase	Start Date	Completion Date	Estimated Duration
1	August 2008	January 2011	630 days
2	December 2010	October 2012	468 days
3	November 2008	September 2011	748 days

As a worst-case scenario, up to three open trench and three jacking operations, in addition to tunnel operations, are anticipated to occur simultaneously over three pipeline phases during peak construction activity.

Construction would generally occur between 7:00 a.m. and 6:00 p.m. Monday through Friday (10-hour work day) and 8:00 a.m. to 5:00 p.m. on Saturdays (8-hour work day). No nighttime construction activities are proposed within public rights-of-way. However, dewatering equipment may remain in 24-hour operation throughout the duration of activities conducted below the groundwater surface. Also, as the schedule dictates, tunneling production may require night shift work.

3 Fundamentals of Noise

Rapid variations in ambient air pressure are perceived as sound by the human ear when they occur within certain limits. Specifically, the ear is sensitive to variations which occur at the rate of twenty times per second (20 Hertz) to twenty-thousand times per second, and at pressure differentials of at least twenty millionths of a Pascal (20 micropascals).

These are extreme limits for healthy ears. Most human hearing takes place in the frequency range of 100 Hz to 10,000 Hz, with the highest sensitivity at about 4,000 Hz. The human voice contains most of its energy in the frequency range between 125 Hertz and 8,000 Hertz.

The pressure variation of 20 micropascals is the lower limit of perceptibility. Human hearing extends from this limit up to the threshold of discomfort where pressure variations approach 20 pascals—a range of one million to one. Because of this large range of values, sound pressure is usually measured in terms of “decibels”:

$$L = 20\log(\frac{P}{P_o})$$

L is the value of sound pressure *level* in decibels, **P** is the mean pressure variation, and $\mathbf{P_o}$ is the lower limit described above. Sound pressure levels are referenced to the lower limit of hearing, meaning a level of zero decibels corresponds to that limit whereas a level of one-hundred decibels represents a pressure variation one-hundred thousand times greater than that limit. The logarithmic conversion provides a compression effect. Thus, sound pressure level is a method of expressing the wide range of human hearing in a manageable range of numerical values.

Because of the logarithmic conversion, decibel arithmetic works differently than ordinary arithmetic. Doubling the sound power in a measured environment results in only a three decibel addition to the measured values, not a doubling of the number of decibels; a ten-fold increase in the sound power results in an addition of ten decibels to the measured value. Similarly, averaging sound levels involves taking the anti-logarithms of measured sound levels. A simple arithmetic average of sound levels produces meaningless results, particularly if the two levels are widely divergent. (Note, however, that local ordinances often use a simple arithmetic average of sound levels when setting statutory thresholds on property-line limits involving two different zoning areas.)

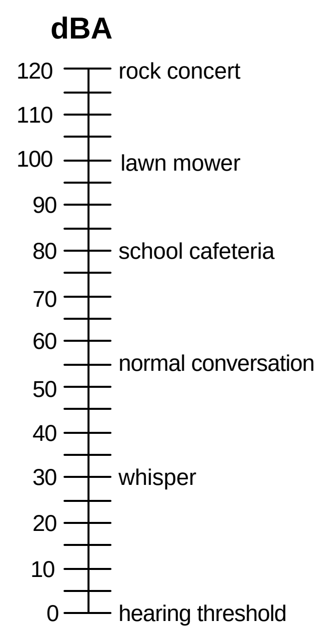


Figure 2

Conveniently, human perception of “loudness” is also approximately logarithmic. A three decibel change in sound level is just noticeable to most people. A five decibel change is readily noticeable, whereas a change of ten decibels is usually perceived as a doubling of the "volume".

Because human hearing is not equally sensitive at all frequencies, various weighting schemes have been developed to account for these variations. The most commonly used is the "A" weighting. It heavily discounts measured levels at lower frequencies, while providing slight emphasis around 2500 Hertz. The abbreviation for decibels is "dB". When levels have been A-weighted, they are expressed as "dBA" or "dB(A)". Figure 2 depicts several representative noise sources and the A-weighted sound levels they produce at a typical receiver location.

Objects in the environment rarely produce steady levels of noise. Fluctuating levels produce fluctuating measurements, thus requiring a method of describing the noise environment in a meaningful way. The common method in use is the equivalent-continuous sound level, abbreviated L_{eq}, which expresses the energy-average noise level over a specified interval of time (typically one hour). It is important to note that, like other averaging methods, L_{eq} does not indicate the range of noise level measurements. Two identical values of L_{eq} may represent two widely different ranges of actual noise measurements. Because of the logarithmic nature of expressing sound level, however, very loud sounds of any significant duration will tend to "swamp" quieter sounds of longer duration, thus biasing measurements in favor of the louder sounds.

Because quieter conditions are normally preferred during sleeping hours, various measures have been developed which account for additional annoyance produced by noises occurring at night. In California, the Community Noise Equivalent Level (CNEL) is standard in most statutes and requirements. CNEL is a twenty-four hour "equivalent" noise level. It accounts for the additional annoyance above by adding a 5 decibel penalty to noises measured between 7 p.m. and 10 p.m., and a 10 decibel penalty to noises between 10 p.m. and 7 a.m. . An alternative measure, the Day-Night Level (DNL or L_{dn}) is similar to CNEL but does not assess a penalty from 7 p.m. to 10 p.m.

DNL and CNEL are average values only. Because a noise source produces a DNL or CNEL value below a specified threshold does not mean that the noise will be inaudible. Rather, DNL and CNEL thresholds are normally set so that the occurrence of a disturbing noise is not so frequent that it causes substantial annoyance to people or other receivers in the affected area.

4 Applicable Regulations

4.1 General

The project will extend through portions of both Los Angeles and Burbank, and therefore be subject to noise ordinances of both of these cities. Thresholds of significant environmental impact are established by the California CEQA Guidelines and the Los Angeles Environmental Quality Act Guidelines, the latter of which incorporates the former by reference. The California CEQA Guidelines refer to levels set by local code or general plan in establishing significance thresholds. Thresholds regarding acceptable vibration levels have been established by the Federal Transit Administration (FTA) and others; those of the FTA are used herein.

4.2 California CEQA Guidelines

The California CEQA Guidelines establish the following criteria for determining a significant impact due to project noise:

Would the project result in:

a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?

c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?

d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?

e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?

All of the above criteria will be addressed in the EIR for this project, however, only paragraphs (a), (b), and (d) are considered in this study.[1]

Paragraph (a) refers to noise limits set by local regulations or general plans. For this project, the ordinances, noise elements, and other documents of Los Angeles (city) and Burbank would apply, and are addressed below. A definition of "excessive" groundborne

[1] This project will not create any permanent operational noise, as addressed by criterion (c), and will not introduce any noise-sensitive receivers in the vicinity of Burbank Airport, as addressed by criteria (e) and (f).

vibration, as discussed in paragraph (b), is developed below and based indirectly on criteria set forth by the Federal Transit Administration for rail vibration. Similarly, a "substantial" increase in ambient noise, as discussed in paragraph (d), is defined below.

4.3 Los Angeles Municipal Code

Chapter 11 of the Los Angeles municipal code regulates noise within the city. Section 112.03, however, defers regulation of construction noise to section 41.40 under chapter 4 (Public Welfare):

```
SEC. 112.03.  CONSTRUCTION NOISE.
Noise due to construction or repair work shall be regulated as
provided by Section 41.40 of this Code.
```

Section 41.40 does not set permissible noise level limits, but instead regulates the hours during which construction may be carried out. Specifically, it prohibits between the hours of 9 p.m. and 7 a.m. the use of machinery which "makes loud noises to the disturbance of persons occupying sleeping quarters in any dwelling hotel or apartment or other place of residence." It further prohibits, during these hours, "the operation, repair or servicing of construction equipment and the job-site delivering of construction materials" in such residential zones. These restrictions do not apply in any manufacturing or industrial zoned areas, or if written permission is obtained from the Board of Police Commissioners.

Section 41.40 further restricts construction activities occurring with 500 feet of a residential property (including maintenance and materials delivery) to the hours of 8 a.m. and 6 p.m. on Saturdays and national holidays, and prohibits activities entirely on Sundays. Again, the Board of Police Commissioners has the authority to grant a waiver to these restrictions.

Despite the above deferral of construction noise regulation to section 41.40, section 112.05 of the code clearly limits the permissible noise emissions from construction machinery. Specifically, this section requires that noise levels not exceed 75 dBA as measured at a distance of fifty feet from any "construction, industrial, [or] agricultural" machine. These include "crawler-tractors, dozers, rotary drills and augers, loaders, power shovels, cranes, derricks, motor graders, paving machines, off-highway trucks, ditchers, trenchers, compactors, scrapers, wagons, pavement breakers, compressors and pneumatic or other powered equipment." This requirement does not apply, however, "where compliance therewith is technically infeasible", meaning that "noise limitations cannot be complied with despite the use of mufflers, shields, sound barriers and/or other noise reduction device or techniques during the operation of the equipment".

4.4 Los Angeles Noise Element

The noise element of the Los Angeles general plan does not prescribe any specific noise levels in regard to construction. Its most relevant statement is Objective 2 which states:

> Reduce or eliminate nonairport related intrusive noise, especially relative to noise sensitive uses.

The conjunctive Policy 2.2 states:

> Enforce and/or implement applicable city, state and federal regulations intended to mitigate proposed noise producing activities, reduce intrusive noise and alleviate noise that is deemed a public nuisance.

4.5 Los Angeles Environmental Quality Act Guidelines

The City of Los Angeles has replaced its previous CEQA Guidelines with a document that incorporates the California CEQA guidelines by reference, and adds a list of exclusions. It does not set specific thresholds for acceptable noise levels or noise level increases due to a project. The following excerpt from the new document provides the essence of its contents:

> **CITY OF LOS ANGELES**
> **ENVIRONMENTAL QUALITY ACT GUIDELINES**
> **Adopted** : July 31, 2002 - **CF#** : 02-1507
> **Section 1.** Articles II, IV through VI, and VIII through X of the 1981 City CEQA Guidelines are hereby repealed.
> **Section 2.** Article I of the City CEQA Guidelines is hereby amended to read as follows:
>
> > **"Article I. INCORPORATION OF STATE CEQA GUIDELINES**
> > The City hereby adopts as its own City CEQA Guidelines all of the State CEQA Guidelines, contained in title 15, California Code of Regulations, sections 15000 et seq, and incorporates all future amendments and additions to those guidelines as may from time to time be adopted by the State."
>
> **Section 3.** Article III of the City CEQA Guidelines is hereby renumbered as Article II and is amended to read as follows:
>
> > **"ARTICLE II: EXEMPTIONS..."** [a list of exempted activities follows]
>
> **Section 4.** Article VII of the City CEQA Guidelines is hereby renumbered as Article III and reads as follows:
>
> > **"ARTICLE III: CATEGORICAL EXEMPTIONS..."** [a list of categorically-exempted activities follows]

4.6 Burbank Municipal Code

Chapter 21 Article 2 (Environmental Protection - Noise Control) of the Burbank municipal code regulates the emission of noise within the city. Section 21-209 appears to exempt construction noise from any numerical noise-level limit, however, controlling instead the permissible hours of activity. It reads as follows:

> **Sec. 21-209. Construction in Residential Areas; Exception.**
> (a) HOURS DURING WHICH CONSTRUCTION IS PROHIBITED.
> It is unlawful for any person performing a Construction activity that requires a building permit in any zone other than R-1, R-1-H, and R-1-E, within a radius of five hundred feet measured from the nearest property line of any residentially zoned property, to operate Construction Equipment or perform any outside Construction on buildings, structures or projects (as those capitalized terms are defined in Section 31-203) within the city other than during the following hours:

Sites 500 Feet or Less from a Residential Zone *	
Monday – Friday	7:00 a.m. to 7:00 p.m.
Saturday	8:00 a.m. to 5:00 p.m.
Sunday and Holidays	None

The section further requires that a sign(s) be posted on the construction site stating the times and days during which construction is permitted. The Community Development Department, the Planning Board, or the City Council may grant exceptions to the above restrictions.

4.7 Burbank Noise Element

The noise element of the Burbank general plan lists areas where noise is a problem within the city, and provides guidelines for its abatement. It does not prescribe any specific noise levels in regard to construction.

4.8 Federal Transit Administration Vibration Impact Criteria

A search of the Los Angeles and Burbank municipal codes yielded no applicable regulation over permissible levels of groundborne vibration and consequent groundborne noise. Lacking any specific vibration limits in local regulations, a determination of significance for this study was based on other available and relevant criteria.

The Federal Transit Administration has set forth a number of criteria to determine whether groundborne vibration is likely to cause annoyance or interfere with activities within a building. These criteria are provided in tables 8-1 and 8-2 of the FTA document *Transit Noise and Vibration Impact Assessment* (May 2006), and are reproduced here. While they carry no statutory authority for this project, they provide a reasonable baseline to determine significant impacts. Though these criteria were developed specifically to assess vibration impacts from trains, they should also serve well for construction activities.

Table 2 below states criteria for three general categories of building use, with Category 1 having the most stringent criteria. Briefly, Category 1 refers to buildings with vibration-sensitive operations, such as medical or manufacturing equipment whose function maybe affected by even imperceptible vibrations. Category 2 refers to buildings where sleep-disturbance may occur, such as residences, hotels, and hospitals. Category 3 refers to buildings such as schools and churches where vibration may interfere with activities but not operation of sensitive equipment.

Within a category, criteria may vary depending upon the frequency of occurrence of a vibration-inducing event.[2] Infrequent events are considered those which occur less than 30 times per day, occasional events are those which occur between 30 and 70 times per day, while frequent events occur more than 70 times per day. Construction activity is considered to fall within the latter class, and therefore has the most stringent criteria within each category.

Levels in the table are stated as decibels referenced to one micro-inch per second, also called "velocity-decibels". They are computed using the root-mean-square (rms) of the ground velocity (not acceleration), and represent the logarithmic sum across the spectrum without any weighting.

Table 2: Groundborne vibration criteria - general assessment (Vdb re 1 m-inch/sec)

Land Use Category	Frequent Events	Occasional Events	Infrequent Events
Category 1: buildings where vibration would interfere with interior operations	65 VdB	65 VdB	65 VdB
Category 2: residences and buildings where people normally sleep	72 VdB	75 VdB	80 VdB
Category 3: institutional land uses with primarily daytime use	75 VdB	78 VdB	83 VdB

Levels provided in Table 2 are broad-scope criteria for general use in many different types of land-use. Certain buildings, however, have specific functions which do not adequately fit into any of the three categories. Specifically, these include concert halls, television and recording studios, auditoria, and theaters. As a result, levels in Table 3 below were developed to address these "special-use" buildings.

Vibration criteria set forth above were all developed with regard to annoyance, not structural damage. Vibration levels well above these are typically required to cause even minor cosmetic damage to a building, and separate criteria are employed to determine potential structural impact.

[2] The premise is that infrequent events are less likely to disturb than frequent events of the same level.

Table 3: Groundborne vibration criteria - special-use buildings (Vdb re 1 m-inch/sec)

Land Use Category	Frequent Events	Occasional or Infrequent Events
Concert halls	65 VdB	65 VdB
TV studios	65 VdB	65 VdB
Recording studios	65 VdB	65 VdB
Auditoriums	72 VdB	80 VdB
Theaters	72 VdB	80 VdB

5 Setting

5.1 Existing Land Uses

5.1.1 General

With the exception of that portion south of the Los Angeles River, the project will pass entirely through existing urban and suburban developments, with varying levels of residential and commercial use as shown in Figure 3. In broad terms, the Phase 1 area of the project is mixed residential and commercial, the Phase 2 area is primarily commercial, while Phase 3 is residential and parks. Each of these phases is discussed in further detail below.

Note that the potential exists that sensitive historic buildings or other fragile structures exist close to the project route which may be subject to cosmetic damage from vibration due to tunneling. Such damage would be limited to minor cracking of plaster and similar effects resulting from the age or condition of the building. No attempt was made to identify such structures for this study, and it would be incumbent upon the contractor to determine which, if any, buildings along the tunnel routes fall under this category.

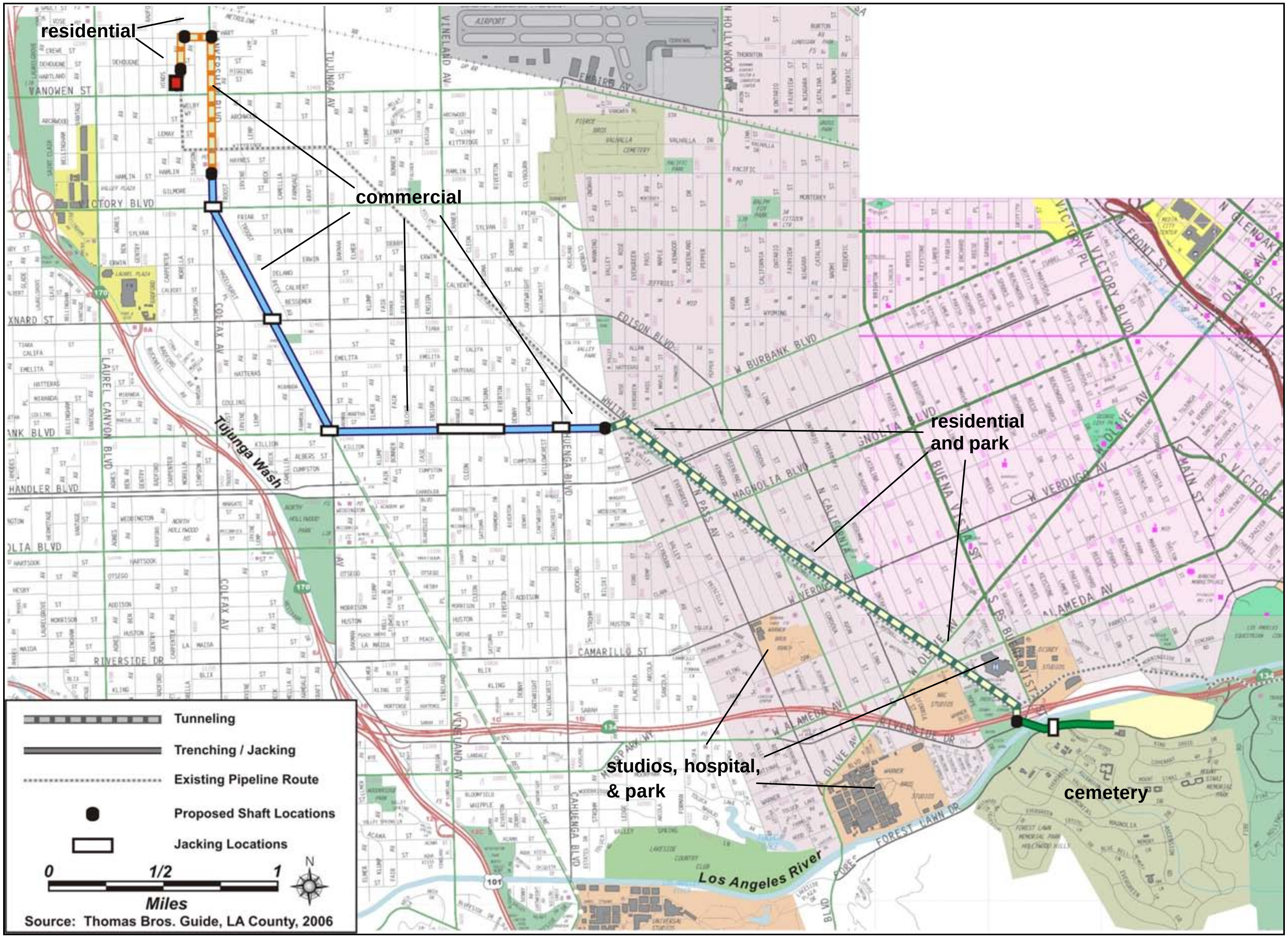


Figure 3: Notional land-use map

5.1.2 Phase 1

The Phase 1 area comprises the tunneling portion from the North Hollywood pump station to the intersection of Lankershim Boulevard and Victory Boulevard. Areas off of Lankershim Boulevard are primarily single and multi-family residences, such as shown in Figure 4. Other noise-sensitive uses include the Sagrado Corazon De Jesus Church and the Iglesia Pentecostes Church.

Along Lankershim Boulevard, land uses are primarily dense urban commercial, as shown in Figure 5, with few sensitive uses such as the Kiddie Academy shown in Figure 6. A medical clinic lies about a block east of Lankershim Boulevard near Archwood Street. The Phase 1 area is also subject to frequent noise from aircraft servicing Burbank Airport, as shown in Figure 7.

Figure 8 and Figure 9 provide an overview of the locations of noise-sensitive receivers with respect to the project alignment. Those receivers of concern, due to their proximity to the project, include:

- residences along Morella Avenue and Hart Street (Figure 8)
- Sagrado Corazon De Jesus church on Lankershim Boulevard (Figure 8)
- Inglesia Pentecostal Unida church on Lankershim Boulevard (Figure 8)
- Kiddie Academy on Lankershim Boulevard (Figure 9).

Figure 4: Residences on Hart Street & Morella Avenue

Figure 5: Lankershim Blvd. & Kittridge Street

Figure 6: Kiddie Academy on Lankershim Blvd.

Figure 7: Aircraft approaching Burbank Airport in the Phase 1 area

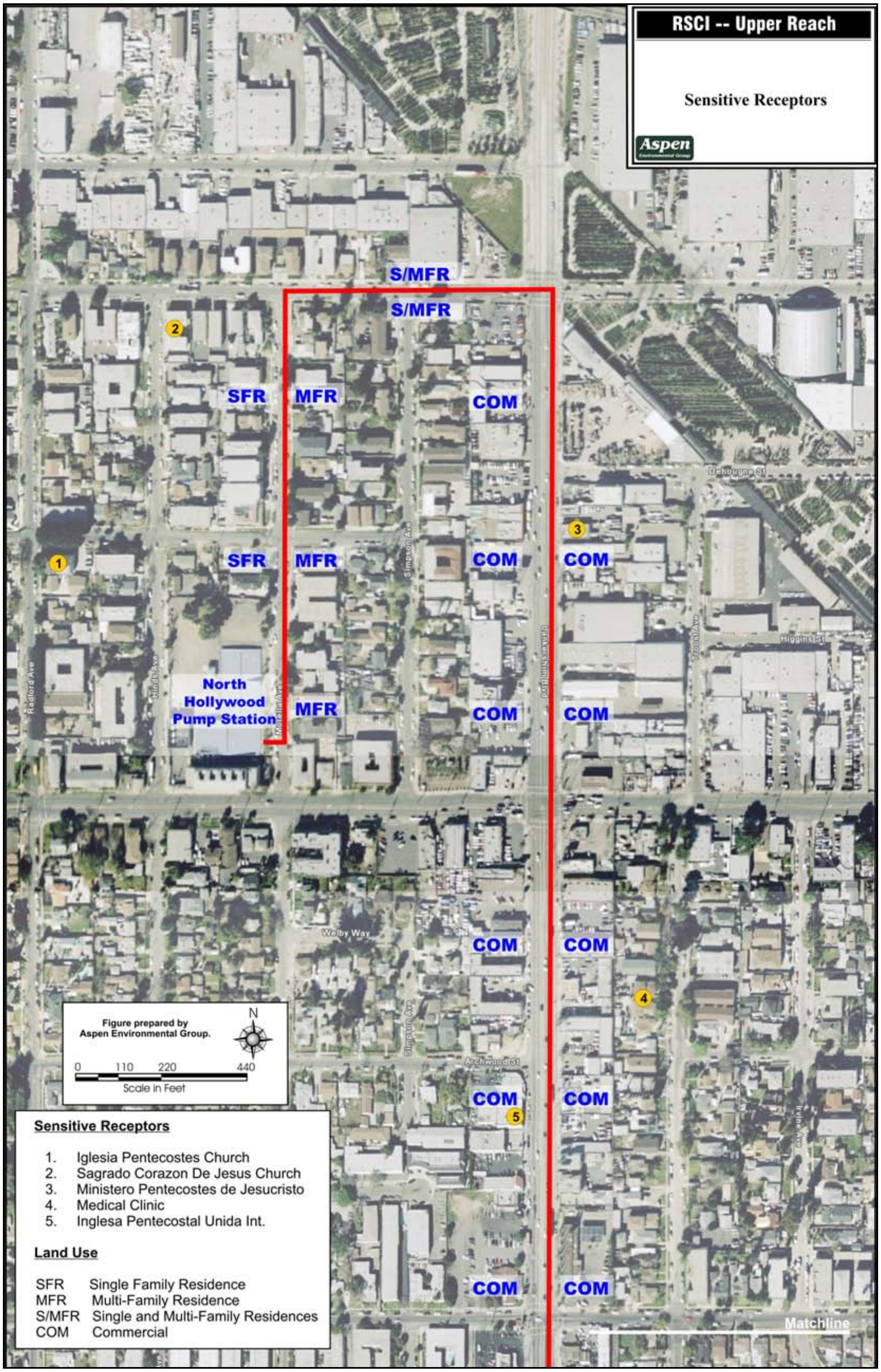


Figure 8: Sensitive receivers - Phase 1 (1 of 2)

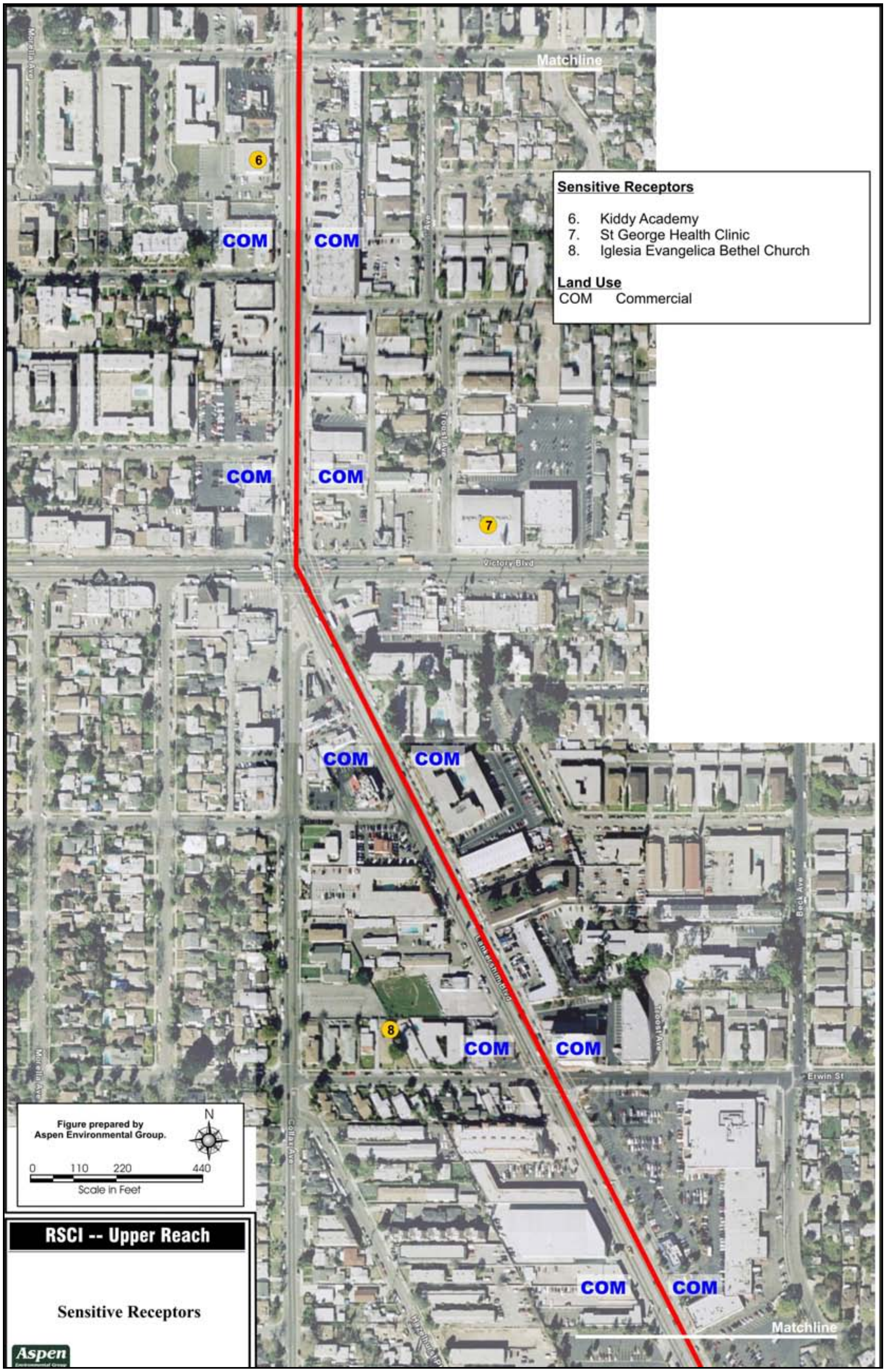


Figure 9: Sensitive receivers - Phase 1 (2 of 2)

5.1.3 Phase 2

The Phase 2 area comprises the open-trenching and jacking portion of the project extending approximately from the intersection of Lankershim Boulevard and Victory Boulevard to the intersection of Burbank Boulevard and Biloxi Avenue near the Burbank border. This portion of the project is largely high-density urban commercial, with some sensitive receivers interspersed. Figure 10 is representative of the land uses along Burbank Boulevard, this view being from the intersection of Satsuma Avenue. The Maurice Sendak Elementary School on Lankershim Boulevard (Figure 11) constitutes a noise-sensitive use, however, the actual school buildings are set back from Lankershim Boulevard by several hundred feet. The playgrounds of this school are still of concern.

A number of other noise-sensitive uses lie along this phase, as indicated in Figure 12 through Figure 14. Those receivers of concern, due to their proximity to the project, are:

- Lankershim Medical Clinic (Figure 12)
- Inglesia Pentecostes Fuente de Luz (Figure 12)
- Maurice Sendak Elementary School (Figure 12)
- Family Hope Medical Clinic (Figure 12)
- Multi-congregational church (Figure 12)
- The Center @ North Hollywood Church (Figure 13)
- Inglesia Pentecostes (Figure 13)
- L.A. Urgent Care Clinic
- West Coast Seminary (Figure 13)
- Triune Science of Being School (Figure 14)
- Lonny Chapman Group Repertory Theatre (Figure 14)
- Medical Career College (Figure 14)
- Jehovah's Witnesses Congregation (Figure 14)
- Ministerio Palabra Verdad Y Vida (Figure 14)
- Cahuenga Potters Studio (Figure 14)[3]
- Iglesia De Dios (Figure 14)
- Screenland Studios (Figure 14)

[3] The Cahuenga Potters Studio would not normally be considered a sensitive receiver, however, filming was observed at this location in October 2007.

Figure 10: Burbank Blvd. & Satsuma Avenue

Figure 11: Maurice Sendak Elementary School

Figure 12: Sensitive receivers - Phase 2 (1 of 3)

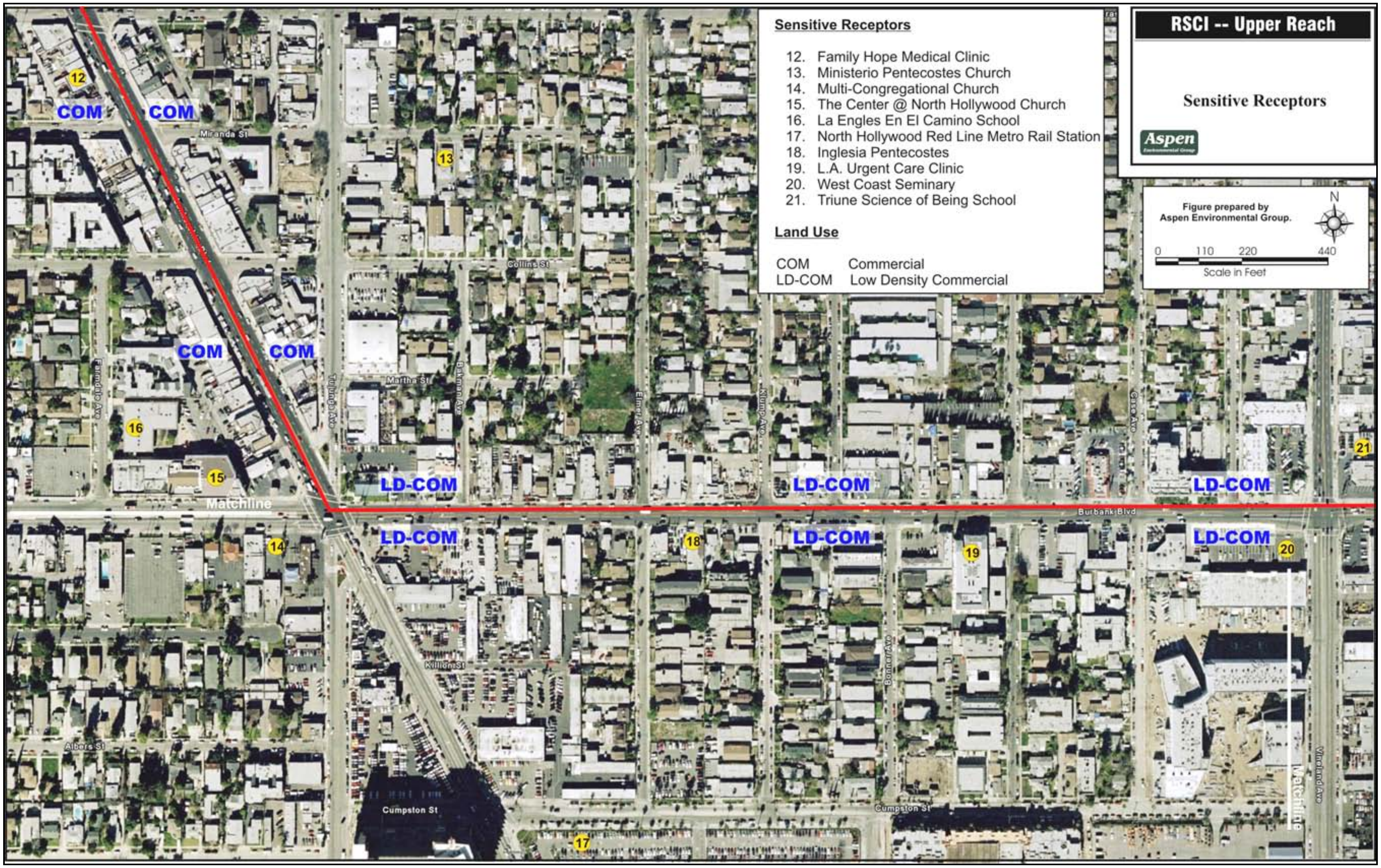


Figure 13: Sensitive receivers - Phase 2 (2 of 3)

Figure 14: Sensitive receivers - Phase 2 (3 of 3)

5.1.4 Phase 3

The Phase 3 area comprises the entirely-tunnel portion under Burbank and the short trenching section in Los Angeles on the south side of the river.

The stretch through Burbank is primarily residential along Whitnall Highway from the north end of this section to around Olive Avenue. Figure 15 shows residences near the Chandler Boulevard intersection, which are subject to heavy air-traffic noise from Burbank Airport. Figure 16 shows residences further south near Verdugo Avenue. In addition to residences, this stretch of Whitnall Highway also includes abundant park land and a number of schools, as shown in Figure 18 through Figure 20.

Land uses along the project alignment below Olive Avenue become more commercial, and include the NBC and Disney studios, and Providence Saint Joseph Medical Center (Figure 21). The Burbank section of the project terminates in the Johnny Carson Park. These areas are affected by noise from Ventura Freeway as well as heavily traveled local roads such as Alameda Avenue.

Cemeteries constitute the only sensitive land use south of the Los Angeles river until the project terminates at the Headworks Spreading Grounds, as shown in Figure 17, Figure 22, and Figure 23. This area is dominated by noise from both Ventura Freeway and Forest Lawn Drive.

Those receivers of concern, due to their proximity to the project, include:

- Universal Adult Day Care (Figure 18)
- Fred Wolfe Films (Figure 18)
- Whitnall Highway Park North (Figure 18 and Figure 19)
- Media Center Montessori Pre-school (Figure 19)
- American Lutheran Church and School (Figure 19)
- Robert Louis Stevenson Elementary School (Figure 20)
- CCI Digital (Figure 21)
- NBC TV, D Lot and NBC Studios (Figure 21)
- Providence Saint Joseph Medical Center (Figure 21)
- Burbank Medical Plaza and Emergency Medical Group (Figure 21)
- Johnny Carson/Buena Vista Park (Figure 21)
- Providence High School (Figure 21)
- Lod Cook Center/Junior Achievement Foundation (Figure 22)
- Forest Lawn Mortuary and Memorial Park (Figure 22)
- Mt. Sinai Mortuary and Memorial Park (Figure 22).

Figure 15: Residences along Whitnall Highway near Chandler Blvd.

Figure 16: Whitnall Highway near Verdugo Avenue

Figure 17: Forest Lawn Drive with cemeteries in background

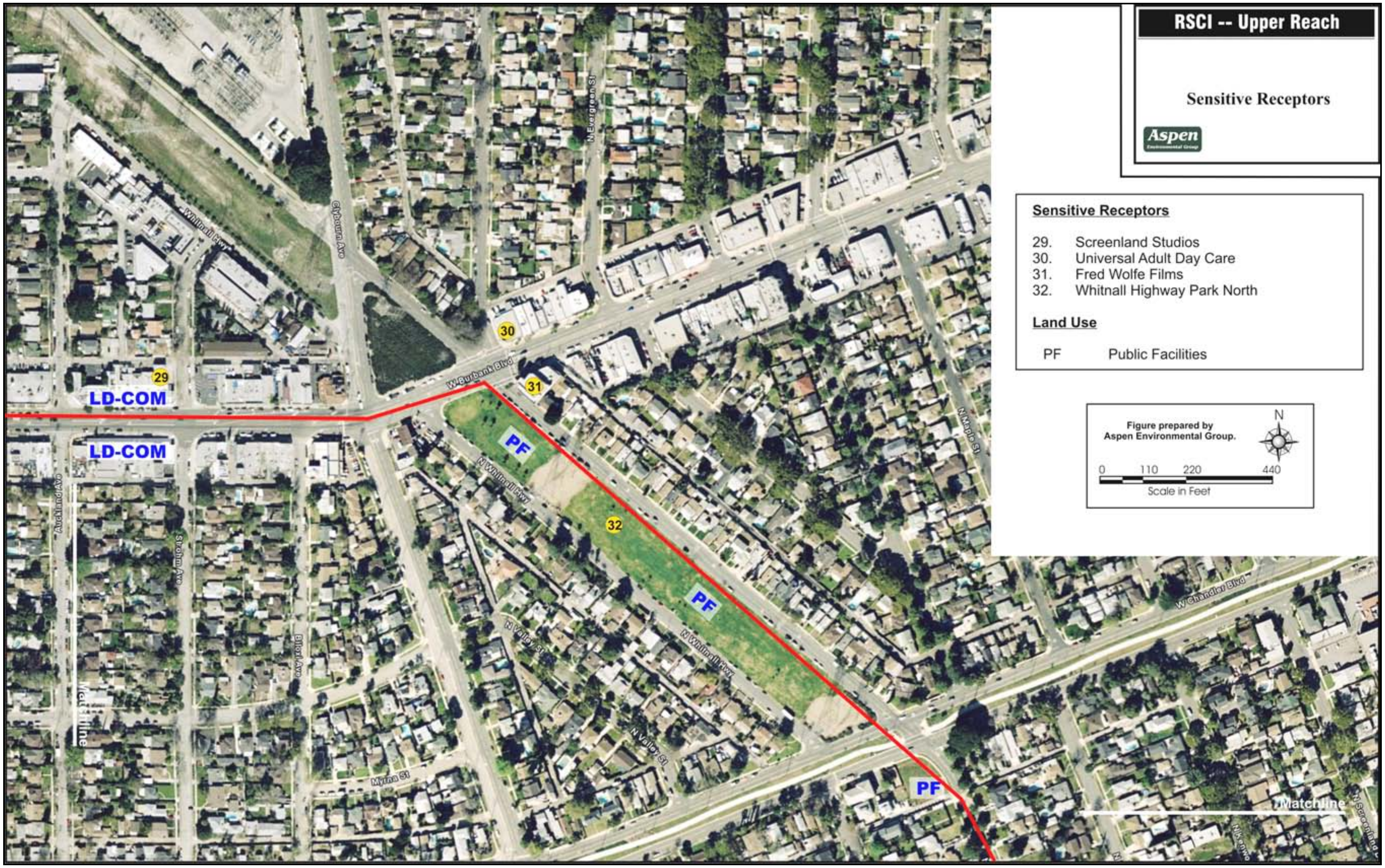


Figure 18: Sensitive receivers - Phase 3 (1 of 6)

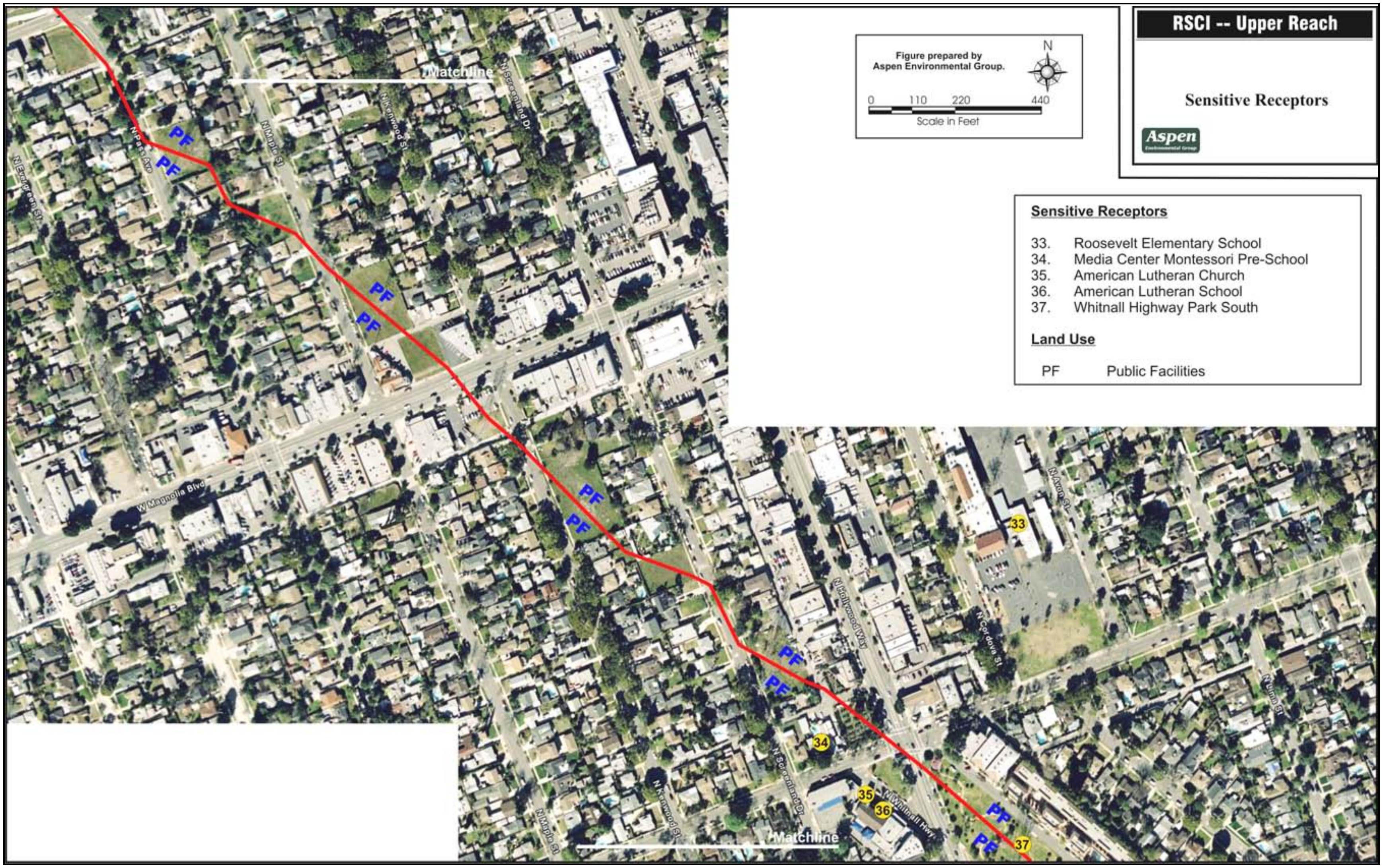


Figure 19: Sensitive receivers - Phase 3 (2 of 6)

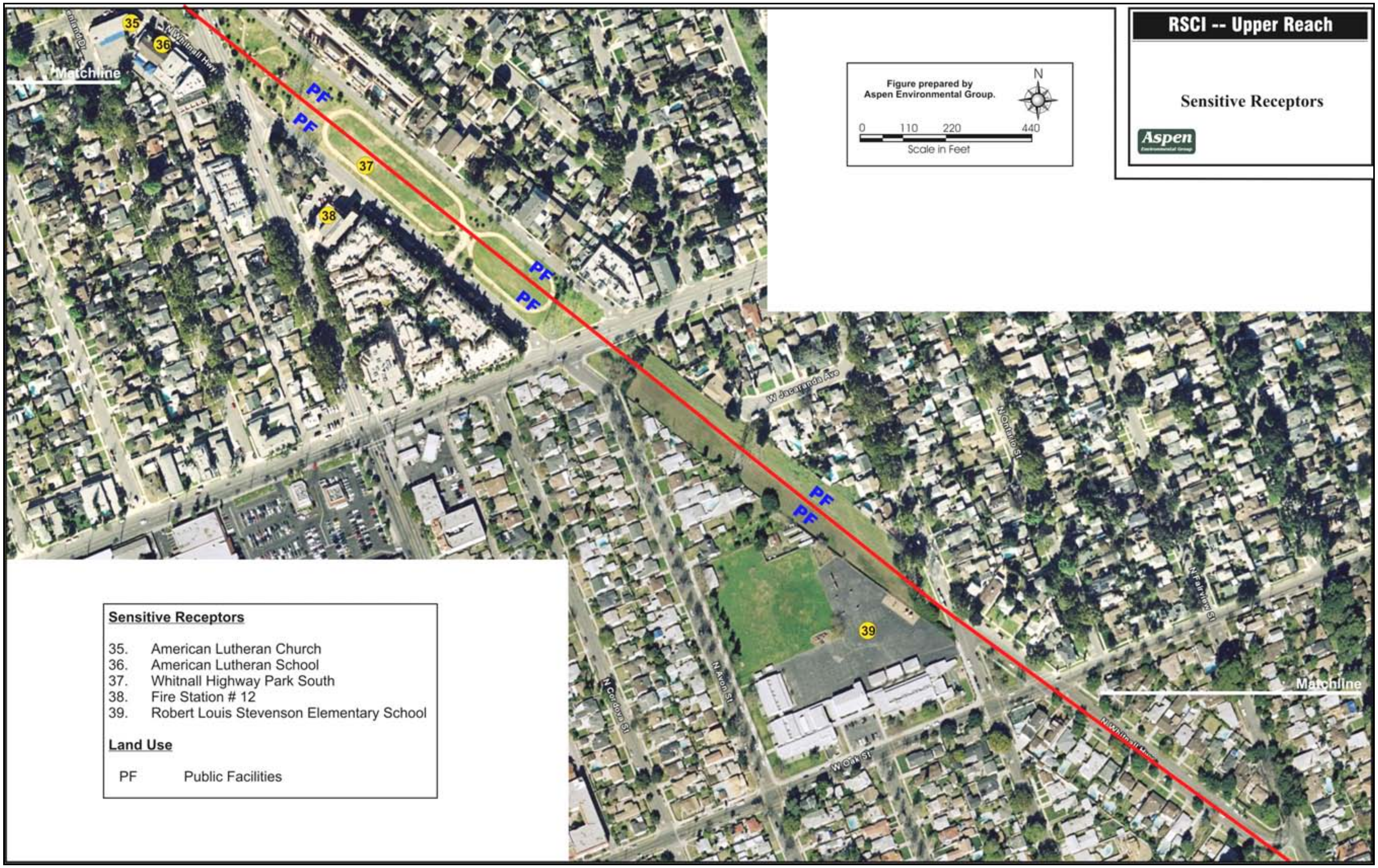


Figure 20: Sensitive receivers - Phase 3 (3 of 6)

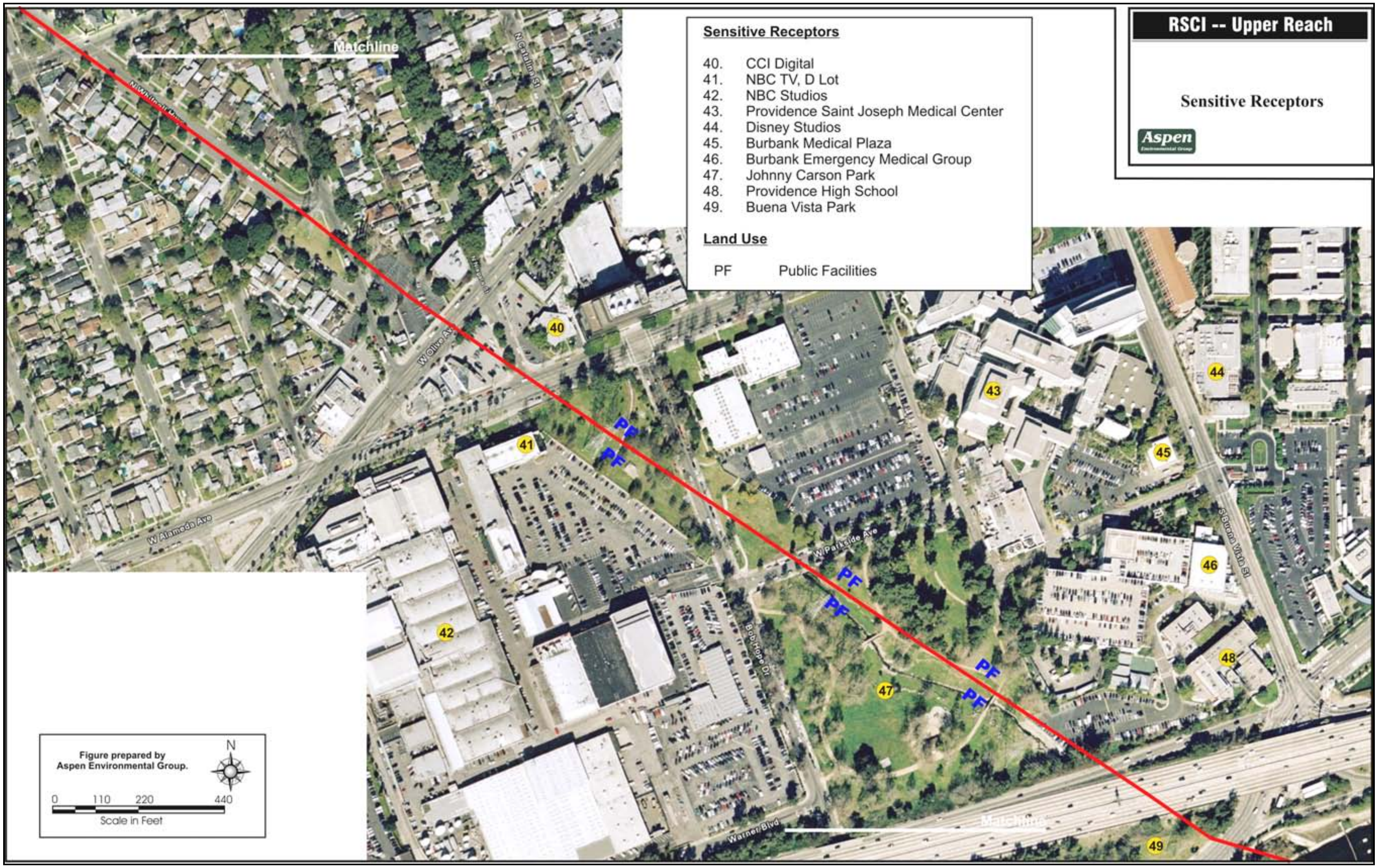


Figure 21: Sensitive receivers - Phase 3 (4 of 6)

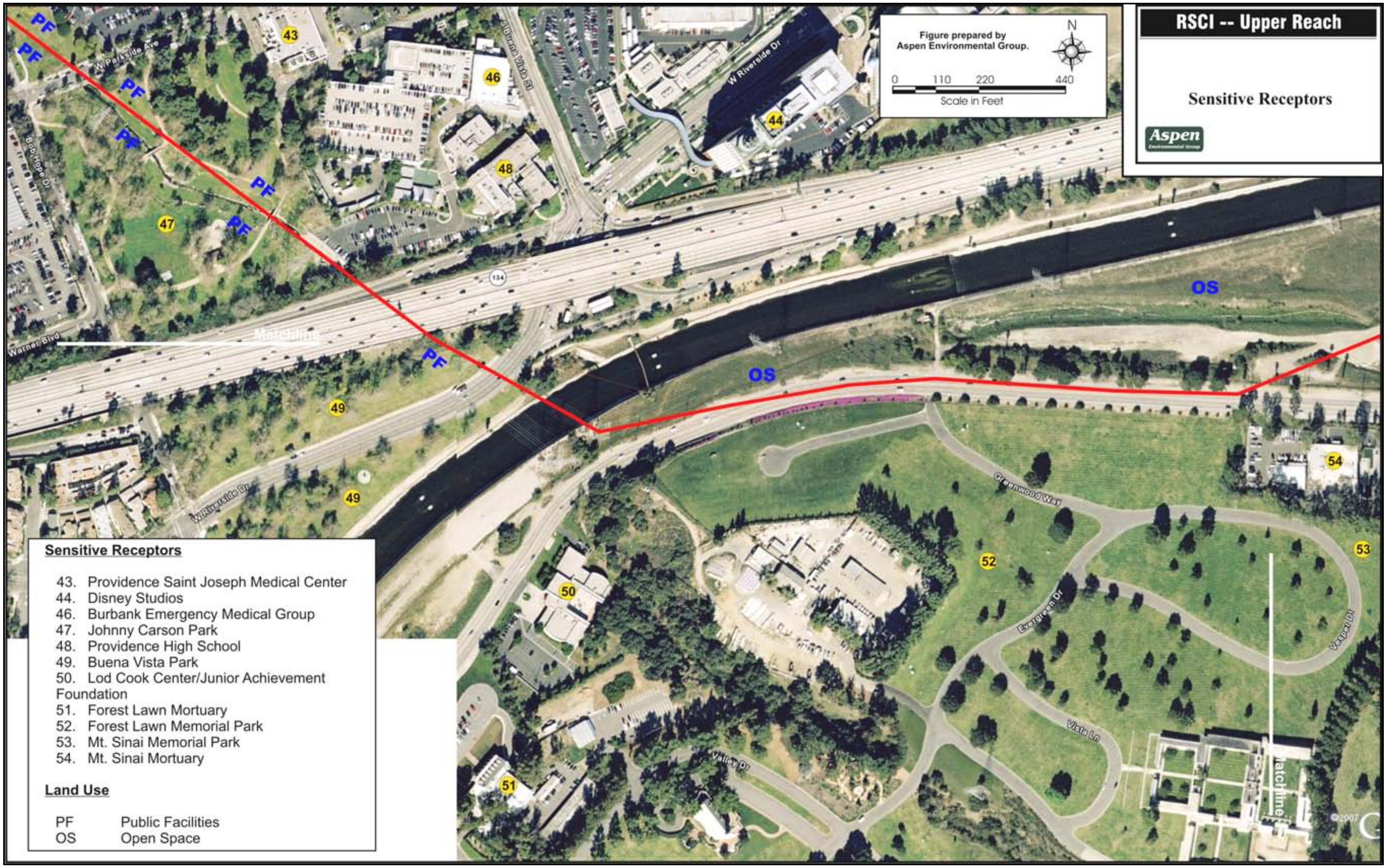


Figure 22: Sensitive receivers - Phase 3 (5 of 6)

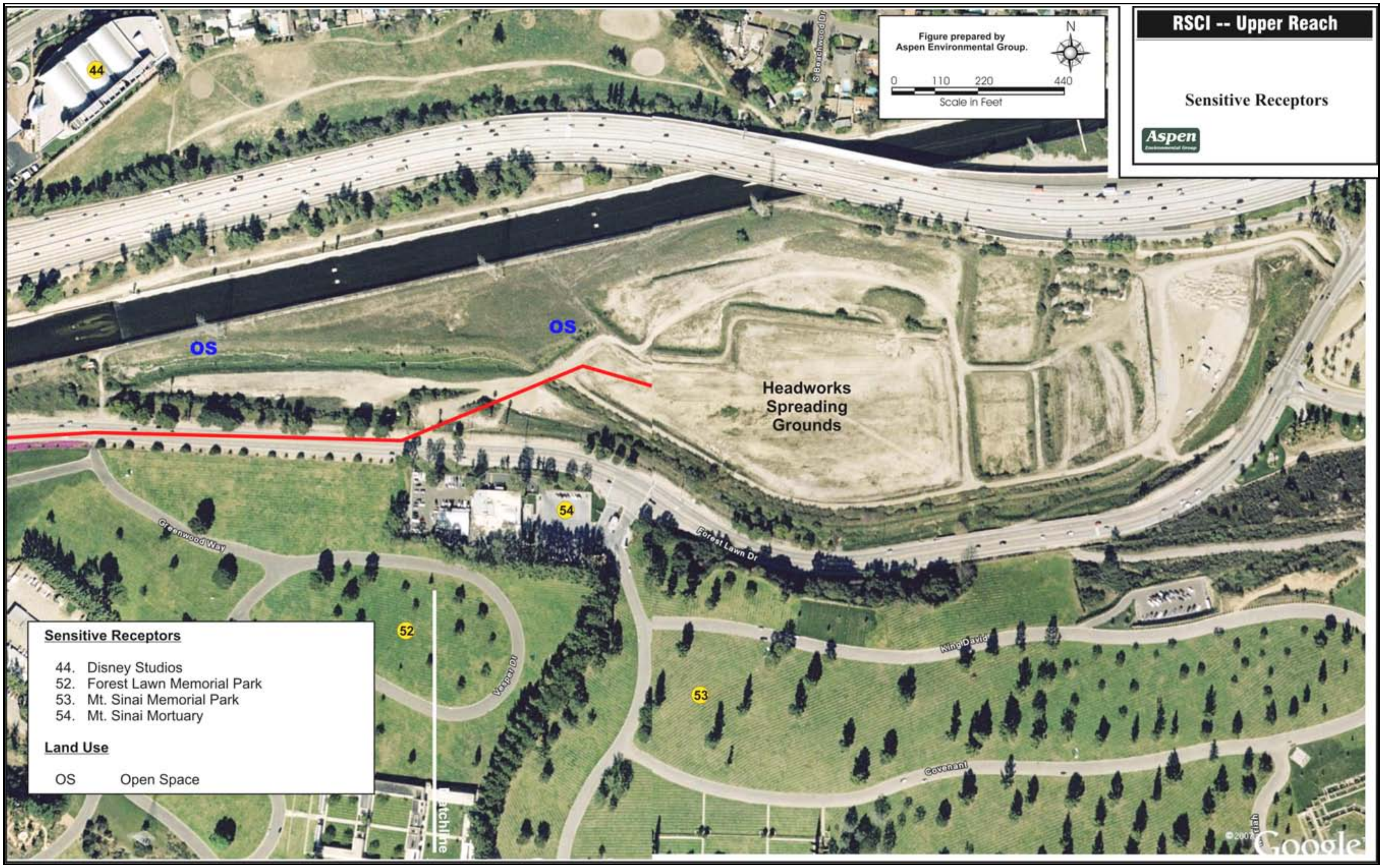


Figure 23: Sensitive receivers - Phase 3 (6 of 6)

5.2 Existing Ambient Noise Levels

In order to document existing noise levels along the project alignment, fourteen ambient noise measurements were conducted around midday on 30 March and 1 April 2007.[4] Measurement results are summarized in Table 4 below, with approximate measurement locations shown in Figure 24. Measurements were nominally fifteen minutes in duration each. Levels shown in the table and figure reflect the A-weighted average noise level over each measurement duration (dBA-Leq).

As expected, ambient noise levels in residential areas such as those along Whitnall Highway are generally lower than those in the commercial district along Lankershim and Burbank Boulevards. Frequent aircraft activity over residential areas both west and south of Burbank Airport, however, raises the ambient noise levels above what would normally be measured at these locations.

Measurements were conducted as follows:

- Three measurements ("a", "b", "c") conducted near the north part of Phase 1 ranged between 60 to 66 dBA. These were all in the residential area near the North Hollywood Pump Station, and were chosen to represent the tunnel-shaft work locations. These measurements included aircraft noise and varying degrees of traffic noise from Lankershim Boulevard.

- A measurement ("d") at the intersection of Kittridge Street and Lankershim Boulevard produced an average noise level of about 67 dBA, due primarily to street traffic, though it also included some low-level construction nearby. This is primarily a commercial district with residences behind, however the Kiddie Academy of Figure 6 above is situated next to this intersection. This location was measured to baseline conditions at the Kiddie Academy and the nearby tunnel-shaft access and jacking areas.

- A measurement ("e") was conducted further down Lankershim Boulevard near the Oxnard Street jacking area and the North Hollywood New Elementary School of Figure 11 above. This district is also primarily commercial along Lankershim Boulevard, with residences behind. The average noise level measured was 62 dBA, which was due primarily to street traffic though it also included some aircraft.

- A measurement ("f") in front of the central jacking area on Burbank Boulevard (by the intersection of Satsuma Avenue) produced an average noise level of about 71 dBA (approximately 68 dBA if the effects of an ambulance siren are removed). This area is also heavily commercial along Burbank Boulevard, with residences to the

[4] Measurements conducted with a Larson Davis 824 Type 1 sound level meter and spectral analyzer, fitted with windscreen and calibration-checked before and after measurements; microphone height was five feet above ground for all measurements; weather 30 March 73 degrees, 42% relative humidity, winds less than 5 mph; weather 1 April 71 degrees, 64% relative humidity, winds calm.

north beyond. Noise levels here are driven primarily by traffic on Burbank Boulevard, with some aircraft effects present.

- Four measurements ("g" through "j") were conducted along the primarily residential Whitnall Highway corridor in Burbank, including the tunnel access shaft on the north end of Phase 3. These locations have less road traffic noise than do the commercial districts, however, they experience frequent high-level noise peaks due to passing aircraft. Consequently, ambient noise levels measured along this corridor ranged from 58 to 69 dBA, depending upon the level of aircraft activity present.

- Further down Whitnall Highway, another measurement ("k") was conducted near the intersection of Alameda Avenue and Bob Hope Drive, in the vicinity of the studios and Providence Saint Joseph Medical Center. The measurement produced an ambient noise level of 67 dBA, driven primarily by traffic on Alameda Avenue, but also in part by traffic on Ventura Freeway (134).

- A measurement ("l") in Johnny Carson park also resulted in an ambient noise level of 67 dBA, driven primarily by traffic on Ventura Freeway and also Riverside Drive. This location represents the park as a sensitive receiver, and covers construction activity at the shaft location on the south end of Phase 3 as well as a potential staging area in this park.

- A companion measurement ("m") to the one above was conducted at the nearest residences, on the corner of Bob Hope Drive and Riverside Drive. Noise levels here are driven by the same traffic, though the ambient level is somewhat less at around 59 dBA.

- A final measurement ("n") was conducted on the south side of the Los Angeles River, north of Forest Lawn Drive, in the vicinity of the jacking area on south end of Phase 3. This measurement produced a high ambient noise level of 70 dBA, driven by traffic on Forest Lawn Drive and Ventura Freeway.

Table 4: Ambient noise measurements

#	Level (dBA)	Duration (minutes)	Time	Date	Major Use	Location & Description
a	60.2	15	12:15	30-Mar	residential	Morella across from pump station - shaft
b	62.4	15	12:33	30-Mar	residential	Morella & Hart - shaft
c	66.4	15	12:52	30-Mar	residential	Hart & Lankershim - shaft
d	66.7	15	13:21	30-Mar	commercial	Kittridge & Lankershim - Kiddie Academy
e	62.0	19	13:50	30-Mar	commercial	Lankershim & Oxnard - school, jacking
f	70.5	31	14:11	30-Mar	commercial	Satsuma & Burbank
g	61.6	11	11:23	30-Mar	residential/comrcl	Clybourn & Burbank
h	68.8	15	11:00	30-Mar	residential/park	Chandler & Whitnall - grassy area
i	56.3	15	9:56	30-Mar	residential/comrcl	Magnolia & Kenwood
j	58.2	16	10:30	30-Mar	residential/park	Whitnall & Verdugo - grassy area
k	67.0	15	11:06	1-Apr	commercial	Alameda & Bob Hope - studios, medical
l	67.2	15	10:45	1-Apr	park	Johnny Carson Park - shaft and staging
m	59.4	16	10:23	1-Apr	residential	Bob Hope & Riverside
n	70.2	15	12:44	1-Apr	--	Headworks/Forest Lawn

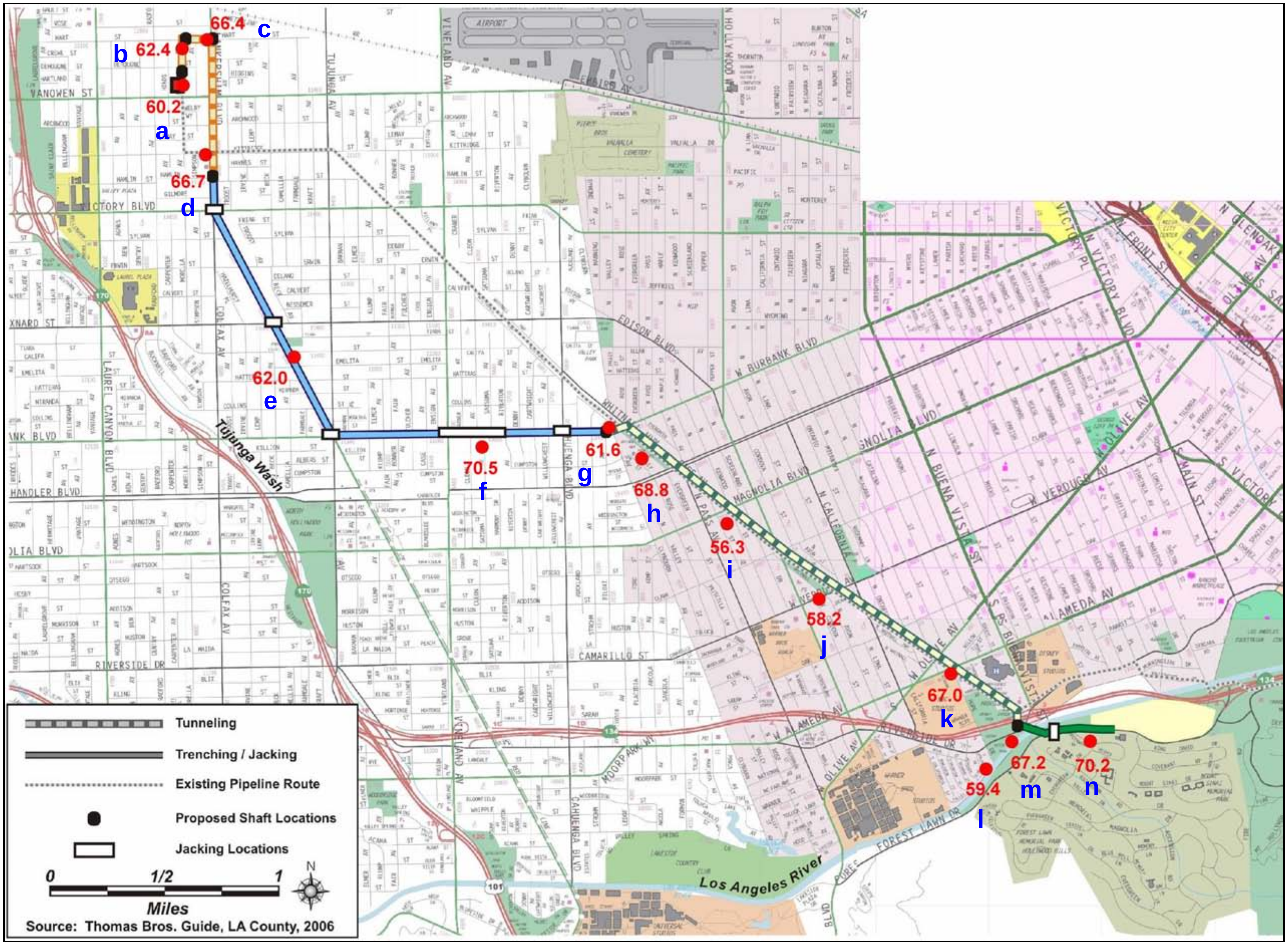


Figure 24: Ambient noise measurements (dBA-Leq)

6 Impacts Assessment

6.1 General

6.1.1 Summary of Potential Impacts

Construction of the project will produce appreciable levels of airborne noise which, due to its long-duration of 51 months, will result in significant temporary environmental noise impacts.[5] Significant levels of ground vibration and accompanying groundborne noise are also anticipated at sensitive receivers close to the tunnel alignments.

Airborne noise will result from operation of heavy machinery along the trenching route (Phase 2) and at jacking pits and tunnel shafts (all phases). The primary areas of concern are around the shafts and pits, with secondary concern given to points along the trenching route (due to their relatively brief exposure).

Ground vibration and accompanying groundborne noise may occur along the tunneled portions of the project (Phases 1 and 3), resulting from operation of the tunnel-boring machine (TBM) and movement of muck trains within the tunnel. Areas of concern are limited to receivers within "impact distances" determined below. Because of the continuous operation of muck trains along the length of the alignments, tunneling operations will produce long-duration impacts.

Trucks hauling materials, dirt, and waste will also produce airborne noise. Unlike that for construction machinery, however, trucking noise will be extended along the delivery routes and consist only of addition to existing traffic noise.

6.1.2 Airborne Noise

Airborne noise will result from operation of heavy machinery along the trenching route and at jacking pits and tunnel shafts. It will consist primarily of engine exhaust noise, with conjunctive other noises produced by these machines such as track squeal, hydraulic pump whine, and banging of dump truck bays. Ancillary on-site equipment may also contribute significant noise to the surrounding environment--examples include portable generators, air-compressors, and concrete-mixers. Certain activities, such as pavement cracking and sawing, may produce intense noise levels for short durations.

Airborne noise from construction equipment will occur at all points along the project except along the tunnel alignments.[6] The primary areas of concern are around the tunnel shafts and jacking pits. While airborne noise levels around the trenched areas will be substantially above ambient, the relatively high rate of trench progression (approximately 80 feet per day) will limit the duration to which any one receiver along the trench route is

[5] Operational noise is expected to be insignificant, and is not addressed in this study.
[6] As tunneling machinery will be underground, it will produce no significant airborne noise.

exposed. Construction activities around tunnel shafts and jacking pits, however, will continue for considerably longer durations (three to six months), thus creating greater impacts on nearby sensitive receivers.

Specifics details regarding construction activities are provided in Section 2 ("Project Description") above. Essentially, however, open-trenching will require equipment to open and close the trench, haul dirt, install the pipe, and deliver materials and waste to and from the site. Approximately 500 feet of trench could be open at one time, with a work area extending up to 1400 feet. Tunnel shafts and jacking pits will require sufficient equipment to excavate the shafts/pits, haul dirt, deliver materials and waste to and from the site, and handle them within the shaft or pit. Activities around tunnel shafts and jacking pits will be essentially stationary, and will continue for as long as necessary to complete the task at hand.

Table 5 below shows the expected types and quantities of machines required for the above two operations.

Table 5: Equipment used by operation

Activity	Equipment	
	Quantity	Type
Open Trench	5	Pickups
	1	Service truck
	1	Backhoe
	6	Dump trucks
	1	Welding trucks
	1	Pitman
	1	Crane
	1	Wheel loader
	1	Compactor
	1	Fork lift
	1	Water truck
	1	Excavator
Jacking & Tunneling	2	Pickups
	1	Dump trucks
	1	Excavator
	1	Crane

A 1971 EPA document is commonly cited as a reference for noise-emission levels of construction equipment. A more recent document put out by the Federal Highway Administration, however, has compiled actual construction equipment noise emission levels from the on-going Central Artery/Tunnel project in Boston.[7] In addition to providing more recent data, the FHWA compilation also lists a "usage factor" for each type of equipment, which allows more accurate prediction of an average noise level. The usage factor indicates the amount of time a particular piece of equipment is likely to run at high noise output (Lmax) during a particular operation. Data from the FHWA document are reproduced in Appendix 1.

7 *FHWA-HEP-05-054 Final Report,* January 2006

In order to estimate airborne noise levels around the Upper Reach project, the FHWA noise data were applied to the list of project equipment in Table 5 above and adjusted for the usage factor and quantity of each type of machine (where an exact match was not found, a similar machine was substituted). Table 6 below shows the adjusted noise levels for equipment to be used on the open-trench portion of the project. The "Lmax" column shows the highest typical noise output for each machine when it is fully engaged in an operation. This level is adjusted down by the usage factor to estimate levels in the " Leq" column, which represent the hourly-average noise level each machine would produce when measured at 50 feet. Table 7 shows similar data for equipment to be used around tunnel shafts and jacking pits.

Detailed impacts on nearby receivers are provided in noise-contour figures below, however, a rough estimate of the noise level near an operation can be obtained by accounting for the quantity of each type of equipment and then summing all of their noise emissions together. This value is shown in the lower right corner of each table below. For open-trench operations, the estimated hourly-average (Leq) noise level is approximately 87 dBA at 50 feet, whereas for tunnel shafts and jacking pits it is 81 dBA. These are rough estimates only, which assume that all of the equipment is clustered together (not valid for trenching operations).

Table 6: Open-trench equipment noise emissions

Project Equipment	Quantity	Modeled Equivalent	Usage Factor	Lmax @ 50 ft	Leq @ 50 ft	Quantity Adjusted
Backhoe	1	Backhoe	40 %	78 dBA	74 dBA	74 dBA
Compactor	1	Compactor	20 %	83 dBA	76 dBA	76 dBA
Crane	1	Crane	16 %	81 dBA	73 dBA	73 dBA
Dump Truck	6	Dump Truck	40 %	76 dBA	72 dBA	80 dBA
Excavator	1	Excavator	40 %	81 dBA	77 dBA	77 dBA
Fork Lift	1	Front-end Loader	40 %	79 dBA	75 dBA	75 dBA
Pickup Truck	5	Pickup Truck	40 %	75 dBA	71 dBA	78 dBA
Pitman	1	Man Lift	20 %	75 dBA	68 dBA	68 dBA
Service Truck	1	Dump Truck	40 %	76 dBA	72 dBA	72 dBA
Water Truck	1	Dump Truck	40 %	76 dBA	72 dBA	72 dBA
Welding Truck	1	Generator	50%	81 dBA	78 dBA	78 dBA
Wheel Loader	1	Front-end Loader	40 %	79 dBA	75 dBA	75 dBA
SUM	--	--	--	**90 dBA**	**85 dBA**	**87 dBA**

Table 7: Tunnel-shaft and jacking-pit equipment noise emissions

Project Equipment	Quantity	Modeled Equivalent	Usage Factor	Lmax @ 50 ft	Leq @ 50 ft	Quantity Adjusted
Crane	1	Crane	16 %	81 dBA	73 dBA	73 dBA
Dump Truck	1	Dump Truck	40 %	76 dBA	72 dBA	72 dBA
Excavator	1	Excavator	40 %	81 dBA	77 dBA	77 dBA
Pickup Truck	2	Pickup Truck	40 %	75 dBA	71 dBA	74 dBA
SUM	--	--	--	**85 dBA**	**80 dBA**	**80 dBA**

Other potential sources of airborne noise will also exist. Prior to trench excavation, existing pavement will be removed using either a concrete saw or pavement breaker, both of which produce high noise levels (greater than 90 dBA at 50 feet). Their use in any one location will be relatively brief, however. Dewatering pumps may be used near the Los Angles River and other locations as necessary. These pumps would likely run at night, and therefore must be shielded or otherwise configured to avoid noise impacts on any nearby sensitive receivers.

6.1.3 Ground Vibration & Groundborne Noise

Ground vibration and associated groundborne noise may occur along the tunneled portions of the project (Phases 1 and 3), resulting from operation of the tunnel-boring machine (TBM) and movement of muck trains within the tunnel. Tunnel boring machines (TBMs) have a rotating cutting wheel in the front and a rear systems of conveyors for soil removal (muck). The cutting wheels of a TBM rotate slowly, between 1-10 rpm. The muck is carted back to the access shaft with the use of muck trains, where it is then removed vertically to the street level. Because of the continuous operation of muck trains along the length of the alignments, tunneling operations will produce long-duration impacts, even after the TBM has passed a given location.

Ground vibration is felt, rather than heard, and may produce other effects such as interference with operation of sensitive equipment. In extreme cases, it may produce cosmetic or even structural damage of buildings, however, such levels of vibration are not anticipated on this project. Groundborne noise is a secondary effect of ground vibration, and results from vibration of interior walls, dishes, picture frames, etc. It is confined to those areas where ground vibration is present, and is usually only of concern in quiet environments (i.e. groundborne noise would likely not be noticeable near a tunnel shaft, as it would be dominated by airborne noise from machinery operating around the shaft).

Ground vibration impacts are substantially more difficult to predict than airborne noise impacts, as propagation characteristics vary widely with soil conditions. Furthermore, only limited data are available regarding ground-vibration levels produced by TBMs and muck trains, thus limiting the ability to predict their impacts. Therefore, estimation of impacts for this study was made using data from two previous projects in Los Angeles.

Regression analyses of two other projects in Los Angeles which employed tunnel boring machines produced the following conclusions:[8]

- TBM operations would create:
  - no significant impact at general receivers (including residential), either from ground vibration or groundborne noise
  - significant impact due to vibration at TV and recording studios lying within a distance of about 110 feet from the tunnel alignment.

- Muck train operations would create:
  - significant impact due to groundborne noise at residential receivers lying within 150 feet of the tunnel alignment;
  - significant impact due to vibration at TV and recording studios lying within a distance of about 170 feet from the tunnel alignment.

In summary, impacts related to ground-vibration are anticipated for this project due to muck-train operation, and are projected to extend to either 150 feet or 170 feet from the tunnel alignment depending upon whether the affected receiver is a residence or a TV/recording studio. Impacts to other types of receivers are not anticipated.

These results were based on application of the FTA criteria shown in Table 2 and Table 3 above, classifying TBM operation as "infrequent" due to its brief duration in any one area, and muck train operation as "frequent" due to its continuous nature. Thus, the vibration impact thresholds were set as shown in Table 8 below. Results were calculated as follows.

Table 8: Ground vibration impact thresholds

Receiver	Operation	Event Frequency	Threshold
Residence	TBM	infrequent	80 VdB
Residence	muck train	frequent	72 VdB
TV/recording studio	TBM	infrequent	65 VdB
TV/recording studio	muck train	frequent	65 VdB

For TBM operations, a regression curve through actual data was calculated as approximately:

$$L = -0.1D + 76 \text{ (VdB)}$$

[8] Regression analyses performed on the North Outfall Replacement Sewer and Metro Red Line projects in the Northeast Interceptor Sewer and Eagle Rock Interceptor Sewer EIR (City of Los Angeles Dept of Public Works).

where "L" is the vibration level in velocity decibels (VdB), "D" is the distance between the TBM and a receiver, and a crest-factor of four is assumed for TBM vibrations.[9] Based on this curve, TBM vibrations would never exceed the 80 VdB threshold for residences, and would not exceed the 65 VdB threshold for TV and recording studios beyond a distance of 110 feet from the tunnel alignment. Likewise, the 83 VdB threshold for institutional uses primarily used during the daytime would also never be breached. No significant groundborne noise from TBMs is anticipated, due to their low rotational speeds; any resulting groundborne noise would be of frequencies below human audibility.

These results do not guarantee that no complaints will be received regarding TBM ground-vibration, since levels as low as 65 VdB are perceptible to humans. However, the above results indicate that no significant impact to residences are anticipated.

In contrast to TBMs, muck trains will continue to operate along the entire tunnel alignment even after the TBM has passed, meaning that their impact must be classified as "frequent", with a correspondingly lower impact threshold. Muck trains are also likely to produce higher-frequency ground vibrations than TBMs, and therefore produce potentially audible levels of groundborne noise in addition to ground-vibration.

Analysis of two previous projects in Los Angeles indicates that ground vibration levels due to muck trains may exceed the 72 VdB threshold for frequent events at residential receivers at distances up to 100 feet from the tunnel alignment, while levels exceeding the 65 VdB for TV and recording studios may occur up to 170 feet from the alignment. These levels are based on a crest factor of five for muck train vibrations. 72 VdB was about the highest level measured on the two previous projects. It is not anticipated that muck-train vibrations will exceed the 75 VdB threshold for institutional uses primarily used during the daytime, therefore no impact is expected to these receivers.

As described in Section 6.2.3 below, an appropriate threshold for groundborne noise impacts inside a residence is 45 dBA (1 hour average). Groundborne noise inside a typical residence is estimated by A-weighting the ground-vibration levels (when stated as VdB referenced to one micro-inch per second).[10] As the highest frequency of muck-train vibration would be on the order of 60 Hertz, groundborne noise levels would be approximately 20-25 dB less than the corresponding ground vibration level. Muck-train vibration on the two previous projects fell to a level of about 66 Vdb at a distance of 150 from the tunnel alignment, corresponding to a groundborne vibration level of 41-46 dBA inside a typical residence. Therefore, residences lying at a distance of up to 150 feet from the tunnel alignment may be considered to be impacted by muck-train operations. Structures other than residences are not considered impacted by groundborne noise.

Combining the above results, it becomes clear that muck-train operations are likely to create the furthest-reaching impacts during tunnel construction, with the outer limits

---

[9] Ground-vibration is typically measured in terms of peak values, whereas the criteria are specified as average (RMS) values; the crest factor relates the two for comparison.

[10] For an explanation of ground-vibration to groundborne noise conversions, see the FTA document *Transit Noise and Vibration Impact Assessment,* May 2006.

being 150 feet from the tunnel alignment for residences (as a result of groundborne noise), and 170 feet for TV/recordings studios or any other industrial facility which employs vibration-sensitive equipment.

No structural or cosmetic damage is anticipated from any TBM or muck car operation on the Upper Reach project. Figure 25 below shows the recommended vibration limits (due to blasting) published by the former U.S. Bureau of Mines.[11] These curves express maximum allowable vibration limits as a function of frequency. In all cases, the recommended limits are far above levels anticipated from either TBM or muck-train operations on this project. The only exceptions to this conclusion might be any fragile or historic buildings lying close to the tunnel alignments. Such buildings may contain weakened old plaster or other construction which may be overly sensitive to vibration. It will be incumbent upon the tunneling contractor to identify any such buildings, if they exist, and take necessary measures to prevent or repair any damage.

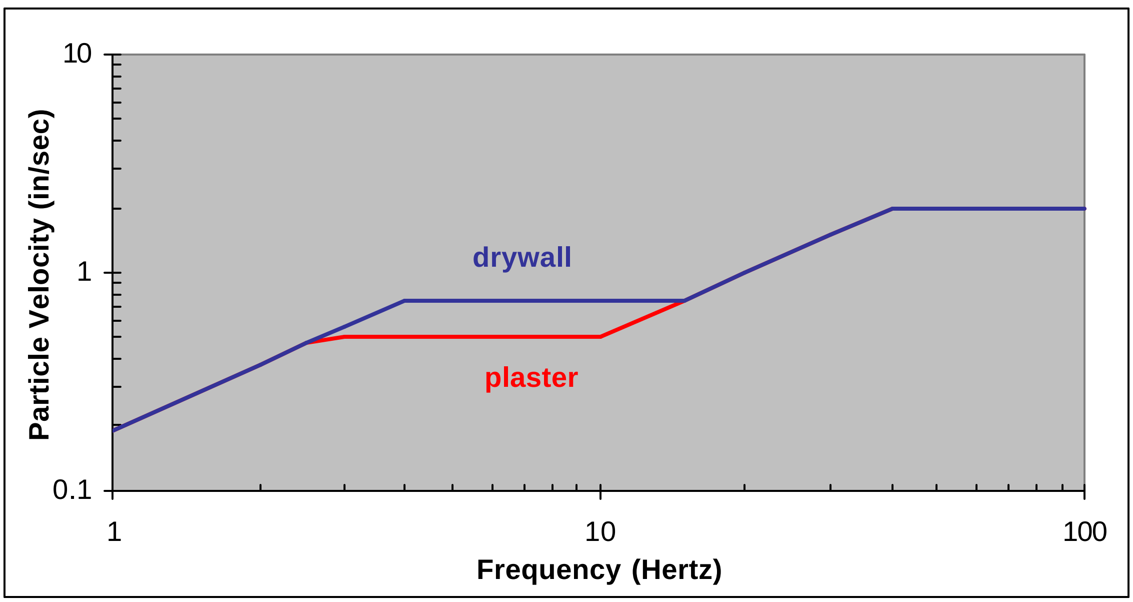


Figure 25: U.S. Bureau of Mines recommended blasting criteria

[11] USBM RI 8507, 1980

6.1.4 Trucking Noise

Trucks hauling materials, dirt, and waste will produce airborne noise along the delivery routes chosen by the contractors. Trucking noise will only contribute to existing traffic noise, and is therefore considered separately from airborne construction-equipment noise above.

Figure 26 below shows the noise levels produced by heavy trucks as measured at a distance of 25 feet from the centerline of travel (the approximate distance of a building from the lanes). These curves are based on results from the Federal Highway Administration's *Traffic Noise Model 2.5* software. They show the hourly-average noise level which would be measured as a function of the number of truck-trips per hour. Two curves are shown, one representing trucks traveling at 30 miles per hour, and the other representing trucks moving at 45 miles per hour. For example, 25 trucks per hour moving at 45 miles per hour would produce an average noise level of 65 dBA at a point 25 feet from the lane centerline.

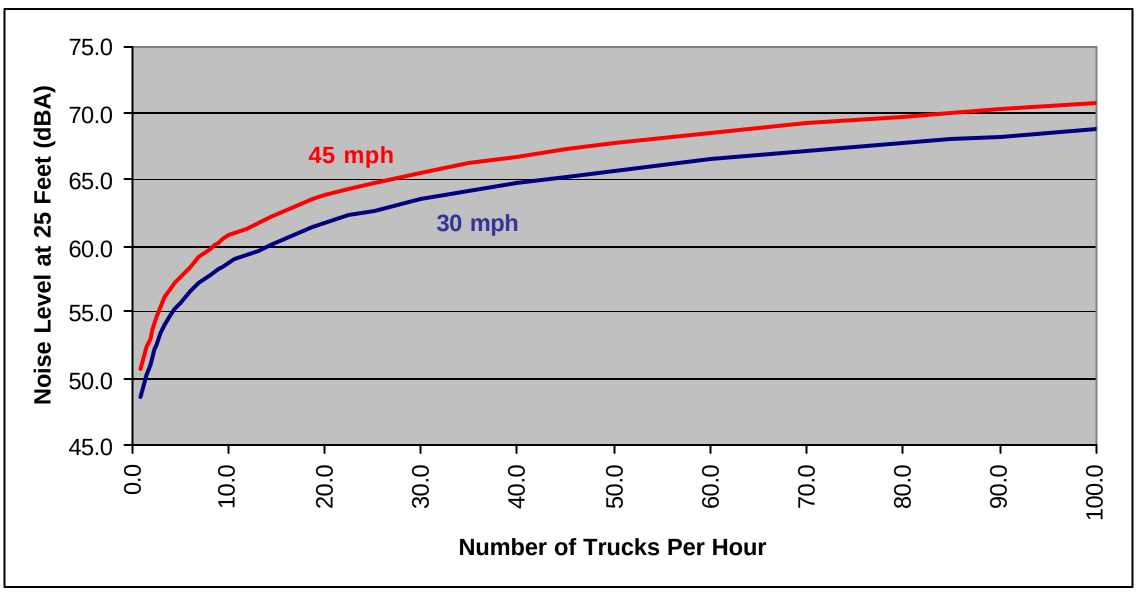


Figure 26: Heavy-truck noise emission at 25 feet; one-hour average (dBA)

Whether trucking would cause a significant impact on any particular delivery route depends upon intended number of truck-trips per hour as well the volume of traffic already using that route (or more specifically the ambient traffic noise level).

Delivery routes will be specified by the project contractors, and have not yet been determined. For this study, it was assumed that trucks servicing the project will use the major thoroughfares through the commercial districts, and not the smaller streets in the residential areas. This assumption may not be valid in certain specific areas.

6.2 Criteria for Determination of Significant Impacts

6.2.1 Sensitive Receivers

The criteria below were used in this study to determine whether significant impacts will occur at noise-sensitive receivers along the Upper Reach project due to construction activities. "Noise-sensitive receivers" comprise any of the following:

- residences - including hotels, dormitories, shelters, etc.
- schools - including day-care facilities, colleges, etc.
- places of worship
- medical facilities actually engaged in treatment of patients (not offices)
- theaters, auditoria, recording studios, etc.
- parks, cemeteries, etc.

Sensitive receivers also include any confined outdoor recreational area, such as school yards or apartment playgrounds, where users do not have the option of moving away from construction noise.

Sensitive receivers do not include any industrial or commercial facility unless it conducts activities which can be specifically shown to be noise or vibration sensitive (e.g. microchip manufacturing).

6.2.2 Airborne Noise

In the absence of statutory limits, airborne-noise impact criteria were determined for this project based on other relevant standards, laws, and industry-accepted criteria. An airborne-noise impact is defined as any of the following when occurring at any noise-sensitive receiver:

- **An hourly-average noise level greater than 75 dBA:** This criterion is intended to provide a substantial margin in avoiding any hazardous noise condition, and is consistent with statutory requirements on HUD-supported development (24CFR51B).
- **An hourly-average noise level which is ten decibels (10 dB) above the existing ambient level:** This criterion is based on the fact that the human ear interprets a ten-decibel increase as a doubling of the "volume" of sound. Whereas the ear interprets a five-decibel increase as a significant increase in noise, such a stringent criterion would be inappropriate for construction noise, which is of limited duration.
- **Any activity which violates statutory limits in the Los Angeles or Burbank municipal codes:** This criterion specifically refers to permitted hours of construction, as stated in section 4 ("Applicable Regulations") above.

6.2.3 Ground Vibration and Groundborne Noise

In the absence of any statutory limits, ground vibration impact criteria were based on the guidance provided by the Federal Transit Administration and summarized in Table 2 and Table 3 above.

A significant impact due to groundborne-noise is assumed to occur if levels exceed 45 dBA at any residence or similar sensitive-receiver. This level is consistent with the interior-noise requirement of the California Building Code (Title 24) and other codes and general-plan requirements in California. No significant impact from groundborne noise is assumed for any commercial facility, including those which house vibration-sensitive equipment.

Combining these criteria with the analyses of section 6.1.3 above, significant impacts are assumed to exist for any of the following conditions:

- **a TV studio, recording studio, or other building which houses vibration-sensitive equipment and lies within 170 feet of the tunnel alignment (muck-train vibration);**
- **a residence or similar sensitive receiver lying within 150 feet of the tunnel alignment (muck-train groundborne noise).**

6.3 Los Angeles Impacts Assessment

6.3.1 General

As shown in Figure 1, pipeline-laying in the City of Los Angeles will comprise tunneling in the Phase 1 area (northern end of the project), with open-trenching and jacking being employed in all other locations. Consequently, vibration concerns associated with tunneling are confined to the Phase 1 area. All other areas will be impacted only by airborne noise due to trenching and activities around the jacking pits and tunnel-access shafts.

6.3.2 Airborne Noise

Airborne noise will occur along the entire length of the open-trench portions of the alignment (Phase 2) and around jacking pits and tunnel shafts (all phases). Because activity around the pits and shafts will be of extended duration and occur within residential zones, it is of higher concern than trenching operations.

6.3.2.1 Jacking Pits and Tunnel Shafts

Projected noise levels surrounding tunnel shafts and jacking pits were modeled using the equipment scenario of Table 7, substituting a single loader for two pickup trucks. This same scenario was applied to each jacking pit and tunnel shaft, with the resulting noise contours shown in Figure 27 through Figure 42 below. These contours represent the hourly-average noise produced by this complement of machinery operating under typical conditions. Modeling incorporated the usage factors shown in Table 7 to obtain average, rather than instantaneous, noise levels. Modeling assumed no attenuation due to shielding or ground absorption; the contours therefore represent a simplified but conservative estimate of expected construction noise levels.

Figure 27 shows projected hourly-average noise contours around the tunnel shaft in front of the North Hollywood pump station. Red contours represent noise levels which exceed the 75 dBA criterion above; yellow contours represent a cautionary range between 70 – 75 dBA; all other noise levels are depicted in blue. As is seen in the figure, the proximity of nearby residences (as close as 30 feet) potentially exposes them to noise levels in excess of 80 dBA, which constitutes a clear noise impact at this location. A similar situation exists farther up Morella Avenue, at the intersection of Hart Street, as shown in Figure 28. These projected noise levels are also well above the existing ambient level of 62 dBA for this location.

Figure 29 shows the scenario at the intersection of Hart Street and Lankershim Boulevard. As this location is the transition from residential to commercial zones, most of the surrounding land uses are not considered noise-sensitive receivers. The 70 dBA contour does approach one of the nearby residential structures, however, projected noise levels exceed the existing ambient level of 66 dBA by only a few decibels. Therefore, no airborne-noise impacts are projected for this location.

Commercial uses also surround the tunnel-shaft/jacking-pit on Lankershim Boulevard north of Victory Boulevard, as shown in Figure 30. St. George Health Clinic on Victory Boulevard is the nearest identified sensitive receiver, however, it lies well outside the range of concern. Because there are no sensitive receivers nearby, there will be no noise impacts from operations around this pit.[12] This point does, however, mark the beginning of Phase 2 trenching operations, which will create potential airborne-noise impacts discussed below.

The jacking pit south of Victory Boulevard (Figure 31) has no nearby sensitive receivers, and therefore will create no airborne noise impacts.

Figure 32 represents the jacking pit north of Oxnard Street. This pit lies directly in front of Inglesia Pentecostes Fuente de Luz, and is expected to create noise levels approaching 80 dBA impinging on this receiver, resulting in a clear impact. The Lankershim Medical Clinic (not shown) lies to the north of this pit, but far enough away that noise levels should fall to the point where they are within a few decibels of existing ambient levels. No impact is therefore projected for this clinic.

The jacking pit to the south of Oxnard Street is shown in Figure 33. No sensitive receivers have been identified near this pit. Similarly, no sensitive receivers lie within the vicinity of the jacking pit north of Hatteras Street, shown in Figure 34.

The jacking pit south of Hatteras Street lies directly in front of the Family Hope Medical Clinic, as shown in Figure 35. Projected noise levels impinging on this facility approach 80 dBA, indicating a clear impact.

Figure 36 shows combined noise contours from operations around the jacking pits straddling the intersection of Lankershim Boulevard and Burbank Boulevard. The only noise-sensitive receivers in the vicinity of this intersection are the Multi-Congregational Church and The Center @ North Hollywood Church. While projected construction noise levels are rather high at these locations, they do not exceed either threshold of 75 dBA or 10 dB above ambient. Therefore, no impact is projected for either receiver.

The jacking pit near the intersection of Burbank Boulevard and Vineland Avenue is shown in Figure 37. Though not visible in the figure, three sensitive receivers lie near this intersection: the West Coast Seminary on the southwest corner, the Triune Science of Being School on the northeast corner, and the Lonny Chapman Theater on the southeast corner. As shown in the figure, however, project noise emissions from pit operations do not exceed 70 dBA at any of these locations. The 70 dBA contour falls short of the West Coast Seminary building, and does not cross to the east side of Vineland Avenue. As the

[12] Residential receivers may lie behind this and other commercial facilities along the project route; because they are shielded by the commercial structures, however, noise impacts upon them are considered less than significant.

existing ambient noise level along this section of Burbank Boulevard is on the order of 71 dBA, and pit noise emissions do not exceed the 75 dBA threshold, no impact is projected for any receiver at this location.

A Jehovah's Witnesses Congregation is the only sensitive receiver near the jacking pit at the intersection of Burbank Boulevard and Cartwright Avenue (Figure 38). Though projected noise levels from pit operations exceed the existing ambient level of 71 dBA, the 75 dBA contour is still constrained to the east side of Cartwright Avenue, and does not impinge on the congregation building. As such, no impact is projected for this location.

Figure 39 shows the jacking pits which straddle the intersection of Burbank Boulevard and Cahuenga Boulevard. The Iglesia De Dios, on the northeast corner of the intersection, lies less than 60 feet away from the east pit and will be subject to construction noise levels in excess of the 75 dBA threshold, resulting in an impact at this location. The Ministerio Palabra Verdad Y Vida on the southwest corner (not shown) lies near the 70 dBA contour, which is less than ten decibels above ambient noise; consequently, there will be no significant impact for this receiver. The Cahuenga Potters Studio--a nominally sensitive receiver--also lies near this intersection, but outside the 75 dBA contour. Noise levels at this location are further not expected to exceed ambient levels by ten decibels, therefore, no impact is projected for this receiver.

Figure 40 shows the location of the tunnel shaft at the beginning of Phase 3. This shaft lies between Strohm Avenue and Biloxi Avenue, where the project approaches Whitnall Highway and transitions into a residential area. Because the shaft is receded from the transition, there is no construction noise impact on these residences. The only other nearby sensitive receiver is Screenland Studios, on the west side of Strohm Avenue. Construction noise associated with this pit are projected to diminish to insignificant levels prior to reaching this receiver, however, creating no significant impact.

Ambient noise along Forest Lawn Drive exceeds 70 dBA. However, projected noise emissions exceeding 75 dBA from shaft operations will impinge on the Lod Cook Center/Junior Achievement Foundation building, as shown in Figure 42. Therefore a noise impact will exist at this location.

Table 9 below summarizes those noise-sensitive receivers described above which will be impacted by airborne noise from jacking-pit or tunnel-shaft operations. The impacts of greatest concern are those occurring at the residences near the North Hollywood pump station in Phase 1. Without mitigation, these residences will be subject to long-term noise levels in excess of 80 dBA, posing a potentially hazardous noise condition.

A significant noise impact will technically exist at small segment of Forest Lawn Memorial Parks, however, most of this cemetery will be remain unaffected by jacking-pit operations on Forest Lawn Drive.

Table 9: Airborne noise impacts from jacking-pit & tunnel-shaft operations

Sensitive Receiver	Figure	Land Use
multiple residences	Figure 27	residential
multiple residences	Figure 28	residential
Inglesia Pentecostes Fuente de Luz	Figure 32	worship
Family Hope Medical Clinic	Figure 35	medical
Iglesia De Dios	Figure 39	worship
Johnny Carson Park see section 6.4.2	Figure 41	park
Lod Cook Center/Junior Achievement Foundation	Figure 42	school

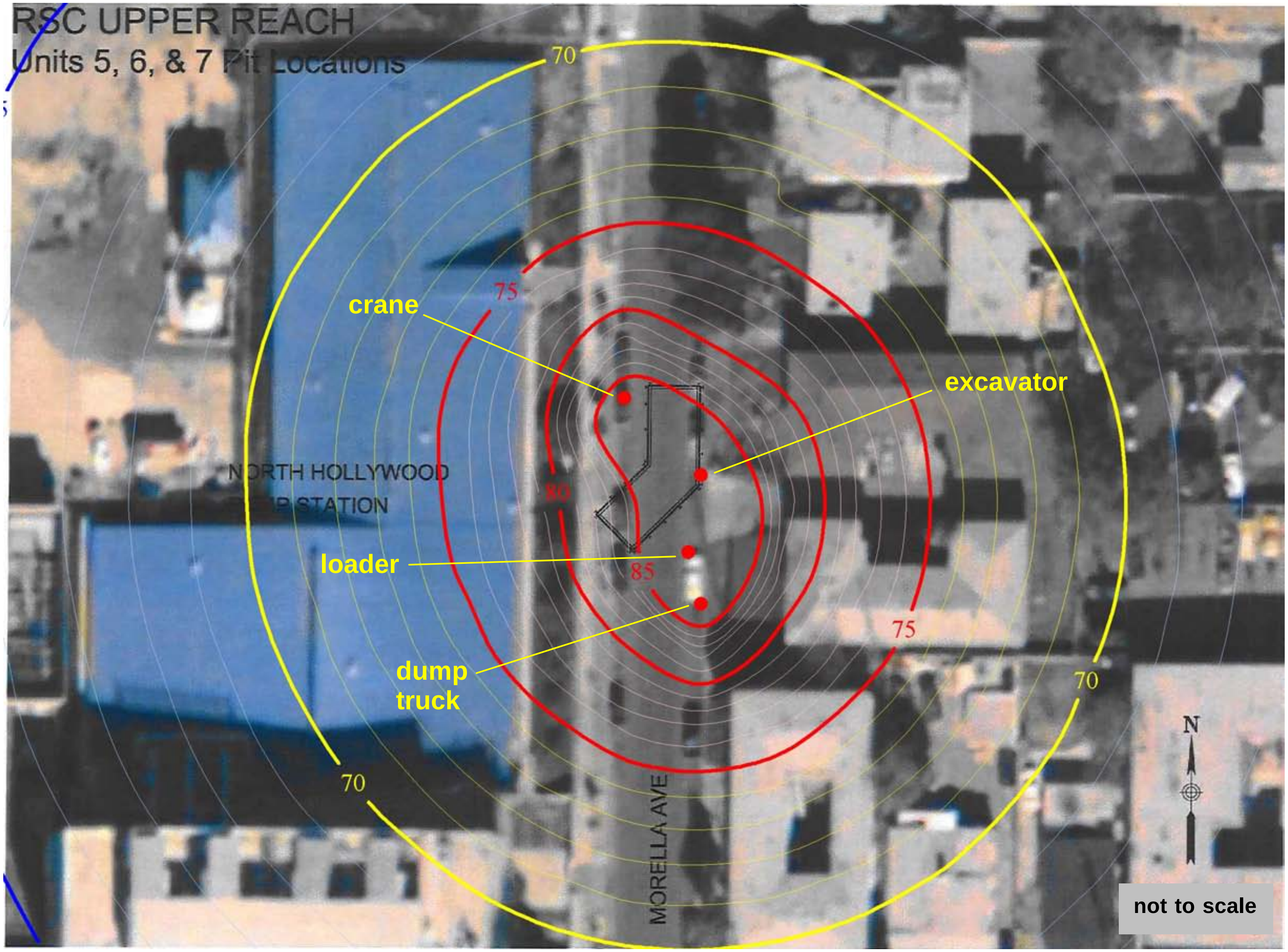


Figure 27: Tunnel shaft near North Hollywood pump station on Morella Ave. (1-hr Leq)

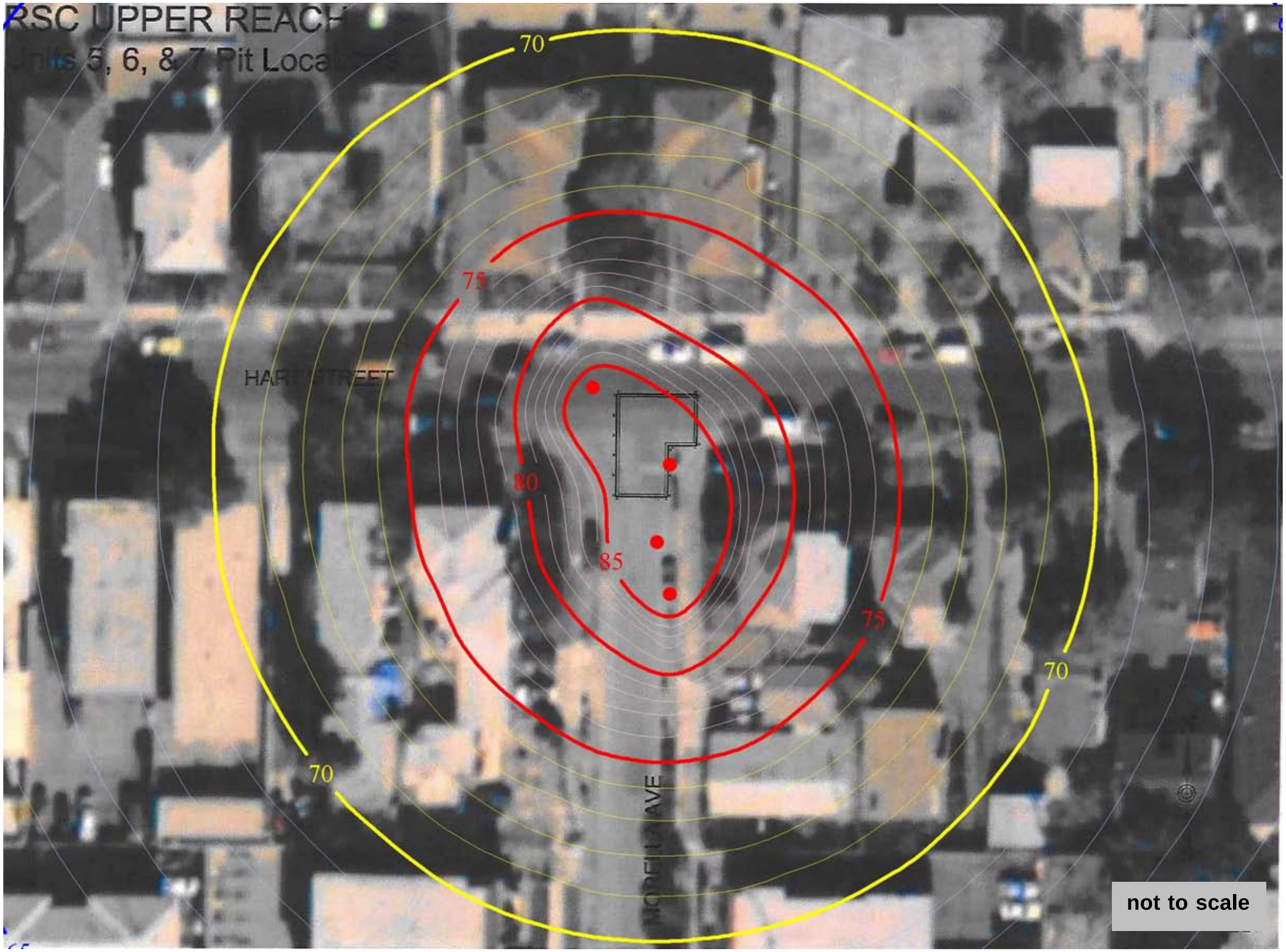


Figure 28: Tunnel shaft at intersection of Morella Ave. and Hart St. (1-hr Leq)

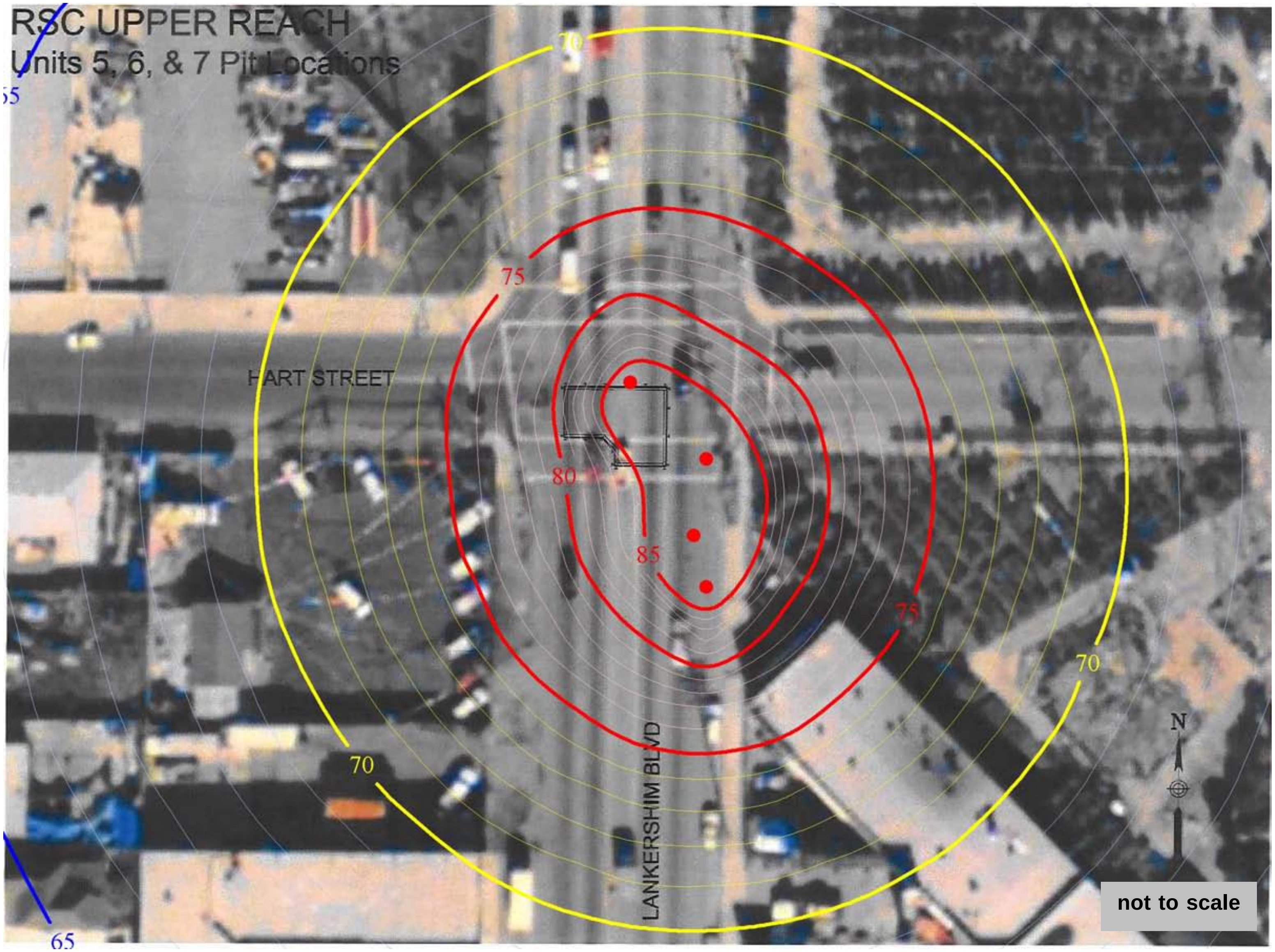


Figure 29: Tunnel shaft at intersection of Hart St. and Lankershim Blvd. (1-hr Leq)

Figure 30: Tunnel shaft/jacking pit on Lankershim Blvd. north of Victory Blvd. (1-hr Leq)

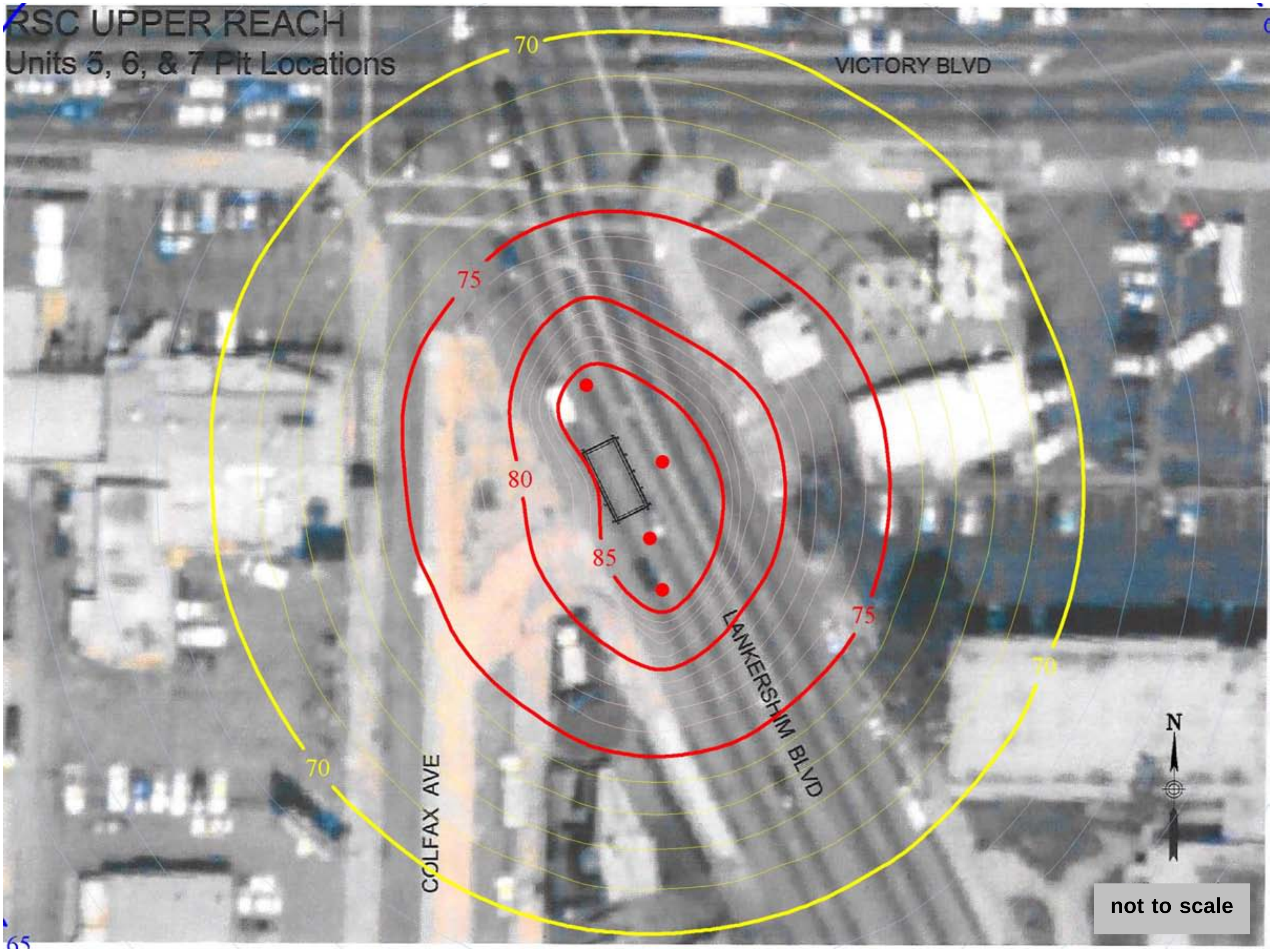


Figure 31: Jacking pit on Lankershim Blvd. south of Victory Blvd. (1-hr Leq)

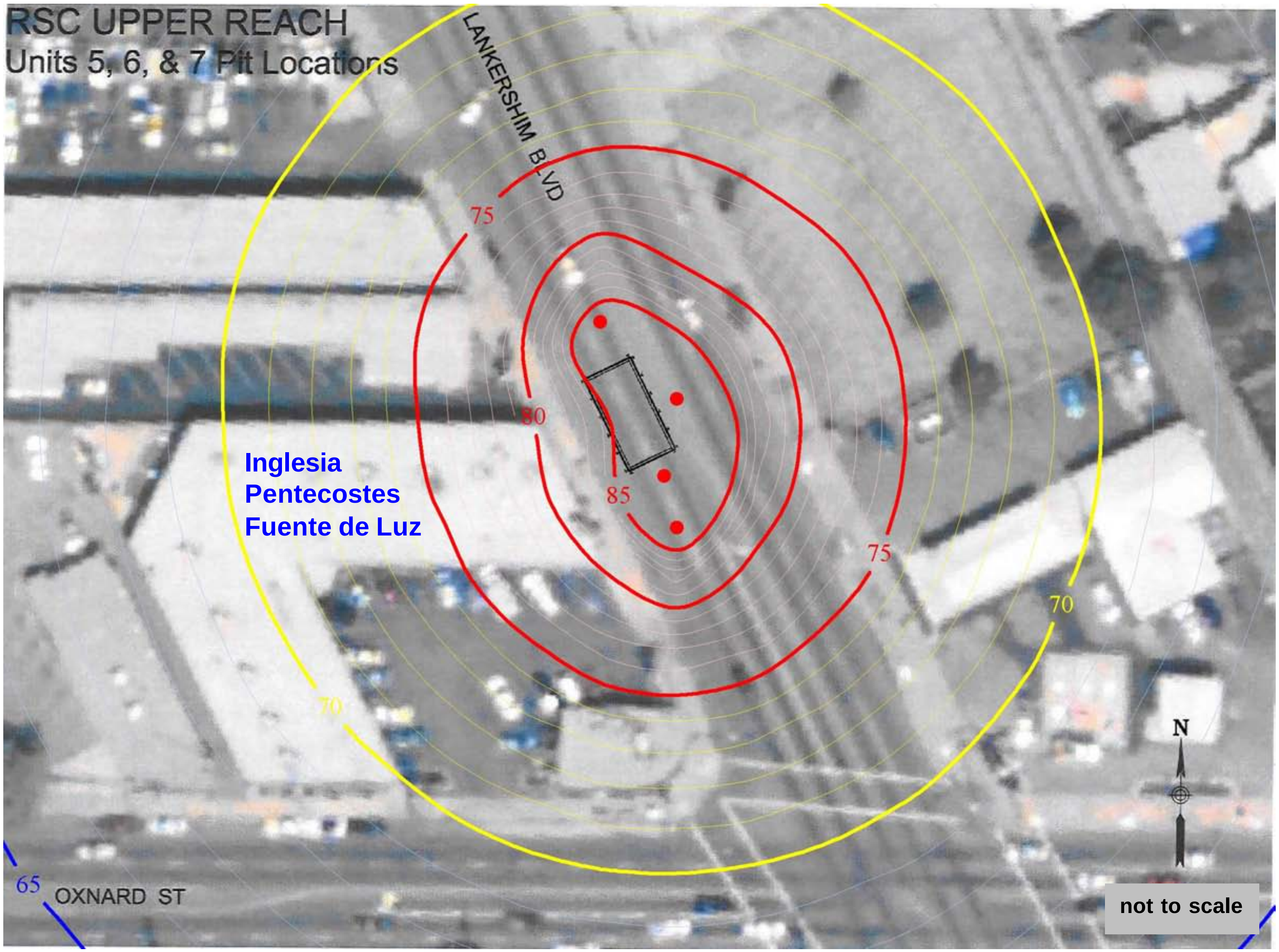


Figure 32: Jacking pit on Lankershim Blvd. north of Oxnard St. (1-hr Leq)

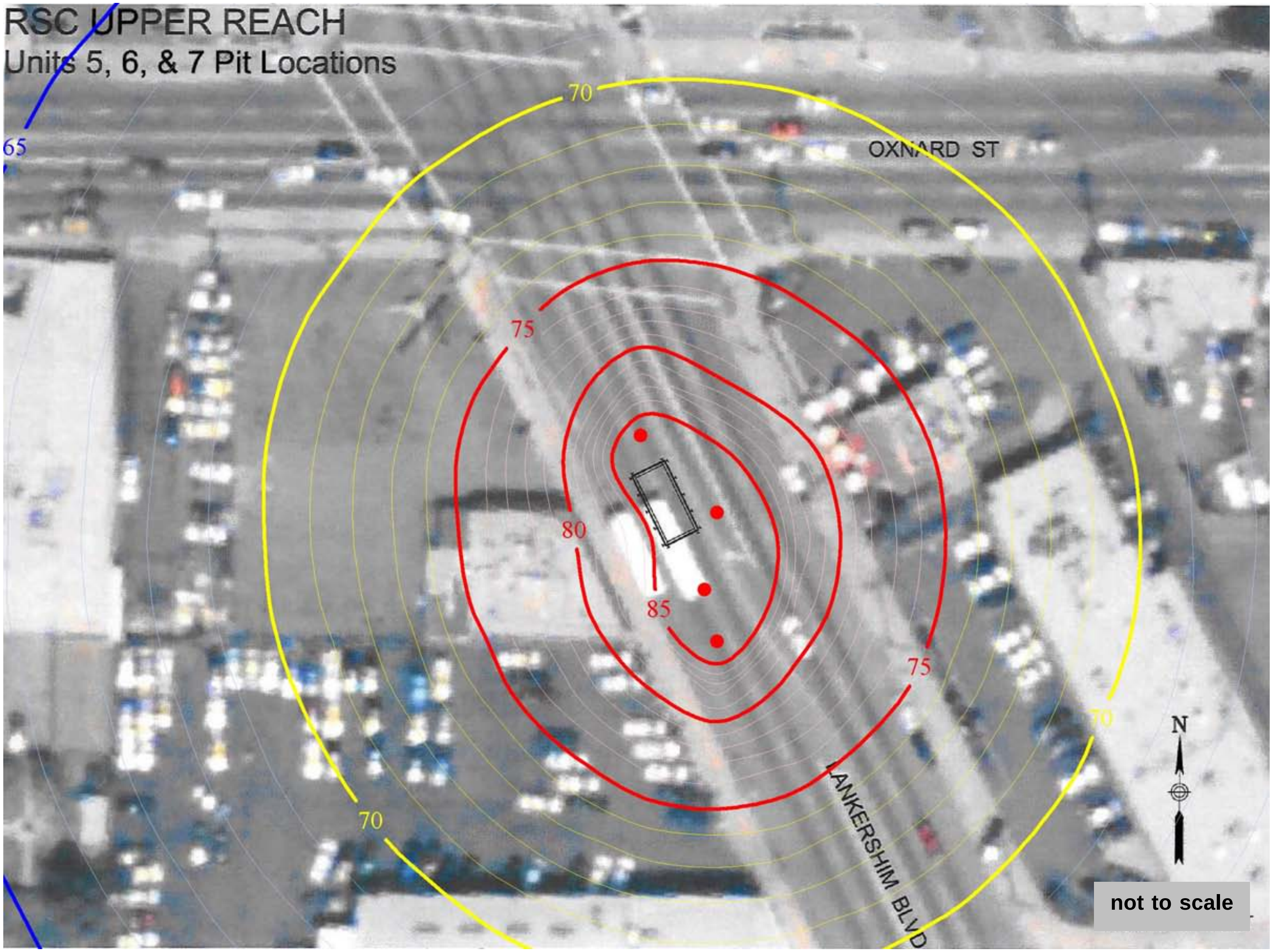


Figure 33: Jacking pit on Lankershim Blvd. south of Oxnard St. (1-hr Leq)

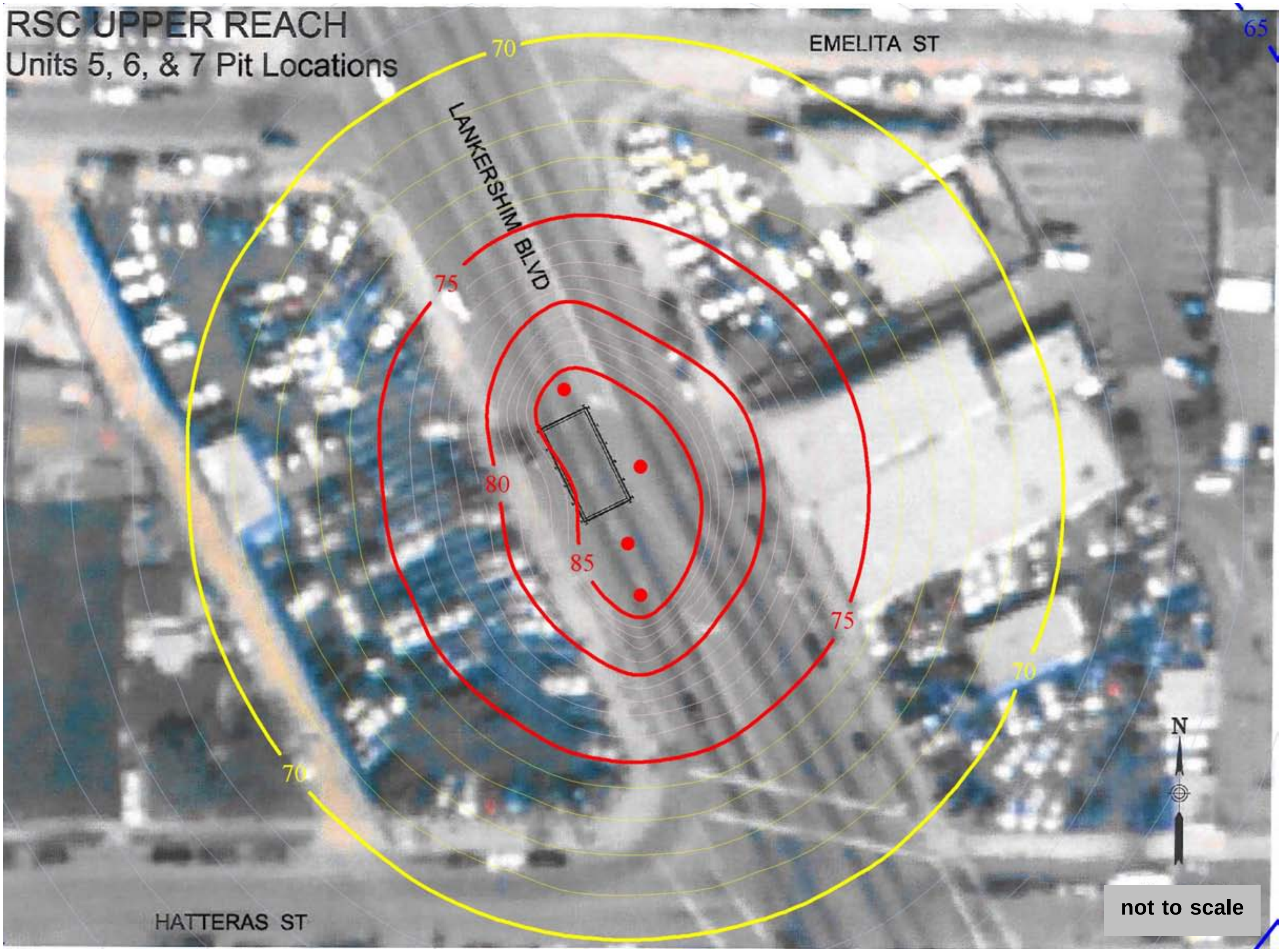


Figure 34: Jacking pit on Lankershim Blvd. north of Hatteras St. (1-hr Leq)

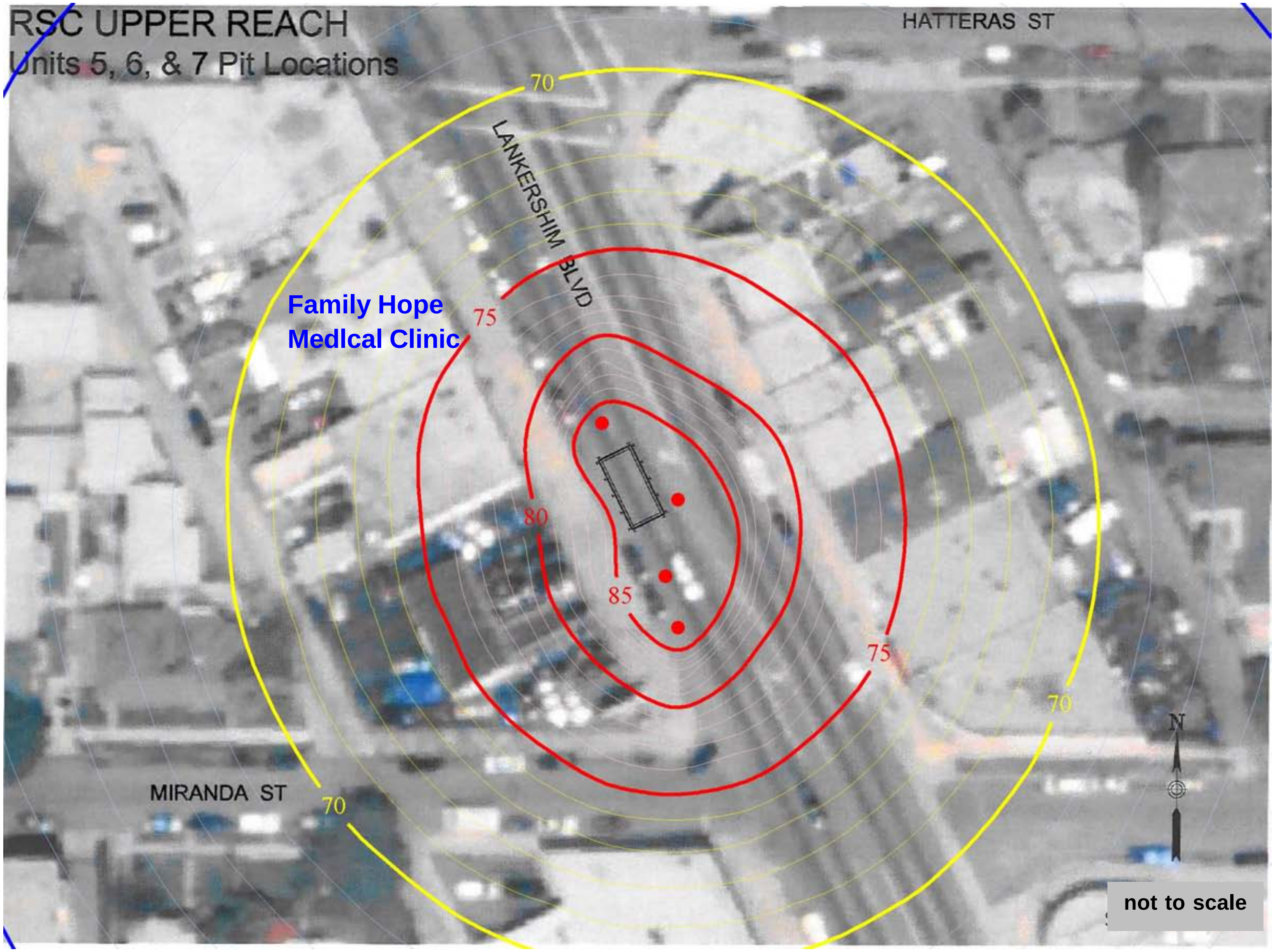


Figure 35: Jacking pit on Lankershim Blvd. south of Hatteras St. (1-hr Leq)

Figure 36: Jacking pits at intersection of Lankershim Blvd. and Burbank Blvd. (1-hr Leq)

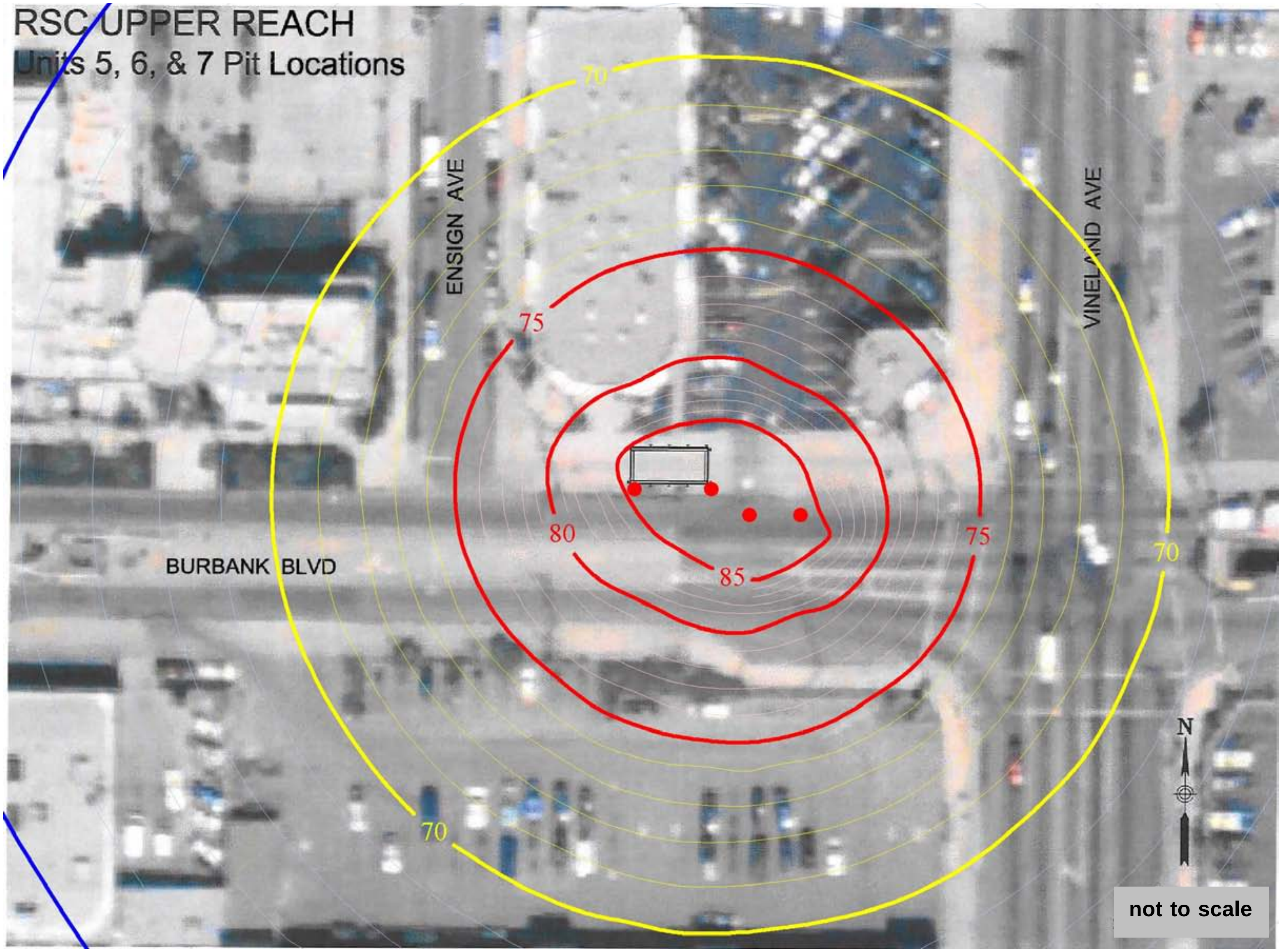


Figure 37: Jacking pit on Burbank Blvd. west of Vineland Ave. (1-hr Leq)

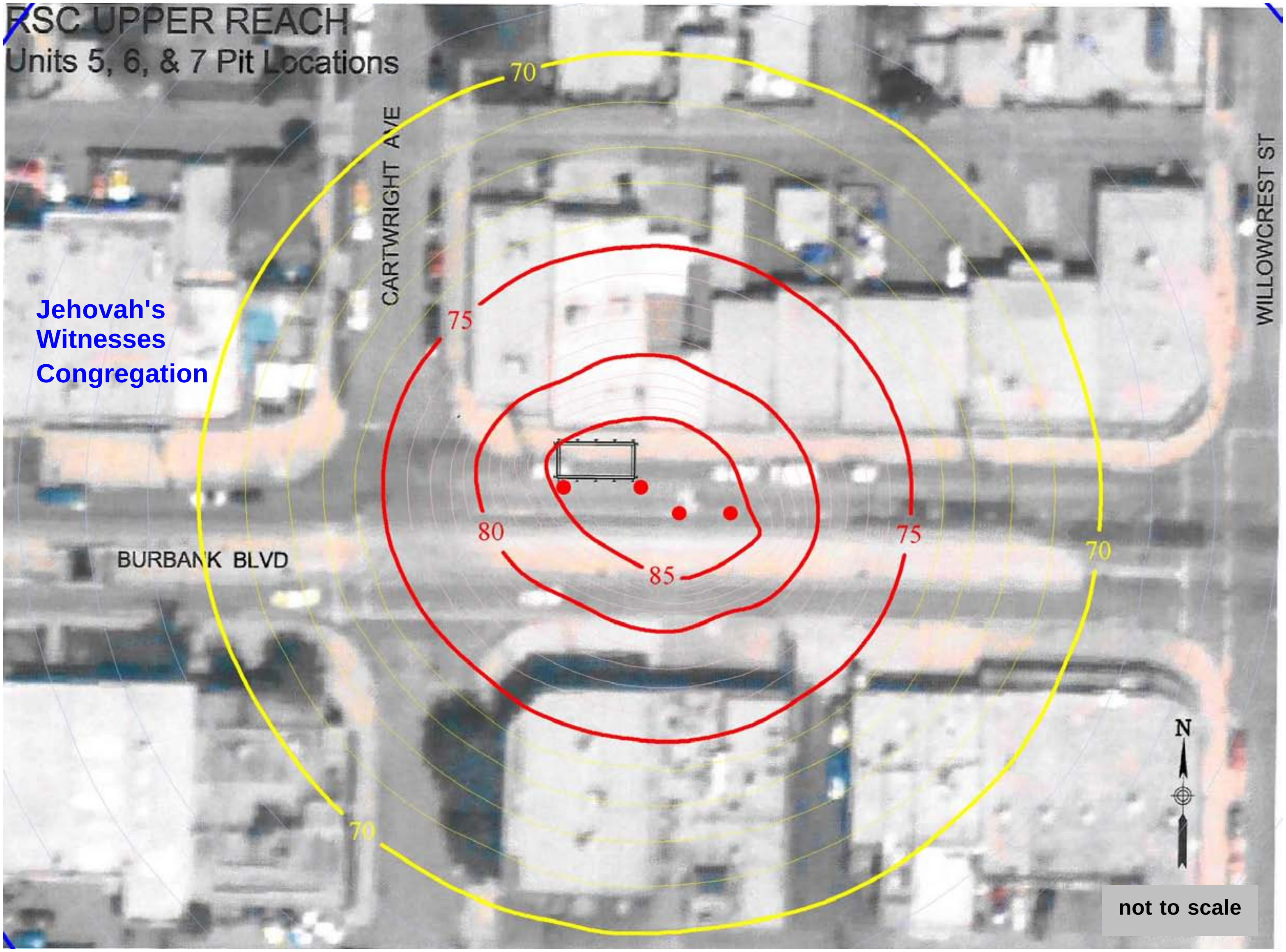


Figure 38: Jacking pit on Burbank Blvd. east of Cartwright Ave. (1-hr Leq)

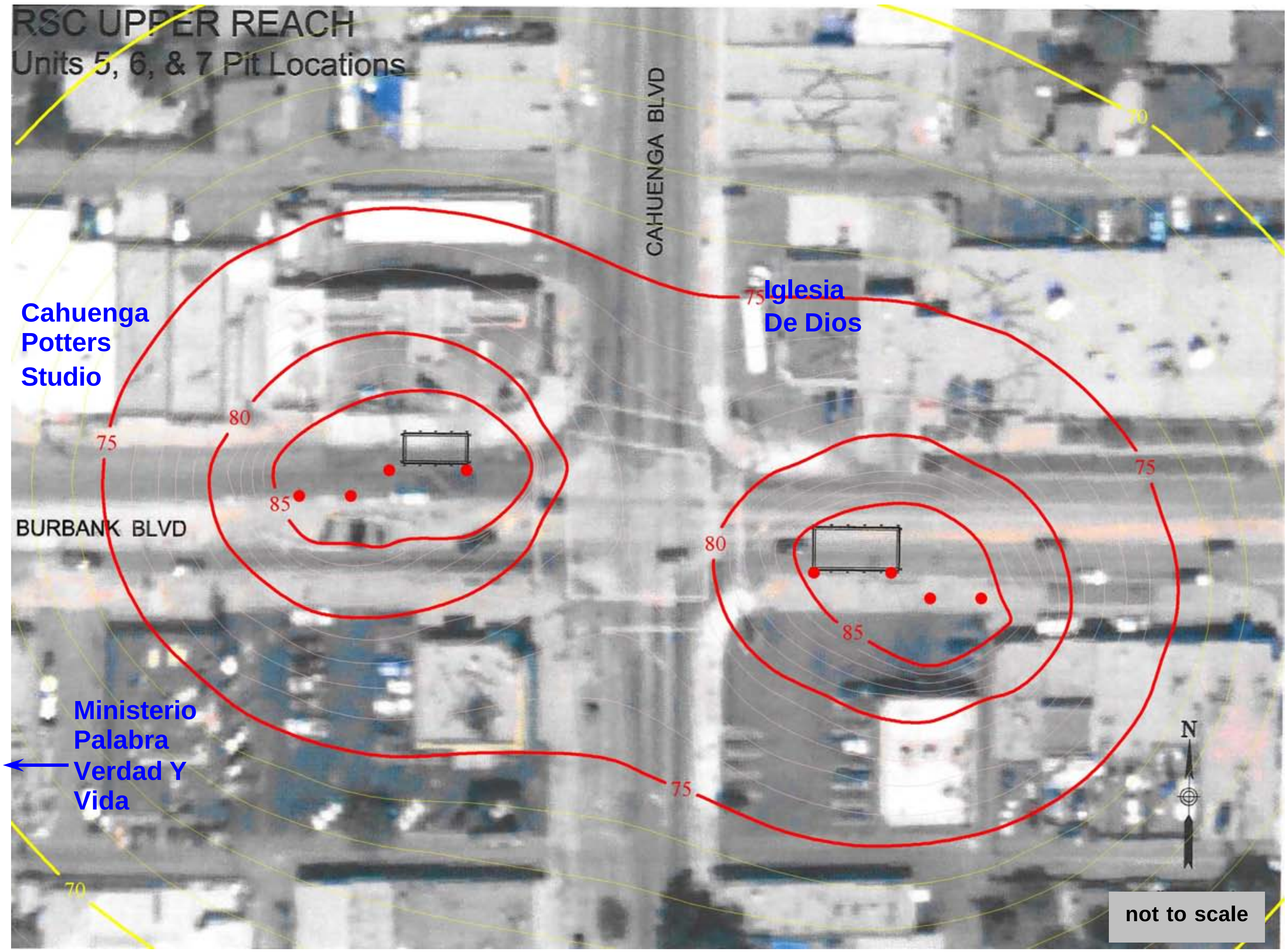


Figure 39: Jacking pit on Burbank Blvd. east of Cahuenga Blvd. (1-hr Leq)

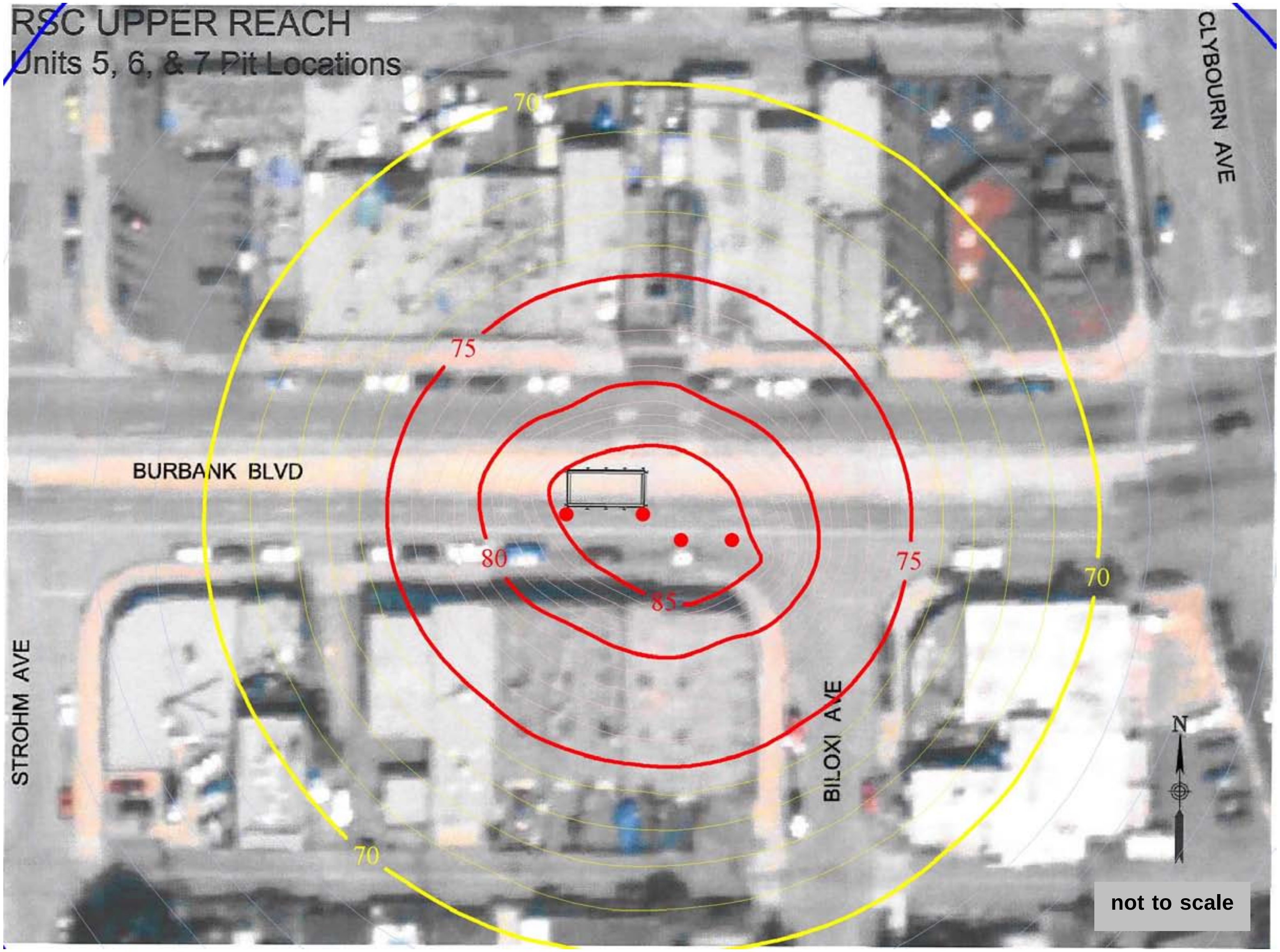


Figure 40: Tunnel shaft on Burbank Blvd. near Whitnall Hwy. (1-hr Leq)

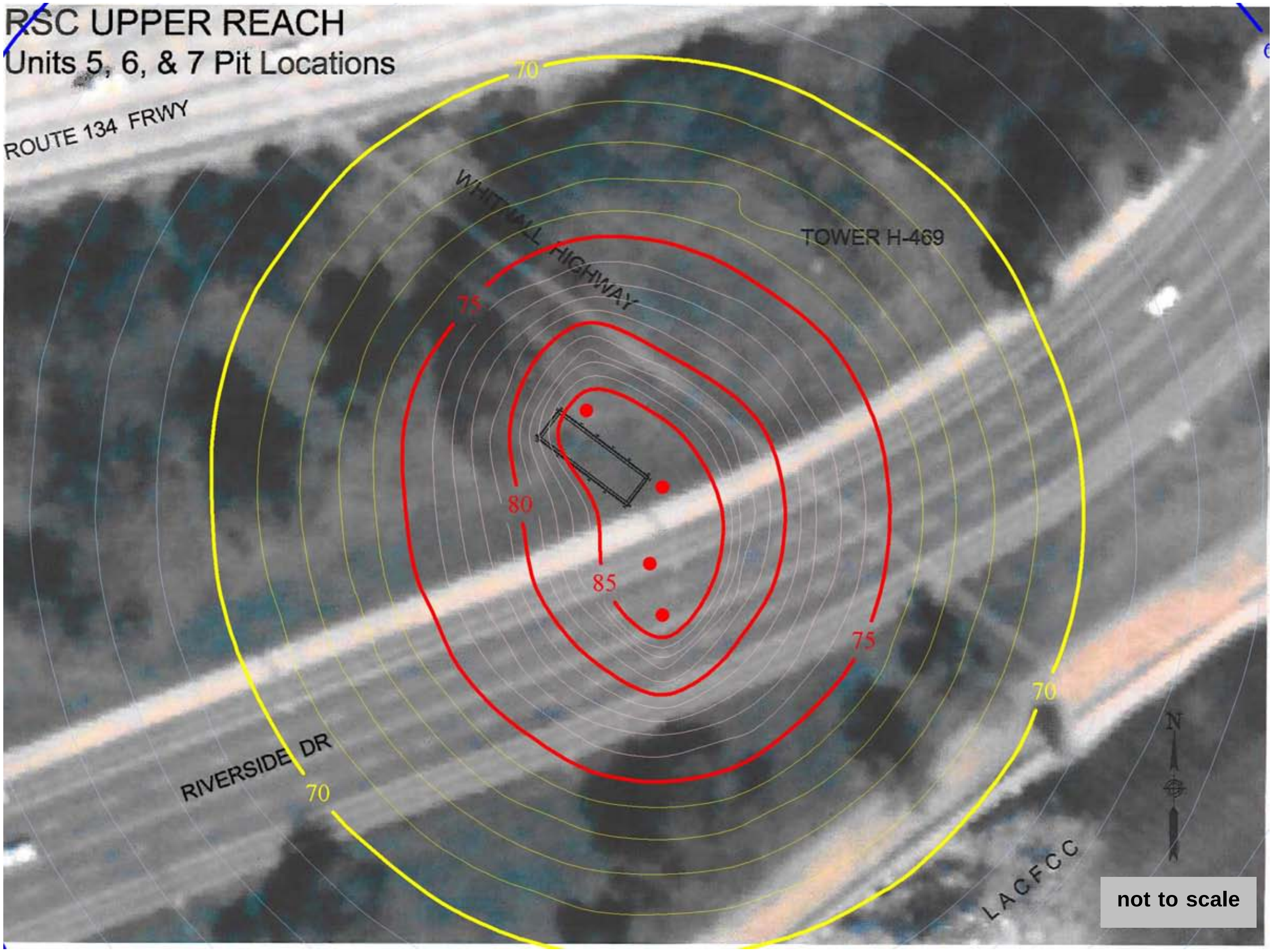


Figure 41: Tunnel shaft in Johnny Carson Park (1-hr Leq)

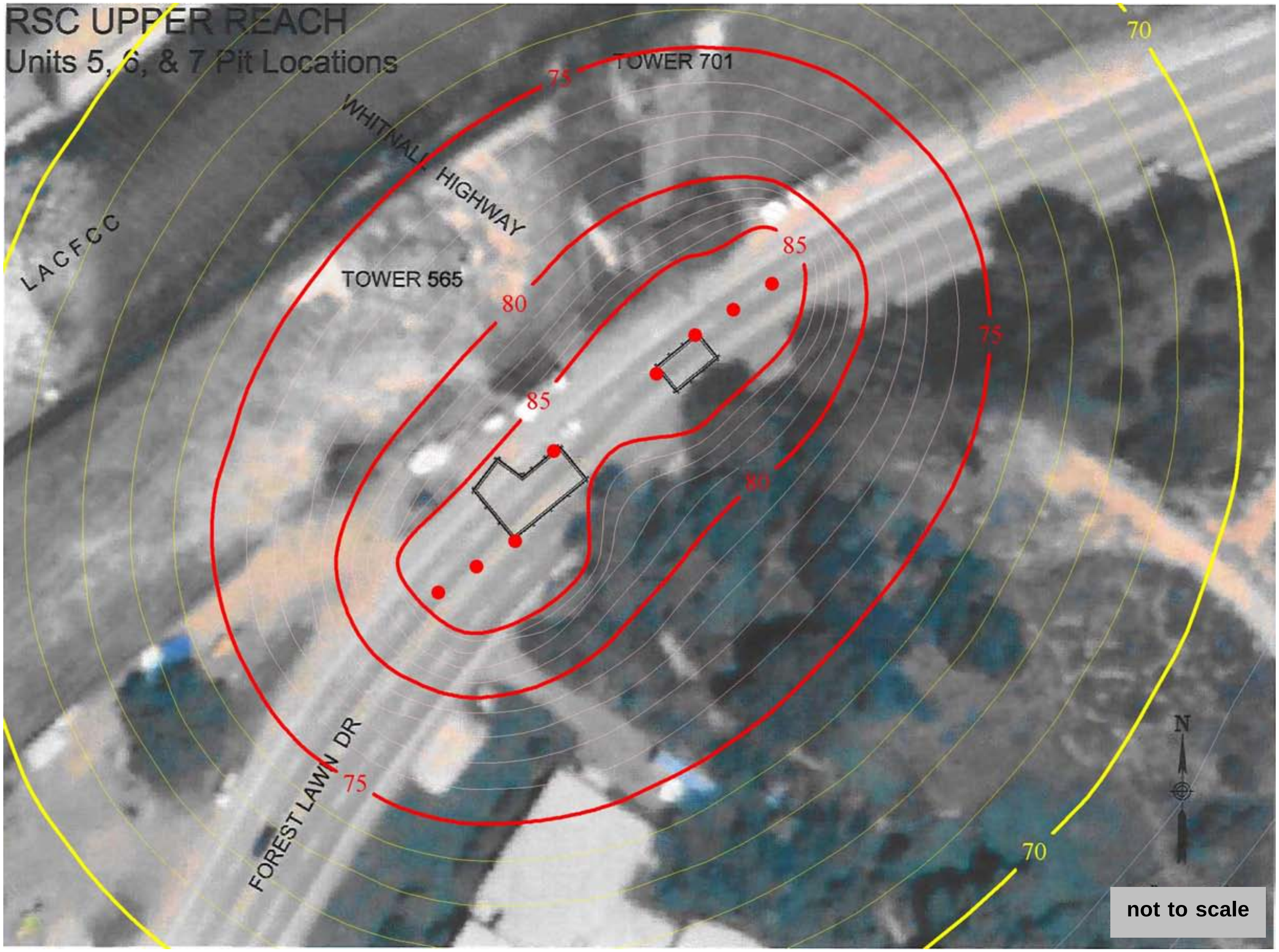


Figure 42: Jacking pits on Forest Lawn Dr. (1-hr Leq)

6.3.2.2 Open-trenching

Projected noise levels along open-trenching portions of the alignment were modeled using the equipment of Table 6. As depicted in Figure 43, the modeled scenario represents a chain of operations extended over a one-thousand foot work area, with an excavator and a line of dump trucks at the head excavating the trench, and a compactor following in the rear repaving the street. The intermediate tasks of placing and attaching the pipe are represented by the crane and welding truck. Various other trucks and machinery are spaced randomly around the operation as they might be found on an actual job site. Not shown are pavement cutting/breaking operations, and ancillary functions such as concrete mixing.

The contours represent the combined hourly-average noise levels of all of the equipment operating simultaneously under typical conditions, stated as average A-weighted decibels. As is seen in the figure, the loudest contours are centered around the area of most intense operation--excavation and pipelaying. The color scheme is the same as above, with red contours representing levels which exceed the 75 dBA criterion. Because open-trenching will occur away from residential areas, the number of potentially impacted sensitive receivers is minimal. Many of those sensitive receivers identified along the trenching route are already exposed to noise impacts from shaft and pit operations, which will dominate those produced by trenching. Below is an assessment of impacts on those individual receivers identified in Section 5.1 above.

The only sensitive receivers along the trenching route north of Oxnard Street are the Lankershim Medical Clinic and the Inglesia Pentecostes Fuente de Luz, as shown in Figure 43. Lacking any mitigation, construction noise levels are projected to exceed 80 dBA at the Lankershim Medical Clinic, clearly indicating a significant impact here. Trenching noise levels will also exceed the 75 dBA threshold at the Inglesia Pentecostes Fuente de Luz, which is also subject to noise impacts due to pit operations. Both of these receivers are therefore subject to significant noise impacts without mitigation.

Likewise, the Maurice Sendak Elementary School is the only sensitive receiver between Oxnard Street and Hatteras Street, shown in Figure 44. As indicated, the 75 dBA contour is projected to cross over onto this school's property. It is difficult to determine whether a significant impact will occur here, however, as the school building itself lies much farther to the east. The portions of school property which lie adjacent to Lankershim Boulevard appear to be playgrounds, though to what extent they are used is unknown. Lacking definitive information, it will be assumed that a significant noise impact exists at this location.

The Family Hope Medical Clinic, shown in Figure 45, is the only sensitive receiver lying between Hatteras Street and Burbank Boulevard. It will likely be exposed to trenching noise exceeding the 75 dBA threshold, in addition to that from jacking pit operations. Without mitigation, a significant impact will occur at this location.

Figure 46 shows the construction scenario on the first open-trench section along Burbank Boulevard, from Lankershim Boulevard to Vineland Avenue. Seen in the figure are the Inglesia Pentecostes and the L.A. Urgent Care Clinic, both of which will be subject to trenching noise in excess of the 75 dBA threshold. Not shown is the West Coast Seminary, which will also likely be subject to noise in excess of the 75 dBA threshold. Without mitigation, significant impacts are expected at all three of these receivers.

Jacking beneath Burbank Boulevard will occur between Vineland Avenue and Cartwright Avenue, eliminating any airborne noise impacts to receivers along this portion of the alignment.

A short stretch of open-trenching will occur between Cartwright Avenue and Cahuenga Boulevard, as shown in Figure 47. Because this stretch is too short to contain the entire trenching operation, only the excavation portion is shown. The two sensitive receivers here, Ministerio Palabra Verdad Y Vida and Cahuenga Potters Studio, will both be subject to noise levels in excess of the 75 dBA threshold. Without mitigation, significant impacts will therefore exist for both receivers.

Trenching will continue east of Cahuenga Boulevard until terminating near Biloxi Avenue. Figure 48 shows the two sensitive receivers along this final stretch, Iglesia De Dios and Screenland Studios. Both receivers will be subject to noise exceeding the 75 dBA threshold, resulting in significant unmitigated impacts at both.

South of the river, trenching will continue along Forest Lawn Drive until the project terminates at the Headworks Spreading Grounds. Figure 49 shows noise contours from trenching operations near the Lod Cook Center/Junior Achievement Foundation building. Trenching noise levels at this building are projected to approach 70 dBA, however, this is comparable to existing noise levels from traffic on Forest Lawn Drive, and no significant impact is therefore expected for this receiver.[13]

Similarly, the Mount Sinai Mortuary is not expected to be subject to trenching noise levels significantly higher than those existing due to traffic, as shown in Figure 50. All other sensitive receivers south of the river lie beyond the range of any significant impact.

Impacts due to open-trenching operations in the City of Los Angeles are summarized in Table 10 below.

[13] This building is impacted by pit/shaft noise, as described above.

Table 10: Airborne noise impacts due to open-trenching operations

Sensitive Receiver	Figure	Land Use
Lankershim Medical Clinic	Figure 43	medical
Inglesia Pentecostes Fuente de Luz	Figure 43	worship
Maurice Sendak Elementary School	Figure 44	school
Family Hope Medical Clinic	Figure 45	medical
Inglesia Pentecostes	Figure 46	worship
L.A. Urgent Care Clinic	Figure 46	medical
West Coast Seminary	--	worship/school
Ministerio Palabra Verdad Y Vida	Figure 47	worship
Cahuenga Potters Studio	Figure 47	film/recording
Iglesia De Dios	Figure 48	worship
Screenland Studios	Figure 48	film/recording

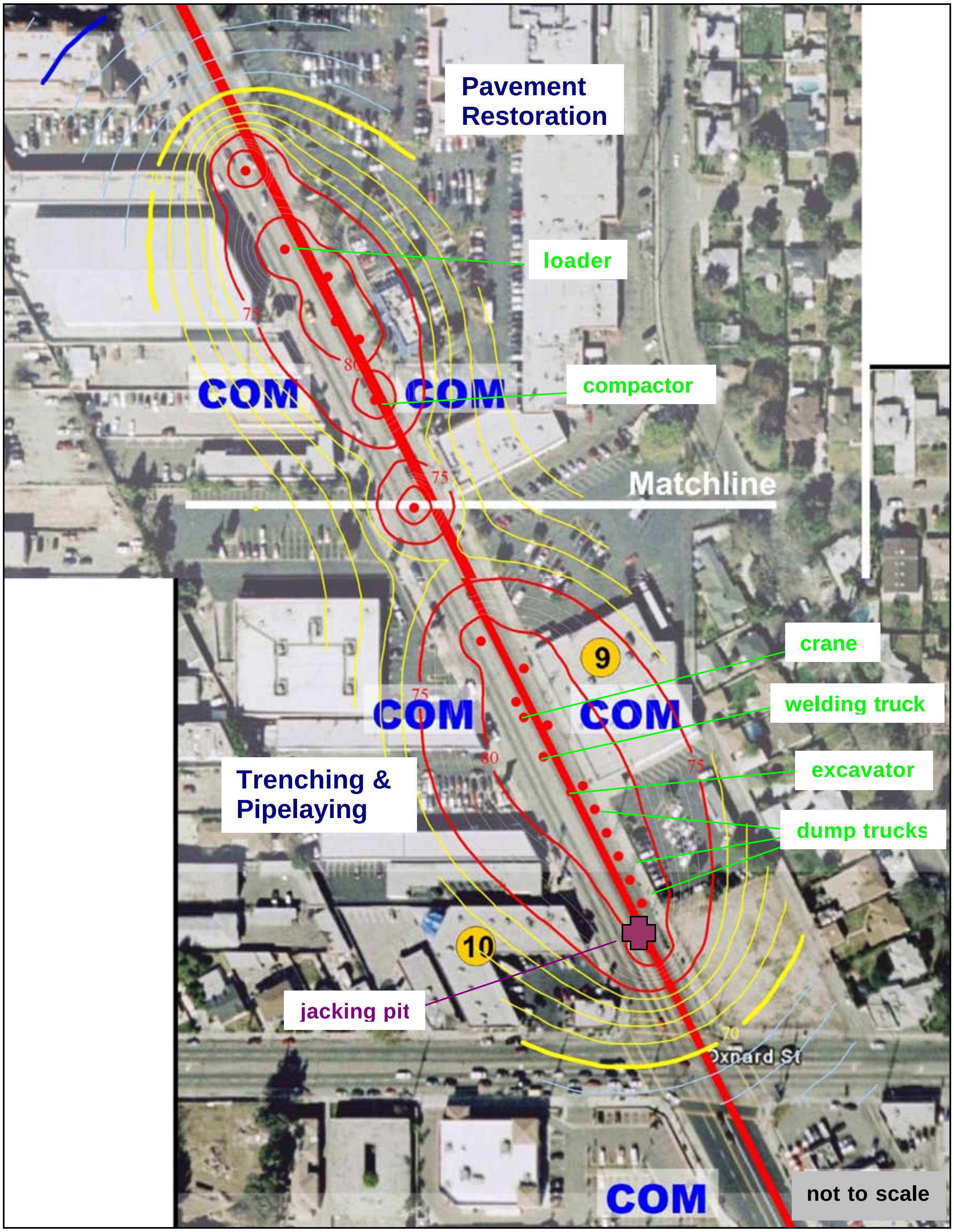


Figure 43: Open-trenching noise contours – north of Oxnard St. (1-hr Leq)

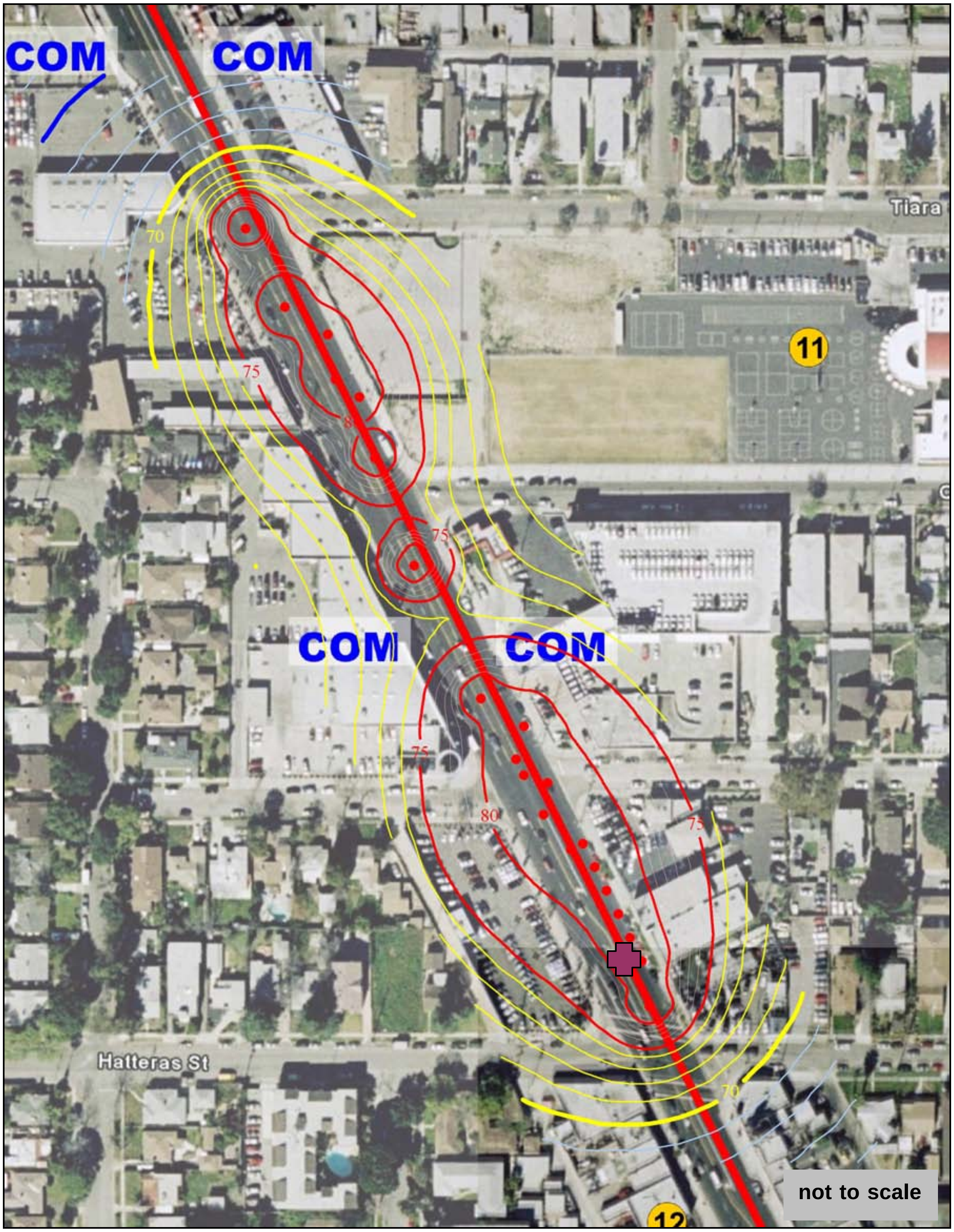


Figure 44: Open-trenching noise contours – Oxnard St. to Hatteras St. (1-hr Leq)

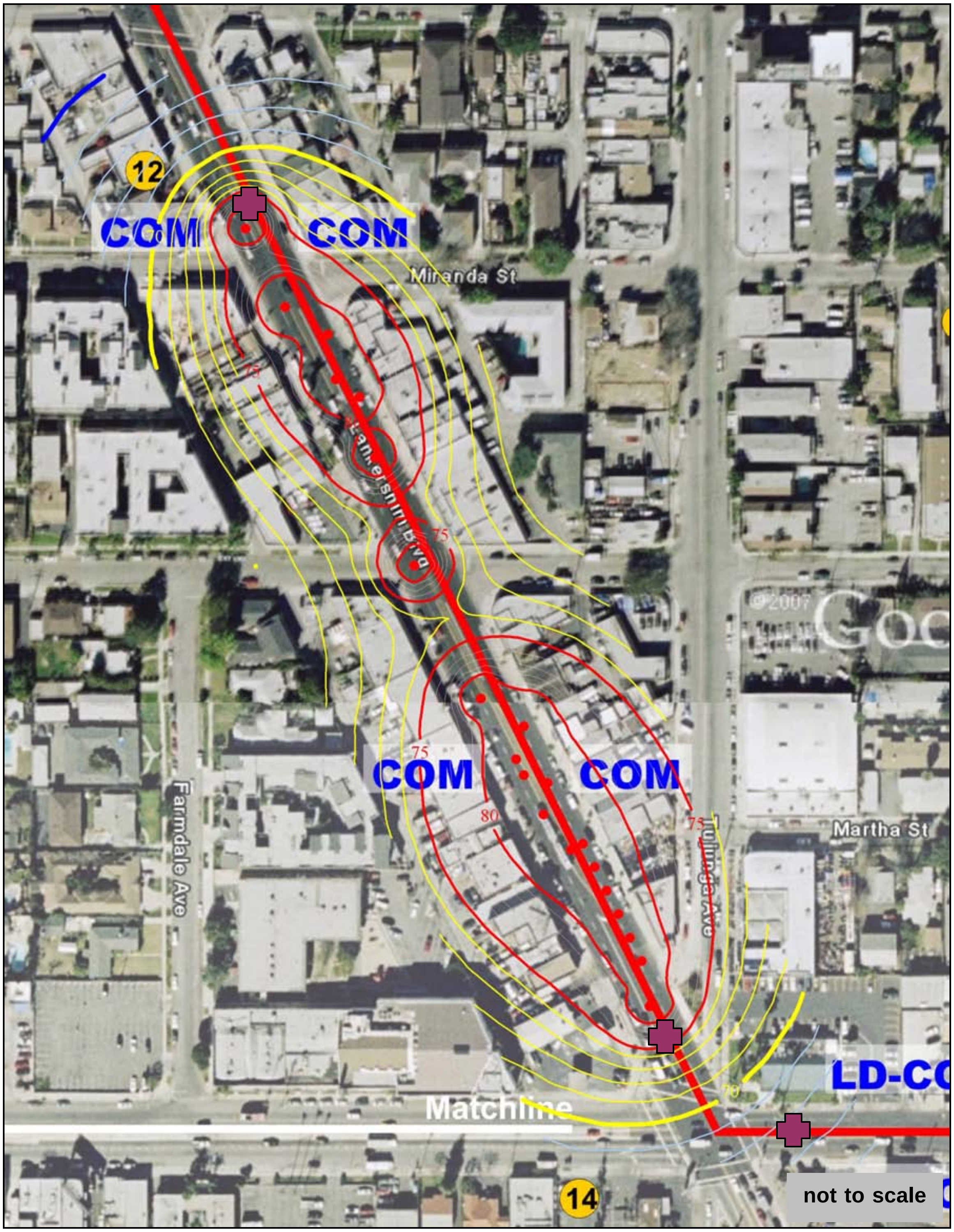


Figure 45: Open-trenching noise contours – Hatteras St. to Burbank Blvd. (1-hr Leq)

Figure 46: Open-trenching noise contours – Lankershim Blvd. to Vineland Ave. (1-hr Leq)

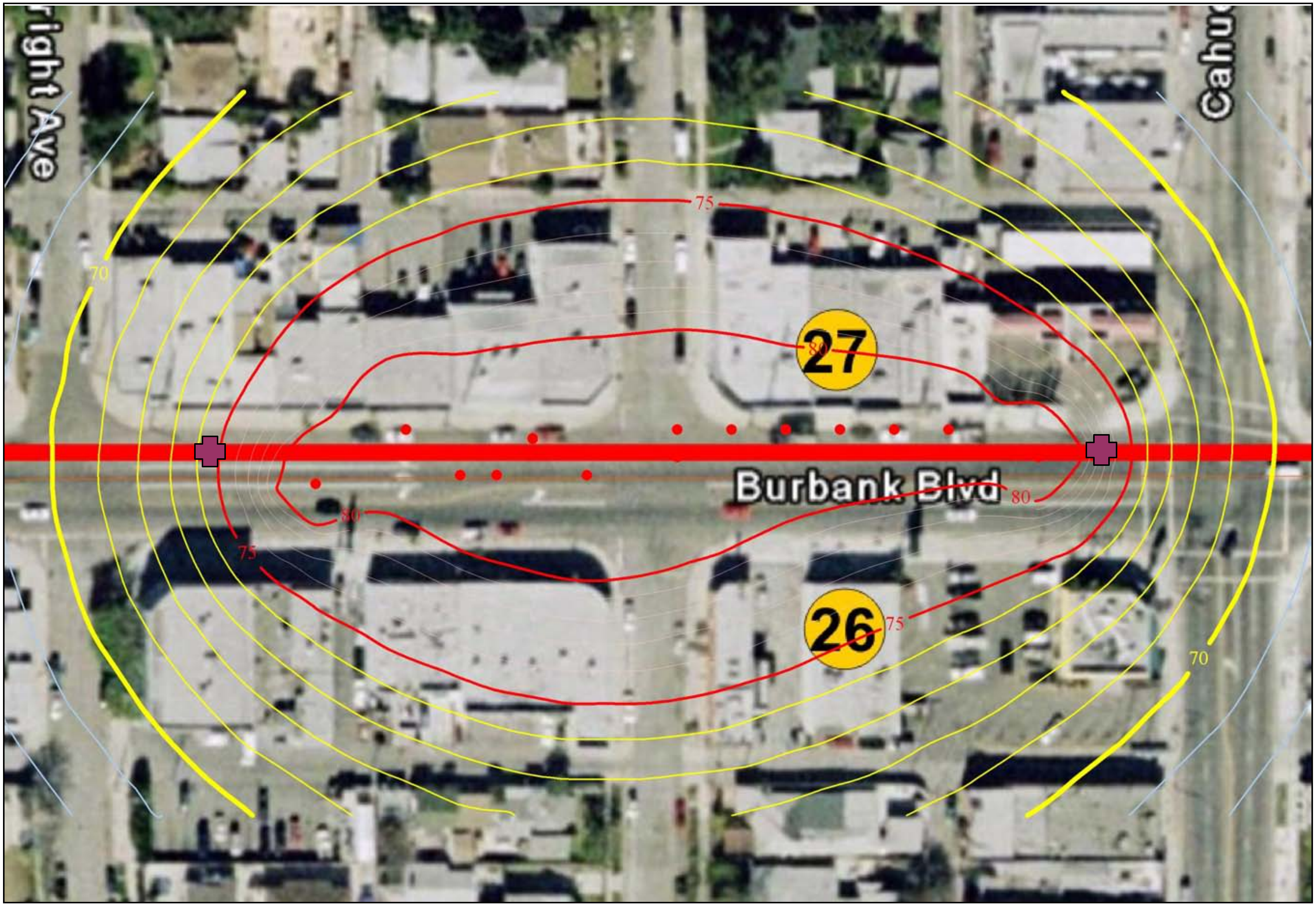


Figure 47: Open-trenching noise contours – Cartwright Ave. to Cahuenga Blvd. (1-hr Leq)

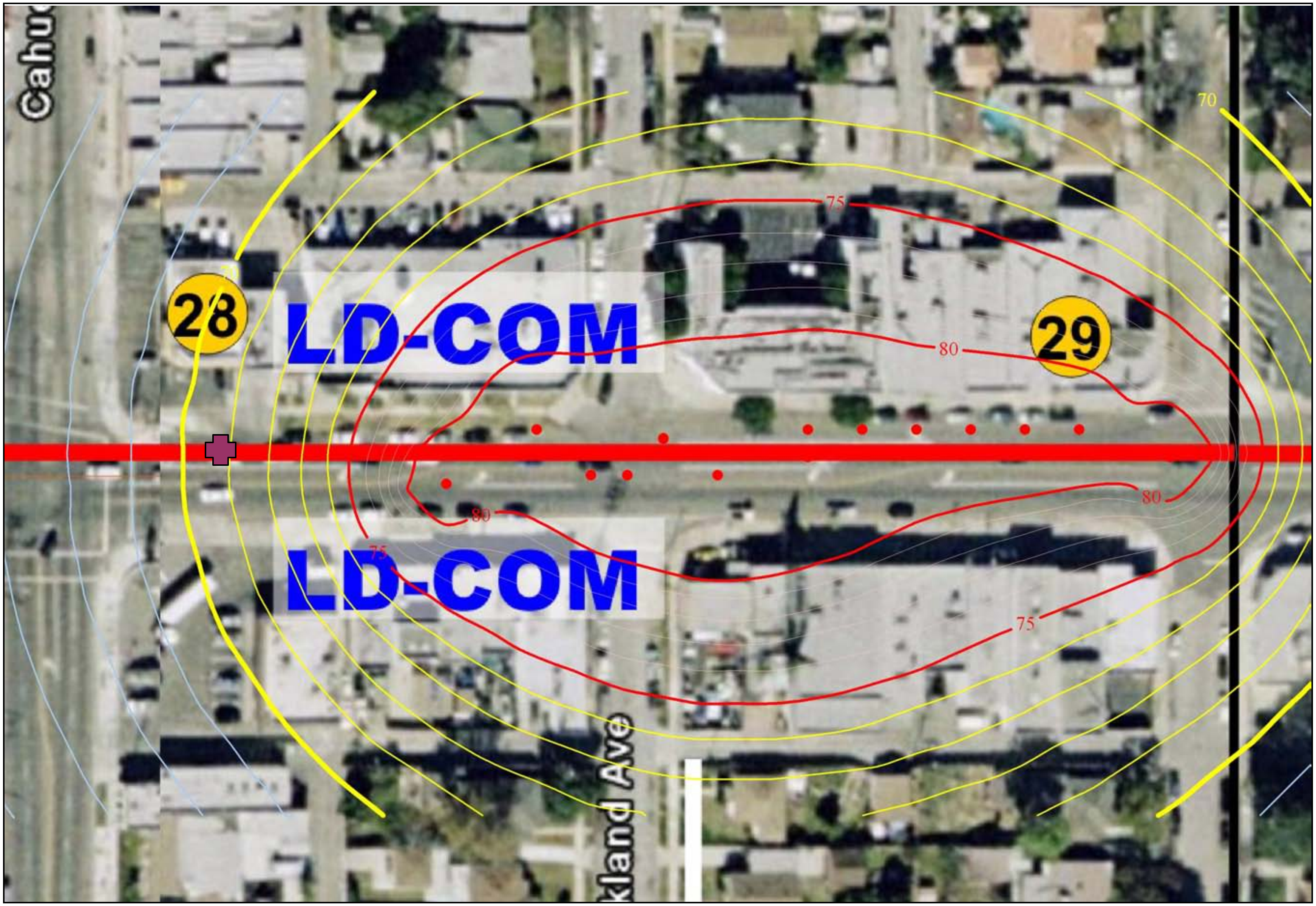


Figure 48: Open-trenching noise contours –Cahuenga Blvd. to Biloxi Ave. (1-hr Leq)

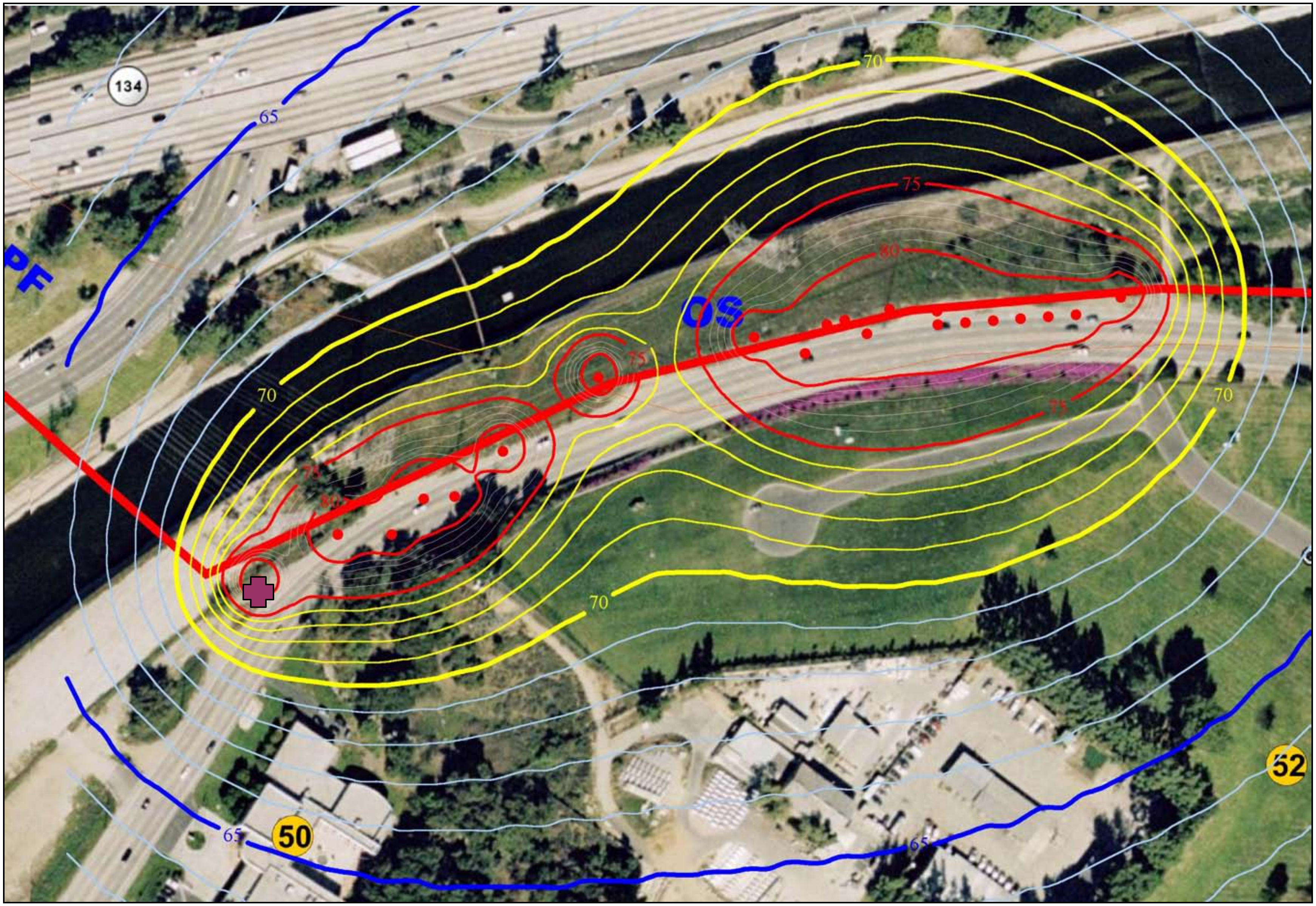


Figure 49: Open-trenching noise contours – Forest Lawn Drive near Lod Cook/Junior Achievement (1-hr Leq)

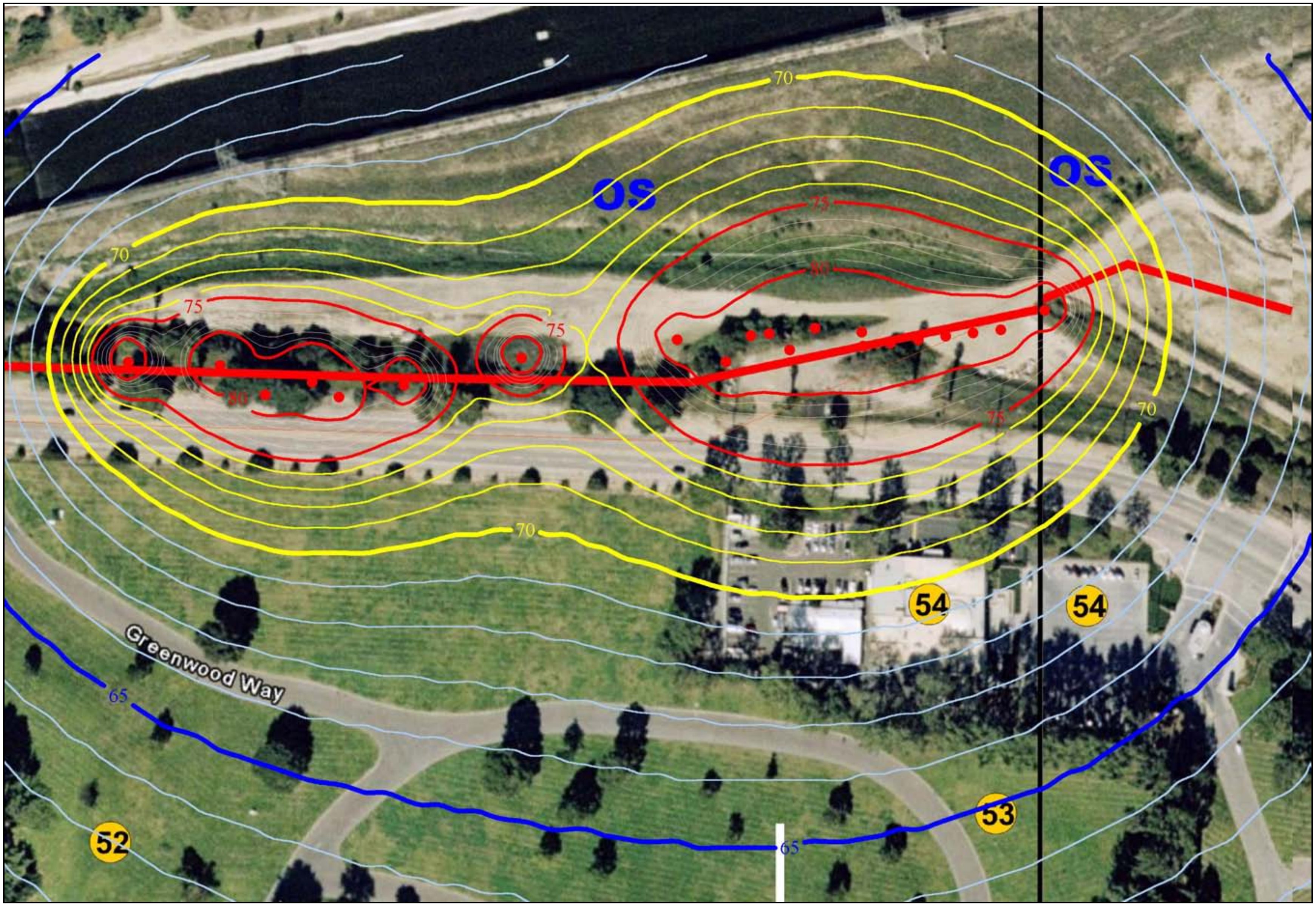


Figure 50: Open-trenching noise contours – Forest Lawn Drive near Mt. Sinai Mortuary (1-hr Leq)

6.3.3 Ground Vibration and Groundborne Noise

In Los Angeles, ground vibration and associated groundborne noise impacts will be limited to the northern portion of the project where tunneling occurs in Phase 1. The 150-foot and 170-foot impact zones, described in Section 6.2.3 above, are shown in Figure 51 and Figure 52 below. In this area, however, only the 150-foot impact zone for residential and similar receivers is likely to apply, as there are no known industrial receivers with vibration-sensitive equipment located here.

As is seen in Figure 51, the 150-foot groundborne-noise zone encompasses all first-tier residences lying adjacent to the project alignment on Hart Street and Morella Avenue, resulting in an impact at these receivers. Though exterior ambient noise levels in this area exceed 60 dBA, an allowance must be made for reduction of noise levels inside these residences due to architectural attenuation. A rule of thumb is that a twenty decibel difference will exist between exterior and interior noise levels with doors and windows closed, when using standard residential construction. Therefore, it is reasonable to assume that muck-train operations which cause groundborne noise levels to exceed 45 dBA inside any of these residences will result in interior noise levels higher than existing ambient levels. It should be noted, however, that residences in the vicinity of tunnel shafts will likely be impacted greater by airborne-noise due to operations around the shaft than groundborne noise due to muck-train activity.

Other sensitive receivers which may be affected by groundborne-noise similar to a residence include Ministero Pentecostes de Jesucristo and Inglesa Pentecostal Unida in Figure 51, and the Kiddie Academy in Figure 52. Commercial receivers along Lankershim Boulevard are not considered impacted for the reason stated above.

Table 11 below summarizes the vibration-related impacts in Los Angeles.

Table 11: Vibration-related impacts

Sensitive Receiver	Figure	Land Use
multiple residences	Figure 51	residential
Ministero Pentecostes de Jesucristo	Figure 51	worship
Inglesa Pentecostal Unida	Figure 51	worship
Kiddie Academy	Figure 52	school

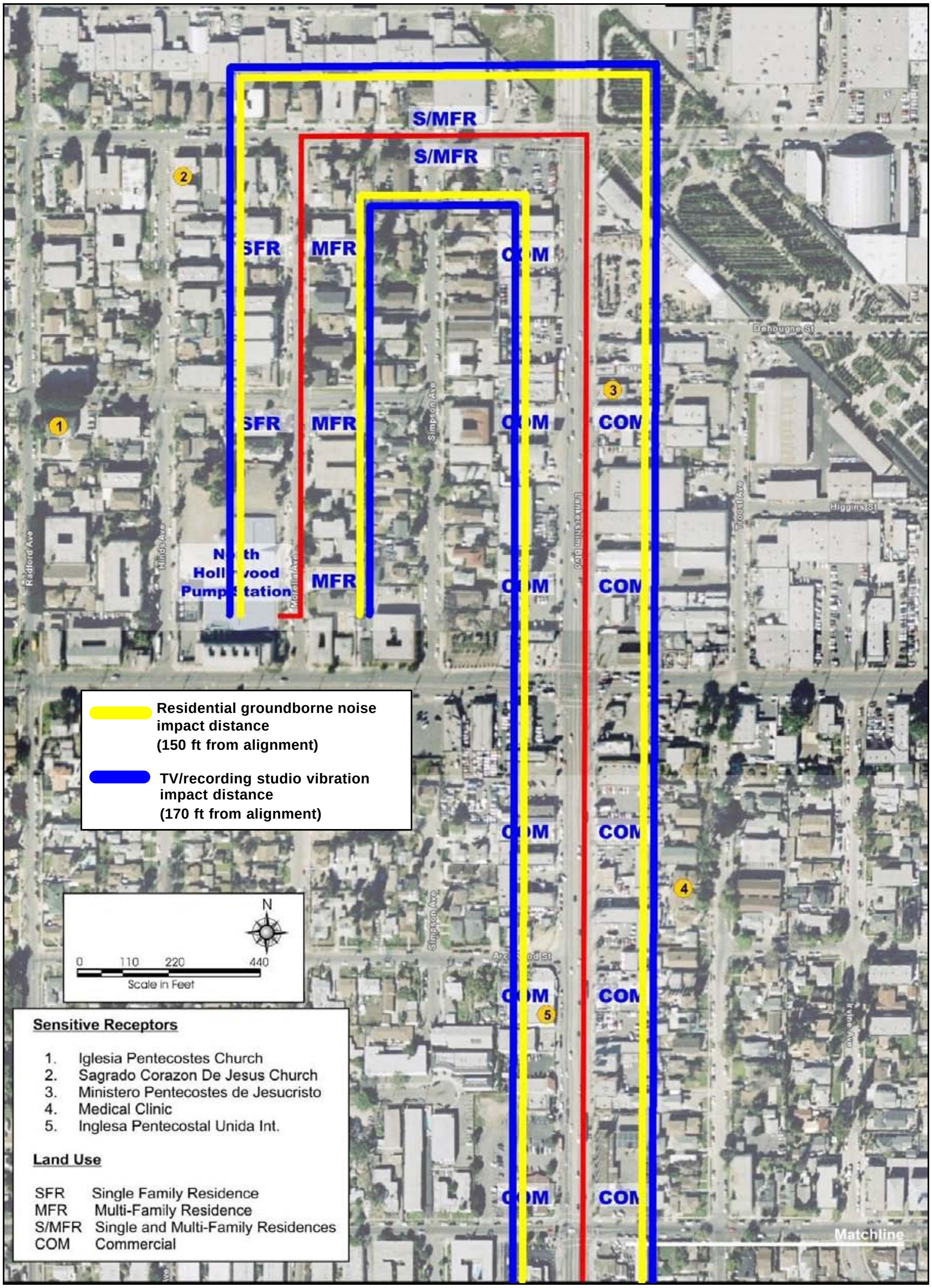


Figure 51: Tunneling impact zones - Phase 1 (1 of 2)

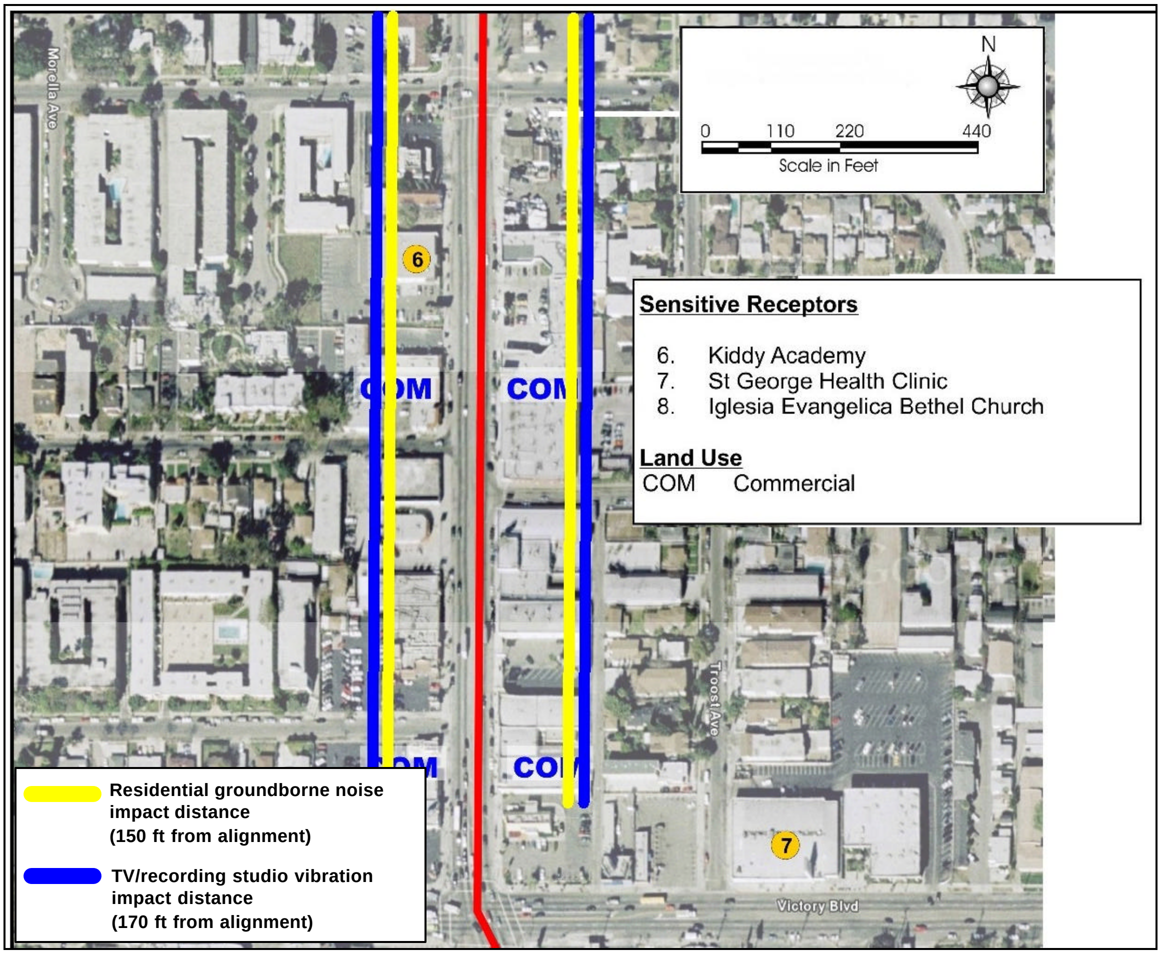


Figure 52: Tunneling impact zones - Phase 1 (2 of 2)

6.3.4 Trucking Noise

No determination has yet been made regarding the routes or number of trucks required to haul soil, materials, and waste to and from the construction zones. It is presumed, however, that trucking will be confined to the major roads such as Lankershim Boulevard and Burbank Boulevard, and will avoid residential side streets.

Figure 26 above shows the average noise emissions produced by heavy trucking as a function of trips per hour. The levels shown by this graph are those which would be experienced by a close-in receiver (25 feet from the centerline of travel). As shown in the graph, thirty truck-trips per hour would result in average noise levels of around 65 dBA, which is comparable to the existing ambient noise levels along Lankershim Boulevard and Burbank Boulevard. Unless project requirements dictate trucking activity at a rate substantially higher than one trip every two minutes, no impact from trucking noise is anticipated.

In the event that trucking is required on residential side streets, a noise impact is likely, and must be handled on a case-by-case basis.

6.3.5 Miscellaneous Noise

No staging areas have yet been identified for this project, therefore no detailed assessment of potential noise impacts can be made. The contractor(s) would be responsible for scouting and securing suitable local lots for staging areas. However, possible staging areas identified for the proposed project include the Headworks Spreading Grounds, Johnny Carson Park north of Riverside Drive, open right-of way within the Whitnall Highway, or local LADWP facilities, including the North Hollywood Pump Station. Potential impacts from staging areas must be addressed as locations are selected.

The possibility exists that the use of dewatering pumps may be required, especially around the river. These pumps would run continuously and at night, and would therefore create potential noise impacts on nearby sensitive receivers. As no details regarding their use are yet available, no specific impacts can be identified. Mitigation of dewatering pump noise, however, should be readily achievable where necessary, and should be handled on a case-by-case basis.

6.4 Burbank Impacts Assessment

6.4.1 General

As shown in Figure 1, pipeline-laying in the City of Burbank will consist entirely of tunneling. Airborne construction noise and ground-vibration are impacts of concern.

6.4.2 Airborne Noise

Noise contours around the tunnel shaft in Johnny Carson Park are depicted in Figure 41. This section of the park is sandwiched between Ventura Freeway and Riverside Drive, where measured ambient noise levels here exceeded 67 dBA. Nevertheless, this shaft lies within a sensitive receiver, as defined above, and noise levels will exceed 75 dBA within a confined area.

Though a significant noise impact will technically exist at Johnny Carson Park (based on the above-defined criteria), it will occur in a rather isolated section of the park which is straddled by two busy roads. The majority of the park will remain unaffected by operations around this tunnel shaft.

It is likely, however, that a portion of Johnny Carson Park between the freeway and Riverside Drive will be set aside for staging construction equipment. In addition to the park itself, nearby residences also constitute noise-sensitive receivers for this location. Assuming the staging area is removed a sufficient distance from these residences, they would be subject primarily to truck traffic accessing the staging area via Bob Hope Drive. As indicated in Figure 26 above, however, it is unlikely that sufficient truck traffic will exist to drive noise levels substantially above the existing ambient level of approximately 60 dBA.

6.4.3 Ground Vibration and Groundborne Noise

Ground vibration and associated groundborne noise are anticipated along the entire length of the tunnel alignment in Burbank. As shown in Figure 53 through Figure 56, most first-tier residences and some second-tier residences along Whitnall highway lie within the 150-foot impact zone for muck-train groundborne-noise impacts (yellow lines). As existing ambient noise levels along this corridor are relatively low, it is expected that groundborne noise will be noticeable inside these residences and may result in some complaints.

In addition to these residences, significant vibration-related impacts are also expected at the sensitive receivers shown in Table 12 below. Three of these are film/recording type facilities and will therefore be impacted by ground vibrations (blue lines in the figures). The remainder will be impacted by groundborne-noise.

Most of the studios and other receivers in Figure 56, which may be vibration-sensitive, lay well outside of the estimated impact zones. Therefore, the expected impact on these receivers from either ground-vibration or groundborne-noise is less than significant. Note that two of the buildings in Figure 56 have been demolished, as annotated; therefore, no impact exists here. Finally, exterior areas are not considered impacted by ground vibration regardless of their distance to the tunnel alignment; therefore, no impact exists for any park land along Whitnall Highway.

Table 12: Vibration-related impacts

Sensitive Receiver	Figure	Land Use
multiple residences	Figure 53 - Figure 56	residential
Universal Adult Day Care	Figure 53	residential
Fred Wolfe Films	Figure 53	film/recording
Media Center Montessori Pre-School	Figure 54	school
American Lutheran Church	Figure 54	worship
American Lutheran School	Figure 54	school
Robert Louis Stevenson Elementary School	Figure 55	school
CCI Digital	Figure 56	film/recording
NBC TV, D Lot	Figure 56	film/recording

6.4.4 Trucking Noise

Because construction will be carried out completely underground, no trucking noise in connection with this project is anticipated in the City of Burbank.

6.4.5 Miscellaneous Noise

No staging areas have yet been identified for this project, therefore no detailed assessment of potential noise impacts can be made. The likelihood that a portion of Johnny Carson Park between the freeway and Riverside Drive will be set aside for staging construction equipment is addressed above. The contractor(s) would be responsible for scouting and securing suitable local lots for staging areas. However, possible staging areas identified for the proposed project include the Headworks Spreading Grounds, Johnny Carson Park north of Riverside Drive, open right-of way within the Whitnall Highway, or local LADWP facilities, including the North Hollywood Pump Station. Potential impacts from project staging areas must be addressed as locations are selected.

The possibility exists that the use of dewatering pumps may be required, especially around the river. These pumps would run continuously and at night, and would therefore create potential noise impacts on nearby sensitive receivers. As no details regarding their use are yet available, no specific impacts can be identified. Mitigation of dewatering pump noise, however, should be readily achievable where necessary, and should be handled on a case-by-case basis.

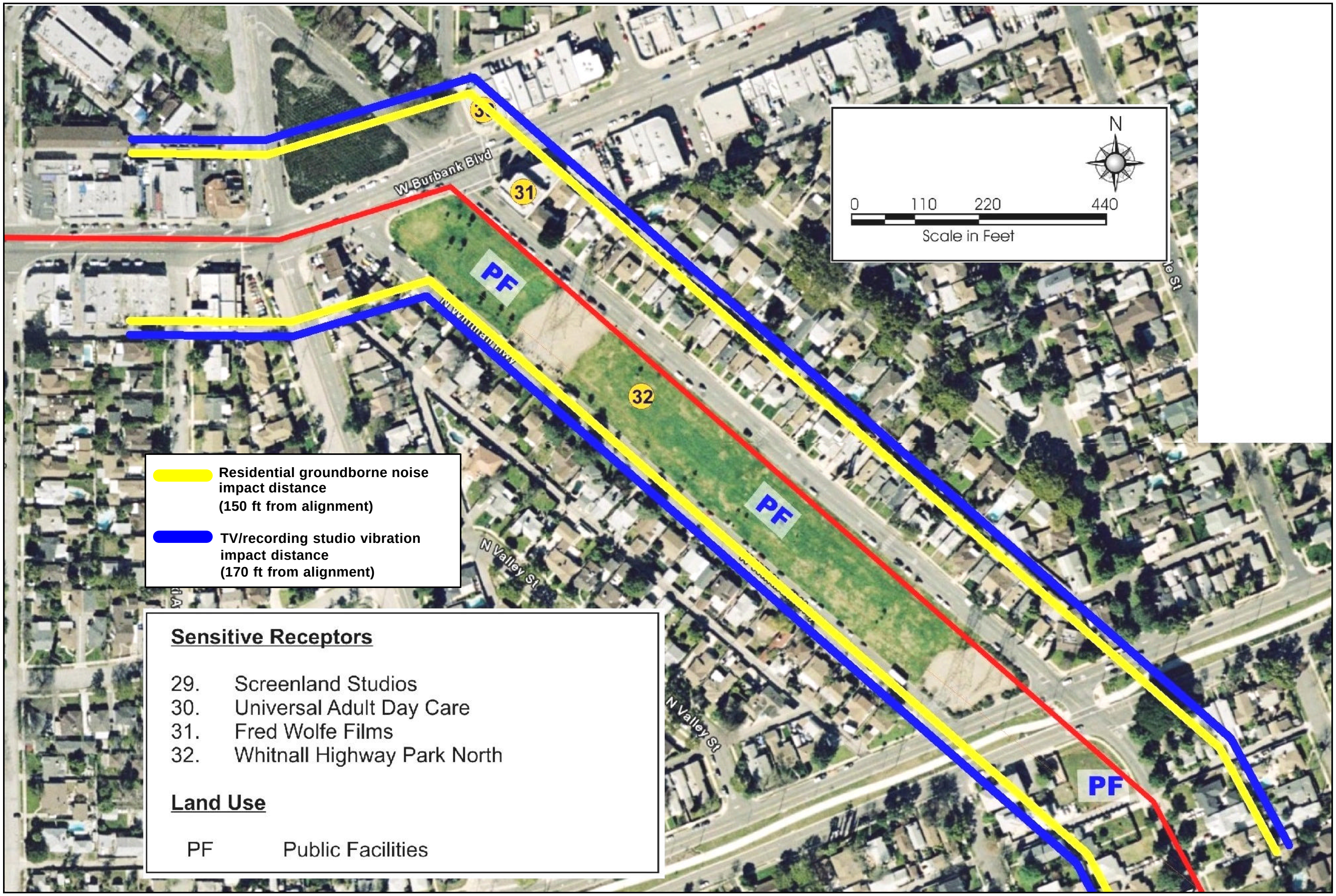


Figure 53: Tunneling impact zones - Phase 3 (1 of 4)

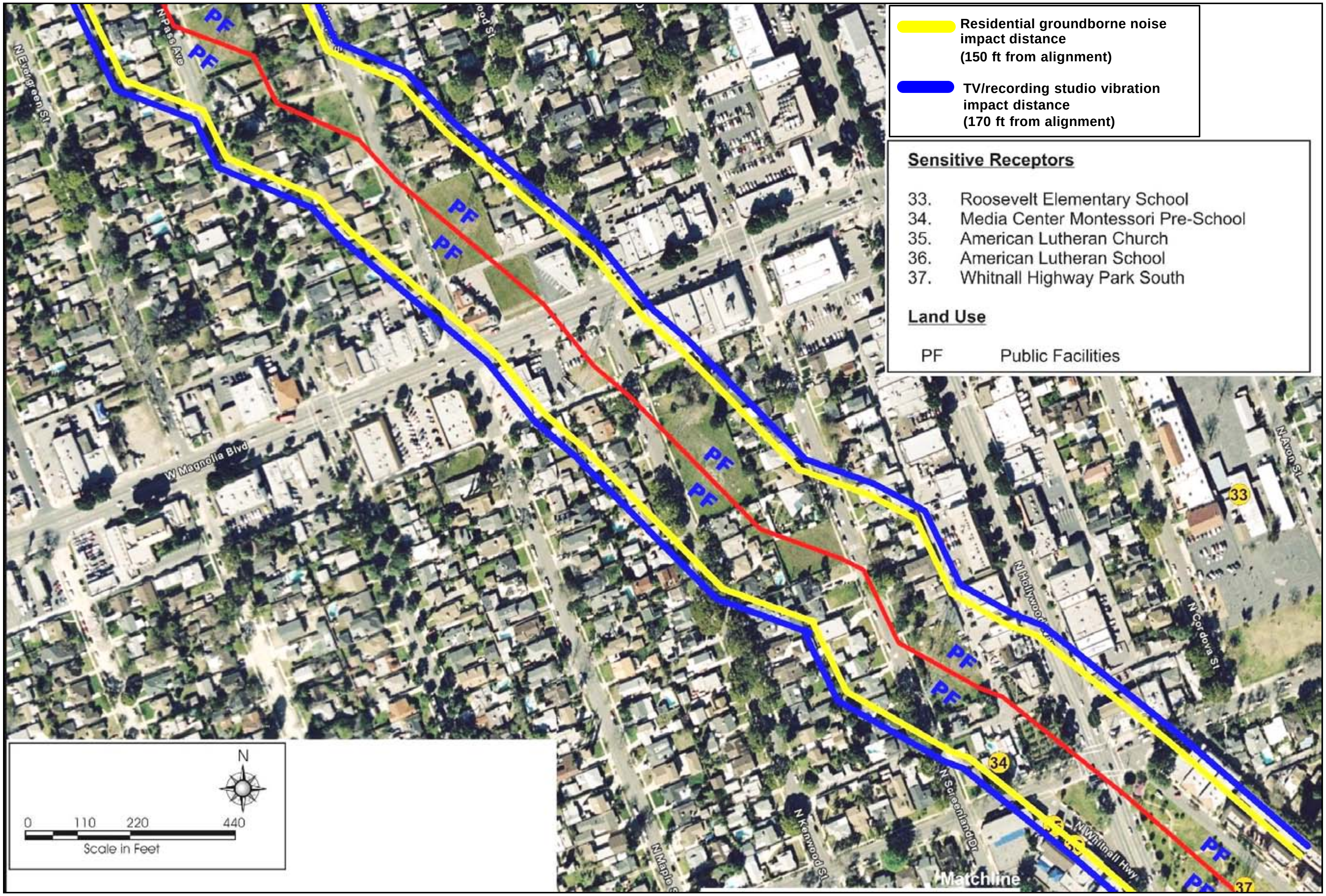


Figure 54: Tunneling impact zones - Phase 3 (2 of 4)

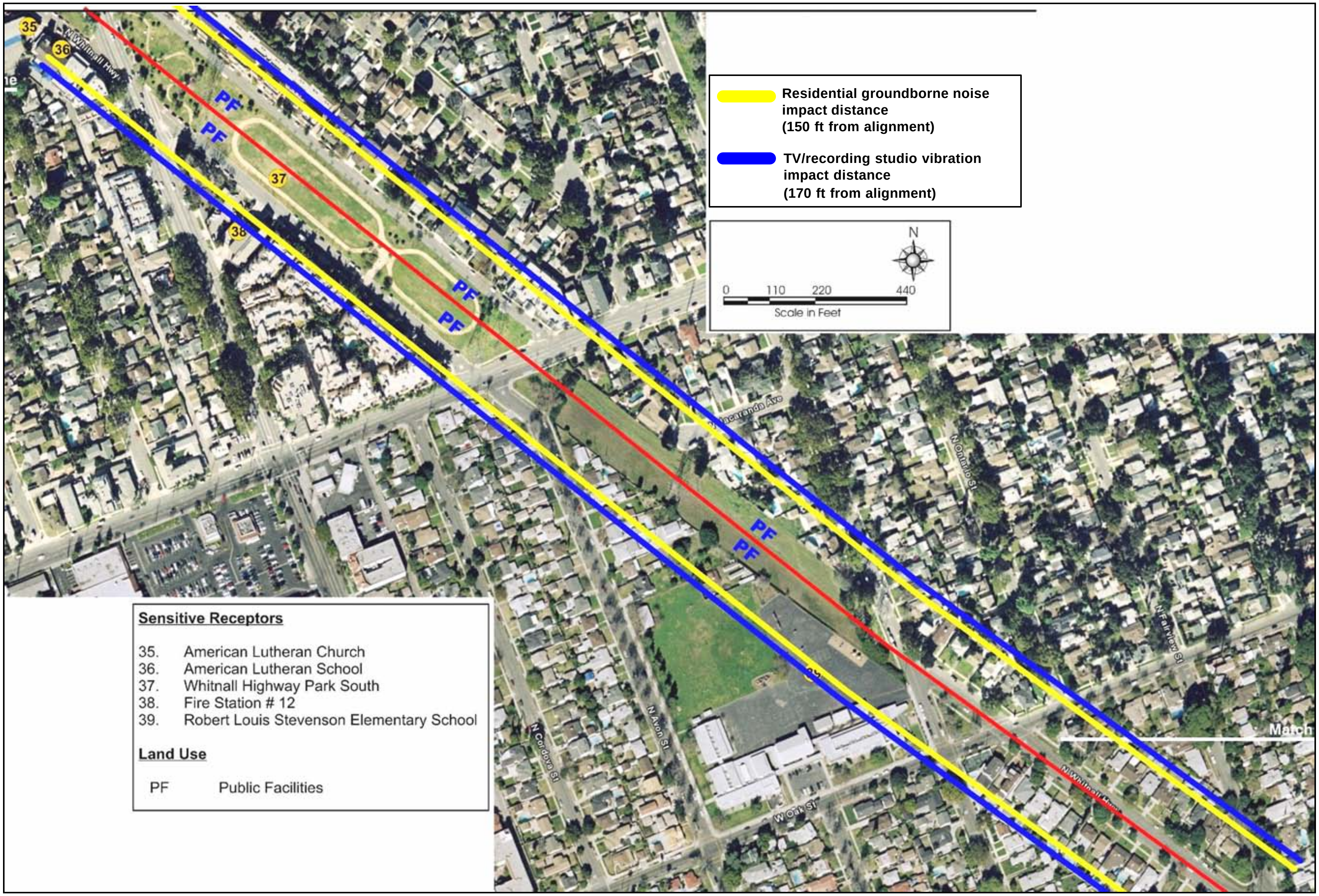


Figure 55: Tunneling impact zones - Phase 3 (3 of 4)

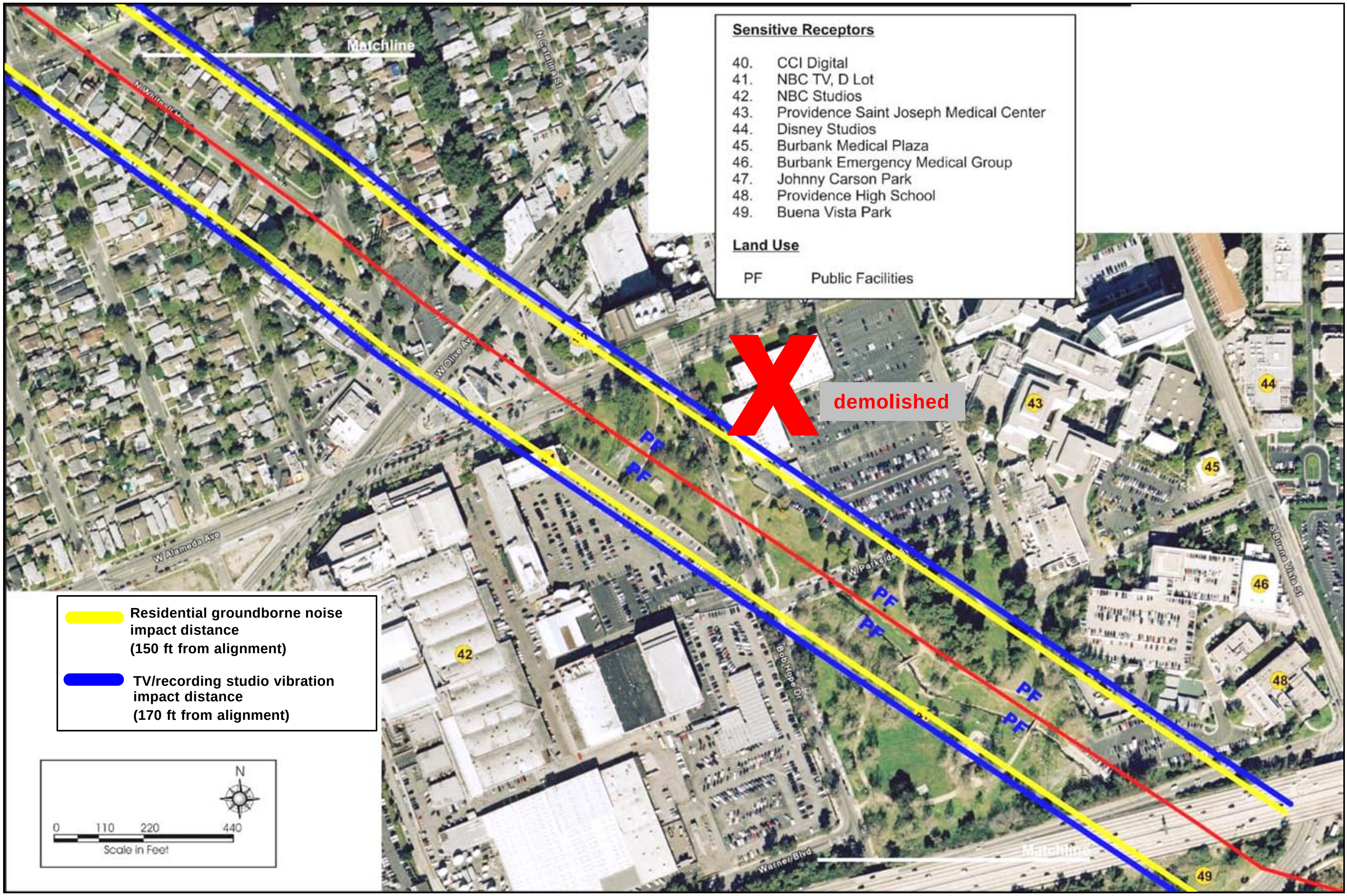


Figure 56: Tunneling impact zones - Phase 3 (4 of 4)

6.5 Summary of Impacts

Significant impacts to noise-sensitive receivers due to the Upper Reach project are summarized in answering the relevant questions from the CEQA Guidelines, as follows:

Would the project result in exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

Significant and unavoidable. Both the Los Angeles and Burbank ordinances focus on restricted operating hours as a means of regulating construction hours. Construction of the project is planned to occur during daytime, swing and nighttime hours. Section 112.05 of the Los Angeles code further restricts noise emissions from construction equipment to a level of 75 dBA at a distance of 50 feet from any construction equipment, if technically feasible. Provided that all equipment used on this project is fitted with appropriate mufflers, shields, or other available noise-attenuating devices, the technical-feasibility requirement is presumed to be met. Only machinery which inherently creates loud noise (e.g. pavement breakers) would be considered exempt from the technical-feasibility requirement.

Would the project result in exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?

Significant and unmitigatable impact. Sensitive receivers lying within a distance of 150 feet (residential or similar) or 170 feet (film/recording studio) of a tunnel alignment may be subject to ground-vibration or groundborne-noise in excess of the criteria recommended by the Federal Transit Administration. These receivers lie along the northern portion of the project (Phase 1) and along Whitnall Highway in Burbank (Phase 3). Although certain mitigation measures may be applied (discussed below), it is unlikely that impacts can be confidently reduced to below the recommended thresholds due to the nature of ground vibration. All impacts, however, will be temporary and only occur during daytime hours as currently planned.

Would the project result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?

Significant but mitigatable impact. Airborne noise from construction equipment will exceed the significant thresholds defined above for many receivers along the alignment. Of primary concern is exceedance of the 75 dBA threshold. Mitigation of airborne noise to acceptable levels is feasible, however, using a combination of noise barriers and other techniques discussed below.

Table 13 below summarizes all of those noise impacts specifically identified above, whether due to above-ground or tunneling operations. Receivers are listed in approximately the order they are found, starting from the north end of the project alignment. Excluded from the table are possible, but unidentified, impacts due to staging-area operations, dewatering, and other activities associated with the project.

Table 13: Summary of identified impacts

Sensitive Receiver	Figure	Land Use	Impact	Source
multiple residences	Figure 27 & Figure 51	residential	airborne & vibration	pit/shaft & tunneling
multiple residences	Figure 28 & Figure 51	residential	airborne & vibration	pit/shaft & tunneling
Ministero Pentecostes de Jesucristo	Figure 51	worship	vibration	tunneling
Inglesa Pentecostal Unida	Figure 51	worship	vibration	tunneling
Kiddie Academy	Figure 52	school	vibration	tunneling
Lankershim Medical Clinic	Figure 43	medical	airborne	trenching
Inglesia Pentecostes Fuente de Luz	Figure 32 & Figure 43	worship	airborne	pit/shaft & trenching
Maurice Sendak Elementary School	Figure 44	school	airborne	trenching
Family Hope Medical Clinic	Figure 35 & Figure 45	medical	airborne	pit/shaft & trenching
Inglesia Pentecostes	Figure 46	worship	airborne	trenching
L.A. Urgent Care Clinic	Figure 46	medical	airborne	trenching
West Coast Seminary	--	worship/school	airborne	trenching
Ministerio Palabra Verdad Y Vida	Figure 47	worship	airborne	trenching
Cahuenga Potters Studio	Figure 47	film/recording	airborne	trenching
Iglesia De Dios	Figure 39 & Figure 48	worship	airborne	pit/shaft & trenching
Screenland Studios	Figure 48	film/recording	airborne	trenching
multiple residences	Figure 53 - Figure 56	residential	vibration	tunneling
Universal Adult Day Care	Figure 53	residential	vibration	tunneling
Fred Wolfe Films	Figure 53	film/recording	vibration	tunneling
Media Center Montessori Pre-School	Figure 54	school	vibration	tunneling
American Lutheran Church	Figure 54	worship	vibration	tunneling
American Lutheran School	Figure 54	school	vibration	tunneling
Robert Louis Stevenson Elementary School	Figure 55	school	vibration	tunneling
CCI Digital	Figure 56	film/recording	vibration	tunneling
NBC TV, D Lot	Figure 56	film/recording	vibration	tunneling
Johnny Carson Park	Figure 41	park	airborne	pit/shaft
Lod Cook Center/Junior Achievement Foundation	Figure 42	school	airborne	pit/shaft

7 Mitigation Options

7.1 General

Mitigation of the above-identified impacts will be readily achievable in some cases, but impractical in others. The discussion that follows addresses general methods of abating each impact and notionally quantifies results where applicable. Because each location and activity will impose its own constraints on mitigation treatments, no attempt is made to definitively determine the effects of treatments.

7.2 Jacking-pit/Tunnel-shaft Noise

Airborne construction noise is usually controlled by use of temporary sound barriers. Typical barriers are solid (e.g. plywood) walls fabricated on site, or commercially-available noise curtains which are hung from scaffolding or some other framework. Rigid temporary sound walls are also commercially available. Solid walls tend to offer greater resistance to sound-penetration than curtains, however, the latter can generally be raised to greater heights given stability and wind-loading considerations.

A curtain, if used, must be massive (heavy) enough to significantly attenuate low-frequency exhaust noise from construction machinery; lightweight curtains will prove unsatisfactory. A minimum rating of STC-28 is recommended, though higher values are preferred.[14] A curtain material that provides reasonably adequate performance is reinforced mass-loaded vinyl. Such curtains can provide attenuation up to ratings of STC-33, with the heavier, thicker sheets performing best. Composite materials are also available which combine an absorptive material with the mass-loaded vinyl, providing additional noise containment.

Solid sound walls should be also be constructed to provide a massive barrier to noise transmission. They are typically constructed of a minimum 1-inch thick plywood or oriented-strand board (OSB). Alternately, a minimum 5/8" thick gypsum board, cement board, or similar material may be substituted for the plywood. Single-layer walls are common, though dual-layer walls are also used for extra protection. Sound walls should preferably be treated with a sound-absorptive face on the construction side, which further enhances its performance. Sound-absorption typically consists of a minimum 2-inches of encased fiberglass or equivalent. Solid sound walls must be constructed so that they contain no gaps or holes which would allow noise penetration, including along the seams. They must also be adequately braced to prevent collapse due to wind-loading, seismic events, and other causes.

Earth berms present a third alternative for noise control, particularly along the trenching portion of the alignment where excavated soil can be laid alongside the trench as a noise

[14] STC: Sound transmission class—a rating of a barrier's ability to attenuate noise; higher values are better.

barrier rather than trucking it off-site. Numerous constraints limit the feasibility of this approach, however, including the locations and heights of receivers, and available ground space. Where conditions are favorable, however, earth berms can provide excellent noise abatement.

Assuming it is sufficiently solid, the height of a sound wall will largely determine its performance. Sound walls shall be constructed as high as practical, but at a minimum should be eight feet tall. Greater heights are preferable in order to block the line-of-sight between receivers and machinery exhaust stacks. Furthermore, second-story receivers require taller barriers to adequately mitigate noise impacts, possibly mandating the use of curtains in lieu of solid walls. It will be incumbent upon the contractor to determine the best approach to mitigation given specific constraints of the project site.

7.3 Open-trenching Noise

Noise from open-trenching activities would be controlled substantially the same as that around the jacking pits and tunnel shafts, namely by the use of temporary sound barriers. Because of the relatively few sensitive receivers located along the open-trenching portions of the alignment, mitigation treatments can focus on the receivers themselves rather than on the construction equipment. Specifically, barriers can be erected directly in front of sensitive receivers, remaining there until construction has moved out of the area. This is a more practical arrangement than mobile barriers which move with construction activity, given that trenching may be extended over a thousand feet.

7.4 Tunneling Vibration

Mitigating groundborne vibration and associated groundborne noise due to tunneling is more problematic than controlling airborne noise from surface machinery. There is no practical way to block the path of vibration as there is with airborne noise, thus all mitigation measures must be implemented at the source of vibration, namely the tunnel-boring machine and the muck-trains. It is not within the scope of this study to perform a detailed assessment and provide recommendations regarding source-level control of vibration, however, the following measures may be considered:

- adjust the speed of the TBM cutting wheel (it is possible that the rotational speed of the cutting wheel may coincide with natural frequencies of nearby structures, thus amplifying the induced vibration; increasing or decreasing the wheel speed would likely reduce this impact);
- use alternate TBM cutting surfaces (different cutting surfaces, if available, may induce varying levels of vibration into the soil, particularly with regard to soil composition and condition);
- minimize the undulations and roughness of muck-train tracks (a muck car which rolls smoothly over its tracks will induce less vibration into the surrounding soils);

- minimize the number of junctions in the muck-train tracks (previous experience indicates that muck-train vibration impacts are greatest near junctions in the tracks, where disjoints are likely to occur in the rails);
- minimize gaps between adjoining rails;
- mount muck-train tracks on resilient pads or springs;
- maintain roundness of muck-train wheels;
- lessen the load of the muck-trains (lightly-loaded cars will induce less vibration into surrounding soils than heavily-laden cars).

The above mitigation treatments are suggested only for consideration. Any or all of them may be infeasible due to operational constraints, and it will be incumbent upon the contractor to determine what mitigation measures are appropriate and implement them accordingly. Where excessive vibration induced in sensitive industrial uses (i.e. TV and recording studios) is unavoidable, coordination between the contractor and facility management should occur such that tunneling activities do not coincide with vibration-sensitive activities at the facility. In the area around NBC and Disney studios, it may be preferable to tunnel at night.

Otherwise, ground-vibration and associated groundborne noise must be considered a significant, but unmitigatable impact. The groundborne noise induced in residential and other sensitive buildings will almost certainly be less than would be present with open-trench construction.

7.5 Staging-area Noise

Locations for staging areas have not yet been determined, as they will be selected by the contractor. Control of staging-area noise is best obtained by locating the staging-areas and their access routes well away from any sensitive receivers. Barring this, staging area noise can be controlled by use of temporary sound barriers (see above) and restrictions on operating hours. Nighttime work and deliveries must be prohibited, including maintenance of construction machinery. The staging area should be fenced and equipped with locks to prevent unauthorized activities after hours, and signs should be prominently displayed indicating the hours of operation.

7.6 Trucking Noise

Mitigation of noise impacts due to trucking activity would be accomplished by restricting delivery routes to the major roadways, specifically Lankershim Boulevard, Burbank Boulevard, and Forest Lawn Drive. Ambient noise levels created by existing traffic on these roads is high enough to be essentially unaffected by trucking activity for this project. Any unavoidable use of residential side streets as alternate routes must be kept to the absolute minimum to meet project requirements.

7.7 Miscellaneous Treatments

Various miscellaneous treatments can be employed to further control construction noise, as described below.

Noise reductions can be obtained at the source by using quiet machinery:

1. **Muffle machinery:** all equipment used on the site should be equipped with appropriate exhaust mufflers and any available "hush kit", the latter of which may include quieter cooling fans, shrouds, etc.
2. **Maintain machinery:** all equipment should be properly maintained and lubricated to ensure it does not produce any extraneous noise due to squeal, vibration, etc.
3. **Substitute machinery models:** some types of construction equipment are available which are specifically designed for noise-control; MQ Power, for example, makes a "Whisperwatt" line of generators which are substantially quieter than comparable generators of the same output; such machines should be selected for use on this project.
4. **Substitute machinery types:** the Bobcat line of construction machines produce substantially lower noise-emissions than do larger loaders and backhoes; where feasible, they should be used in lieu of the larger and louder machines; the same approach also applies to trucks. Gasoline-powered trucks and equipment should be favored over diesel-powered units where feasible, and small pickup trucks should be used in lieu of large delivery trucks where feasible.

Stationary equipment used on-site (electric generators, air compressors, cement mixers) should be located as far as feasible from any noise-sensitive receiver. They should further be shielded or enclosed, as appropriate, to prevent unnecessary noise emissions. This requirement applies to dewatering pumps that are run in the vicinity of any noise-sensitive receiver.

Equipment that is not in use should be turned off. No machinery should be allowed to idle unnecessarily, including waiting delivery trucks. Signs should be prominently posted advising on-site personnel to limit machinery noise.

All personnel, including subcontractors, should be regularly briefed on the necessity for, and methods of, controlling noise. Briefings should occur primarily before construction enters any noise-sensitive areas.

7.8 Construction Noise Monitoring

Requiring that the contractor implement a noise-monitoring program as part of the construction contract will also help to control noise emissions associated with the project. The primary goal of a monitoring program is to raise the contractor's awareness of noise and the responsibility for controlling it to the extent practical. As part of the program, the contractor would be encouraged to:

- exclude noisier equipment from the project site - noise emissions of each piece of machinery would be tested against a set of criteria before allowing it onto the site;
- substitute low-noise equipment where possible, as described above;
- conduct noisy operations off-site where possible (e.g. rock crushing);
- diligently use noise shielding near all residences and other noise-sensitive receivers;
- impose noise-control procedures on all subcontractors;
- designate an on-site noise representative.

The monitoring program should be ongoing and goal-directed to reduce hazardous noise levels and address individual complaints before they escalate to community concerns.

8 Conclusions and Recommendations

8.1 Conclusions

Three different types of pipelaying techniques (trenching, jacking, and tunneling), will be employed on the Upper Reach project in the vicinity of many and varied receivers. Each construction technique varies in the level and type of impact it produces, and the various receivers have different impact thresholds. The impacts may be summarized as follows:

- open-trenching will generally produce significant airborne-noise impacts on all residences and other sensitive receivers immediately adjacent to the project alignment in Phase 2, requiring the use of noise barriers and other techniques to mitigate these impacts;
- jacking will produce significant (and extended) airborne-noise impacts at sensitive receivers in the vicinity of jacking pits, also requiring noise mitigation measures;
- tunneling will produce airborne noise impacts around tunnel shafts similar to those around jacking pits, and requiring the same mitigation measures; it will further produce significant ground-vibration and associated groundborne-noise impacts at nearby residences and commercial facilities using vibration-sensitive equipment.

8.2 Recommendations

Medlin & Associates, Inc. recommends that the mitigation options discussed in Section 7 above be applied, as appropriate, on the Upper Reach project. Mitigation measures shall be incorporated into the construction contract documents, and an independent monitoring program shall be implemented to verify contractor compliance and initiate corrective actions where necessary.

Medlin & Associates, Inc. further recommends that the Los Angeles Department of Water and Power establish a community liaison program for the Upper Reach project, the purpose of which would be to advise residences and sensitive establishments of the anticipated activities and their necessity, and to provide an open feedback path for complaints and consequent corrective actions.

Specific recommendations are as follows.

8.2.1 Airborne-noise Shielding

The contractor shall erect temporary noise-barriers to shield nearby residences and other sensitive receivers from direct exposure to airborne construction noise. Said barriers shall be erected wherever project construction is taking place in the vicinity of sensitive receivers, and to the extent necessary to reduce construction noise levels to 70 dBA or below if feasible. Under no conditions, however, shall one-hour average noise levels exceed 75 dBA at any sensitive receiver. Barriers shall be erected to heights necessary to protect any second-floor receivers; otherwise, they shall be constructed to a minimum height of twelve feet unless safety or other considerations constrain their heights.

Barriers shall either consist of commercially-available noise-control curtains, in-situ fabricated sound walls, or any equivalent with an overall sound-transmission class rating of STC-28 or higher. Solid barriers shall be equipped with an absorptive face on the construction side with a noise reduction coefficient of NRC-0.65 or greater. Curtains shall have an inherent absorption of NRC-0.65 or greater. Barriers shall preferably comprise solid walls unless stability or other considerations prevent their use. All barriers shall be constructed to contain no unnecessary holes or gaps. Where access through the barrier is required, overlapping sections shall be constructed to prevent noise escaping through the opening.

Sound walls shall be placed as dictated by construction activities underway. Semi-permanent barriers are preferred around jacking pits and tunnel shafts, whereas receiver-specific barriers are recommended along the open-trenching areas. Portable, hand-held barriers (e.g. a single sheet of plywood) shall be used in the immediate vicinity of certain noise-intensive activities such as concrete sawing. Stationary equipment such as air-compressors and generators shall be contained in temporary shelters or otherwise shielded from direct exposure to sensitive receivers (e.g. placing them behind larger equipment, dirt mounds, etc.). The most appropriate barrier shall be determined specific to each situation.

Noise barriers shall be erected around staging areas wherever these are established near residences or other sensitive receivers. To the maximum extent practicable, staging areas shall not be located within residential areas.

8.2.2 Machinery Silencing and Selection

All machinery to be used on-site shall be equipped with the best available exhaust mufflers and any applicable "hush kits". No machinery shall be allowed on-site which emits noise levels in excess of 75 dBA when measured at a distance of 50 feet from the machine, unless technically infeasible due to the nature of the machine or its operation. Each piece of machinery shall be measured by a qualified acoustical engineer for its noise-level emissions prior to allowing it onto the construction site. Any piece which exceeds acceptance criteria shall be prohibited from use on-site.

The contractor shall substitute quieter machinery wherever feasible.

All machinery shall be maintained in good working order and lubricated as necessary to minimize unnecessary noise emissions. No machine shall generate unusual squeals, groans, or other noises which may be eliminated due to proper maintenance and lubrication. All cabinets, panels, covers, shrouds, and similar components shall be securely fastened to ensure that they do not create excessive noise due to vibration.

The contractor shall turn off all unused machinery. Delivery and hauling trucks shall not sit with their engines idling. The contractor shall post signs advising drivers to turn off idling engines.

Contractor personnel shall park personal vehicles off-site wherever feasible.

8.2.3 Ground-vibration

The contractor shall take all reasonable measures necessary to maintain ground-vibration levels below a peak-particle velocity of 0.02 inches per second at any sensitive receiver. Such measures include those discussed in Section 7 above, or any others the contractor chooses to implement. Under no circumstances shall ground-vibration levels exceed a peak-particle velocity of 0.2 inches per second anywhere.

8.2.4 Off-site Work

The contractor shall perform noisy work off-site and away from any residential areas wherever feasible. Such off-site activities may include rock-crushing, materials pre-fabrication, and equipment maintenance.

8.2.5 Trucking

All trucking shall be constrained to major roadways (e.g. Lankershim Boulevard). The contractor shall establish designated truck routes to serve each project area. All subcontractors shall also be required to adhere to the designated truck routes.

8.2.6 Hours of Operation

The contractor shall restrict operations, including deliveries, to those hours permitted by the Los Angeles and Burbank ordinances. Staging areas in the vicinity of sensitive receivers shall be locked after hours, and shall have signs prominently displaying operating hours.

8.2.7 Contractor Personnel Training

The contractor shall instruct all personnel, including subcontractor personnel, of the necessity and procedures for controlling noise and vibration impacts on sensitive receivers.

8.2.8 Pre-construction Survey and Damage Repair

The contractor shall perform a pre-construction survey of all historic and fragile buildings along the tunneling portions of the alignment. The conditions of the buildings shall be recorded and assessed for their ability to withstand ground-vibrations. The contractor shall take any measures necessary to reinforce the structures against vibration damage, and shall correct any damage which occurs as a result of project construction.

8.2.9 Monitoring and Mitigation

A noise and vibration monitoring and mitigation program shall be implemented under the guidance of an independent qualified acoustical consultant. The program shall comprise measuring construction equipment noise emissions levels, continuous or frequent spot-checks of noise and vibration levels at sensitive receivers near the construction site, and guidance by the acoustical consultant regarding the control of excessive noise and vibration emissions.

Noise measurements of equipment prior to allowing it on-site, as discussed above, shall be a part of the noise monitoring a mitigation program.

The noise consultant or LADWP shall have the authority to cease any activity which is deemed to create a hazardous noise level at any residence until an appropriate mitigation measure is found.

8.2.10 Public Notification and Complaint Resolution

The contractor shall issues notices of start of construction to the public, residences and commercial establishments in the impacted vicinity of the project sites, 30 days in advance of the start of construction. The notices shall include hours of construction and construction schedule. The notices shall provide an overview of the types of noise and vibration which will occur, the reason for their occurrence, and measures being taken to minimize disturbance. The notices shall establish a noise-complaint hotline and include the number in the notification letter.

The contractor shall promptly respond to all complaints received at the noise-complaint hotline. The contractor shall assess the complaint to determine if the complainer is experiencing noise or vibration levels which are hazardous, significantly above expected levels, or out of line with levels experienced at other nearby similar receivers. The contractor shall further assess whether the complainer has any medical or other condition which makes the complainer especially susceptible to noise or which might create a hazardous situation. Contractor shall resolve all complaints commensurate with the findings.

Appendix 1: Construction Machinery Noise

Data in the table below are from the Federal Highway Administration Document *FHWA-HEP-05-054 Final Report*, dated January 2006. It contains a compilation of noise data from the on-going Central Artery/Tunnel project in Boston. Noise levels shown are both from the project specification as well as actual levels measured in the field. Additionally, the table also lists a "usage factor" for each type of equipment, which allows more accurate prediction of an average noise level. The usage factor indicates the amount of time a particular piece of equipment is likely to run at high noise output (L_{max}) during a particular operation.

Equipment Description	Impact Device?	Usage Factor (%)	Spec Levels Lmax @ 50 ft (dBA, slow)	Actual Measured Lmax @ 50 ft (dBA, slow)
All Other Equipment > 5 HP	No	50 %	85 dBA	N/A
Auger Drill Rig	No	20 %	85 dBA	84 dBA
Backhoe	No	40 %	80 dBA	78 dBA
Bar Bender	No	20 %	80 dBA	N/A
Blasting	Yes	N/A	94 dBA	N/A
Boring Jack Power Unit	No	50 %	80 dBA	83 dBA
Chain Saw	No	20 %	85 dBA	84 dBA
Clam Shovel (dropping)	Yes	20 %	93 dBA	87 dBA
Compactor (ground)	No	20 %	80 dBA	83 dBA
Compressor (air)	No	40 %	80 dBA	78 dBA
Concrete Batch Plant	No	15 %	83 dBA	N/A
Concrete Mixer Truck	No	40 %	85 dBA	79 dBA
Concrete Pump Truck	No	20 %	82 dBA	81 dBA
Concrete Saw	No	20 %	90 dBA	90 dBA
Crane	No	16 %	85 dBA	81 dBA
Dozer	No	40 %	85 dBA	82 dBA
Drill Rig Truck	No	20 %	84 dBA	79 dBA
Drum Mixer	No	50 %	80 dBA	80 dBA
Dump Truck	No	40 %	84 dBA	76 dBA
Excavator	No	40 %	85 dBA	81 dBA
Flat Bed Truck	No	40 %	84 dBA	74 dBA
Front End Loader	No	40 %	80 dBA	79 dBA
Generator	No	50 %	82 dBA	81 dBA
Generator (<25KVA, VMS signs)	No	50 %	70 dBA	73 dBA
Gradall	No	40 %	85 dBA	83 dBA
Grader	No	40 %	85 dBA	N/A
Grapple (on backhoe)	No	40 %	85 dBA	87 dBA
Horizontal Boring Hydr. Jack	No	25 %	80 dBA	82 dBA
Hydra Break Ram	Yes	10 %	90 dBA	N/A
Impact Pile Driver	Yes	20 %	95 dBA	101 dBA

Equipment Description	Impact Device?	Usage Factor (%)	Spec Levels Lmax @ 50 ft (dBA, slow)	Actual Measured Lmax @ 50 ft (dBA, slow)
Jackhammer	Yes	20 %	85 dBA	89 dBA
Man Lift	No	20 %	85 dBA	75 dBA
Mounted Impact Hammer (hoe ram)	Yes	20 %	90 dBA	90 dBA
Pavement Scarafier	No	20 %	85 dBA	90 dBA
Paver	No	50 %	85 dBA	77 dBA
Pickup Truck	No	40 %	55 dBA	75 dBA
Pneumatic Tools	No	50 %	85 dBA	85 dBA
Pumps	No	50 %	77 dBA	81 dBA
Refrigerator Unit	No	100 %	82 dBA	73 dBA
Rivet Buster/chipping gun	Yes	20 %	85 dBA	79 dBA
Rock Drill	No	20 %	85 dBA	81 dBA
Roller	No	20 %	85 dBA	80 dBA
Sand Blasting (Single Nozzel)	No	20 %	85 dBA	96 dBA
Scraper	No	40 %	85 dBA	84 dBA
Shears (on backhoe)	No	40 %	85 dBA	96 dBA
Slurry Plant	No	100 %	78 dBA	78 dBA
Slurry Trenching Machine	No	50 %	82 dBA	80 dBA
Soil Mix Drill Rig	No	50 %	80 dBA	N/A
Tractor	No	40 %	84 dBA	N/A
Vacuum Excavator (Vac-truck)	No	40 %	85 dBA	85 dBA
Vacuum Street Sweeper	No	10 %	80 dBA	82 dBA
Ventilation Fan	No	100 %	85 dBA	79 dBA
Vibrating Hopper	No	50 %	85 dBA	87 dBA
Vibratory Concrete Mixer	No	20 %	80 dBA	80 dBA
Vibratory Pile Driver	No	20 %	95 dBA	101 dBA
Warning Horn	No	5 %	85 dBA	83 dBA
Water Jet deleading	No	20 %	85 dBA	92 dBA
Welder / Torch	No	40 %	73 dBA	74 dBA

* Source: *FHWA-HEP-05-054 Final Report*, January 2006

APPENDIX D

TRAFFIC STUDY

Traffic Study for the LADWP River Supply Conduit (RSC) Upper Reach Project

February 14, 2008

Prepared For:

Aspen Environmental Group
30423 Canwood Street, Suite 215
Agoura Hills, CA 91301
p (818) 597-3407
f (818) 597-8001

Prepared by:

KOA CORPORATION
PLANNING & ENGINEERING

1055 Corporate Center Drive, Suite 300
Monterey Park, CA 91754-7668
p (323) 260-4703
f (323) 260-4705

JA6205X

Table of Contents

List of Figures

List of Tables

1. Introduction

KOA Corporation (formerly Katz, Okitsu & Associates) was retained by Aspen Environmental Group to conduct a traffic analysis for the River Supply Conduit (RSC) Improvement Upper Reach Project. This project has been proposed by the City of Los Angeles Department of Water & Power (LADWP) for implementation with the San Fernando Valley. KOA served as a subconsultant to Aspen Environmental Group while conducting the traffic analysis.

A. Project Corridors

Existing Pipeline Route

Approximately 60,000 feet in length, the existing pipeline begins at the North Hollywood Pump Station and ends at the Ivanhoe Reservoir. Hollingsworth Spillway, a structure located about midpoint on the existing pipeline, is used to control the pressure in the lower portion of the pipeline. The section of the existing pipeline that is located to the north of Hollingsworth Spillway is referred to as the Upper Reach.

The existing overall RSC pipeline is a major north-south LADWP pipeline. The existing facility was constructed in the 1940s. The Upper Reach portion of the pipeline provides transmission between the North Hollywood Pump Station on the north and the Griffith Park/Headworks Spreading Grounds on the south.

About 70 percent of the existing Upper Reach pipeline is located within the public rights-of-way or easements of City of Los Angeles streets and property. The remainder of the pipeline route is located within City of Burbank easements.

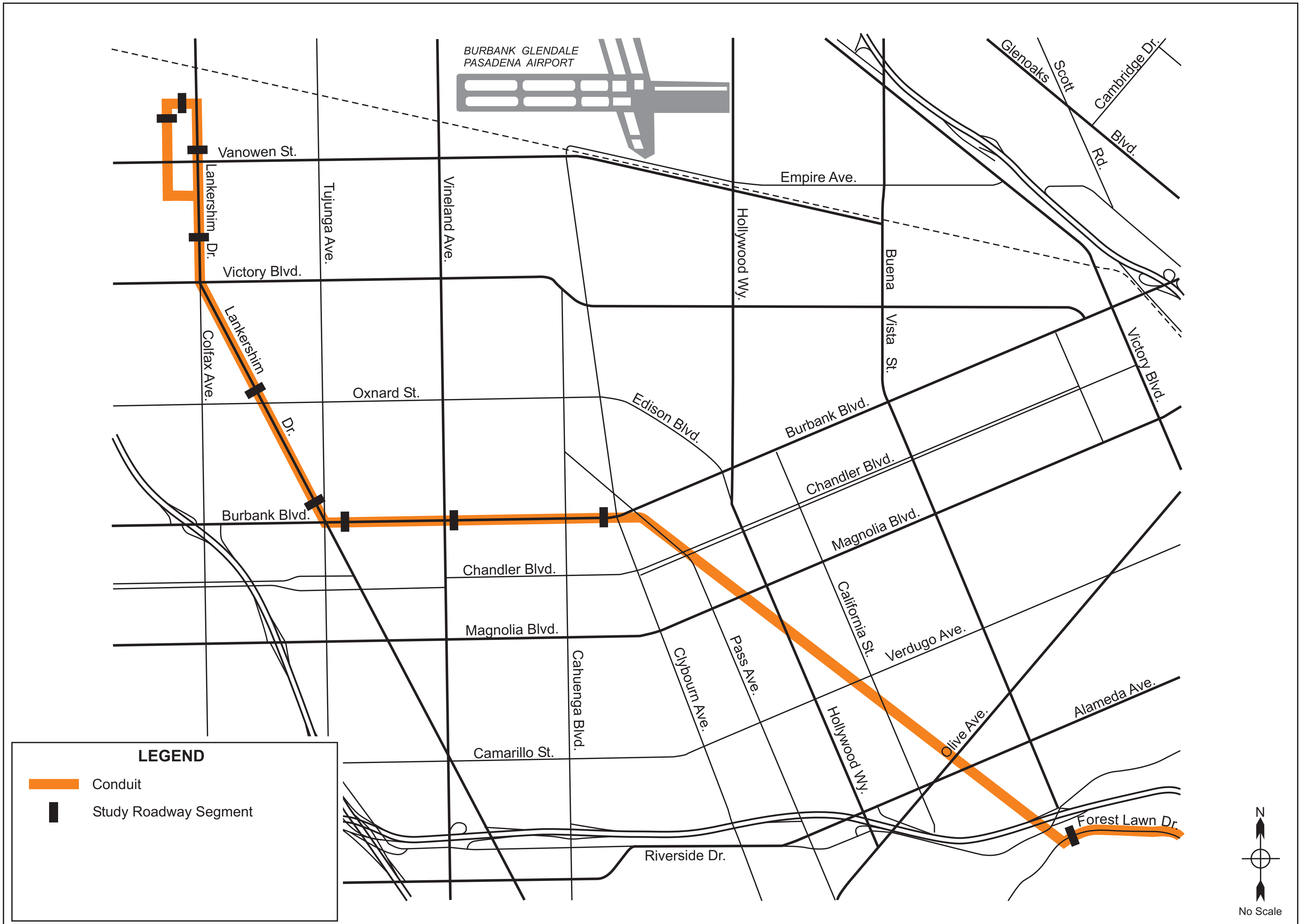
Project Purpose & Background

The proposed Upper Reach replacement pipeline (Project) is a new larger pipeline, which would replace the existing pipeline within some portions of the existing alignment and also within new alignments that would deviate from the existing alignment.

The proposed Project would involve the construction of new 78-inch diameter welded steel underground pipeline and related structures such as maintenance holes, regulator station, flow meters, valves, and vaults. Construction for the Project would occur within existing public street rights-of-way, new and existing easements such as Whitnall Highway and Headworks Spreading Grounds within both Burbank and Los Angeles, and recreation areas within the City of Burbank that are owned by the City of Los Angeles.

The Upper Reach pipeline replacement has been warranted by water pressure regulations, capacity issues created by air in the pipeline (entrainment), groundwater supplies, the need for increased water supply capacity and flexibility, and the need for stronger pipeline materials for seismic integrity.

The proposed Upper Reach corridor is illustrated within Figure 1. After completion of the Project, the existing Upper Reach pipeline, from the North Hollywood Pump Station to the Hollingsworth Spillway Structure, would remain in service to transport well water.



KOA CORPORATION
PLANNING & ENGINEERING

River Supply Conduit Improvement - Upper Reach

Figure 1

Overall Upper Reach Project Corridors

Proposed Pipeline Route

The proposed Upper Reach pipeline would be located within both the City of Los Angeles (primarily on public streets and within City parks) and the City of Burbank (within the Whitnall Highway utility corridor and Johnny Carson Park). The portion of the pipeline within the City of Burbank would be approximately 11,900 feet long, and the approximate remaining total length of 19,700 feet would be within the City of Los Angeles. The majority of the proposed pipeline would be located within public streets surrounded by urban development including both residential and commercial zones, as well as the existing Whitnall Highway utility (transmission) corridor.

The north end of the Upper Reach would begin at the North Hollywood Pump Station, north of Vanowen Street at Morella Avenue, in the North Hollywood area of the City of Los Angeles. From the North Hollywood Pump Station, the pipeline would continue north along Morella Avenue, turning east onto Hart Street, then south onto Lankershim Boulevard, and east again onto Burbank Boulevard until reaching the Whitnall Highway. At this point the alignment would turn southeast and travel within the Whitnall Highway, continuing through Johnny Carson Park and Buena Vista Park east of Bob Hope Drive. The pipeline would then cross the Los Angeles River to Forest Lawn Drive, and east to the west end of the Headworks Spreading Grounds site.

The project construction is being defined in three phases, within the overall project route:

- Phase UR1 is defined as the portion of the overall project route from the northern end of the overall defined project route at the North Hollywood Pump Station to the intersection of Lankershim Boulevard and Victory Boulevard.
- Phase UR2 is the portion of the project route between the intersection of Lankershim Boulevard and Victory Boulevard and the intersection of Clybourne Avenue & Burbank Boulevard.
- Phase UR3 is the portion of the project route between the intersection of Clybourne Avenue & Burbank Boulevard and the southern end of the overall project route at the Spreading Grounds.

In addition to these three segments, an alternate segment is being considered for the project analysis. Phase UR1a would proceed south from the North Hollywood Pump Station along Morella Avenue, and then continue to the east on Archwood Street, then proceeding south along the main project route on Lankershim Boulevard. Construction within this segment, if utilized for the final project route, would be conducted via tunneling with jacking underneath the Victory Boulevard crossing.

Construction Methods

Installation of the Upper Reach pipeline would be accomplished by a combination of open-trench excavations, jacking, and traditional tunneling. A majority of the construction would be accomplished via jacking or tunneling.

In general, deep sections of pipe would be tunneled and routes across major street intersections would be jacked or tunneled In sequence, the general process for the construction methods consists of site preparation, excavation, piping and related structure, installation and backfilling, and site restoration (where applicable). For tunneling and jacking operations, a vertical pit would be required at the entrance and exit of each tunneled or jacked segment to enable installation of the pipeline.

It is estimated that a typical construction spread (width of the work area) would require the closure of three travel lanes. Intersections where open trench construction is used would be affected for approximately four weeks with turning traffic affected considerably longer. Active trenching per segment would take 30 days, including restoration of roadway surface paving and striping. Work areas for tunneling and jacking shafts would remain active for three to six months, except in the southern part of the route where the shafts would remain active for a longer period of time, possibly one year or longer.

The Project construction plans endeavor to avoid any above ground structures within the City of Burbank, including parks and the Whitnall Highway green space corridor. While there will be no flow control valves within the City of Burbank, some air vacuum valves may be required to adequately vent the pipeline. No major work zones within public roadway rights-of-way would be necessary to construct pipeline vents. Roadway capacity on any Burbank roadway would not be reduced. Traffic flow, therefore, would not be negatively affected by construction related to these appurtenant structures.

Staging Areas

Contractors would be responsible for scouting and securing suitable local lots for staging areas. However, possible staging areas identified for the proposed project include the Headworks Spreading Grounds, Johnny Carson Park north of Riverside Drive, open right-of-way within the Whitnall Highway, or local facilities, including the North Hollywood Pump Station.

All of the construction methods to be utilized will require off-site staging area for the storage of supplies and materials. The staging area for the southern end of the Project corridor is planned to be located at Johnny Carson Park, located south of the SR-134 (Ventura Freeway) in Burbank. A minimum 15,000 square feet of the portion of Johnny Carson Park between Route 134 and Riverside drive is proposed as a staging area for tunneling and river crossing work under Project Phase UR3. This is parkland physically within and operated by the City of Burbank, but owned by the City of Los Angeles. According to a title report dated October 23, 2006, that portion of Johnny Carson Park is owned in fee by the City of Los Angeles. The area would be used for staging, field offices, material storage and handling, work area and shafts for tunneling & jacking. Use of this site would be required for approximately two years, throughout the duration of work on Phase UR3.

Order of Construction Tasks

Pipeline construction would be composed of several activities. The construction activities would be organized to proceed in the order listed below.

1. Pre-construction activities	5. Applying protective coating to the weld joints
2. Right-of-way clearing	6. Backfilling
3. Excavation and Pipeline installation	7. Hydrostatic testing and disinfection
4. Weld inspection	8. Restoring and cleaning of affected construction areas

Details of the physical extents of typical construction work areas for the Project are provided within Section 2 of this report.

B. Project Schedule & Logistics

Construction of the proposed project is expected to commence in August 2008 and be completed in October 2012, for a total of 51 months. Table 1 provides the overall Project construction schedule, broken down into each Project phase.

Table 1 – Proposed Construction Schedule

Phase	Early Start Date	Completion Date	Estimated Duration (Days)*
UR1	January 2009	April 2011	630
UR1a	January 2009	January 2011	500
UR2	January 2009	October 2012 (late)	470
UR2a	January 2009	October 2012 (late)	540
UR3	November 2008	September 2011	748

* Estimated duration is the number of days it will take to complete construction at each phase. For each phase, the estimated duration (in days) may take place anywhere between the early start and completion dates noted on the table.

In a worse-case construction scenario estimate, up to three open trench and three jacking operations, in addition to tunnel operations, could occur simultaneously on the three separate pipeline phases (UR1, UR2, and UR3) during the peak construction period. Approximately 71 construction workers would be employed on the Project during the peak construction period. On a typical workday, workers would travel directly to one of the predetermined staging areas, where they would gather equipment and proceed in work crews to the construction sites along the alignment. Construction truck trips would be generated primarily by the required transport of unused excavated soil from trenching activities.

C. Analysis Methodology

The proposed Project was analyzed by separate roadway segments, and the analysis for each segment is presented in individual sections of this report. The analysis includes the following:

- The use of collected daily volumes to analyze general roadway operations, as necessary
- Analysis of lane closures at jacking pits and shaft locations within roadway right-of-way, utilizing cross-sectional widths measured in the field.
- Analysis of on-street parking area closures for curb-lane work and general construction work areas.

Traffic counts utilized for base volumes at the study roadway segments were conducted during the week of March 26, 2007. Traffic count locations were chosen based on the analyzed roadway corridors and their characteristics. Where characteristics or surrounding land uses changed significantly, an additional traffic count was taken at another location on the corridor. Otherwise, a count within a long segment of a roadway where characteristics were significant throughout was considered to represent a typical volume for the entire segment.

Construction of open trenches and tunnel shafts for the Project will have the greatest traffic circulation impact. Current LADWP project assumptions indicate that trenching operations will necessitate the closure of up to three travel lanes. Construction of tunnel shafts will also necessitate similar closures.

Analysis of potential traffic circulation and area access impacts were analyzed based on these typical roadway closures. The required dimensions of construction work areas were applied to the surveyed width of roadway cross-sections. Roadway width that would remain during closures was then analyzed to determine what capacity could remain (available travel lane width, on-street parking area width, etc.)

Impact thresholds defined by the City of Los Angeles Department of Transportation (LADOT) and the County of Los Angeles Congestion Management Program (CMP) were not utilized for the Project traffic analysis. These standards apply to significant impacts to traffic operations and the long-term mitigation of such impacts through the provision of additional traffic signal or roadway capacity. As construction of the Project will constrict roadway capacity with no capability to provide more capacity in affected segments, the discussion was concentrated on the capacity that can be provided during construction and alternative/detour routes that may be necessary. Therefore, the impact analysis was based on roadway flow during construction, pedestrian and bicycle access, and generalized application of volume-to-capacity calculations.

Many potential peak-period Project traffic impacts would not occur if major construction activities, where feasible, were limited to off-peak periods. Such restrictions would not be possible for activities for trenching and other intensive earthwork activities, but for many activities it may be feasible. Therefore, construction activities and hauling truck movements should be scheduled per the City of Los Angeles Mayor's Directive #2, dated October 20, 2005. This directive states that road construction, outside of emergency repairs, cannot be conducted from 6:00 a.m. to 9:00 a.m. and from 3:30 p.m. to 7:00 p.m.

Final construction closure plans will need to be reviewed and approved by LADOT and the City of Burbank, as applicable to reviewing jurisdiction within each Project roadway segment.

The subsequent sections of this report are organized as follows:

- Section 2 – Project Construction on Public Roadways: This section provides an overview of how the project would be constructed within the public rights-of-way analyzed for the traffic analysis. The physical extents of typical construction work areas are discussed.

- Section 3 thru 7 – Project Construction on Public Roadways: These sections provide analysis of anticipated construction closures within each of the five overall roadway segments analyzed for the traffic analysis.

- Section 8 – Conclusions and Recommendations: This section provides a synopsis of the major conclusions from the traffic analysis, and any recommendations for the avoidance of potential significant impacts.

A list of sources utilized for the creation of this report is provided as an attachment at the end of this document.

2. Project Construction on Public Roadways

This section of the report serves to identify the construction intensity within each Project phase. LADWP has defined approximate construction timeframes and physical dimensioning for each typical work area. These details are discussed further within this report section.

Due to the extensive surface work that is required, open trench and tunnel shaft construction will both have the greatest traffic circulation impacts. As discussed in the project description, it is assumed that trenching operations will require a "spread" of approximately three travel lanes. LADWP has also estimated the physical extents of tunneling and pipe jacking pit locations within the public right-of-way.

This report analyzes the effects of typical construction work areas, including work areas for jacking pits and tunnel shafts, and the physical effect of the establishment of these areas on typical roadway cross-sections. The worst-case physical extents of related roadway capacity constrictions within each Project segment have been considered. This analysis is therefore consistent with the requirements of the California Environmental Quality Act (CEQA).

A. Project Construction Phases

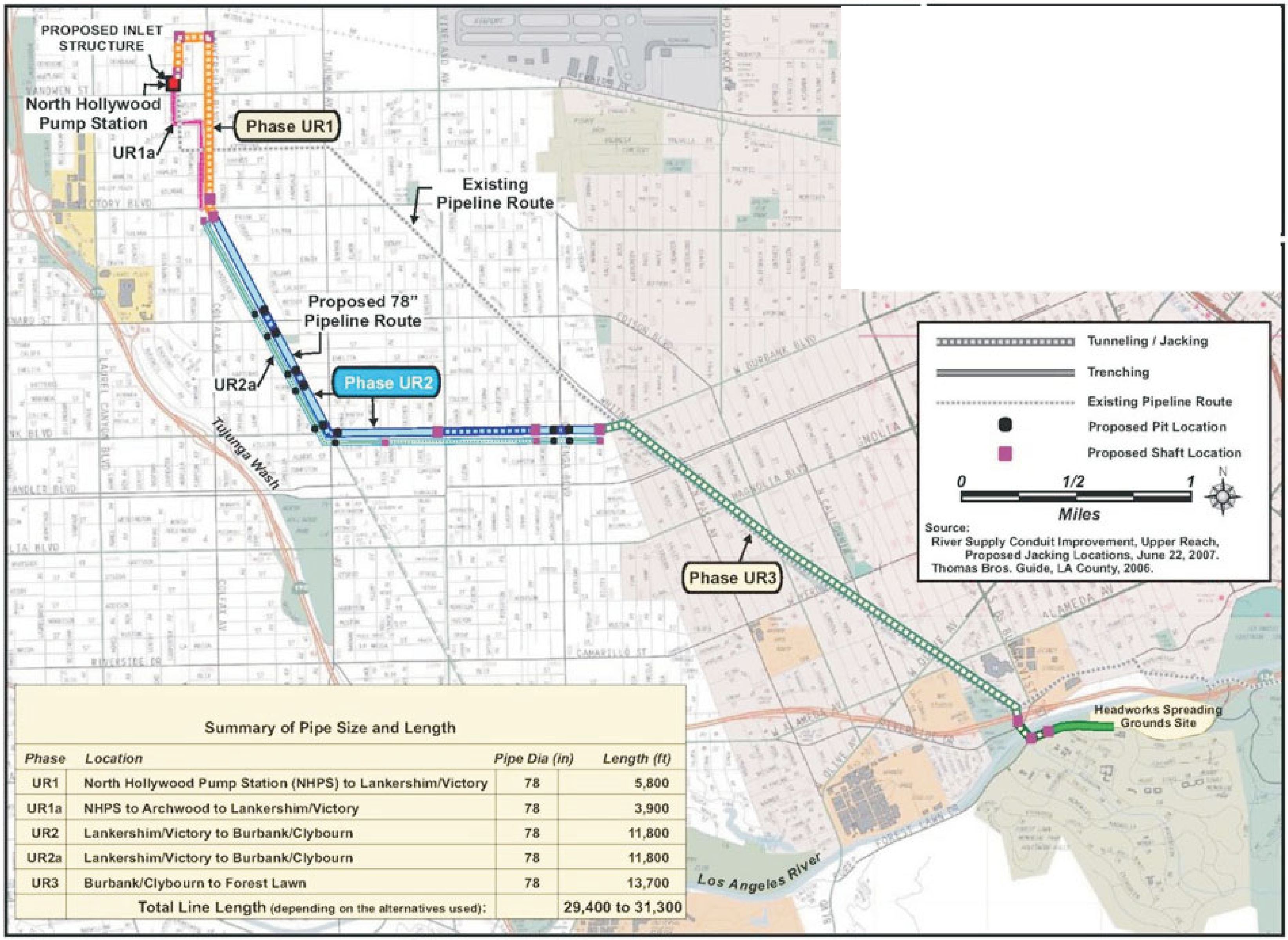
Table 2 below provides a summary of the defined Project construction phases. The defined phases are not necessarily sequential – some Project construction on each phase will be conducted at different time periods in the overall Project timeframe, and each phase will be constructed by separate contractors.

Table 2 – Project Construction Phases

Phase and Location	Roadway Jurisdictions	Route
		UPPER REACH
Phase UR1: North Hollywood Pump Station to Lankershim/Hamlin	City of Los Angeles	- Morella Avenue from the North Hollywood Pump Station north to Hart Street - Hart Street east to Lankershim Boulevard - Lankershim Boulevard south from Hart Street to Victory Boulevard
UR1a: *	City of Los Angeles	- Morella Avenue from the North Hollywood Pump Station south to Archwood Street - Archwood Street east to Lankershim Boulevard - Lankershim Boulevard south from Archwood Street to Victory Boulevard
Phase UR 2: Lankershim/Hamlin to Burbank/Clybourn	City of Los Angeles	- Lankershim Boulevard south from Victory Boulevard to Burbank Boulevard - Burbank Boulevard east to Clybourn Avenue/Whitnall Highway
UR2a	City of Los Angeles	- Same route as UR2 but with extended tunneling along Burbank Boulevard
Phase UR 3: Burbank/Clybourn to Headworks	City of Burbank & City of Los Angeles	- Burbank Boulevard east from Clybourn Avenue to Whitnall Highway - Whitnall Highway southeast to Buena Vista Park east of Bob Hope Drive - Across the Los Angeles River from Buena Vista Park to Forest Lawn Drive - Forest Lawn Drive east to the west end of the Headworks Spreading Grounds site

** This alternate route for Phase UR1 is being considered by LADWP.*

Figure 2 provides an illustration of the location of each Project Phase in relation to the entire Project corridor.



Summary of Pipe Size and Length

Phase	Location	Pipe Dia (in)	Length (ft)
UR1	North Hollywood Pump Station (NHPS) to Lankershim/Victory	78	5,800
UR1a	NHPS to Archwood to Lankershim/Victory	78	3,900
UR2	Lankershim/Victory to Burbank/Clybourn	78	11,800
UR2a	Lankershim/Victory to Burbank/Clybourn	78	11,800
UR3	Burbank/Clybourn to Forest Lawn	78	13,700
	Total Line Length (depending on the alternatives used):		29,400 to 31,300

Source: Aspen Environmental Group.

N

No Scale

KOA CORPORATION
PLANNING & ENGINEERING

River Supply Conduit Improvement - Upper Reach

Figure 2

Project Construction Phases

B. Physical Extents of Construction Areas

It is estimated by LADWP that typical construction activity would require the closure of up to three travel lanes. Within the Project extents, 78-inch diameter pipe would be installed. Specific physical areas of tunneling and pipe jacking pits have also been defined by LADWP.

The length of each trenching operation will be 500 feet for the entire active construction process, and an additional 500 feet for tail-end dirt hauling and related operations. The overall width, including the work area along the side of the trench, would be approximately 30 to 35 feet. Traffic detours would begin at least 200 feet from either side of the overall work area.

The minimum trench depth would be 12 feet with a maximum of approximately 46-feet at approaches to jacking pits. The maximum trench width would be the pipe diameter plus two feet on either side of the pipe for the open trench method (10.5 feet for 78-inch diameter pipe). The maximum pit sizes for jacking or tunneling would be approximately 18 feet wide by 60 feet long.

Based on LADWP experience with projects of this type, typical tunnel shafts are constructed with a diameter of 35 to 45 feet. However, because many of the shafts will be located within roadway rights-of-way, narrower rectangular shafts may be utilized to better accommodate surface traffic requirements.

Additional construction areas may be necessary where retrofitting of existing buried pipelines may need to take place, and Project-related valves and meters may need to be installed. The locations of these minor construction activities have not been defined for this analysis and would not likely create any measurable impacts to traffic flow.

C. Construction Methods

<u>General Construction Methods</u>

The current Project construction plans have defined the following overall work scope:

- 19,700 to 23, 200 linear feet, depending on which alternative is used, of tunneling or jacking with steel or concrete cylinder casing;
- 8,800 to 9,900 linear feet, depending on which alternative is used, of open trench excavation; and
- Jacking operations across seven (7) street intersections, including Lankershim Blvd./Victory Blvd., Lankershim Blvd./Burbank Blvd. and Burbank Blvd./Clybourn Ave., under the Los Angeles River from north of Riverside Drive (and south of the SR-134 freeway) to Forest Lawn Drive, and beneath the existing storm drain on Forest Lawn Drive to the northeast of Memorial Drive.

Table 3 provides a summary of the proposed pipeline route's construction phase details, pipeline length, pipeline diameter, and general construction methods.

Table 3 – Summary of Phase Characteristics and Construction Methods

Phase No.	Phase Details	Length (Feet)	Pipe Diam. (in)	Proposed Construction Method *
UR 1	North Hollywood Pump Station to Lankershim/ Victory	5,800	78	Tunneling
UR1a	North Hollywood Pump Station to Lankershim/Archwood/Victory	3,900	78	Tunneling
UR 2	Lankershim/ Victory to Burbank/Clybourn	11,800	78	Open Trench / Jacking Tunneling – Vineland Avenue to Cartwright Avenue
UR2a	Lankershim/ Victory to Burbank/Clybourn *(Same route as UR2 with extended tunneling)*	11,800	78	Open Trench / Jacking Tunneling – Fair Avenue to Cartwright Avenue
UR 3	Burbank/Clybourn to Forest Lawn	13,700	78	Open Trench /Tunneling / Jacking

Source: Aspen Environmental Group, 2007

The Project construction plans endeavor to avoid any above ground structures within the City of Burbank, including parks and the Whitnall Highway green space corridor. Roadway capacity on any Burbank roadway would not be reduced. Traffic flow within Burbank, therefore, would not be negatively affected by construction related to these appurtenant structures.

Trenching across intersections will last four weeks for all primary construction tasks. Four to six weeks per work zone is the estimated amount of time needed to conduct all mobilization and clean-up tasks and restore original roadway striping. Construction will generally be scheduled between the hours of 7:00 a.m. and 6:00 p.m. on weekdays and 8:00 a.m. to 5:00 p.m. on Saturdays. Intersections where open trench construction is used would be affected for approximately four weeks with turning traffic affected considerably longer.

Construction activities and hauling truck movements should be scheduled per the City of Los Angeles Mayor's Directive #2, dated October 20, 2005 (see Section 1C).

Specific Pipeline Construction Methods

The following text describes the three major types of construction methods that would be utilized along the Project corridors: open trench excavation, jacking under major intersections, and tunneling within the utility corridor. For the analysis of construction-related closures, each analyzed segment was first examined for general construction closures for typical trenching work areas. Secondly, each analyzed segment was examined for specific closures necessary for pipe jacking pits.

1. Open Trench Excavation

Open trench excavation, as a construction method for pipelines and related structures, includes the installation of maintenance holes, flow meters, valves, and vaults. The following is a description of the phases of construction for open trenching:

- Site Preparation: Traffic control plans, where necessary, are first prepared in coordination with the local agency to detour and delineate the traffic lanes around the work areas. The approved plans are then implemented. The existing pavement along the pipeline alignment is cut with a concrete saw or otherwise broken and then removed using jackhammers, pavement breakers, and loaders. The pavement is removed from the project site.

- Excavation and Shoring: A trench is excavated along the pipeline alignment using backhoes, excavators, or other types of excavation equipment. Portions of the trench adjacent to some utilities may be manually excavated. The excavated soil may be temporarily stored in single rows adjacent to the trenches, stored at off-site staging areas, or immediately hauled off-site. As the trench is excavated, the trench walls are supported or shored.

- Pipe Installation and Backfilling. Once the trench has been excavated and shored, pipe laying begins. Bedding material is placed on the bottom of the trench. Pipe segments are then be lowered into the trench and placed on the bedding. The segments would be welded to one another at the joints. Prior to backfilling, appurtenant structures would be installed as necessitated by design. After laying and attaching the pipe segments, the trench is immediately backfilled with native soils, crushed miscellaneous bases, or cement slurry.

- Site Restoration. Any portion of the roadway damaged as a result of construction activities will be repaved and restored in accordance with all applicable City of Los Angeles standards. Once the pavement has been restored, traffic delineation (restriping) will also be restored.

2. Jacking Method

This method is utilized when open trenching is not feasible, or when construction must avoid the disruption of other facilities such as flood control channels such as the Los Angeles River. Although the installation of pipelines using jacking techniques avoids the continuous surface disruption common to open-trench construction, some surface disruption is unavoidable because jacking and receiving pits are required and may be located within public rights-of-way.

Pipe jacking is an operation in which the soil ahead of the steel casing is excavated and brought out through the steel casing barrel while the casing is pushed forward by a horizontal, hydraulic jack which is placed at the rear of the casing. The jacking equipment utilized for this operation is placed in the jacking pit. Once the casing is placed, the pipe is installed inside the casing. The following is a description of the phases of construction for jacking:

- Site Preparation: Traffic control plans, where necessary, are first prepared in coordination with the City of Los Angeles, to detour and delineate the traffic lanes around the work areas and then implemented. In preparing to construct the jacking and receiving pits, the pavement is first cut using a concrete saw or pavement breaker. As with open-trench excavation, the pavement is removed from the project site and recycled, reused as a backfill material, or disposed of at an appropriate facility.

- Excavation and Shoring: A jacking pit and a receiving pit are generally used for each jacking location, one at each end of the pipe segment. The distance between the pits typically ranges from 250 to 500 feet, but may be longer or shorter depending on site conditions. The pits are excavated with backhoes, cranes, and other excavation equipment. The excavated soil is immediately hauled away. As excavation occurs, the pits are shored utilizing a beam and plate shoring system.

- Pipe Installation: Once the pits are constructed and shored, a horizontal hydraulic jack is placed at the bottom of the jacking pit. The steel casing (84-inch internal diameter) is lowered into the pit with a crane and placed on the jack. A simple cutting shield is placed in front of the pipe segment to cut through the soil more easily. As the jack pushes the steel casing and cutting shield into the soil, soil is removed from within the leading casing with an auger or boring machine, either by hand or on a conveyor. Once the segment has been pushed into the soil, a new segment is lowered, set in place, and welded to the casing that has been pushed.

- Site Restoration: After completion of the pipe installation along the jacking location, the shoring system is disassembled as the pits are backfilled, the soil compacted and the pavement above replaced. Once the pavement has been restored, roadway striping would also be restored as necessary.

3. Traditional Tunneling

This construction method involves the placement of the pipeline in an underground tunnel, which is excavated between two or more shafts. The following is a description of the phases of construction for tunneling:

- Shaft Excavation: Two or more shafts are constructed as described previously for pipe-jacking.

- Tunnel Excavation: Most tunnels of significant width are excavated using a tunnel boring machine (TBM). For tunneling below the groundwater level without dewatering, pressurized-face TBMs are used to stabilize the tunnel face and prevent water from entering the tunnel. Excavation by EPB machine supports the tunnel face by pneumatically pressurizing the excavated soil (muck) within a chamber behind the cutter head. Muck is removed from the chamber by a screw conveyor and then transported out of the tunnel by means of a conveyor belt and/or muck cars on rails. Excavation by the machine supports the tunnel face using a pressurized slurry mix within the cutter head. The tunneling process proceeds until a fully supported tunnel has been constructed. Typical tunnel supports include steel or pre-cast concrete linings. Support linings are lifted into the proper position and bolted or otherwise fixed in place.

- Pipe Installation: The pipeline is installed in segments following completion of the tunnel. Each pipe segment is lowered into the pit with cranes or other loading equipment, mechanically pushed, carried, or hauled into the proper position within the tunnel, and placed on supports that allow for adjustments in the pipe's alignment. The joints of adjoining pipe segments are welded as pipe placement occurs. Once the entire length of pipe has been placed in the proper position and the joints welded, the annular space between the pipe and the tunnel wall (supports) is completely filled with grout or concrete and allowed to cure.

- Site Restoration: After completion of the pipe installation along the tunneling alignment, the shoring system is disassembled as the pits are backfilled, the soil compacted and the pavement above replaced. Once the pavement has been restored, roadway striping is also restored as necessary.

Spoils from cuts, including cuts in streets, would typically be used as backfill materials at the site of origin. Materials unsuitable for backfill use and economically not usable for other purposes would be disposed of in accordance with local and county guidelines in available landfills and/or recycling facilities. It is possible that contaminated soil would be excavated during construction, especially in older industrial areas with shallow groundwater. Soil that cannot be returned as backfill would be disposed of or treated at an appropriate permitted facility.

The amount of spoils that need to be carried from the construction site will determine the overall number of hauling truck trips to and from each work area.

D. Tunneling Operations within Burbank

Within the City of Burbank, there will be no Project construction within public roadways per LADWP Project plans. A tunnel shaft would be constructed to avoid surface disturbance within the City of Burbank. The tunnel would have a southern terminus at the Los Angeles River pipeline crossing (near Forest Lawn Drive) and a northern terminus at Burbank Boulevard. This route segment would be constructed entirely underground, except for minor surface construction for air vacuum valves. These valves would be utilized to vent the pipeline and would be similar in size to a fire hydrant.

E. Analysis of Construction-Related Closures

The analysis of the potential effects of construction-related closures on public roadways is discussed within Sections 3 through 7 of this report. The discussion is segmented into the following roadways, which are listed in a general south-to-north manner:

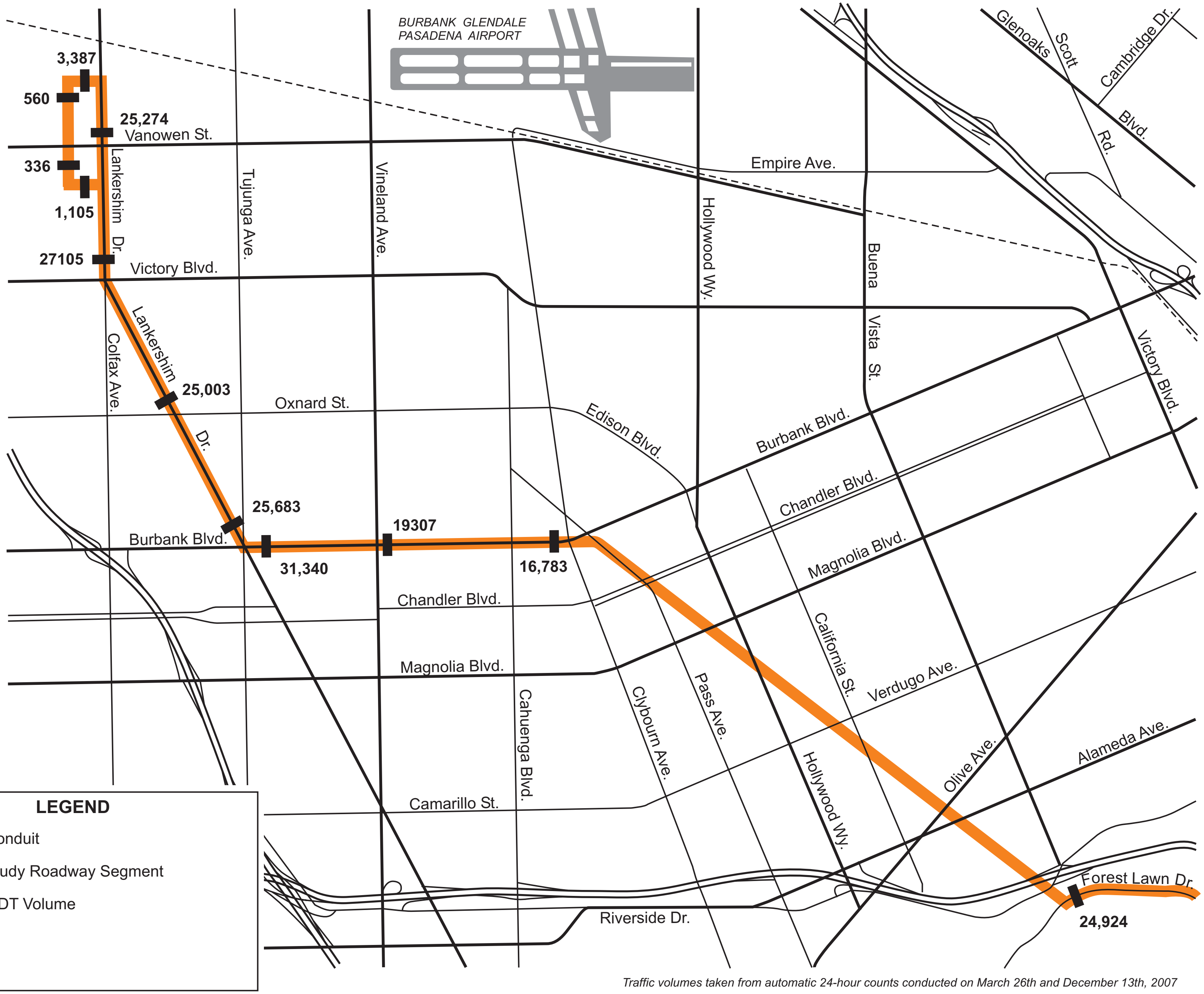
- Forest Lawn Drive (southern segment of Project Phase UR3) – from Headworks Spreading Ground Site on east to crossing of Los Angeles River on west
- Burbank Boulevard (southern segment of Project Phase UR2) – from intersection with Whitnall Highway corridor on east to Lankershim Boulevard on west
- Lankershim Boulevard (northern segment of Project Phase UR2) – from Burbank Boulevard on south to Victory Boulevard at beginning of Phase UR1 corridor
- Lankershim Boulevard (eastern segment of Project Phase UR1) – from Project Phase UR2 on south to Hart Street on North
- Hart Street and Morella Street (western/northern segments of Project phase UR1) – westerly on Hart Street from Lankershim Boulevard and southerly on Morella Street to the North Hollywood Pump Station

The Whitnall Highway corridor, part of Phase UR3 of the Project, was not described above. This corridor would be the route of a contiguous tunnel segment between the Los Angeles River pipeline crossing (near Forest Lawn Drive) and Burbank Boulevard. Construction of this tunnel and installation of the pipeline would not necessitate surface construction work within roadway rights-of-way within Burbank. Some appurtenant structures may be installed at the surface, but these structures would not intersect with public roadways.

Discussion of access constraints and significant traffic impacts is provided for each of these Project segments within the next five sections of this report.

Average Daily Traffic (ADT) volumes were collected at multiple points for public roadways that would be part of the proposed Project route. Volumes were collected on segments with similar cross-sectional widths and fronting land uses – additional counts were taken where such characteristics changed along the route. Volumes were collected on March 28, 2007, over a 24-hour period (midnight to midnight), by automatic volume counting equipment. Additional volumes within the UR1a segment were collected in December, 2007.

These volumes are provided within Figure 3.



LEGEND

(orange line)	Conduit
(black bar)	Study Roadway Segment
XXX	ADT Volume

KOA CORPORATION
PLANNING & ENGINEERING

River Supply Conduit Improvement - Upper Reach

Figure 3

Roadway Segment Traffic Volumes

3. Route Segment Analysis – Forest Lawn Drive & Whitnall Highway

This report section provides information on Project trenching and tunnel shaft construction along Forest Lawn Drive and tunneling within the Whitnall Highway corridor. A discussion is provided on the general impacts that could occur with Project construction-related closures along these corridors.

Located at the northern tunnel shaft location for the corridor analyzed within this section, and falling roughly between the Forest Lawn Drive Project corridor and the Whitnall Highway corridor, Johnny Carson Park would be used as a construction staging area for Project Phase UR3. Potential traffic impacts associated with the use of this park as a staging area are discussed within Section 4 of this report.

A. Project Segment Description – Forest Lawn Drive

The southern Project corridor would run along Forest Lawn Drive, connecting a pipeline crossing of the Los Angeles River and the southern terminus of the Project, the Headworks Spreading ground site in Griffith Park. Figure 4 illustrates the Project Phase UR3 route along this roadway. The jacking location site represents the transition point from Forest Lawn Drive right-of-way to the east and the Los Angeles River crossing to the northwest.

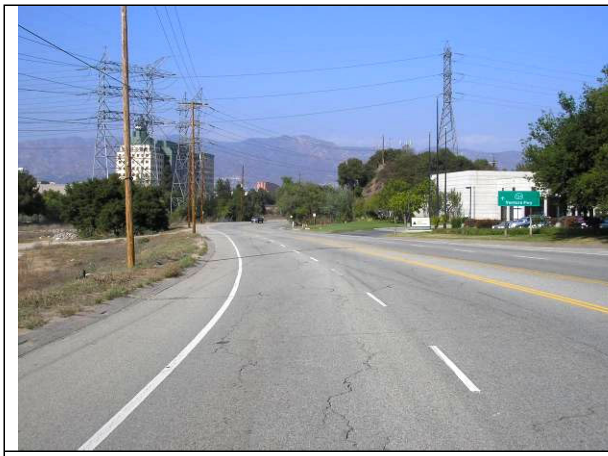
FIGURE 4 – PROJECT ROUTE ON FOREST LAWN DRIVE
& WHITNALL HIGHWAY CORRIDOR TUNNEL

Table 4 provides a summary of the typical curb-to-curb width of Forest Lawn Drive, within the Project Phase UR3 corridor.

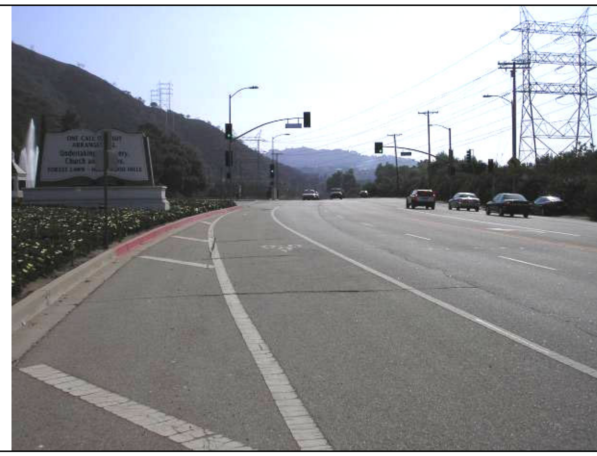
Table 4 – Typical Forest Lawn Drive Cross-Section

Roadway	Location	# of Lanes	Median	Parking	Curb-to-Curb Width (Feet)
Forest Lawn Dr.	at Memorial Dr.	4	Striped Median	Prohibited	70

The photographs below illustrate the typical cross-section of Forest Lawn Drive within the Project corridor. Four travel lanes are provided (two in each direction), along with bicycle lanes and a soft shoulder. On-street parking is prohibited within the Project corridor.



View toward east on Forest Lawn Drive, near Memorial Drive (Forest Lawn Cemetery)



View toward west on Forest Lawn Drive, near Memorial Drive (Forest Lawn Cemetery)

B. Proposed Construction Methods – Forest Lawn Drive

A combination of trenching and tunneling would be utilized to install the replacement pipeline within the Forest Lawn Drive corridor. Typical Project trench dimensions would be 10.5 feet. Including the work area, widths of roadway closures for trenching work would be up to 35 feet in width. The effect of work areas for construction of and work within tunnel shafts on roadway carrying capacity would vary based on the location and configuration of the shafts. Two of the three tunnel shafts planned for the Forest Lawn Drive corridor would be constructed within the roadway right-of-way. LADWP has provided conceptual plans that indicate where the shafts would be generally located in relation to the Forest Lawn Drive travel lanes. In order to provide a conservative analysis, the width of work areas was assumed to be as wide as those for jacking pits – 35 feet wide.

The tunnel shafts for the overall Whitnall Highway corridor tunneling effort will be open for one year or more.

C. Traffic Flow – Forest Lawn Drive

Key Access Issues

Forest Lawn Drive is a four-lane roadway with a striped centerline and shoulders (but prohibited parking), with few fronting land uses. In the vicinity of the Project corridor, the primary fronting land use is the Forest Lawn Cemetery. Left turn movements from westbound Forest Lawn Drive into the primary cemetery entrance would need to be preserved during Project construction closures.

Typical Closures

Project Construction along Forest Lawn Drive would likely require only partial closure of the roadway. The relatively high traffic volumes (approximately 25,000 daily vehicle trips across four travel lanes) along Forest Lawn Drive could generally be accommodated if two travel lanes remain open. As the current roadway width is 70 feet, roadway closures of up to 35 feet in width would allow for a remaining 35 feet of width to remain open. This remaining width could accommodate two travel lanes and additional width for emergency shoulders, construction zone buffer space, or turn lanes. The total length of any Project-related work area would be 1,400 feet under worst-case conditions (500 feet for the active construction process, an additional 500 feet for tail-end dirt hauling and related operations, and 200-foot traffic transitions on both sides of the work area).

Specific Closures – Tunnel Construction

Two tunnel access shafts would be constructed on Forest Lawn Drive, in the vicinity of the intersection of this roadway with the extension of the Whitnall Highway utility corridor from the north side of the Los Angeles River. Construction of these shafts would encompass the two westbound travel lanes and a partial area of one of the eastbound travel lanes. With minor travel lane width reductions, the provision of two travel lanes within the work area extents for these two shaft locations appears to be feasible.

Recommended Actions

The following actions would mitigate any potential significant Project impacts within the Forest Lawn Drive corridor:

- Tunneling access shaft construction within Forest Lawn Drive would allow for the continued operation of two travel lanes. The bicycle lanes would need to be closed during the presence of construction activities and the associated work area for the jacking pits.

- Directional capacity (westbound in the a.m. peak and eastbound in the p.m. peak) should be considered in roadway closure planning. The provision of two travel lanes in the peak direction, while providing one travel lane for the opposite direction of traffic flow, would help to alleviate any potential traffic impacts during construction. This peak provision would not be possible within the vicinity of the access shaft work areas.

- On-street parking is prohibited along the Forest Lawn Drive Project corridor, but there are bicycle lanes on both shoulders. Closure of these lanes, which link to recreation trails within Griffith Park, could be necessary during Project construction. If these lanes are closed and direct alternates are not provided during construction, bicycle route closure signs should be posted at the next major intersections to the west and east of the construction area (Griffith Park area and Barham Boulevard). Outside of east-west roadways to the north of the SR-134 freeway, there are no direct nearby alternate bicycle routes.

- The westbound left turn lane into the Forest Lawn cemetery should be maintained during Project construction, as well as the right turn access into the cemetery from the eastbound curb lane. Based on the typical widths analyzed, provision of these lanes within the construction work zones on Forest Lawn Drive appears to be feasible.

An alternate route during construction would be the SR-134 freeway between Barham Boulevard on the west and Victory Blvd.-Riverside Drive/Zoo Drive on the east. Use of such an alternate route would only be necessary during complete roadway closures, which are not anticipated.

There are no scheduled public transit routes that utilize this portion of Forest Lawn Drive. Emergency vehicle access within the corridor would not be negatively affected as thru lanes would remain open.

D. Tunneling within Whitnall Highway Corridor

To the north of the Forest Lawn Drive corridor, the Project pipeline will be constructed within an underground tunnel, terminating on the north at Burbank Boulevard. The only surface disruptions that would occur within City of Burbank jurisdiction along the tunneling route would be for the installation of vents and other related features.

These tunneling surface features would be installed within the utility corridor and not within public roadway rights-of-way. Related construction activities would not generate a significant number of construction truck trips, nor would these activities create any major surface street closures.

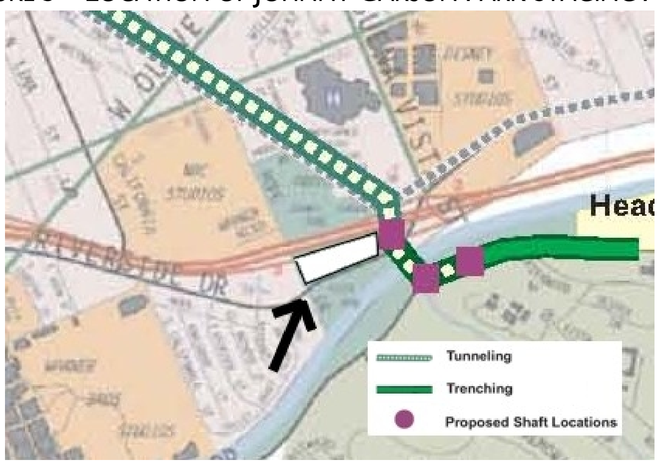
4. Route Staging Area Analysis – Johnny Carson Park

This report section provides information on the proposed Project staging area at Johnny Carson Park, and access issues that would need to be considered during planning for this staging area.

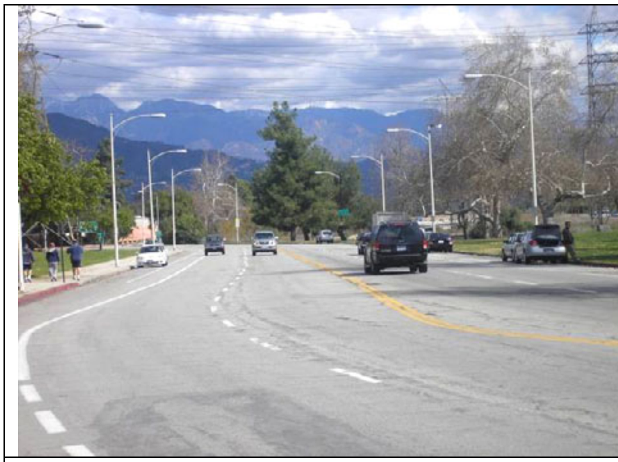
A. Staging Area Site Description

The planned staging area for Project Phase UR3 would be located within the existing Johnny Carson Park, between the SR-134 freeway on the north and Riverside Drive on the south. Figure 5 illustrates the location of this staging area.

FIGURE 5 – LOCATION OF JOHNNY CARSON PARK STAGING AREA



The photos below provide views of the roadways that surround the planned staging area. Riverside Drive defines the southern boundary of the site, and Bob Hope Drive defines the western boundary.

	
View to east on Riverside Drive, near Bob Hope Drive (proposed staging area site is to left of photo)	View to north on Bob Hope Drive, near SR-134 eastbound off-ramp (proposed staging area site is to the right)

B. Staging Area Access

The current LADWP plans for the Johnny Carson Park staging area include temporary access by hauling trucks via a western inbound driveway, an internal roadway, and an eastern outbound driveway. This access configuration would allow for hauling trucks to exit the eastbound SR-134 freeway and the Bob Hope Drive exit, and continue straight across Bob Hope Drive into the staging area. Exiting movements would be made via the eastern driveway, with trucks crossing Riverside Drive to directly reach the SR-134 eastbound on-ramp at that location. Initial analysis of the planned staging area by LADWP indicates that likely destinations for dirt hauling could be accommodated via this access scheme.

<u>Key Access Issues</u>

The truck hauling route to and from the staging area would provide direct on/off capabilities from the SR-134, with no through movements on area roadways. Trucks would cross Bob Hope Drive and Riverside Drive at single points to travel between the SR-134 freeway ramps and the staging area site. Both ramp locations, however, are unsignalized.

There is no direct access to neighboring land uses to and from Bob Hope Drive and Riverside Drive in the immediate vicinity of Johnny Carson Park. Nearby major land uses such as the St. Joseph hospital and Disney Studios to the north on Buena Vista Street do not likely have significant trip distribution to the roadways surrounding the Park. Access to and from the SR-134 eastbound ramps could be temporarily affected during truck maneuvers between the freeway and the Johnny Carson Park site.

Emergency vehicle access to and from the St. Joseph hospital facilities would be maintained, as traffic closures would be short and access to and from the freeway ramps would be maintained. Access to areas of Burbank to the south of the SR-134 freeway for emergency vehicles would also be maintained.

The City of Burbank submitted a letter on February 23, 2007 in response to the Notice of Preparation for the Project. The City expressed concerns with access and traffic flow during construction.

A pipe jacking access pit would be constructed within the park near the north edge of Riverside Drive, but would not affect the public right-of-way.

Recommended Actions

The following actions would mitigate any potential significant Project impacts within the Forest Lawn Drive corridor:

- As the access points to and from the SR-134 freeway could create safety problems for construction trucks crossing uncontrolled traffic, flagpersons should be provided as trucks enter and exit the site. Arrival of trucks should be coordinated via radio so that entering trucks can make ingress movements with a flag person present.

- At the egress point on the eastern side of the staging area site, flagpersons should be provided for truck movements from the site to the SR-134 eastbound on-ramp. This driveway intersection would be on a curve of Riverside Drive and trucks would need to cross four travel lanes to reach the on-ramp.

- So that delays are not significant for motorists on Bob Hope Drive and Riverside Drive, flagpersons should limit truck movements into and out of the site to one or two trucks at a time. Inbound truck movements should be scheduled to allow for this management to be effective, and outbound truck movements should be held if necessary.

- All traffic control and roadway closure plans must be submitted to the City of Burbank for review and approval before implementation. This includes the traffic control plan for truck access to and fro the Johnny Carson Park site and any roadway closures near the park of the Whitnall Highway corridor tunnel.

5. Route Segment Analysis – Burbank Boulevard

This report section provides information on the Project routing along Burbank Boulevard, and the general traffic and parking impacts that could occur with Project construction-related closures along this roadway.

A. Roadway Corridor Description

Project Phase UR2 would utilize Lankershim Boulevard and Burbank Boulevard, on a route entirely within the City of Los Angeles. Burbank Boulevard would provide an east-west route for the Project pipeline, connecting the northern end of Project Phase UR3 within the Whitnall Highway utility corridor to Lankershim Boulevard.

Figure 6 illustrates the Project route on Burbank Boulevard.

FIGURE 6 – PROJECT ROUTE ON BURBANK BOULEVARD

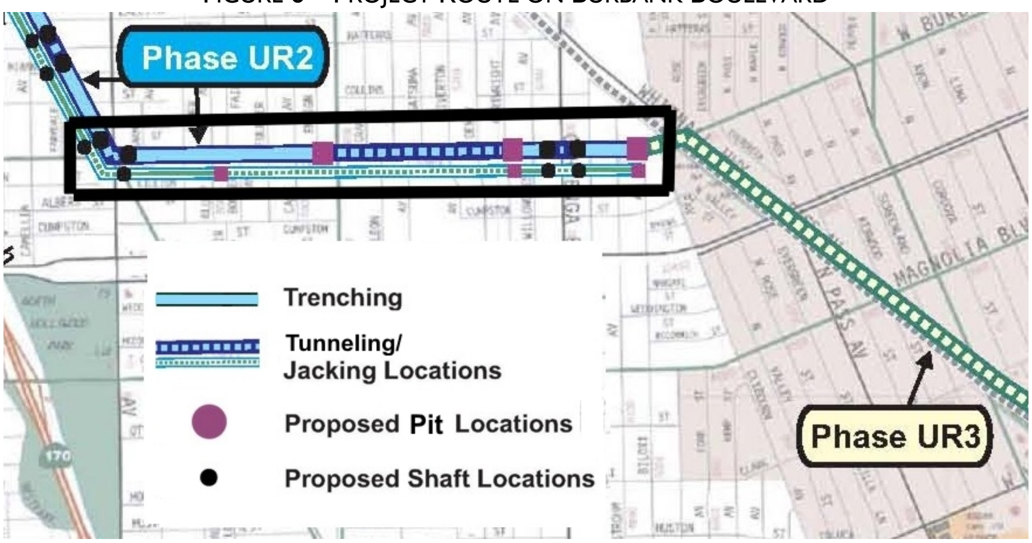


Table 5 provides a summary of typical cross-sections along the Burbank Boulevard corridor that would be utilized by Project Phase UR2.

Table 5 – Typical Burbank Boulevard Cross-Sections

Roadway	Location	# of Lanes	Median	Parking	Curb-to-Curb Width (Feet)
Burbank Blvd.	w/o Clybourn Ave.	2	Center Turn Lane	Permitted	60
Burbank Blvd.	e/o Cartwright Ave.	2	Center Turn Lane	Permitted	60
Burbank Blvd.	w/o Cartwright Ave.	2	Striped Centerline	Permitted	50
Burbank Blvd.	e/o Lankershim Blvd.	2	Center Turn Lane	Permitted	55

The photographs below illustrate two typical cross-sections of Burbank Boulevard along the Project corridor. The first two photographs illustrate the portion of the roadway near Clybourn Avenue, while the last two photographs illustrate the portions of the roadway near Lankershim Boulevard.

View toward west on Burbank Boulevard along southern curb, west of Cartwright Avenue

View toward west on Burbank Boulevard along northern curb, west of Cartwright Avenue

	
View to west on Burbank Boulevard, near Case Avenue	View to west on Burbank Boulevard, near Lankershim Boulevard

B. Proposed Construction Methods

Construction of the Project pipeline on Burbank Boulevard will likely occur along the northern curb of the roadway or near the centerline, depending on the location within the overall roadway. A combination of trenching and jacking would be utilized to install the replacement pipeline within the Burbank Boulevard corridor. Typical construction closures would be 35 feet in width for both trenching and jacking operations, and the worst-case length of construction work areas would be 1,400 feet. LADWP has provided conceptual plans that indicate where tunneling shafts – for tunneling at the eastern end of this analyzed corridor – would be generally located in relation to the Burbank Boulevard travel lanes, on-street parking areas, and sidewalks.

Jacking would be conducted under the intersections with Cahuenga Boulevard, and Tujunga Avenue. and Lankershim Boulevard. Tunneling would be conducted under a multi-intersection segment between Riverton Avenue and Vineland Avenue. This tunneling section may be extended further to the west (under Project Phase UR2a), depending upon the final construction plans. This analysis assumes that the maximum work area width extents of 35-feet could occur anywhere within the analyzed segment, and that the location of tunneling access shafts would remain as defined within the conceptual plans.

C. Traffic Flow and Analysis of Lane Closures

<u>Key Access Issues</u>

Fronting land uses along the Project extents within the Burbank Boulevard corridor include neighborhood commercial retail businesses and light industrial uses. On-street parking demand is high, which was noted during fieldwork conducted for this project by KOA. On a majority of the blocks within the corridor, most of the on-street parking areas are occupied on a weekday. Driveway access for many fronting businesses is provided solely from Burbank Boulevard.

<u>Typical Closures</u>

The curb-to-curb width of Burbank Boulevard within the Project corridor ranges from 50 to 60 feet. Based on typical construction closures of 35 feet along the roadway, there would be 15 to 25 feet of width available for temporary travel lanes. As minimum lane widths should be 10 feet, closures within the narrower portions of Burbank Boulevard (west of Cartwright Avenue) would allow for only one travel lane during construction.

Turn movements may be restricted from cross-streets within the Burbank Boulevard corridor during construction. Jacking would be utilized, however, under many major intersections within the corridor, minimizing significant impacts to area access.

Average daily traffic on Burbank Boulevard ranges from 16,000 to 31,000 vehicles. At the locations of higher vehicle volumes (occurring toward the western end of the corridor near Lankershim Boulevard), significant and unavoidable impacts will result unless two travel lanes remain open during construction.

The City of Los Angeles is planning to widen Burbank Boulevard, but the schedule of that project in comparison to the proposed LADWP project is unknown. This analysis is conservative as it assumes the widening would not take place and is therefore based on the narrower existing roadway.

<u>Specific Closures – Jacking Pit and Tunnel Shaft Construction</u>

Construction within this project segment will include the creation of open pits for tunnel construction and associated work areas. The approximate locations of these pits, as identified by LADWP, are as follows:

- <u>Burbank Boulevard, east of Lankershim Boulevard</u> – At the westbound approach to the intersection with Lankershim Boulevard, a pipe jacking access pit would be constructed that encompasses one travel lane and the westbound left turn lane. Based on the location identified by LADWP, two travel lanes could continue to operate if on-street parking is temporarily removed.

- <u>Burbank Boulevard, west of Vineland Avenue</u> – At the end of the eastbound approach to the intersection with Vineland Avenue, a tunnel access shaft would be constructed on the north side of the roadway. This shaft would be located outside of any travel lanes or on-street parking areas.

- <u>Burbank Boulevard, east of Cartwright Avenue</u> – At the end of the eastbound approach to the intersection with Cartwright Avenue, a tunnel access shaft would be constructed on the north side of the roadway. This shaft would be located outside of any travel lanes but would overlap with the on-street parking area at the north curb.

- <u>Burbank Boulevard, at Cahuenga Boulevard</u> – Two jacking access pits would be constructed in the vicinity of the intersection with Cahuenga Boulevard. At the eastbound approach, a pit would be constructed on the north side of the roadway, within the sidewalk and on-street parking area. At the westbound approach, a pit would be constructed within the southern travel lane and the westbound left turn lane. Travel lanes could remain during construction, if on-street parking is temporarily removed near the westbound approach. A new temporary westbound left turn lane could also be provided.

- <u>Burbank Boulevard, west of Biloxi Avenue</u> – To the west of the intersection with Biloxi Avenue, a tunnel access shaft would be constructed near the centerline of the roadway. This shaft would be located within the continuous center left turn lane and partially within the eastbound travel lane. Travel lanes could remain during construction, if on-street parking is temporarily removed within the vicinity of the work area.

All of these pit and shaft locations would affect on-street parking but would not affect the ability to maintain the existing travel lanes. Potential parking impacts are discussed later within this report section.

Recommended Actions

The following action would mitigate any potential significant Project traffic impacts within the Burbank Boulevard corridor:

- As LADWP is considering narrower rectangular working areas for jacking pit and shaft operations, such strategies should be utilized to provide for two travel lanes along the narrower portions of Burbank Boulevard. Otherwise, significant traffic impacts could result. Work area width would need to be reduced to 25 to 30 feet to allow for two 10-foot temporary travel lanes.

- Pedestrian crossings at intersections should be maintained during the course of trenching work, to provide access to transit, on-street parking, and general pedestrian travel paths. Trenching should be conducted so that one crossing leg, across Burbank Boulevard, is maintained at each intersection.

D. Potential Impacts to On-Street parking

Project construction along the Burbank Boulevard corridor could create a temporary but significant effect to the on-street parking supply. Along all segments of the roadway, the existing curb-to-curb configuration is not of adequate width to provide temporary travel lanes and on-street parking.

As the Project trenching work will be limited to 1,400-foot linear segments, parking could be found within adjacent blocks, but on-street parking supplies for the immediate area (one block) would be significantly-impacted for the four to six week period of construction within each work area. Parking demand that is currently absorbed by Burbank Boulevard would then move to side streets (which are also currently well utilized by both Burbank Boulevard businesses and adjacent residential uses) or adjacent Burbank Boulevard blocks.

Impacts along some segments will be minimized where extensive jacking or tunneling is utilized. Otherwise, significant and unavoidable parking impacts would occur, as demand may exceed supply within on-street parking areas in the immediate vicinity of the work areas.

E. Potential Transit Service Impacts

The following Metro and City of Burbank public transit lines serve the Project corridor on Burbank Boulevard:

Metro Line 152 & 153 operates as a north-south regional bus that provides service between North Hollywood, Sun Valley, Panorama City, Van Nuys, Reseda, Canoga Park, and Woodland Hills. Within the study area, both lines operate along Vineland Avenue with different time schedules. Both lines provide an approximate frequency of 20-60 minutes during weekday peak periods.

The Burbank Bus No-Ho – Empire Line operates as a local bus route that provides service within City of Burbank and Los Angeles. Within the study area, the line travels along Burbank Boulevard, Empire Avenue, Buena Vista Street, and Hollywood Way. This service operates at an approximate trip frequency of 10-20 minutes during weekday peak periods.

Service on the Metro Bus lines that operate on Vineland Avenue would not be significantly impacted by Project construction within the Burbank Boulevard corridor. The Project pipeline would be jacked under the intersection of Lankershim Boulevard & Vineland Avenue, allowing buses to pass without significant restriction.

Service on the Burbank bus line would not be significantly impacted by the Project. The City of Burbank utilized smaller shuttle-size buses that can more readily access temporary stops with smaller turning radii. Temporary bus stop closures could easily be accommodated with temporary bus stops outside of the immediate work area. The temporary stops, however, would need to be located along wide portions of the roadway where two travel lanes can be accommodated during construction.

6. Route Segment Analysis – Lankershim Boulevard

This report section provides information on the Project routing along Lankershim Boulevard, and the general traffic and parking impacts that could occur with Project construction-related closures along this roadway.

A. Roadway Corridor Description

Project Phase UR1 and Phase UR2 would utilize Lankershim Boulevard, on an overall route between Burbank Boulevard on the south and Hart Street on the north, entirely within the City of Los Angeles.

FIGURE 7 – PROJECT ROUTE ON LANKERSHIM BOULEVARD

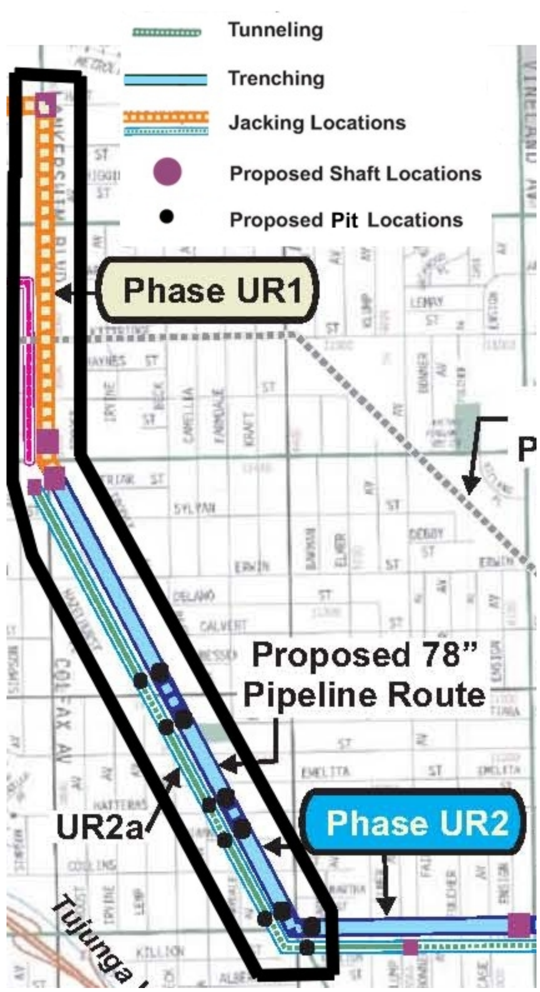


Table 6 provides a summary of typical cross-sections along the Lankershim Boulevard corridor that would be utilized by Project Phase UR2 (south of Victory Boulevard) and Project Phase UR1 (north of Victory Boulevard). Project Phase UR2a would not be implemented in any manner different from Phase UR2 – the difference between these phase options is the length of tunneling along Burbank Boulevard.

Table 6 – Typical Lankershim Boulevard Cross-Section

Roadway	Location	# of Lanes	Median	Parking	Curb-to-Curb Width (Feet)
Lankershim Blvd.	n/o Burbank Blvd.	4	Striped Centerline	Permitted	65
Lankershim Blvd.	s/o Kittridge St.	4	Striped Centerline	Permitted	75

View toward north on Lankershim Boulevard from west curb, north of Burbank Boulevard

View toward north on Lankershim Boulevard from east curb, north of Burbank Boulevard

B. Proposed Construction Methods

Construction along the Lankershim Boulevard corridor of the Project would be conducted within two separate phases. Project Phase UR2 encompasses the corridor of Lankershim Boulevard, south of Victory Boulevard. This phase would be constructed by trenching, and jacking would be utilized under the intersections of Victory Boulevard, Oxnard Street, and Burbank Boulevard.

Construction along Project Phase UR1 (Lankershim Boulevard north of Victory Boulevard) would be almost entirely within an underground tunnel, except for limited retrofitting of existing buried pipelines and the installation of valves and meters. Also, tunnel access shafts would be constructed near the intersections of Hamlin Street and Hart Street. The pipeline would be installed near the centerline of the roadway, so related surface construction work would be near the centerline.

C. Traffic Flow Issues

Key Access Issues

Fronting land uses along the Project extents within the Burbank Boulevard corridor include neighborhood commercial retail storefronts and larger self-standing commercial businesses. On-street parking demand is light, which was noted during fieldwork conducted for this project by KOA. On a majority of the blocks within the corridor, on-street parking can be found immediately as spaces are available on a weekday.

Typical Closures

The curb-to-curb width of Lankershim Boulevard ranges from 65 feet (near Burbank Boulevard in Project Phase UR2) to 75 feet (near Kittridge Street in Project Phase UR1). If the maximum anticipated work area width of 35 feet is utilized, the remaining available roadway width would be 30 feet within Phase UR2 of the Project. This phase would be constructed primarily via trenching. The roadway could be reconfigured during construction to provide three 10-foot travel lanes.

Within the Phase UR1 corridor of Lankershim Boulevard, 40 feet of roadway width would likely remain within construction areas. This width would be adequate to provide at least three travel lanes. On-street parking would need to be prohibited during construction.

Specific Closures – Jacking Pit and Tunnel Shaft Construction

Construction within this project segment will include the creation of open pits for pipe jacking and associated work areas. The approximate locations of these pits, as identified by LADWP, are as follows:

- Lankershim Boulevard at Hart Street – Within this intersection, a tunnel access shaft would be constructed that encompasses three travel lanes. Based on the location identified by LADWP, one southbound travel lane and two northbound travel lanes could be provided if on-street-parking is temporarily removed. It would not be possible to provide directional capacity (two lanes peak direction, one lane off-peak direction) based on the planned location of the shaft.

- Lankershim Boulevard, north of Victory Boulevard – Immediately north of the Victory Boulevard intersection approach, a tunnel access shaft would be constructed that encompasses two travel lanes and the northbound left turn lane onto Gilmore Street. Based on the identified location, up to four travel lanes (matching existing conditions) could be provided if on-street-parking is temporarily removed.

- Lankershim Boulevard, south of Victory Boulevard – Immediately south of the Victory Boulevard intersection approach, a tunnel access shaft would be constructed that encompasses two travel lanes. Based on the identified location, up to three travel lanes could be provided if the northbound left turn lane onto Victory Boulevard was temporarily reduced in length.

- Lankershim Boulevard, north of Oxnard Street – Immediately north of the Oxnard Street intersection approach, a pipe jacking access pit would be constructed that encompasses two travel lanes. Based on the identified location, up to three travel lanes could be provided if on-street-parking is temporarily removed.

- Lankershim Boulevard, south of Oxnard Street – At the northbound approach to the Oxnard Street intersection, a pipe jacking access pit would be constructed that encompasses two travel lanes. Based on the identified location, up to three travel lanes could be provided if on-street-parking is temporarily removed and the northbound left turn lane onto Oxnard Street is temporarily reduced in length.

- Lankershim Boulevard, north of Hatteras Street – Immediately north of the Hatteras Street intersection approach, a pipe jacking access pit would be constructed that encompasses two travel lanes. Based on the identified location, up to three travel lanes could be provided if on-street-parking is temporarily removed and the northbound left turn lane onto Emelita Street is temporarily reduced in length.

- Lankershim Boulevard, north of Miranda Street – Immediately north of the Miranda Street intersection approach, a pipe jacking access pit would be constructed that encompasses two travel lanes. Based on the identified location, up to three travel lanes could be provided if the northbound left turn lane onto Hatteras Street is temporarily reduced in length.

- Lankershim Boulevard, north of Burbank Boulevard – Immediately north of the Burbank Boulevard intersection approach, a pipe jacking access pit would be constructed that encompasses the western on-street parking area, two travel lanes, and the southbound left turn lane onto Burbank Boulevard. Based on the identified location, up to three travel lanes could be provided if on-street-parking is temporarily removed and the southbound left turn lane onto Burbank Boulevard is temporarily closed.

Out of the jacking pit and tunnel shaft locations identified above, construction at all but one (Lankershim Boulevard at Hart Street) would be equally-intensive, as compared to closures identified for the standard work areas for trenching activities. Recommended actions for the Hart Street closure are discussed below.

Recommended Actions

Average daily traffic volumes on the Lankershim Boulevard Project corridors range from 25,000 to 27,000 vehicles. Provision of less than three travel lanes (accommodating peak directional flow with two lanes) during construction could create significant and unavoidable impacts, though temporary, along Lankershim Boulevard. The following measures should be taken, to avoid significant impacts:

- Three travel lanes should be provided during the construction period. The closure should be configured to provide two travel lanes in the peak direction of travel.

- For tunnel shaft construction at the Lankershim Boulevard and Hart Street intersection, two lanes of travel could not likely be provided for the peak direction of travel (southbound in the a.m. peak period). In order to avoid significant traffic impacts, a recommended alternate route (not a full detour route) should be established and signed for southbound traffic on Lankershim Boulevard. This route would utilize eastbound Sherman Way, southbound Tujunga Avenue, and westbound Hart Street.

- Pedestrian crossings at intersections should be maintained during the course of construction, to provide access to transit, on-street parking, and general pedestrian travel paths. Trenching should be conducted so that one crossing leg, across Lankershim Boulevard, is maintained at each intersection.

D. Potential On-Street Parking Impacts

Some prohibition of on-street parking within construction areas will be necessary along both Project Phase UR1 and Phase UR2 along Lankershim Boulevard. As parking will be available just outside of the construction area, and on-street parking on Lankershim Boulevard is not used as intensely as Burbank Boulevard, significant impacts would be unlikely during the four to six week construction timeframe for each work area.

E. Potential Transit Line Impacts

The following Metro bus lines have published routes that operate on Lankershim Boulevard, or have routes that cross Lankershim Boulevard.

Metro Line 154 operates as an east-west regional bus route that provides service between Burbank, North Hollywood, Van Nuys, Encino, and Tarzana. Within the study area, the line travels along Oxnard Street. This service provides an approximate frequency of one hour during the peak periods.

Metro Line 164 operates as an east-west regional bus route that provides service between West Hills, Woodland Hills, Reseda, Lake Balboa, Van Nuys, North Hollywood, and Burbank. Within the study area, the line travels along Victory Boulevard. This service provides an approximate frequency of 10-20 minutes during the weekday peak periods.

Metro Line 165 operates as an east-west regional bus route that provides service between West Hills, Woodland Hills, Canoga Park, Reseda, Lake Balboa, Van Nuys, North Hollywood, and Burbank. Within the study area, the line travels along Vanowen Street. This service provides an approximate frequency of 10 to 20 minutes during the weekday peak periods.

Metro Line 224 operates as a north-south regional bus route that provides service between Universal City, North Hollywood, Sun Valley, Pacoima, San Fernando, and Sylmar. Within the study area, the line travels along Lankershim Boulevard. This service operates at an approximate trip frequency of eight to twelve minutes during weekday peak periods.

Metro Lines 353 & 363 operates as north-south limited-stop bus routes that provides service between North Hollywood Metro Red Line Station, Sun Valley, Panorama City, Northridge, Canoga Park, and Chatsworth. Within the study area, the line travels along Lankershim Boulevard. Line 353 is a limited stop service that provides services approximately from 5:30 a.m. to 10:00 a.m., the resumes from 3:30 p.m. to 7:30 p.m. Line 363 is also a limited stop service that provides services approximately from 5:00 a.m. to 9:30 a.m., the resumes from 3:30 p.m. to 8:00 p.m. Both lines operate at an approximate trip frequency of 30 minutes during weekday peak periods.

As jacking would be utilized within Project Phase UR2 under Oxnard Street, Victory Boulevard, and tunneling would be utilized within Project Phase UR1 under Vanowen Street, there would not be any significant impacts to Metro Bus Lines 154, 164, and 165.

Metro Bus Lines 224, 353, and 363 travel on Lankershim Boulevard within the Project area. As travel lanes would likely be kept open during construction, access for these bus lines would continue but stops would need to be temporarily moved within construction zones. As jacking will be utilized as major intersections, access to transfer points at these major intersections would continue. Although some time delays may result, there would not be any significant impacts to transit service within the Lankershim Boulevard corridor during Project construction.

7. Route Segment Analysis – Northern Terminus

This report section provides information on the Project routing along local roadways at the Project northern terminus, and the general traffic and parking impacts that could occur with Project construction-related closures along these roadways.

A. Roadway Corridor Description

The northern terminus of Project Phase UR1 would be constructed within the roadways of Hart Street (between Lankershim Boulevard and Morella Street) and Morella Street (between Hart Street and the North Hollywood Pump Station). Figure 8 provides an illustration of these two local Project roadway corridors.

FIGURE 8 – PROJECT ROUTE ON HART STREET & MORELLA STREET

The photographs below provide views of the typical two-lane cross-sections of Hart Street and Morella Street.

View to east on Hart Street,
near Lankershim Blvd.

View to south on Morella Street,
near Hart Street

B. Alternate Roadway Corridor Description

An alternate corridor is being considered within the project northern terminus area by LADWP. This route, identified as Phase UR1a, would proceed to the south on Morella Street from the Pump Station, cross under Vanowen Street, and then connect back to Lankershim Boulevard via Archwood Street. The local roadway characteristics along this alternate UR1a route are similar to those along the Phase UR1 route. Tunnel shaft locations along the Phase UR1a route are not yet known, but impact and roadway closure issues would be similar to those identified for the Phase UR1 route.

The photograph below provides a view of the typical two-lane cross-section of Morella Street within the vicinity of the Pump Station.

View to south on Morella Avenue,
to Vanowen Street and Archwood Street

C. Proposed Construction Methods

Construction along Hart Street and Morella Street within Project Phase UR1 would be conducted entirely by tunneling, except for limited retrofitting of existing buried pipelines and the installation of valves and meters. Also, tunnel shafts would be constructed near the intersections of Hamlin Street and Hart Street and the North Hollywood Pump Station.

One tunnel shaft would be located within the roadway of Morella Avenue, adjacent to the Pump Station. A second shaft would be located within the intersection of Morella Avenue and Hart Street. Construction at both of these shafts would entail the full closure of the roadways.

<u>Access Issues During Construction</u>

Construction of tunnel shafts at or near the intersections of Lankershim Boulevard & Hart Street, Morella Street & Hart Street, and Morella Street at the Pump Station, could create full but temporary closures of the local roadways. On-street parking would also be unavailable during the construction period. The following measure should be taken to mitigate potentially significant traffic impacts:

- In order to minimize potential significant traffic and parking impacts within the local residential neighborhood, construction should be limited to as few shafts at a time, if possible.
- Detour routes would need to be established where complete roadway closures are necessary.

There are no public transit routes that utilize these two local roadways.

8. Conclusions and Recommendations

A. Major Impact Conclusions

The RSC Improvement Upper Reach Project will not result in any permanent traffic generating impacts on area roadways. As such, permanent physical or operations improvements to either study intersections or roadway segments are not required. However, the project will potentially create significant impacts in some areas during construction since much of the project will be performed via open trenching that will occur on roadways that are heavily traveled. This work will reduce capacities on the roadways directly affected and possibly divert traffic to adjacent roadways that are also heavily traveled. Trenching is the only feasible cost alternative for the majority of the route. While jacking and tunneling can be used to reduce traffic impacts at specific locations, use of this method throughout the entire route would be prohibitive in terms of costs.

There are no measures that can be implemented to make all project impacts less than significant. These impacts will be temporary in nature and as such should have no lasting impact on the study roadways or the adjacent roadway systems, including monitoring stations of the Los Angeles County Congestion Management roadways on area arterials and freeways. Daily roadway volumes have been analyzed to achieve an understanding of the magnitude of potential roadway lane closures during construction.

The following sub-sections summarize the potential traffic impacts within each roadway corridor, and the identified staging area, on the overall Project route.

Forest Lawn Drive

As the current roadway width is 70 feet, roadway closures of up to 35 feet in width would allow for a remaining 35 feet of width to remain open. This remaining width could accommodate three travel lanes; or two travel lanes and additional width for emergency shoulders, construction zone buffer space, or turn lanes.

Directional capacity (westbound in the a.m. peak and eastbound in the p.m. peak) should be considered in roadway closure planning. The provision of two travel lanes in the peak direction, while providing one travel lane for the opposite direction of traffic flow, should help to alleviate any potential traffic impacts during construction. The following measures should be taken to mitigate any potentially significant traffic impacts:

- The provision of two travel lanes in the peak direction, while providing one travel lane for the opposite direction of traffic flow, would remove any potential traffic impacts during construction.
- Tunnel shaft pit construction within Forest Lawn Drive would allow for the continued operation of two travel lanes. The bicycle lanes would need to be closed during the presence of construction activities and the associated work area for the shafts.
- If bicycle lanes are closed and direct alternate routes are not provided during construction, bicycle route closure signs should be posted at the next major intersections to the west and east of the construction area. Outside of east-west roadways to the north of the SR-134 freeway, there are no direct nearby alternate bicycle routes.

- The westbound left turn lane into the Forest Lawn cemetery should be maintained during Project construction, as well as the right turn access into the cemetery from the eastbound curb lane. Based on the typical widths analyzed, provision of these lanes within the construction work zones on Forest Lawn Drive appears to be feasible.

Johnny Carson Park Staging Area

As the access points to and from the SR-134 freeway could create safety problems for construction trucks crossing uncontrolled traffic, flagpersons should be provided as trucks enter and exit the site. Arrival of trucks should be coordinated via radio so that entering trucks can make ingress movements with a flag person present.

At the egress point on the eastern side of the staging area site, flagpersons should be provided for truck movements from the site to the SR-134 eastbound on-ramp. This driveway intersection would be on a curve of Riverside Drive and trucks would need to cross four travel lanes to reach the on-ramp.

The following measures should be taken to mitigate any potentially-significant Project impacts:

- As the access points to and from the SR-134 freeway could create safety problems for construction trucks crossing uncontrolled traffic, flagpersons should be provided as trucks enter and exit the site. Arrival of trucks should be coordinated via radio so that entering trucks can make ingress movements with a flag person present.

- At the egress point on the eastern side of the staging area site, flagpersons should be provided for truck movements from the site to the SR-134 eastbound on-ramp. This driveway intersection would be on a curve of Riverside Drive and trucks would need to cross four travel lanes to reach the on-ramp.

- So that delays are not significant for motorists on Bob Hope Drive and Riverside Drive, flagpersons should limit truck movements into and out of the site to one or two trucks at a time. Inbound truck movements should be scheduled to allow for this management to be effective, and outbound truck movements should be held if necessary.

- All traffic control and roadway closure plans must be submitted to the City of Burbank for review and approval before implementation. This includes the traffic control plan for truck access to and fro the Johnny Carson Park site and any roadway closures near the park of the Whitnall Highway corridor tunnel.

Burbank Boulevard

The curb-to-curb width of Burbank Boulevard within the Project corridor ranges from 50 to 60 feet. Based on typical construction closures of 35 feet along the roadway, there would be 15 to 25 feet of width available for temporary travel lanes. As minimum lane widths should be 10 feet, closures within the narrower portions of Burbank Boulevard (west of Cartwright Avenue) would allow for only one travel lane during construction.

As LADWP is considering narrower rectangular working areas for tunnel shaft construction work areas, such size reduction strategies should be considered to provide for two travel lanes along the narrower portions of Burbank Boulevard. Otherwise, significant traffic impacts could result. Work area widths would need to be reduced to 25 to 30 feet (depending on the segment width) to allow for two 10-foot temporary travel lanes.

Project construction along the Burbank Boulevard corridor could create a temporary but significant effect to the on-street parking supply. Along all segments of the roadway, the existing curb-to-curb configuration is not of adequate width to provide temporary travel lanes and on-street parking. Project parking impacts along Burbank Boulevard could be significant and unavoidable.

As the Project construction extents for trenching will be limited to 1,400-foot linear segments (and smaller lengths for jacking pit and tunnel shaft construction), parking could be found within adjacent blocks, but on-street parking supplies for the immediate area (one block) would be significantly-impacted for the four to six week period of construction within each work area. Impacts along some segments will be minimized where extensive jacking is utilized.

The following measures should be taken to mitigate any potentially-significant Project impacts:

- As LADWP is considering narrower rectangular working areas for jacking operations, such strategies should be utilized to provide for two travel lanes along the narrower portions of Burbank Boulevard. Otherwise, significant traffic impacts could result. Work area width would need to be reduced to 25 to 30 feet to allow for two 10-foot temporary travel lanes.

- Pedestrian crossings at intersections should be maintained during the course of construction, to provide access to transit, on-street parking, and general pedestrian travel paths. Trenching should be conducted so that one crossing leg, across Burbank Boulevard, is maintained at each intersection.

Potentially-significant on-street parking supply impacts cannot be mitigated and would remain unavoidable during the construction period.

<u>Lankershim Boulevard</u>

The curb-to-curb width of Lankershim Boulevard ranges from 65 feet (near Burbank Boulevard in Project Phase UR2) to 75 feet (near Kittridge Street in Project Phase UR1). If the maximum anticipated work area width of 35 feet is utilized, the remaining available roadway width would be 30 feet within Phase UR2 of the Project. This phase would be constructed primarily via trenching and pipe jacking. This area could provide three 10-foot travel lanes during construction.

Within the Phase UR1 corridor of Lankershim Boulevard, 40 feet of roadway width would likely remain within construction areas. Within this segment, traffic on Lankershim Boulevard will only be affected at the tunnel shafts, as tunneling would be used along this entire Project segment. The existing roadway width would be adequate to provide at least three travel lanes at the tunnel shaft work areas

With the provision of three travel lanes (providing two lanes for peak directional flow), significant traffic impacts would be unlikely.

The following measures should be taken to mitigate any potentially-significant Project impacts:

- Three travel lanes should be provided during the construction period. The closure should be configured to provide two travel lanes in the peak direction of travel.

- For tunnel shaft construction at the Lankershim Boulevard and Hart Street intersection, two lanes of travel could not likely be provided for the peak direction of travel (southbound in the a.m. peak period). In order to avoid significant traffic impacts, a recommended alternate route (not a full detour route) should be established and signed for southbound traffic on Lankershim Boulevard. This route would utilize eastbound Sherman Way, southbound Tujunga Avenue, and westbound Hart Street.

- Pedestrian crossings at intersections should be maintained during the course of construction, to provide access to transit, on-street parking, and general pedestrian travel paths. Trenching should be conducted so that one crossing leg, across Lankershim Boulevard, is maintained at each intersection.

Hart Street and Morella Avenue

Construction of tunnel shafts at or near the intersections of Lankershim Boulevard & Hart Street, Morella Street & Hart Street, and Morella Street at the Pump Station, could create full but temporary closures of the local roadways. On-street parking would also be unavailable during the construction period. In order to minimize potential significant traffic and parking impacts within the local residential neighborhood, construction should be limited to as few tunnel portals at a time, if possible.

The following measures should be taken to mitigate any potentially-significant Project impacts:

- In order to minimize potential significant traffic and parking impacts within the local residential neighborhood, construction should be limited to as few tunnel shafts at a time, if possible.
- Detour routes would need to be established where complete roadway closures are necessary.

Construction Schedules

Construction activities and hauling truck movements should be scheduled per the City of Los Angeles Mayor's Directive #2, dated October 20, 2005. This directive states that road construction, outside of emergency repairs, cannot be conducted from 6:00 a.m. to 9:00 a.m. and from 3:30 p.m. to 7:00 p.m. The rule does state, however, that exemptions would be carefully considered for public works projects, as long as the proper mitigation measures are in place.

B. Pedestrian, Transit and Parking Impacts

Construction of the pipeline and related facilities could potentially impact pedestrian movements on sidewalks and at crosswalk locations. The construction activities are also likely to affect transit interface locations (e.g. bus stops) and transit vehicle travel times. Finally, the project will likely eliminate on-street parking at the location of trenching activities. The elimination of parking could have an adverse impact on the narrower Burbank Boulevard roadway, which is a commercial corridor.

C. General Impacts to Roadway Facilities and Transit Service

As detailed construction and closure plans for the project are not yet available, analysis was not conducted of specific intersections or specific project segments. Capacity will be constricted, in some form, along each Project segment during construction.

Typical traffic impact mitigation measures would not be available for impacts caused by Project construction. The need for manual traffic control, detours, and roadway/approach closures would be defined through traffic plans developed for each construction segment. These plans would be reviewed by the City prior to implementation along the Project corridor. True mitigations would not be achieved along the Project construction areas, as capacity cannot be restored until construction is completed.

Impacts to transit service would be likely along Project segments during construction. Temporary stop relocations/closures and line re-routing could be necessary based on the roadway width needed for Project construction on Lankershim Boulevard and Burbank Boulevard. Turning movements could be restricted or closed, forcing re-routing from neighborhoods currently served by transit.

D. Recommended Traffic Control Design Considerations

To mitigate project impacts, the final design of the project should be performed to minimize the locations of complete roadways closures and to minimize the number and duration of lane closures. Detailed construction traffic control and detour (alternative route) plans should be prepared for each phase of construction and a public outreach program should be implemented to inform the public on the need for the project and the project's roadway closure and lane closure characteristics. A Construction Traffic Management Plan will have to be prepared and approved by LADOT prior to the start of work with public roadways along the Project corridors. No surface roadway work within the City of Burbank is envisioned.

The design of traffic plans should be performed in consultation with local transit agencies to minimize impacts to passenger loading areas and to minimize travel times on scheduled transit routes. All affected transit agencies (such as Metro and the City of Burbank) must be contacted to provide for any required modifications or temporary relocation of transit facilities. In addition, local business that might be potentially impacted by a loss of on-street parking should be contacted to best develop plans to mitigate the affect of these loses on their businesses.

LADWP will be required to prepare worksite traffic control plans and detour plans to provide the travel lanes specified to remain open during construction. The plans must be prepared by a registered traffic or civil engineer, as appropriate based on LADOT and City of Burbank permit guidelines, for submittal to the reviewing agency for review and approval. It is anticipated that the reviewing agency will work with LADWP to refine the traffic control lane requirements presented in the memorandum prior to preparation of final traffic control plans.

Caltrans should be contacted to obtain permits for the transport of over-sized loads and to obtain encroachment permits, if necessary.

E. CEQA Checklist Question Responses

The following section of this memorandum is intended to respond to the standard California Environmental Quality Act (CEQA).

Would the project:

A. Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections)?

Response: The project construction activities will for brief periods of time result in increased traffic from construction activities and reduced roadway capacities. This will occur for several weeks to several months within each of the three Project Phase corridors (UR1, UR2, and UR3). The increased traffic and reduced roadway capacities will be temporary and traffic conditions would go back to normal after the four to six week construction period within each work area.

LADOT and the City of Burbank will require that LADWP prepare worksite traffic control and detour plans to best mitigate traffic impacts during construction activities. However, it would be anticipated that project impacts would be significant during various construction phases, albeit for relatively short time periods (several weeks to a few months) at some or all of the work areas.

B. Exceed, either individually or cumulatively, a level-of-service threshold established by the county congestion management agency for designated roadways or highways?

Response: The project traffic impacts will occur during construction activities only. No traffic impacts are anticipated upon project completion. The County of Los Angeles Congestion Management Program (CMP) level-of-service impact thresholds are not intended to be applied to construction activities. As such, the project is not forecast to exceed the significant impact thresholds defined by the CMP.

C. Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?

Response: The project will not result in any significant changes to air traffic patterns.

D. Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g. farm equipment)?

Response: The project construction activities will be performed in compliance with applicable city, county, state and federal codes. Worksite traffic control plans and detour plans will be designed in compliance with LADOT standards. As such, project construction or the project will not include any known safety hazards resulting from the design of the project.

E. Result in inadequate parking capacity?

Response: The project, upon completion, will not result in a reduction of parking in the project vicinity. During construction, curbside parking will be reduced in various work areas to accommodate the construction “foot print”. The reduction in parking supply will be temporary and should last for a few weeks to up to a few months, depending on the work area under construction.

Temporary but significant parking impacts could occur within the Burbank Boulevard corridor under Phase UR2 of the Project. The limited width of this roadway, and the strong demand for on-street parking in this area, could create significant but temporary parking impacts as the Project work sites move down the corridor.

F. Conclusions

The RSCI Upper Reach Project, once complete, will not have any significant impacts to the area traffic circulation system. Traffic impacts, though temporary in nature, are anticipated during construction as roadway trenching will be required to install the new pipeline. The construction "footprint" will reduce roadway widths, thereby, in some cases, reduce the number of travel lanes and eliminate on-street parking.

LADWP has divided construction activities into three phases and 1,400-foot work areas (worst-case length). Reviewing agencies will require project schedules and construction worksite traffic control and detour plans to reduce the temporary project construction impacts.

ATTACHMENT –
LIST OF SOURCES

Aspen Environmental Group, 2007. Project Description for the RSCI Upper Reach Project. December.

Los Angeles County Metropolitan Transportation Authority. *2004 Congestion Management Program for Los Angeles County*. January, 2004. various pages.

City of Los Angeles Department of Transportation (LADOT), Development Review. *Traffic Study Policies and Procedures.* Revised August 2003. various pages.

Institute of Transportation Engineers. *Trip Generation – 7th Edition.* Washington, DC. Copyright 2003, Institute of Transportation Engineers. various pages.

City of Los Angeles Department of Transportation (LADOT). Internal memorandum from Bill J. Shao to Victor Soto. "LADOT Comments for River Supply Conduit (RSC) Improvements – Upper Reach".

City of Burbank. Letter of February 23, 2007 from Greg Hermann. "Notice of Preparation for River Supply Conduit Improvement – Upper Reach".

Caltrans. Letter of February 7, 2007 from February 7, 2007. "IGR/CEQA No. 070141AL, NOP – River Supply Conduit Improvement – Upper Reach…".

APPENDIX E

AIR POLLUTANT EMISSION CALCULATIONS

RSC Upper Reach Construction - Emission Calculation Assumptions

Proposed Project General Assumptions

1) Worst case day includes concurrent overlap of three pipe jacking operations, three open trench operations, three tunneling operations and three site restoration operations. The other identified construction activities: pre-construction activities, right of way clearing, weld inspection, applying protective coating to the weld joints, hydrostatic testing, and backfilling are minor in comparison to the worst case day activities and would not impact LST emission findings.
2) Main work schedule maximum would be during the day and graveyard shifts (8 am to 11 pm) for 15 hour total.

Offroad Equipment Emission Calculation Assumptions

1) Emission factors are the latest available from the SCAQMD website, where the assumed horsepower is interpolated between the available horsepower data given in the SCAQMD emission factor database to determine equipment specific hourly emission factors.
2) Emission factors from 2009 are assumed to calculate the maximum daily emissions.
3) Equipment type, number, and usage estimates are used as estimated using equipment data and quantity estimates provided by the LADWP with additional engineering assumptions for generator to power dewatering, lighting and air blowers.

Onroad Equipment Emission Calculations Assumptions

1) Emission factors are the latest available from the SCAQMD website, where the vehicles have been assigned three classes, passenger (i.e. employee vehicles and pickups), delivery (all nonpassenger vehicles smaller than Heavy-Heavy Duty), and heavy-heavy duty vehicles.
2) Emission factors from 2009 are assumed to calculate the maximum daily emissions.
3) Trip estimates are based on import/export quantities, equipment and worker trips estimated using information provided by LADWP and determined through engineering estimates.
4) All onroad traffic for the project is assumed to occur within SCAQMD jurisdiction.
5) Dump truck waste loads are 20 cubic yards. Grout loads are 10 cubic yards.

Fugitive Dust Emission Calculations Assumptions

1) Unpaved road travel is considered negligible for this project.
2) Paved road fugitive dust emission factors are calculated using the most current version of USEPA AP-42 Section 13.2.1 and use the following assumptions: a) Silt loading is average for >10000 ADT road; b) average vehicle weight is calculated on VMT average basis.
3) Earthmoving emission factors are calculated using the recent version of USEPA AP-42 Section 11.9 for Trenching, and Section 13.2.4 for soil handling (drop emissions).
4) Considering work areas are in pits and trenches or underground, the wind erosion potential is considered negligible.
5) Asphalt emissions from restoration repaving is considered to be negligible in comparison with the other emissions sources.

Table E-1
RSC Upper Reach Maximum Daily Emissions (lbs/day)

	Onroad Emissions (1)	Offroad Emissions (1)	Fugitive Dust (2)	Total Emissions
CO	184.70	367.35	---	552.05
NOx	469.70	753.27	---	1222.97
ROG	40.83	115.46	---	156.29
SOx	0.49	0.78	---	1.27
PM10	20.89	41.71	328.15	390.76
PM2.5	19.12	38.37	77.54	135.03

(1) Tailpipe emissions only.

(2) Construction fugitive dust emissions including paved road fugitive dust.

Table E-2
RSC Upper Reach Maximum Day Offroad Emissions

Pipe Jacking/Tunneling Spread	HP	Number	SCAQMD Emission Factor lbs/hour ROG	CO	NOX	SOX	PM	Hours/day	Daily Emissions lbs ROG	CO	NOX	SOX	PM
Main Diesel Generator	600	1	0.3138	1.1967	3.9866	0.0042	0.1221	14	4.39	16.75	55.81	0.06	1.71
Excavator/Drill 315B	99	1	0.1439	0.4742	0.7101	0.0007	0.0678	14	2.02	6.64	9.94	0.01	0.95
Crane	187	1	0.1282	0.4706	1.0370	0.0010	0.0554	8	1.03	3.77	8.30	0.01	0.44
Diesel Generator (dewatering, lights, air blower)	50	1	0.1182	0.2970	0.3115	0.0004	0.0296	24	2.84	7.13	7.47	0.01	0.71
Diesel Powered Welder	50	1	0.1292	0.3084	0.2760	0.0003	0.0299	12	1.55	3.70	3.31	0.00	0.36
								Total	11.82	37.99	84.84	0.09	4.17
								x6 spreads	70.93	227.91	509.02	0.54	25.03

Trenching Spread	HP	Number	SCAQMD Emission Factor lbs/hour ROG	CO	NOX	SOX	PM	Hours/day	Daily Emissions lbs ROG	CO	NOX	SOX	PM
Backhoe - 436C	89	1	0.1170	0.3672	0.4784	0.0005	0.0458	10	1.17	3.67	4.78	0.01	0.46
Forklift - RT-708H	80	1	0.1549	0.4399	0.5407	0.0006	0.0537	10	1.55	4.40	5.41	0.01	0.54
Loader - 962G	200	1	0.1569	0.5711	1.3611	0.0014	0.0665	10	1.57	5.71	13.61	0.01	0.67
Excavator/Drill 315B	99	1	0.1439	0.4742	0.7101	0.0007	0.0678	10	1.44	4.74	7.10	0.01	0.68
Compactor 224C	90	1	0.1311	0.3808	0.5644	0.0005	0.0516	4	0.52	1.52	2.26	0.00	0.21
Crane	187	1	0.1282	0.4706	1.0370	0.0010	0.0554	4	0.51	1.88	4.15	0.00	0.22
Diesel Generator (dewatering, lights, air blower)	50	1	0.1182	0.2970	0.3115	0.0004	0.0296	24	2.84	7.13	7.47	0.01	0.71
Diesel Powered Welder	50	1	0.1292	0.3084	0.2760	0.0003	0.0299	8	1.03	2.47	2.21	0.00	0.24
								Total	10.63	31.53	46.99	0.05	3.72
								x3 spreads	31.90	94.58	140.98	0.15	11.15

Restoration Spread	HP	Number	SCAQMD Emission Factor lbs/hour ROG	CO	NOX	SOX	PM	Hours/day	Daily Emissions lbs ROG	CO	NOX	SOX	PM
Paver	200	1	0.2283	0.7815	1.9396	0.0017	0.0963	8	1.83	6.25	15.52	0.01	0.77
Pavement Roller	145	1	0.1408	0.5168	1.0021	0.0009	0.0679	8	1.13	4.13	8.02	0.01	0.54
Loader - 962G	200	1	0.1569	0.5711	1.3611	0.0014	0.0665	8	1.26	4.57	10.89	0.01	0.53
								Total	4.21	14.96	34.42	0.03	1.85
								x3 spreads	12.63	44.87	103.27	0.10	5.54

Assumptions:
Daily emissions include a total of six pipe jacking/tunneling spreads, three trenching spreads, and three restoration spreads.
PM2.5 is 0.92 of PM10 emissions per CEIDARS fraction assumption for diesel engines.

	Project Emissions ROG	CO	NOX	SOX	PM	PM2.5
Maximum lbs/day	115.46	367.35	753.27	0.78	41.71	38.37

Table E-3
RSC Upper Reach Maximum Day Onroad Emissions

Passenger Vehicles (Worker Travel and Pickups)

Pollutant	**(pounds/mile)**	**miles/trip**	**trips/day**	**pounds/day**
CO	0.009686	30	126	36.61
NOx	0.001005	30	126	3.80
ROG	0.000992	30	126	3.75
SOx	0.000011	30	126	0.04
PM10	0.000086	30	126	0.33
PM2.5	0.000054	30	126	0.20

Delivery Size Trucks (crew trucks, welding trucks, fueling, etc.)

	(pounds/mile)	miles/trip	trips/day	pounds/day
CO	0.020161	20	20	8.06
NOx	0.022366	20	20	8.95
ROG	0.002789	20	20	1.12
SOx	0.000027	20	20	0.01
PM10	0.000805	20	20	0.32
PM2.5	0.000692	20	20	0.28

Heavy Heavy Diesel Trucks (Dump trucks, concrete trucks, semi trucks, etc.)

	(pounds/mile)	miles/trip	trips/day	pounds/day
CO	0.012822	30	364	140.02
NOx	0.041846	30	364	456.96
ROG	0.003293	30	364	35.96
SOx	0.000040	30	364	0.44
PM10	0.001854	30	364	20.24
PM2.5	0.001707	30	364	18.64

Total Onroad Emissions

Pollutant	**pounds/day**
CO	**184.70**
NOx	**469.70**
ROG	**40.83**
SOx	**0.49**
PM10	**20.89**
PM2.5	**19.12**

Assumptions:

SCAQMD 2009 Onroad Emission Factors

Delivery truck estimates assume 144 trips (to deliver materials such as grout, backfill, and steel pipe), 12 trips for water trucks, and 208 trips for excavated soil waste.

Table E-4
RSC Upper Reach Fugitive Dust Emissions

Emission Categories
1) Earthmoving
2) Road Dust Paved

1) Earthmoving

Emission Types
A) Trenching
B) Material Loading/Handling

A) Trenching (AP-42 Section 11.9 for drag-line)

E = (k)(0.0021)(d^0.7)/(M^0.3)
E = lb/cuyd
k = Scaling Constant (0.75 for PM10 and 0.017 for PM2.5)
d = Drop Height = 5 feet (conservative estimate)
M = Moisture Content = 10% (assumes moist watered soils - controlled)

PM10 Emission Factor
0.00243534 lb/cuyd

PM2.5 Emission Factor
0.000055 lb/hr

Maximum Daily Trenching Quantity
2400 Cuyds

Excavator Trenching Emissions

Lbs/Day	
PM10	PM2.5
5.84	0.13

B) Material Loading/Handling (AP-42, p. 13.2.4-3)

$E = (k)(0.0032)[(U/5)^{1.3}]/[(M/2)^{1.4}]$
E = lb/ton
k = Particle Size Constant (0.35 for PM10 and 0.11 for PM2.5)
U = average wind speed = 16.0 MPH worst day (5th percentile SCAQMD 1981 Burbank Met File)
M = moisture content = 10% (mitigated)
Three separate drops are assumed

14400 Maximum daily tons (all nine active tunnel/trenches - 2 drops - one for final disposal)

Emission Factors and Emissions
Emission Factors

PM10 Daily	PM2.5 Daily
0.00053	0.00017

Emissions lbs/day

PM10	PM2.5
7.69	2.42

Table E-4
RSC Upper Reach Fugitive Dust Emissions

2) Paved Road Dust
Emission Types
A) Paved Road Dust
B) Unpaved Road Dust

A) Paved Road Dust

E = [k x (sL/2)0.65 x (W/3)1.5 -C] x (1-P/4N)
E = lb/VMT
k = Constant (0.016 for PM10 and 0.0040 for PM2.5)
sL = Silt Loading (assumed to be 0.03 g/m2 - assumes >10,000 ADT profile of Table 13.2.1-3 ubiquitous baseline)
W = Average weight of vehicles in tons (calculated below)
C = Correction for exhaust, break wear, tire wear (0.00047 lb/VMT for PM10, 0.00036 lb/VMT for PM2.5)
No correction for number of wet days due to assumption of working in dry season

Average Vehicle Weight Calculation

Assumptions
Passenger Vehicles = 2 tons average
Midsize "Delivery" Vehicles = 8 ton average
Heavy-Heavy Duty Trucks = 30 tons average (loaded 40 tons, unloaded 20 tons)

Worst Case Day VMT

3780	Passenger Vehicles
400	Delivery/Work Vehicles
10920	Heavy-Heavy Duty Vehicles
15100	Total Paved VMT (2009)

Average Weight = 22.4 Tons

Emission Factors and Emissions
Emission Factors

PM10 Daily	PM2.5 Daily
0.0208	0.0050

Emissions lbs/day

PM10	PM2.5
314.62	74.99

Fugitive Dust Maximum Day Emission Totals

		PM10 lb/day	PM2.5 lb/day	Location
Trenching		5.84	0.13	on-site
Soil Handling		7.69	2.42	on-site
Paved Road Dust		314.62	74.99	off-site
	Totals	328.15	77.54	

Table E-5
RSC Upper Reach Maximum LST Construction Emissions

Assumptions:
1) Only single spread on-site construction activity is included, onroad equipment emissions not included.
2) Project area is within SRA 7 (although a very small portion at the south tip of the route may be in SRA 1).
3) Only NOx, CO, PM10, and PM2.5 have LSTs

Pipe Jacking/MTBM Tunneling

Worst-Case Onsite Day	Emissions (lb/day)			
	NOx	CO	PM10	PM2.5
Offroad Vehicles/Equipment	84.84	37.99	4.17	3.84
Fugitive Dust	---	---	0.17	0.05
Totals	84.84	37.99	4.34	3.89

Trenching

Worst-Case Onsite Day	Emissions (lb/day)			
	NOx	CO	PM10	PM2.5
Offroad Vehicles/Equipment	46.99	31.53	3.72	3.42
Fugitive Dust	---	---	2.38	0.18
Totals	46.99	31.53	6.09	3.60

Restoration

Worst-Case Onsite Day	Emissions (lb/day)			
	NOx	CO	PM10	PM2.5
Offroad Vehicles/Equipment	34.42	14.96	1.85	1.70
Fugitive Dust	---	---	0.17	0.05
Totals	34.42	14.96	2.02	1.75